DRAFT ENVIRONMENTAL ASSESSMENT FOR THE BARGE MOORING PROJECT CONDUCTED AT NAVAL BASE KITSAP BANGOR SILVERDALE, WASHINGTON

February 2013

Naval Facilities Engineering Command Northwest

1101 Tautog Circle

Silverdale, WA 98315

[This page intentionally left blank.]

Lead Agency: United States Department of the Navy

DRAFT ENVIRONMENTAL ASSESSMENT FOR THE BARGE MOORING PROJECT CONDUCTED AT NAVAL BASE KITSAP BANGOR SILVERDALE, WASHINGTON

FEBRUARY 2013

ABSTRACT

This Environmental Assessment (EA) evaluates potential environmental effects of constructing a mooring location for a new research barge at the Service Pier along the waterfront at Naval Base Kitsap Bangor located in Silverdale, WA. The Proposed Action consists of the following three components: moving and reconfiguring sections of an existing Port Operations floating pier from the north side of the Service Pier to the south side, and installing new float sections; removing an existing mooring dolphin and concrete pile cap in order to accommodate the new barge; and installing pier moorings on the north side of the Service Pier for the new research barge. 16 steel piles would be installed primarily using a vibratory pile driver, and installation may need to be completed using an impact hammer. Construction is planned to begin on approximately July 16, 2013 and is planned to be completed by approximately 30 September 2013. This EA analyzes two action alternatives and a no-action alternative. The purpose of the Proposed Action is to provide a safe, secure mooring location for a new research barge in order to accommodate research equipment upgrades. The Proposed Action is needed to support new research, development, testing, and evaluation activities.

This EA analyzes the potential effects on the environment of the Preferred Alternative, Alternative 2, and the no-action alternative. The following resource areas have been addressed in the EA: air quality, noise, water quality and marine sediment, biological resources, marine traffic and transportation, socioeconomics and environmental justice, cultural and historical resources, and American Indian traditions.

For further information, please contact:

Ben Keasler
NEPA Project Manager
NAVFAC Northwest
1101 Tautog Circle, Suite 203
Silverdale, WA 98315

[This page intentionally left blank.]

ACRONYMS AND ABBREVIATIONS

APE	Area of Potential Effect
AQCR	Air Quality Control Region
BMPs	Best Management Practices
BA	Biological Assessment
°C	degrees Celsius
CAA	Clean Air Act
Caltrans	California Department of Transportation
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CNEL	Community Noise Equivalent Level
CNRNW	Commander Navy Region Northwest
CSDS-5	Commander Submarine Development Squadron Five
CSL	Cleanup Screening Level
CO	Carbon Monoxide
CO_2	Carbon Dioxide
$CO_{2\text{-}e}$	CO_2-Equivalent
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
CRM	Cultural Resources Manage
dB	decibel(s)
dB re 20 µPa	decibels relative to 20 micropascals
dBA	A-weighted decibel(s)
dBC	C-weighted decibel(s)
DO	Dissolved Oxygen
DoD	Department of Defense
DPS	Distinct Population Segment
EA	Environmental Assessment
Ecology	Washington State Department of Ecology
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EHW	Explosive Handling Wharf
EIS	Environmental Impact Statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EPNA	environmental designation for noise abatement
ESA	Endangered Species Act
ESU	Evolutionary Significant Unit
°F	degrees Fahrenheit
FHWA	Federal Highway Administration
FHWG	Fisheries Hydroacoustic Working Group
FMC	Fishery Management Councils
FMP	Fisheries Management Plan
FONSI	Finding of No Significant Impact
ft	foot/feet
ft^2	square foot/feet
FR	Federal Register
FY	fiscal year
GHG	Greenhouse Gases
HAP	Hazardous Air Pollutants
HAPC	Habitat Areas of Particular Concern
HCDOP	Hood Canal Dissolved Oxygen Program
Hz	hertz
IHA	Incidental Hazard Assessment
INRMP	Integrated Natural Resources Management Plan
IR	Installation Restoration
kHz	kilohertz
km	kilometer
km^2	square kilometers
Lpeak	Peak Sound Pressure Level
m	meter(s)
MBTA	Migratory Bird Treaty Act
µg/L	micrograms per liter
µPa	micropascal
min	minutes
mg/L	milligram per liter
mL	milliliters
MLLW	mean lower low water
MMPA	Marine Mammal Protection Act
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NAVFAC NW	Naval Facilities Engineering Command Northwest
NAVBASE	Naval Base
Navy	U.S. Navy
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NO_2	Nitrogen Dioxide
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOC	Notice of Construction
NRHP	National Register of Historic Places
NSR	New Source Review

NTU	nephelometric turbidity unit
NWTRC	Northwest Training Range Complex
NWTT	Northwest Training and Testing
OPNAVINST	Chief of Naval Operations Instruction
PAH	polycyclic aromatic hydrocarbons
PCE	primary constituent elements
PFMC	Pacific Fishery Management Council
$PM_{2.5}$	particulate matter <2.5 microns in diameter
PM_{10}	particulate matter <10 microns in diameter
PSAMP	Puget Sound Ambient Monitoring Program
PSCAA	Puget Sound Clean Air Agency
PSD	Prevention of Significant Deterioration
PSWQAT-PSEP	Puget Sound Water Quality Action Team and Puget Sound Estuary Program
PNPTC	Point No Point Treaty Council
RCRA	Resource Conservation and Recovery Act
RDT&E	research, development, test and evaluation
rms	root mean square
ROI	region of influence
s.d.	standard deviation
SEL	sound exposure level
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SMS	Washington State Sediment Management Standards
SO_2	Sulfur Dioxide
SPL	Sound Pressure Level
SQS	Sediment Quality Standards
TOC	Total Organic Carbon
U&A	Usual and Accustomed
U.S.	United States
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USFWS	U.S. Fish and Wildlife Service
VOCs	Volatile Organic Compounds
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WRIA	Water Resource Inventory Area
WSDOT	Washington State Department of Transportation

EXECUTIVE SUMMARY

Naval Base (NAVBASE) Kitsap Bangor is proposing to install pier moorings for a new research barge equipped with upgraded technology necessary for Commander Submarine Development Squadron Five Detachment (CSDS-5), to continue their mission. CSDS-5 is a tenant command at NAVBASE Kitsap Bangor and is the U.S. Navy's technical expert for deep ocean technology and the operational, at-sea application of that technology. The project proponent is NAVBASE Kitsap. NAVBASE Kitsap Bangor is located in Kitsap County on Hood Canal, approximately 20 miles west of Seattle, Washington and east of Silverdale, Washington. The Proposed Action is within the waterfront restricted area in Hood Canal on NAVBASE Kitsap Bangor that provides berthing and support services to Navy submarines and other fleet assets.

PURPOSE AND NEED FOR THE PROPOSED ACTION

The purpose of the Proposed Action is to provide research equipment upgrades to the level and type required by new tasks and research equipment assigned to CSDS-5 at NAVBASE Kitsap Bangor.

The Proposed Action is needed to support the evolution of the CSDS-5 in new research, development, testing and evaluation activities and continuing mission operations. New research, development, testing, and evaluation needs drive the requirements for new equipment. In turn, new equipment and methods require additional infrastructure to house this equipment and associated operations.

ALTERNATIVES CONSIDERED

This Environmental Assessment (EA) addresses two alternatives for the location of mooring facilities for the new research barge. Operations of a new research barge would not change from existing operations; therefore, operations are not discussed further in the EA.

Alternative 1 would install 16 steel pipe piles at the NAVBASE Kitsap Bangor Service Pier and relocate a Port Operations floating pier to the south side of the Service Pier trestle. In addition, the existing mooring dolphin infrastructure that supports the existing barge would be removed and demolished.

Alternative 2 would install anchored pier moorings for the new research barge within a sheltered area along the installation shoreline, south of the Service Pier and Carderock Pier.

The Preferred Alternative site is located on the north side of Carlson Spit (365 meters), but not on the Carlson Spit. Alternative 2 is in the water and south of Carlson (345 meters) and is also not on Carlson Spit.

This EA also evaluates a No-Action Alternative under which no piles would be installed and the research barge would not be moored at NAVBASE Kitsap Bangor. The smaller barge would be maintained on-site and the research activities would continue to be constrained.

The Navy evaluated alternative ways to meet the purpose and need based on several screening criteria. The screening criteria for alternatives focused primarily on location and natural constraints (i.e., depth of water, wave, and wind action), space availability on existing piers, avoidance of obstructing other activities conducted on the waterfront, easy access to moving key equipment on and off the barge, and location (i.e., close proximity to the Service Pier).

Alternative 1 was selected as the Preferred Alternative over Alternative 2 as it provided greater flexibility in adapting to any future change in CSDS-5 missions due to:

- Direct linkage to space on the adjacent dock and Building 7100 on an interim basis;
- Less intertidal zone shading impacts;
- Direct utility connections if there is an increased demand in energy generation for research; and
- Less wave or wind impacts due to the protected area behind the Service Pier.

The Navy considered several additional alternatives that were eliminated from detailed consideration. These included installing new mooring dolphins in the existing barge location, installing pier moorings on the outer harbor (western) side of the Service Pier, or mooring the barge at Delta Pier or other nearby piers. These were eliminated due to their inability to meet the screening criteria.

ENVIRONMENTAL ANALYSIS

The Council on Environmental Quality (CEQ) regulations, the National Environmental Policy Act (NEPA), and Navy instructions for implementing NEPA specify that an EA should only address those resource areas that are potentially significant. In addition, the level of analysis should be commensurate with the anticipated level of environmental impact.

This EA analyzes the potential effects on the environment of the Preferred Alternative, Alternative 2, and the No-Action Alternative. Accordingly, the following resource areas have been addressed in the EA: air quality, noise, water quality, biological resources, marine traffic and transportation, public health and safety, socioeconomics and environmental justice, and cultural and historical resources.

Because potential impacts were considered to be negligible or nonexistent, the following resources were not evaluated in the EA: land use, aesthetics/visual, and utilities. Land use was not considered as the Proposed Action is within the industrial waterfront development. There would be no substantive upland or land use activity associated with the Proposed Action. The Proposed Action would have no impacts to the aesthetic or visual environment associated with the surrounding industrial waterfront and would not impact view sheds from across Hood Canal. The Proposed Action would be limited to existing utility service connections and power lines and require minimal upgrades in the form of onboard power generators. The Proposed Action would not impact public health due to the location in the restricted industrial waterfront area. The Proposed Action would not impact hazardous materials and waste, as there are no hazards materials cleanup sites or generate of hazardous waste.

Each resource area evaluated is briefly described below.

Air Quality

The Preferred Alternative and Alternative 2 would have short-term air emissions from construction vehicle emissions. No new major air emission sources are proposed as part of the action. The action alternatives would not exceed United States (U.S.) Environmental Protection Agency (EPA), Washington State Department of Ecology (Ecology), Puget Sound Clean Air Agency (PSCAA) thresholds, or greenhouse gas (GHG) reporting thresholds. The action alternatives would not have significant adverse air quality impacts. Air emissions would not be significant and would not cause or contribute to a significant air quality impact. The No-Action Alternative would not result in any changes to the environment and would not have an impact on air quality.

Noise

The Preferred Alternative would generate increased noise levels during construction, predominantly during impact pile driving. However, noise generated by the Preferred Alternative would result in a relatively minor increase relative to the ambient conditions (i.e., 70 a-weighted decibels [dBA] – 90 dBA and as high as 99 dBA) that occur on a daily basis at the NAVBASE Kitsap Bangor's industrial waterfront. The noisiest activity (impact pile driving) would be temporary and short-term (20 days of pile driving) and would attenuate down to ambient levels by the time it reaches sensitive noise receptors (residences located approximately 3,700 feet south of the base). Alternative 2 would have minor intermittent noise increases at the location, south of Carlson spit (outside the fenced restricted area of the Service Pier) that would be primarily generated by cranes and increased barge/vessel traffic to accommodate the pier mooring construction. This noise would not impact sensitive noise receptors as any slight increase would attenuate down to ambient by the time it reaches a sensitive noise receptor. Therefore, there would not be impacts to sensitive noise receptors from Alternative 2. The No-Action Alternative would result in no changes to the environment and therefore would result in no impacts. Underwater noise would occur due to the construction activity and is discussed in the Biological Resource element.

Water Quality and Marine Sediment

The Preferred Alternative and Alternative 2 would not involve any withdrawals of groundwater and there would not be stormwater runoff associated with the Proposed Action. Impacts to water quality would be as a result of relatively minor suspension of bottom marine sediments turbidity with limited sediment transport during construction activities. The Preferred Alternative would create localized and temporary marine sediment resuspension from installation of the 16 steel piles to accommodate the new barge and removal of an existing mooring dolphin (40 days total for in-water work). Alternative 2 would result in a smaller and localized area of disturbance with installation of the anchor clumps and construction days would also be less (10 days of in-water work) as compared to the Preferred Alternative. No substantive long-term impacts to water quality or marine sedimentation transporting would result with implementation of either the Preferred Alternative or Alternative 2. The No-Action Alternative would not result in any changes to the environment and would not have long term impacts on water quality or marine sediment quality.

Biological Resources

The Preferred Alternative would have temporary (20 days of pile driving) noise disturbance (airborne and underwater) that could potentially expose Endangered Species Act (ESA)-listed species to harassment noise levels from impact pile driving. Resident and migratory birds (including marbled murrelets) that occur at the NAVBASE Kitsap Bangor waterfront have likely acclimated to existing baseline noise levels that are not much lower than anticipated airborne noise from pile driving. Eelgrass is not present within the proposed project area, but is adjacent to it and thus measures would be implemented to avoid this area. Some macroalgae and benthic invertebrates may inadvertently be impacted by pile driving activity, but no long-term impacts to the population along the waterfront are expected. Fish would likely avoid the area during pile driving and work would be conducted within the in-water work window when juvenile salmonids are not expected to be present. Marine mammals (whales) are not expected in the area as they typically avoid areas of nearshore human activity during construction. Pinnipeds (California sea lions and harbor seals) may be temporarily affected if present within the area during construction and Steller sea

lions are not expected during the construction period. Temporary and localized disturbance to water quality during pile driving would result in a small reduction of macroalgae, but no long-term impacts to Essential Fish Habitat (EFH) are expected.

The determination of impacts on endangered species are that overall, impacts from sediment disturbance, underwater noise, and general changes to water quality would be temporary, localized, and short-term therefore they would not be significant with implementation of the Preferred Alternative. The Navy concludes that the appropriate ESA effects determination for Puget Sound Chinook salmon, Hood Canal summer-run chum salmon, Puget Sound steelhead trout, bull trout, Puget Sound/Georgia Basin bocaccio, canary, yelloweye rockfish, humpback whales, Steller sea lions, marbled murrelet is "may affect, not likely to adversely affect." A "no effect" determination is appropriate for Coastal-Puget Sound Bull trout critical habitat as the closest designated area is in Dabob Bay located on the west side of Toandos Peninsula. With implementation of Best Management Practices (BMPs), in-water work window, marine mammal and marbled murrelet monitoring, and noise attenuation, no significant impacts to biological resources are expected with implementation of the Preferred Alternative.

Alternative 2 would not result in any impacts to birds. Short-term water quality impacts during installation of the anchor clumps, which may cause fish to temporarily avoid the area, would likely result. However, work would be conducted within the allowable work window when juvenile salmonids are least likely to be present and adults would likely navigate by without delay. Therefore, no impacts to ESA-listed salmonids are expected. There would be no impacts to ESA-listed marine mammals or marbled murrelet as only human activity and slight increase in noise from vessel and crane activity would occur. No pile driving is associated with Alternative 2. Temporary disturbance to water quality may affect EFH and installation of anchor clumps would displace unconsolidated sediment EFH potentially used by Pacific Coast groundfish. Areas displaced are small in comparison to adjacent available EFH; thus, no significant impacts to EFH would result. With implementation of BMPs and project minimization measures, no significant impacts to biological resources are expected under Alternative 2.

The No-Action Alternative would not result in any changes to the environment and would have no impacts to biological resources.

Marine Traffic and Transportation

The Preferred Alternative would not adversely affect existing recreational or commercial marine traffic as the existing security barrier currently restricts traffic up to 2,500 ft from the installation shoreline. During construction of the Preferred Alternative, additional marine traffic is estimated at approximately three construction barges per week, which would result in 30-minute cycles for the opening and closing of the Hood Canal Bridge. Each barge, accessing the installation via Hood Canal Bridge, would be scheduled to avoid morning and afternoon peak traffic periods (i.e., 6:00 to 8:30 a.m. and 3:30 to 6:00 p.m.). During construction, the Preferred Alternative would result in short-term increases in vehicular traffic on the surrounding road network and on base internal roadways. While the Preferred Alternative would cause some limited increase in construction vehicles, it would not result in significant impacts to the installation's land transportation network or the adjacent Hood Canal marine transportation network. Because of the relatively minor amount of marine traffic resulting from construction of the Preferred Alternative location, no significant adverse impact to marine traffic is expected. The existing assigned personnel would not change and there is not an anticipated increase in vehicular traffic after construction.

Alternative 2 would have similar impacts, with shorter-term vehicular construction traffic. This alternative, similar to the Preferred Alternative, would add up to three construction barge trips a week transiting the Hood Canal Bridge. From an operational perspective and a proposed location without dockside access, there would be more daily Navy vessel traffic with boat trips to the barge for personnel and materials. However, these daily trips are within the Navy restricted area on the waterfront would not result in significant impacts to the marine transportation network.

There would be no impacts to land or marine traffic under the No-Action Alternative.

Socioeconomics and Environmental Justice

It is not anticipated that construction of the mooring location for the barge would lead to any appreciable change to population, racial composition, or socioeconomics in the area. The Proposed Action does not impact the economic baseline of employment at the installation or in Kitsap County. The Proposed Action would not disrupt adjacent communities during and after construction. The Preferred Alternative and Alternative 2 would be in compliance with Executive Order (EO) 12898 and EO 13045 as no low-income, children, or minority communities exist at the restricted-industrial project location or immediate vicinity, and there would not be a disproportionately high and adverse effect on schools, children, or local communities with implementation of either alternative. There would be no adverse impacts to socioeconomics and environmental justice under the No-Action Alternative.

Cultural and Historic Resources

There are archaeological and architectural resources in the general vicinity identified by past surveys in the Proposed Action area. The Navy conducted field reconnaissance archeological surveys of various tracts of land within the installation in 1992. The field effort involved intensive pedestrian survey of the entire coastline with subsurface inspections due to a high probability for precontact resources. Sampling was conducted along flat and gently sloping shoreline and along waterfront bluffs. The overall waterfront was included in the intensive sampling. This survey resulted in the identification of the 3 documented shell-midden sites. The shell middens were identified on the southern side of the Carlson spit, which is located south of the Preferred Alternative and north of the Alternative 2 project areas; however, the shell middens are upland and would not be impacted by either action alternative from in-water construction.

In addition past surveys identified an architectural resource, Building 7101 (Port Operations Building), upland from the proposed project area and associated with the Service Pier constructed in 2003. The Navy determined that the building was not eligible for nomination to the National Register of Historic Properties (NRHP) in 2010 as it was constructed in the post-Cold War period. The building is upland from the Preferred Alternative and Alternative 2 and would not be impacted by either alternative.

Within the Area of Potential Effects (APE) there are no known or identified cultural or historical resources in the project area. The Navy determined that the Preferred Alternative and Alternative 2 would have no effect on historic properties and submitted an APE and the determination of no effects report for concurrence from the Washington State Historic Preservation Office (SHPO). There would be no adverse impacts to cultural resources under the No-Action Alternative.

American Indian Traditional Cultural Resources

Pursuant to Department of Defense and Navy instructions, the Navy is engaged in government to government consultations with the Skokomish, Port Gamble S'Klallam, Jamestown S'Klallam, Lower

Elwha Klallam, and the Suquamish tribes who have Usual and Accustomed (U&A) fishing grounds and stations that include the project area.

Under the Preferred Alternative and Alternative 2, access to the waterfront area would remain unchanged. The quantity of fish and shellfish inventories would not be significantly impacted. Accordingly, the impacts to Indian resources and tribal treaty rights would be less than significant. There would be no adverse impacts to Indian resources and tribal treaty rights under the No-Action Alternative.

Cumulative Impacts

Implementation of the Proposed Action would have direct impacts to the marine environment. The Proposed Action and other present and reasonably foreseeable future projects would include measures to avoid, minimize impacts, such as in-water construction windows to minimize impacts to salmonids, use of stormwater BMPs to minimize erosion and pollution, marine mammal and bird monitoring, and pile-driving shutdown zones. Additional project-specific impact minimization measures would be required for each project. Although some resources may be subject to potential cumulative significant adverse impacts, the Proposed Action would not substantially contribute to those impacts.

PUBLIC INVOLVEMENT

NEPA requires that environmental information supporting a decision be made available to the public, agencies, and other stakeholders. The Navy's public involvement process for the Proposed Action is designed to inform stakeholders of the Navy's proposed action early in the NEPA process, to provide stakeholders with the opportunity to comment on the Navy's proposed action and assessment of the proposed action and to keep stakeholders informed throughout the NEPA process. This section of the EA summarizes this public involvement process. The Navy's public involvement plan for the proposed action includes the following:

- Public Review of the Draft EA. The draft EA is made available to the public for review and comment. A notice of availability (NOA) is posted in the local newspaper and the draft EA is posted on the internet for review and comment.
- Release of the Final EA and Decision Document. The final EA and decision document are made available to the public. The NOA is posted in the local newspaper for the final EA and decision document are posted on the internet.

CONCLUSION

As summarized above, implementation of the Preferred Alternative or Alternative 2 would not result in significant impacts to any resource area when considered individually in the context of NEPA, including direct, indirect, and cumulative impacts. Implementation of either action alternative, or the No-Action Alternative, would not constitute a "major Federal action significantly affecting the quality of the human environment" and therefore, this EA supports a Finding of No Significant Impact (FONSI) for the Preferred Alternative and the preparation of an Environmental Impact Statement (EIS) is not required.

TABLE OF CONTENTS

CHAPTER 1.0 PURPOSE AND NEED FOR THE PROPOSED ACTION 1-1
1.1 Introduction 1-1
1.2 Location 1-1
1.3 Background 1-1
1.4 Purpose and Need for the Proposed Action 1-4
1.5 Environmental Review Process 1-4
1.5.1 Other Relevant Laws and Regulations 1-4
1.5.2 Scope of the Environmental Assessment 1-5
CHAPTER 2.0 PROPOSED ACTION AND ALTERNATIVES 2-1
2.1 Proposed Action 2-1
2.2 Development of Reasonable Alternatives and Selection Criteria 2-1
2.3 Alternatives Carried Forward 2-1
2.3.1 No-Action Alternative 2-1
2.3.2 Alternative 1 – Service Pier Barge Mooring Location 2-1
2.3.3 Alternative 2 – Anchored Mooring Location 2-7
2.3.4 Selection of Preferred Alternative 2-9
2.4 Alternatives Considered But Eliminated From Further Analysis 2-9
2.4.1 Service Pier Mooring Dolphins 2-9
2.4.2 Service Pier Outer Harbor Location 2-9
2.4.3 Alternative Piers 2-9
2.5 Best Management Practices and Minimization Measures 2-10
2.5.1 Best Management Practices 2-10
2.5.2 Project Minimization Measures 2-10
CHAPTER 3.0 AFFECTED ENVIRONMENT & ENVIRONMENTAL CONSEQUENCES 3-1
3.1 Air Quality 3-1
3.1.1 Regulatory Overview 3-1
3.1.2 Affected Environment 3-2
3.1.3 Environmental Consequences 3-3
3.2 Noise 3-4
3.2.1 Regulatory Overview 3-5
3.2.2 Environmental Consequences 3-8
3.3 Water Quality and Marine Sediments 3-9
3.3.1 Regulatory Overview 3-10
3.3.2 Affected Environment 3-10
3.3.3 Environmental Consequences 3-13
3.4 Biological Resources 3-15
3.4.1 Regulatory Overview 3-15
3.4.2 Affected Environment 3-17
3.4.3 Environmental Consequences 3-40
3.5 Marine Traffic and Transportation 3-65

3.5.1 Regulatory Overview 3-65
3.5.2 Affected Environment 3-65
3.5.3 Environmental Consequences 3-66
3.6 Socioeconomics and Environmental Justice 3-67
3.6.1 Regulatory Overview 3-67
3.6.2 Affected Environment 3-67
3.6.3 Environmental Consequences 3-68
3.7 Cultural Resources 3-69
3.7.1 Regulatory Overview 3-69
3.7.2 Affected Environment 3-70
3.7.3 Environmental Consequences 3-71
3.8 American Indian Traditional Cultural Resources 3-71
3.8.1 Regulatory Overview 3-71
3.8.2 Affected Environment 3-72
3.8.3 Environmental Consequences 3-72
3.9 Summary of Environmental Consequences 3-73
CHAPTER 4.0 CUMULATIVE IMPACTS 4-1
4.1 Past, Present, and Reasonably Foreseeable Projects 4-1
4.2 Assessment of Cumulative Impacts by Resource 4-4
4.2.1 Air Quality 4-4
4.2.2 Noise 4-5
4.2.3 Water Quality 4-5
4.2.4 Marine Sediments 4-6
4.2.5 Biological Resources 4-6
4.2.6 Marine Traffic and Transportation 4-11
4.2.7 Socioeconomics and Environmental Justice 4-11
4.2.8 Cultural Resources 4-11
4.2.9 American Indian Traditional Cultural Resources 4-12
4.3 Conclusion 4-12
CHAPTER 5.0 OTHER CONSIDERATIONS REQUIRED BY NEPA 5-1
5.1 Possible Conflicts Between the Proposed Action and the Objectives of Federal, State, Local, and Regional Land Use Plans, Policies, and Controls 5-1
5.2 Irreversible or Irretrievable Commitment of Natural or Depletable Resources 5-3
5.3 Relationship Between Local Short-Term Use of the Human Environment and Maintenance and Enhancement of Long-Term Natural Resource Productivity 5-3
5.4 Means to Mitigate and/or Monitor Adverse Environmental Impacts 5-4
5.5 Any Probable Adverse Environmental Effects That Cannot Be Avoided and Are Not Amenable To Mitigation 5-5
CHAPTER 6.0 REFERENCES 6-1
CHAPTER 7.0 LIST OF PREPARERS 7-1

List of Figures

Figure 1-1. Vicinity Map 1-2
Figure 1-2. Restricted Areas 1 and 2....1-3
Figure 2-1. Project Area....2-2
Figure 2-2. Alternative 1 – Proposed Relocated and New Infrastructure for Barge Mooring Location....2-4
Figure 2-3. Typical Buoy Anchor....2-7
Figure 2-4. Alternative 2 – Proposed Anchored Mooring Location 2-8
Figure 3-1. Sand lance Spawning Habitat within the Vicinity of the Action Area....3-21
Figure 3-2. Chinook Salmon Critical Habitat within Vicinity of Project Area....3-24
Figure 3-3. Hood Canal Summer-Run Chum Critical Habitat within Vicinity of Project Area 3-26
Figure 3-4. Bull Trout Critical Habitat within Vicinity of Project Area....3-28
Figure 3-5. Pinniped Haul out Sites within Vicinity of Project Area 3-35
Figure 3-6. Distance to Underwater Sound Thresholds for Fish during Impact Pile Driving (48-inch steel piles)....3-49
Figure 3-7. Distance to Underwater Sound Threshold for Fish during Vibratory Pile Driving (48-inch steel piles)....3-50
Figure 3-8. Area Exceeding Underwater Sound Thresholds for Marine Mammals during Impact Pile Driving (48-inch steel piles)....3-53
Figure 3-9. Distance to Underwater Sound Thresholds for Marine Mammals during Vibratory Pile Driving (48-inch steel piles)....3-54
Figure 3-10. Distance to Underwater Sound Thresholds for Marbled Murrelet during Impact Pile Driving (36” and 48” Steel Piles) 3-58
Figure 3-11. Masking Zone for Marbled Murrelet during Impact Pile Driving 3-59
Figure 3-12. Area Exceeding Airborne Sound Thresholds for Pinnipeds during Impact Pile Driving (48” Steel Piles)....3-61
Figure 3-13. Area Exceeding Airborne Sound Thresholds for Pinnipeds during Vibratory Pile Driving (48” Steel Pile) 3-62

List of Tables

Table 2-1. Total Number of Piles Required....2-3
Table 2-2. Physical Features of the Preferred Alternative 2-6
Table 3-1. Estimated Emissions from Off-Road and On-Road Mobile Source Emissions under Preferred Alternative....3-4
Table 3-2. Estimated Emissions from Off-Road and On-Road Mobile Source Emissions under Alternative 2....3-4
Table 3-3. WAC 173-60 Maximum Permissible Environmental Noise Levels....3-6
Table 3-4. Examples of Typical Sound Levels in the Environment 3-6
Table 3-5. Estimated Received Airborne Sound Levels over Water from Impact Pile Driving a 48-inch Steel Pile....3-9
Table 3-6. Hood Canal Water Quality Classification and Criteria 3-11
Table 3-7. Marine Birds within Vicinity of Project Area (Mar-Sept)....3-18

Table 3-8. Survey Total of All Fish Species Caught within the Vicinity of the Project Area 3-20
Table 3-9. ESA Species and Critical Habitat Potentially Present within Vicinity of Proposed Action...3-22
Table 3-10. Fish Species with Designated EFH in Hood Canal 3-39
Table 3-11. Airborne and Underwater Noise Injury and Disturbance Thresholds for Marine Mammals, Fish, and Marbled Murrelets 3-43
Table 3-12 Summary of Sound Levels During the Test Pile Program.....3-44
Table 3-13. Maximum Range to Fish Sound Criteria Thresholds from Pile Driving 3-47
Table 3-14. Distance to Marine Mammal Exposure Thresholds 3-52
Table 3-15. Distance from Piles Where Underwater Noise for Impact Pile Driving Exceeds Marbled Murrelet Threshold.....3-56
Table 3-16. Calculated Distances to and the Area(s) Encompassed by the Non-ESA listed Marine Mammal Noise Thresholds In-Air from Pile Driving Steel Piles 3-60
Table 3-17. Racial Profiles for Washington State, Kitsap County, and Key Cities.....3-68
Table 3-18. Summary of Potential Environmental Consequences by Resource.....3-74
Table 4-1. Past, Present, and Reasonably Foreseeable Future Projects at NAVBASE Kitsap Bangor and the ROI 4-2

APPENDICES

Appendix A: Agency Correspondence
Appendix B: Air Quality Calculations
Appendix C: Coastal Consistency Determination
Appendix D: Biological Assessment and Essential Fish Habitat Assessment
Appendix E: Noise Definitions, Fundamentals of Sound
Appendix F: Incidental Harassment Authorization
Appendix G: Tribal Government to Government Correspondence

CHAPTER 1.0 PURPOSE AND NEED FOR THE PROPOSED ACTION

1.1 INTRODUCTION

The United States (U.S.) Department of the Navy (Navy) has prepared this Environmental Assessment (EA) in accordance with the National Environmental Policy Act (NEPA) of 1969 (42 U.S. Code [USC] §4321-4370h), as implemented by the Council on Environmental Quality (CEQ) Regulations (40 Code of Federal Regulations [CFR] Parts 1500-1508); Navy procedures for implementing NEPA (32 CFR Part 775); and Chief of Naval Operations Instruction (OPNAVINST) 5090.1C CH-1, Environmental Readiness Program Manual. NEPA (42 USC 4321-4370d), requires federal agencies to take into consideration the potential environmental consequences of proposed actions in their decision-making process. The intent of NEPA is to protect, restore, or enhance the environment through well-informed federal decisions.

The Navy proposes to construct a mooring for a new research barge at Naval Base (NAVBASE) Kitsap Bangor, Silverdale, Washington, (Figure 1-1) within the waterfront restricted area in Hood Canal (Figure 1-2). NAVBASE Kitsap Bangor provides berthing and support services to Navy submarines and other fleet assets. The action proponent for the Proposed Action is NAVBASE Kitsap. The Proposed Action includes removal of an existing mooring dolphin, the relocation and addition of floating pier sections, and the installation of 16 steel piles ranging in size from 20 to 48 inches.

1.2 LOCATION

NAVBASE Kitsap Bangor is located in Kitsap County on Hood Canal, approximately 20 miles west of Seattle, Washington (Figure 1-1). The base encompasses approximately 7,186 acres with a mix of industrial, commercial support uses, residential, and undisturbed natural vegetation, with 4.5 miles of waterfront along the eastern shoreline of Hood Canal. The eastern shoreline of Hood Canal is within the Water Resource Inventory Area (WRIA) 15. The western and southern portion of Hood Canal is within the Skokomish-Dosewallips/South Shore Lower Hood Canal WRIA 16/14b.

The base is restricted from public access and portions are restricted for military only operations areas as classified by the U.S. Army Corps of Engineers (USACE). The two restricted areas are: Naval Restricted Areas 1 and 2 (33 CFR 334.1220) (Figure 1-2). Naval Restricted Area 1 covers the area to the north and south along Hood Canal encompassing the NAVBASE Kitsap Bangor waterfront. Naval Restricted Area 2 encompasses the waters of Hood Canal within a circle of 1,000 yards (3,000 feet [ft]) centered at the north end of NAVBASE Kitsap Bangor and partially overlapping Naval Restricted Area 1.Navigation within Naval Restricted Area 2 is not permitted during certain Navy exercises (33 CFR 334.1220).

1.3 BACKGROUND

Commander Submarine Development Group Five (CSDS-5), formerly known as Commander Submarine Development Group 1, is a tenant command at NAVBASE Kitsap Bangor. CSDS-5 is responsible for undersea research, development, test and evaluation (RDT&E) and the associated at-sea technology. CSDS-5 has had a presence at NAVBASE Kitsap Bangor since 1994 when the organization moved from Mare Island Shipyard in California as result of decisions made under the Base Realignment and Closure program. CSDS-5 currently conducts research operations from a barge that was built in 1940.

Figure 1-1. Vicinity Map

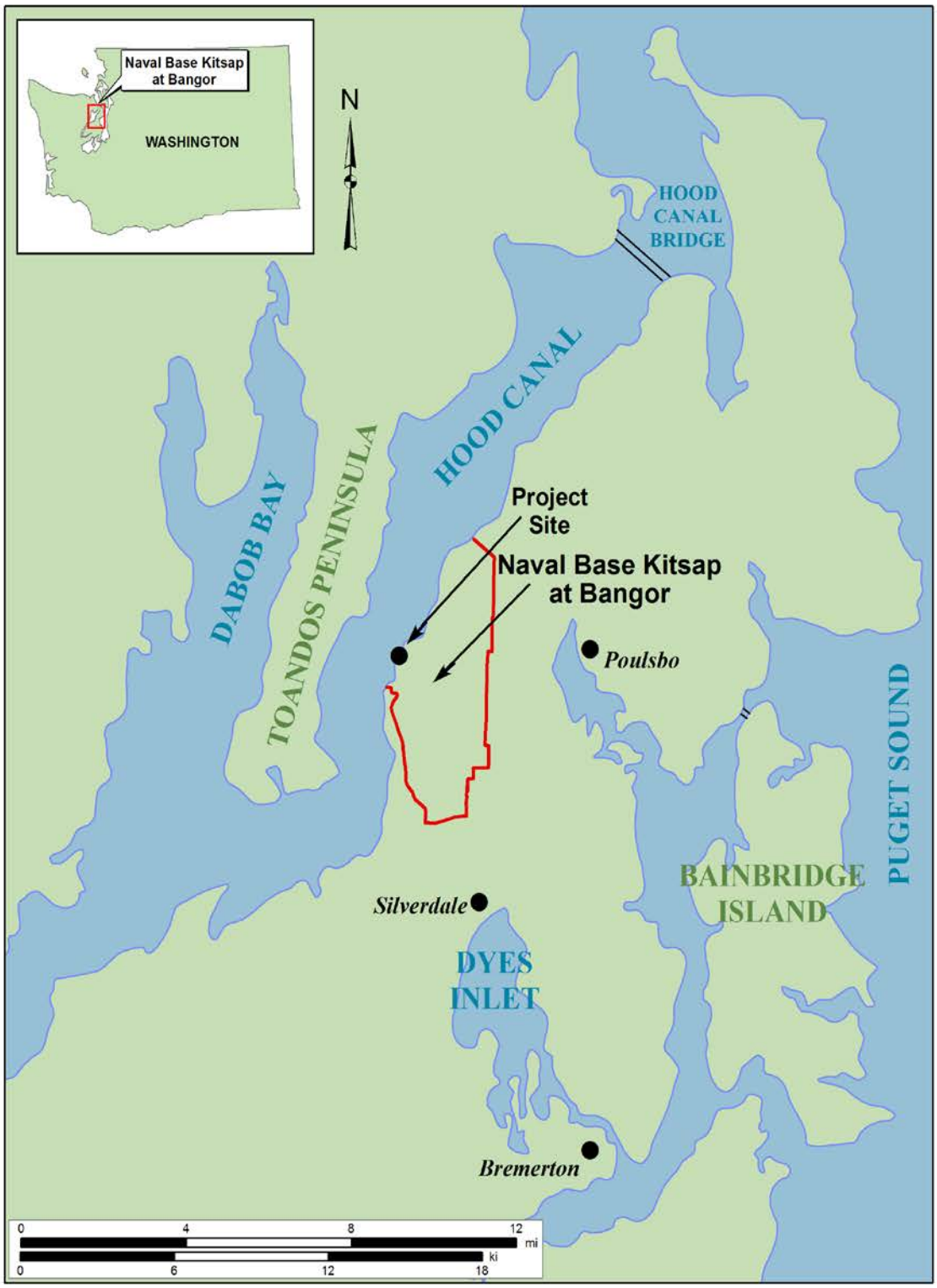
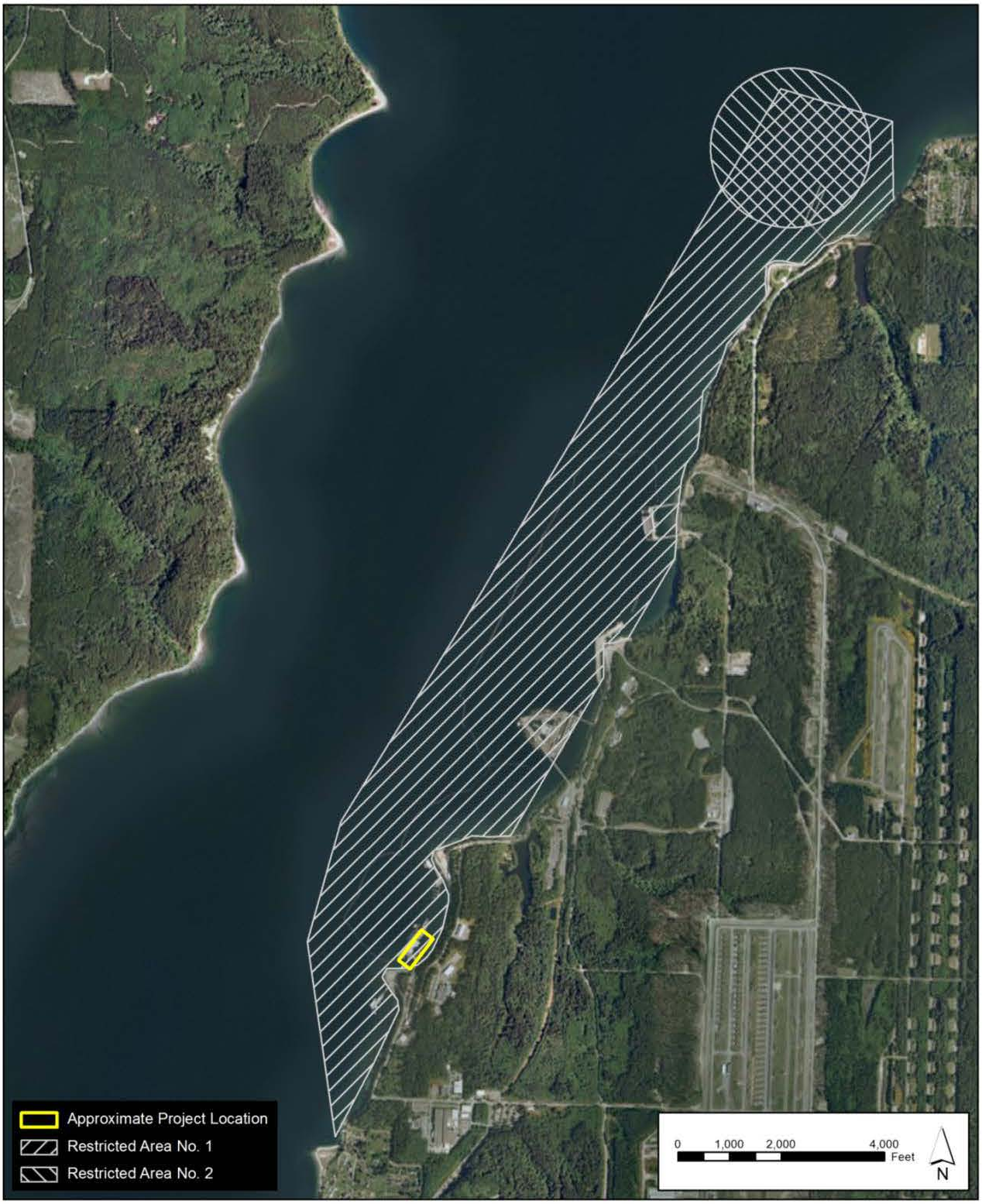


Figure 1-2. Restricted Areas 1 and 2



1.4 PURPOSE AND NEED FOR THE PROPOSED ACTION

The purpose of the Proposed Action is to provide a safe, secure mooring structure for a new barge in order to accommodate research equipment upgrades for CSDS-5.

The need for the Proposed Action is to support the evolution of the CSDS-5 in new research, development, testing and evaluation activities and continuing mission operations. New research, development, testing, and evaluation needs drive the requirements for new equipment. In turn, new equipment and methods require additional infrastructure to house this equipment and associated operations. The specific need is that CSDS-5 requires a mooring location for a new research barge equipped with upgraded technology to continue their mission.

1.5 ENVIRONMENTAL REVIEW PROCESS

1.5.1 Other Relevant Laws and Regulations

As required under NEPA, various federal and state laws, ordinances, rules, regulations, and policies are pertinent to implementation of the Proposed Action. These include, but are not limited to, the following:

- CEQ Regulations for Implementing NEPA (40 CFR 1500-1508)
- Clean Air Act (CAA) (42 USC 7401 et seq.)
- Clean Water Act (CWA), Sections 401 and 404 (33 USC 1251 et seq.)
- Rivers and Harbors Act, Section 10 (33 USC 401 et seq.)
- National Historic Preservation Act (NHPA) (16 USC 470 et seq.)
- Archaeological Resources Protection Act of 1979 (ARPA) (16 U.S.C. § 470aa-mm)
- Native American Graves Protection and Repatriation Act (NAGPRA) (25 U.S.C. § 3001)
- Coastal Zone Management Act (CZMA) (16 USC 1451 et seq.)
- Migratory Bird Treaty Act (MBTA) (16 USC 703-712)
- Endangered Species Act (ESA) (16 USC 1531 et seq., as amended)
- Bald and Golden Eagle Protection Act (16 USC 668-668c)
- Marine Mammal Protection Act (MMPA) (16 USC 1361-1421h, as amended)
- Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 USC 1801-1882)
- Executive Order (EO) 12088, Federal Compliance with Pollution Control Standards
- EO 13148, Greening the Government through Leadership in Environmental Management
- EO 13175, Consultation and Coordination with Indian Tribal Governments
- EO 12898 Federal Actions to Address Environmental Justice (50 Federal Register 7629 [Sect. 1-101]
- EO 13045 Protection of Children from Environmental Risks and Safety Risks (62 Federal Register 1985)

A description of the Proposed Action's consistency with these policies and regulations is presented in Chapter 5.0 (Table 5-1).

1.5.2 Scope of the Environmental Assessment

This EA includes an evaluation and analysis of potential environmental impacts associated with two action alternatives and the No-Action Alternative. Operations of the existing barge were previously considered in the Construction of Supporting Shore and Waterfront Facilities for USS Parche Environmental Assessment (Navy 1994). Operations of the new barge would not change in tempo, types of activities performed, or personnel required to support the barge. Research, development, testing, and evaluation (RDT&E) activities are being further evaluated in the ongoing Environmental Impact Statement for NWTT (Northwest Training and Testing) and therefore, this EA does not include those activities.

The following resources were not carried forward for analysis in this EA as potential impacts were considered to be negligible or non-existent:

Land Use – The Proposed Action would be consistent with existing land uses. The land use on the Service Pier is industrial and is consistent with the surrounding industrial waterfront development. There would be no substantive upland or land use activity associated with the Proposed Action. Therefore, no impacts to land use with implementation of the Proposed Action are anticipated.

Aesthetics/Visual Resources –The piles and the barge would be consistent with the visual quality of adjacent NAVBASE Kitsap Bangor infrastructure and industrial waterfront development. In addition, the pier mooring piles and research barge are located on the east side and behind the existing Service Pier building and would not be visible to the public from boats on Hood Canal or the western shoreline. The Proposed Action would have no impacts to the aesthetic or visual environment associated with the surrounding industrial waterfront and would not impact view sheds from across Hood Canal. Therefore, no impacts to aesthetics or visual resources with implementation of the Proposed Action are anticipated.

Utilities – The Proposed Action would not require upgrades to existing utility service connections and power lines. Therefore, no impacts to utilities with implementation of the Proposed Action are anticipated.

Public Health - The Proposed Action would not affect public health because it would be located entirely within the Naval Restricted Area of an industrial waterfront where there is no public access. During construction and operation of the proposed action, applicable Navy regulations to protect the health and safety of military and civilian personnel would be strictly followed. Therefore, no impacts to public health and safety are anticipated.

Hazardous Materials and Waste - There are no known hazardous materials at the alternative locations, the Proposed Action is within an industrial restricted area, and hazardous materials use and hazardous waste generated from the project would be managed in accordance with federal and state regulations and base instructions. Therefore, there would be no impacts involving hazardous materials and waste.

[This page intentionally left blank.]

CHAPTER 2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

The Navy proposes to install piles and implement other improvements at the NAVBASE Kitsap Bangor Service Pier that would support the mooring of a new research barge. At the present time, CSDS-5 conducts its research equipment operations from an existing 115 ft x 35 ft barge built in 1940, and currently moored adjacent to Building 7100 (Figure 2-1). A new barge measuring 260 ft x 85 ft would be used to accommodate new research equipment. The Proposed Action would provide a safe, secure location for the mooring of the new barge in order to continue to fulfill mission requirements and accommodate new technology.

2.2 DEVELOPMENT OF REASONABLE ALTERNATIVES AND SELECTION CRITERIA

When evaluating potential action alternatives for the Proposed Action, the Navy's goal was to balance its mission and operational requirements while minimizing environmental impacts. All potential alternatives were evaluated against the following screening criteria:

1. Construction based on location and natural constraints (depth of water, wave and wind action);
2. Space availability on piers;
3. Obstruction of other Navy marine vessels movement and activities conducted on the waterfront;
4. Easy access to moving key equipment on and off the barge;
5. Location of close proximity to the Service Pier;
6. Maintain dockside access to fleet ships during assigned missions, 24 hours a day, 7 days a week;
7. Ability to adapt to and support future mission requirements; and,
8. Impacts to other missions at NAVBASE Kitsap Bangor.

2.3 ALTERNATIVES CARRIED FORWARD

2.3.1 No-Action Alternative

Under the No-Action Alternative, the new moorage would not be constructed and the new barge would not be moored at NAVBASE Kitsap Bangor. As required under NEPA, the No-Action Alternative is carried forward as a baseline for the analysis in this EA.

2.3.2 Alternative 1 – Service Pier Barge Mooring

Under Alternative 1, existing infrastructure at the Service Pier would be relocated or removed and 16 steel pipe piles would be installed to accommodate mooring a new barge. The project consists of three components: the relocation and addition to the Port Operations Pier, the removal of existing infrastructure, and the installation of the new barge mooring piles. The following sections describe in more detail the specific components of this alternative.

Figure 2-1. Project Area

2.3.2.1 Relocated and New Infrastructure

In order to accommodate the new CSDS-5 research barge, some portions of the Port Operations floating pier would be relocated to the south side of the Service Pier trestle[1]. This would require removing six 9 ft x 12 ft floating pier sections/modules running east-west on the north side of the trestle and placing them in a north-south orientation on the south side of the trestle. In addition, seven new modules (five added to the end of the relocated section and two installed in an east-west orientation) would be installed to complete the Port Operations infrastructure (Figure 2-2). Anchoring of the relocated and new floating pier modules would require the installation of three 24-inch diameter hollow steel pipe piles. Finally, a new 12 ft x 16 ft concrete transformer pad would be constructed and supported by four 20–inch diameter hollow steel pipe piles. The total area of relocated infrastructure would be 648 square feet (ft^2) and total area of new infrastructure would be 948 ft^2.

2.3.2.2 Pile Installation

The new mooring would be located at the east side of the Service Pier at approximately -20 ft to -30 ft mean lower low water (MLLW) (Figure 2-2). The new barge would be moored by five 36-inch diameter and four 48-inch diameter hollow steel pipe piles. Table 2-1 shows the maximum number of piles required to complete the entire project.

All piles would be installed at the eastern side of the service pier and would include:

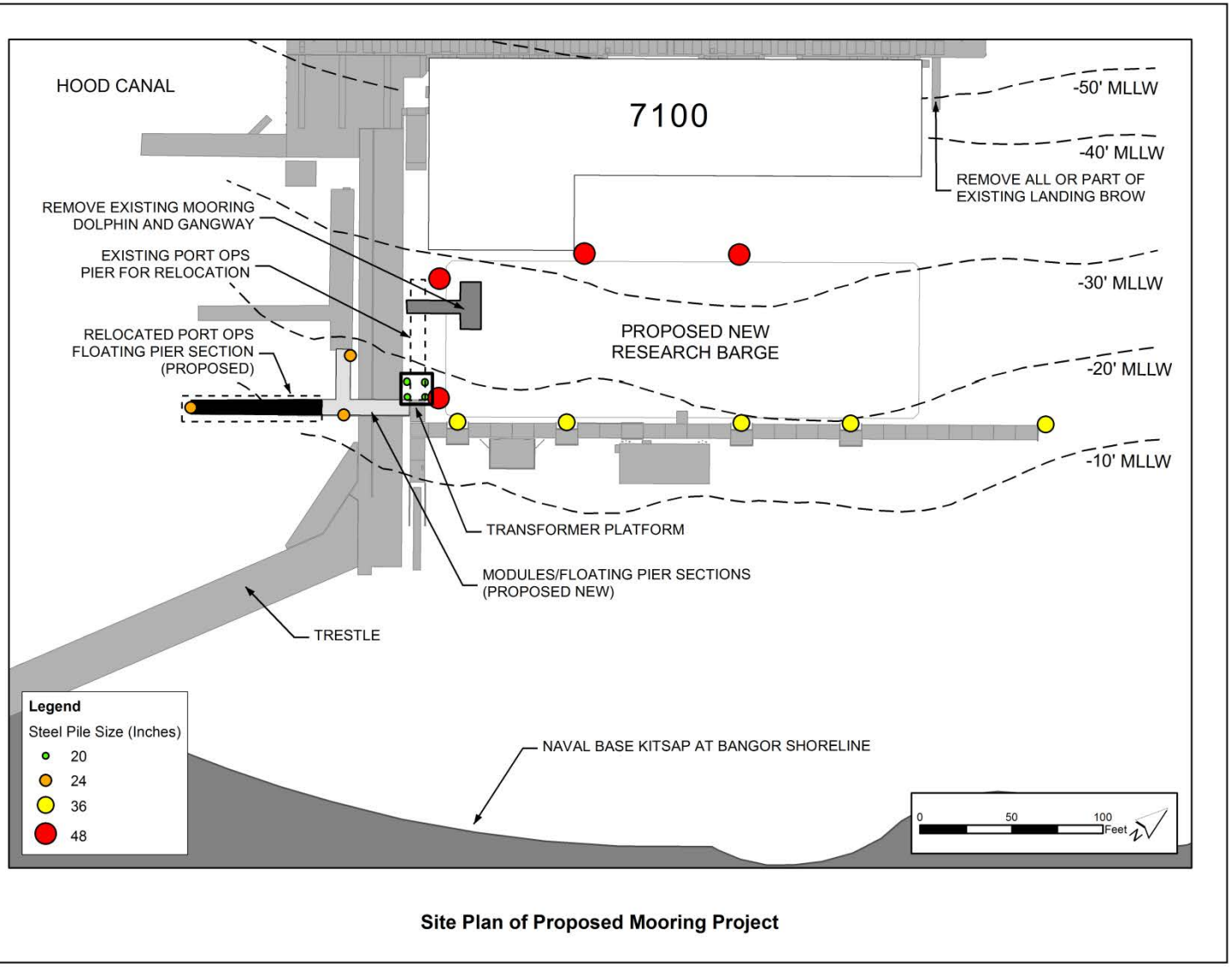
- Four 20-inch diameter steel pipe piles approximately 100 ft (30.48 meters) long would be driven to a depth of approximately 55 ft;
- Three 24-inch diameter steel pipe piles approximately 60 ft (18.29 meters) long would be driven to a depth of approximately 34 ft;
- Five 36-inch diameter steel pipe piles approximately 100 ft (30.48 meters) long would be driven to a depth of approximately 55 ft; and
- Four 48-inch diameter steel pipe piles approximately 115 ft (35.05 meters) long would be driven a the depth of approximately 70 ft. If any of the piles are out of engineering tolerance standards, they would be removed by cutting or pulling and reinstalled.

Table 2-1. Total Number of Piles Required

Pile Size	*Total Number Required*
20-inch diameter	4
24-inch diameter	3
36-inch diameter	5
48-inch diameter	4
Total piles	16
Total area	104 ft^2

[1] A trestle is a framework of vertical, slanted supports and horizontal crosspieces supporting a bridge or road.

Figure 2-2. Alternative 1 – Proposed Relocated and New Infrastructure for Barge Mooring Location



2.3.2.3 Removed/Demolished Infrastructure

Existing infrastructure to be removed under this alternative encompasses at least 1,023 ft^2 of overwater coverage and 29 ft^2 of seafloor displaced by piles, and includes the following:

- Concrete mooring dolphin and pile cap located north of the proposed relocated floating pier modules and the gangway from the concrete mooring dolphin (totals 512 ft^2).
    - Concrete that makes up the dolphin would be carefully separated and removed from the pile dolphin.
- Eight steel piles including six 24-inch diameter steel batter piles and two 30-inch diameter steel vertical piles (totals 29 ft^2).
    - One 24-inch steel pile would be removed with the use of vibratory pile driving equipment.
    - The remaining piles would be removed by cutting them at the mudline with hydraulic shears or by a diver utilizing a thermal lance, followed by a crane lifting them out of the water for proper disposal.
- Fenders and two electrical pedestals located on existing Port Operations dock.
- At least 511 ft^2 of additional floats and brow infrastructure no longer required for existing barge. Removed infrastructure could include, but would not be limited to, the following:
    - Pedestrian brow (barge landing brow) - 4 ft x 45 ft (totals 180 ft^2).
    - Pedestrian brow floats – three 8 ft x 12 ft floats (totals 288 ft^2).
    - Maintenance platform float – 10 ft x 12 ft (totals 120 ft^2).
    - Other floats.

2.3.2.4 Physical Features of the Preferred Alternative

The relocation of six existing floating pier sections to the south side of the trestle would not result in additional overwater coverage. As discussed in Sections 2.3.2.1. and 2.3.2.2, new infrastructure and piles comprise an area of overwater coverage and sea floor area totaling 1,052 ft^2. As discussed in Section 2.3.2.3, removed/demolished infrastructure and piles comprise an area of overwater coverage and sea floor area totaling 1,052 ft^2. As such, implementation of the Preferred Alternative would result in no net change in overwater coverage and seafloor area displaced by piles (Table 2-2).

2.3.2.5 Project Schedule

In-Water Work Window

In-water work for Alternative 1 would occur during the in-water work window for Tidal Reference Area 13, which occurs from July 16 through February 15 (USACE 2010). However, a condensed window would be adhered to (July 16 – September 30) in order to include conservation for forage fish and to avoid Steller sea lions. NAVBASE Kitsap Bangor fish surveys in the 1970s and 2005 – 2008 indicated that greater than 95 percent of the juvenile salmonids migration is complete prior to this window and forage fish are only present in very low numbers (Schreiner et al. 1977, Bax et al. 1978, Salo et al. 1980, Bax 1983, SAIC 2006, Bhuthimethee et al. 2009a).

Table 2-2. Physical Features of the Preferred Alternative

Feature	*Area/Quantity*
Existing Relocated Port Operations Float (-10 to -20 ft MLLW)	648 ft^2 [a]
New Port Operations Float Sections (-10 to -20 ft MLLW)	756 ft^2
New Transformer Platform	192 ft^2
Number of in-water piles to support barge mooring	13
Number of in-water piles to support Port Operations floating pier	3
Area of piles to be installed	104 ft^2
Area of gangway/mooring dolphin removed	(-512 ft^2)
Area of existing floats and landing brow removed	(-511 ft^2)[b]
Removal of piles associated with an existing mooring dolphin (-20 to -30 ft MLLW)	8
Area of piles removed	(-29 ft^2)
Total Area of New Overwater Coverage from relocated Port Operations and new Transformer Pad (-10 to -20 ft MLLW) 756 ft^2 +192 ft^2 - (512 ft^2) – (511 ft^2)	(-75 ft^2)
Total Area of Seafloor Displaced by Piles 104 ft^2 – (29) ft^2	75 ft^2
Net change in overwater coverage and seafloor area displacement	0 ft^2
Total Pile Driving Days	20 days
Total Days of In-Water Construction (July 16 – Sept 30)	40 days
Total Duration of In-Water Construction (July 16 – Sept 30)	76 days

a. Relocation of existing floats would not result in additional overwater coverage.

b. At least 511 ft^2 of the existing floats and landing brow would be removed to provide a net-zero change in overwater coverage and seafloor displacement.

Project Duration

Construction duration for the overall project is estimated to not exceed 76 days between July 16 and September 30. No more than 16 piles ranging in diameter from 20 to 48 inches would be installed following relocation and demolition of existing infrastructure. Based on the glacial till that the piles will be driven into, up to 4 additional piles could be installed to replace piles that do not meet engineering standards. It is anticipated that 4 piles could be driven per day with an expected average of 500 strikes per pile, resulting in 2,000 pile strikes per day. Piles would primarily be installed using a vibratory pile driver[2]. Impact pile driving[3] would follow to reach required depth and to verify load-bearing capacity ("proofing"). It is anticipated that only 20 workdays would be required for pile driving and the in-water work could be completed in 8 weeks/40 workdays. As mentioned above, all in-water work would begin on or shortly after July 16 with anticipated overall project completion by the end of September 2013.

[2] Vibratory pile drivers use hydraulic-powered weights to vibrate a pile until the surrounding sediment liquefies; this enables the pile to be driven into the ground using the weight of the pile plus the pile driver.

[3] Impact hammer pile drivers use a rising and falling piston to repeatedly strike a pile and drive it into the substrate.

2.3.3 Alternative 2 – Anchored Mooring

Under Alternative 2, an anchored mooring location would be created for the new barge south of the Service Pier and Carderock Pier, in a sheltered area along the shoreline (Figures 2-3 and 2-4). The new anchor moorings clumps and buoys are essentially large screws. To install mooring clumps for the buoys, the anchor clumps would be rotated into the bottom sediment from a surface vessel using an extended shaft connected to each anchor and turning the anchors until they reach the required depth within the seafloor. This alternative would require installing approximately 8 anchor clumps and 4 buoys and is anticipated to take no longer than 10 days. Alternative 2 would not require the three major components of Alternative 1 of relocating the Port Operations Pier, the removal of existing infrastructure, and the installation of the research barge mooring piles.

Figure 2-3. Typical Buoy Anchor

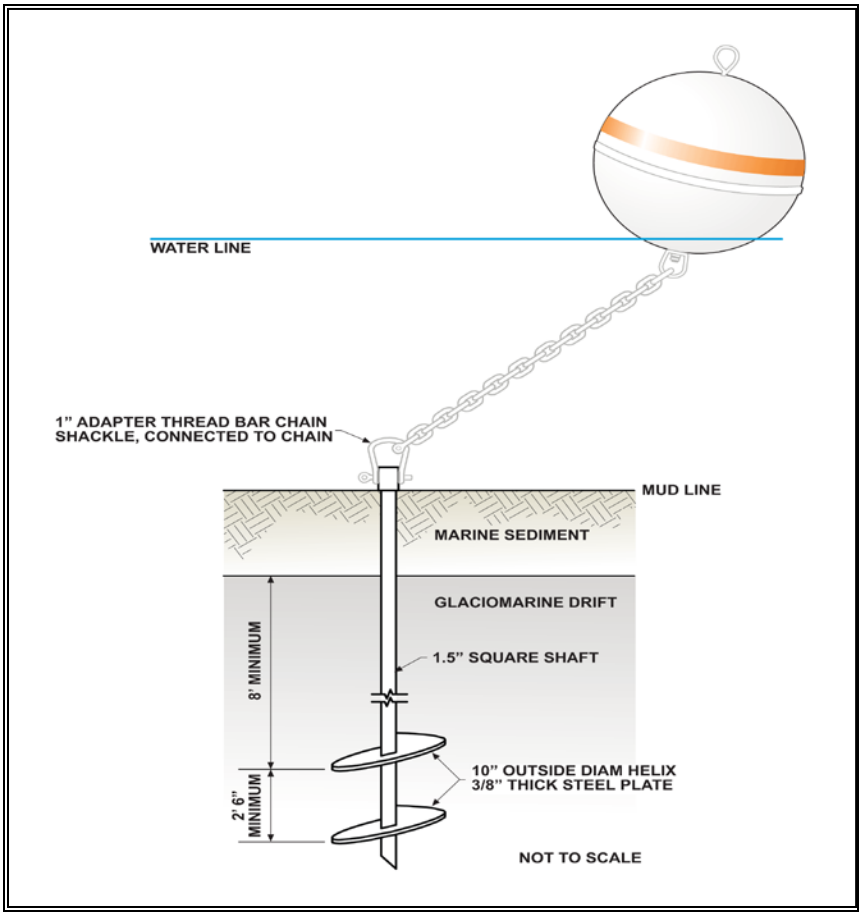


Figure 2-4. Alternative 2 – Proposed Anchored Mooring Location

2.3.4 Selection of Preferred Alternative

Alternative 1 meets all 8 of the screening criteria and Alternative 2 meets 7 of the 8 screening criteria listed Section 2.2. Beyond these screening criteria, Alternative 1 was selected over Alternative 2 due to greater flexibility in adapting to any future change in CSDS-5 missions due to:

- Avoiding obstruction of Navy marine vessels movement and activities conducted on the waterfront;
- Location in close proximity to the Service Pier;
- Direct linkage to space on the adjacent dock and Building 7100 on an interim basis;
- Direct utility connections if there is an increased demand in energy generation for research; and
- Less wave or wind impacts due to the protected area behind the Service Pier.

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER ANALYSIS

Alternatives that were considered but eliminated from further analysis because they did not satisfy the selection criteria include:

1) Service Pier Mooring Dolphins;
2) Service Pier Outer Harbor Location; and,
3) Alternative Piers.

Each alternative and how they did not meet the screening criteria is described below.

2.4.1 Service Pier Mooring Dolphins

Under this alternative, mooring dolphins would be installed within the same general location where the existing barge is currently moored. Due to the size requirement of the new barge, the alternative was eliminated as the mooring dolphins would not support the new barge, and there is not enough physical space to support it.

2.4.2 Service Pier Outer Harbor Location

Under this alternative, a mooring location would be placed on the outer harbor (western) side of the Service Pier. However, pier space is limited and placing the barge on the western side would impact critical space for current missions on the Service Pier. This alternative would create obstructions for access and would require continual shifting of the research barge. In addition, wave-on-wave action on the western side was determined to be a safety concern and a detriment to the primary operational research mission of the barge. Revisions to the existing Port Security Barrier would be required, resulting in added cost and temporary bottom disturbance in the area of the Port Security Barrier anchors during construction.

2.4.3 Alternative Piers

Placement of a moorings location at the Delta Pier or other nearby piers was also considered. However, use of other existing piers would conflict with current missions carried out at NAVBASE Kitsap Bangor. The location needs to be within close proximity to submarines assigned to CSDS-5. Other piers in the vicinity were determined to have insufficient area to moor the barge.

2.5 BEST MANAGEMENT PRACTICES AND MINIMIZATION MEASURES

2.5.1 Best Management Practices

Implementation of the Proposed Action or alternatives would include incorporation of the following Best Management Practices (BMPs) to avoid or minimize any potential environmental impacts.

- To reduce the likelihood of any petroleum products, chemicals, or other toxic or deleterious materials from entering the water, fuel hoses, oil or fuel transfer valves and fittings would be checked regularly for drips or leaks, and will be maintained and stored properly to prevent spills.
- All chemicals, liquid products, petroleum products, and other wastes present at the construction site would be covered, contained, and protected.
- Any spills would be handled according to Commander Navy Region Northwest (CNRNW) Instruction 5090.1, *Integrated Contingency Plan* and reported pursuant to Navy protocols.

2.5.2 Project Minimization Measures

Project minimization measures are used to reduce or minimize impacts that are unavoidable, for example, applying buffers around sensitive habitat types and habitat features that are important to sensitive species or by using a bubble curtain to reduce underwater sound from impact pile driving. The following minimization measures are proposed for this project:

- Where eelgrass is present in the vicinity of the project area, the Navy will provide the contractor with plan sheets showing eelgrass boundaries. The following restrictions would be enforced in areas designated as eelgrass:
    - No anchoring or line dragging would occur, and
    - Spuds would be used to elevate barges during low tides in order to avoid grounding or sediment scour.
- To minimize the number of fish exposed to underwater noise and other construction disturbance, in-water work would occur during an abbreviated in-water work window (July 16 through September 30) when juvenile ESA-listed salmonids and forage fish are least likely to be present. Steller sea lions are not expected to be present within the project area during this time period.
- To minimize impacts to foraging marbled murrelets during their nesting season, impact pile driving would occur between 2 hours after sunrise and end 2 hours before sunset July 16 through September 23. The in-water work window would be adjusted between September 24 and September 30, with work occurring from sunrise and sunset.
- To the maximum extent practicable, a vibratory hammer would be used for the pile driving actions.
- To attenuate noise, a bubble curtain, or similar device, would be used during impact pile driving operations. The bubble curtain would be turned on prior to initiation of pile strikes in an effort to flush fish and marine mammals away from the injury zone near the pile. The bubble curtain would remain on during the entire active pile driving effort.
- A floating surface boom and silt curtains would be deployed during demolition and construction activities to contain and collect debris.

- Developed in coordination with the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) and approved by these agencies prior to initiation of in-water work, a Marine Mammal Monitoring Plan and Marbled Murrelet Monitoring Plan would be prepared and finalized. Implementation of these plans would prevent exposure to potentially injurious noise levels.
    - Monitoring would occur within pre-determined shutdown zones for purposes of avoiding injurious effects. Marine mammal monitoring would take place from 15 minutes prior to initiation through 15 minutes post-completion of pile driving. Marbled Murrelet monitoring would take place from 30 minutes prior to initiation through 30 minutes post-completion of impact pile driving. Should a marine mammal or marbled murrelet enter the shutdown zone, pile driving would be immediately halted until the marine mammal or marbled murrelet has left the area.

[This page intentionally left blank.]

CHAPTER 3.0 AFFECTED ENVIRONMENT & ENVIRONMENTAL CONSEQUENCES

Information presented in this chapter represents the baseline conditions of the affected environment. This chapter also presents an assessment of the potential impacts, or environmental consequences, of implementing the alternatives within the affected environment. To evaluate impacts, the analysis presented in this chapter overlay the components of the alternatives described in Chapter 2.0 onto baseline conditions within the region of influence (ROI). In compliance with NEPA, CEQ regulations, and Navy procedures for implementing NEPA, the description of the affected environment and environmental consequences focuses only on those resources potentially subject to impacts. Accordingly, the resources evaluated include air quality, noise, water quality and marine sediments, biological resources, marine traffic and transportation, socioeconomics and environmental justice, cultural resources, and American Indian traditional cultural resources.

Table 3-18, located at the end of this chapter, summarizes environmental consequences by resource area, for each of the alternatives, to provide a comparison of potential impacts.

3.1 AIR QUALITY

For the purposes of this analysis, the ROI for air quality is defined as the Puget Sound Interstate Air Quality Control Region (AQCR) (40 CFR 81.32). This AQCR includes the Washington counties of King, Snohomish, Pierce, and Kitsap; NAVBASE Kitsap Bangor is located in Kitsap County. Air quality in Kitsap County is protected by federal regulations administered by the U.S. Environmental Protection Agency (EPA), state regulations administered by Ecology and the regional clean air agency, Puget Sound Clean Air Agency (PSCAA). PSCAA serves all of the Puget Sound Interstate AQCR (PSCAA 2011).

Air quality impacts would be significant if emissions exceed 250 tons/year for all criteria pollutants, or 25 tons/year cumulative emission of hazardous air pollutants (HAPs) (or 10 tons/year of any individual HAP). These impact thresholds are used as threshold for significance because if the action alternative pollutant emissions exceed the threshold it would be comparable to a major stationary source of air pollution and would have similar effects on ambient air quality (USEPA 2010e).

3.1.1 Regulatory Overview

Under the CAA, as amended, states are responsible for enforcing the established air quality regulations. As required by the CAA Amendments of 1990, Washington State has prepared a State Implementation Plan (SIP). The SIP is a compilation of goals, strategies, schedules, and enforcement actions that help lead a state into compliance with the National Ambient Air Quality Standards (NAAQS). Areas not in compliance with the NAAQS can be declared nonattainment areas by the EPA or by the appropriate state or local agency. Areas in compliance with the NAAQS are defined as being in attainment. Areas that have been reclassified from nonattainment to attainment are designated as attainment/maintenance areas. Areas that lack the monitoring data to demonstrate attainment or nonattainment status are designated as unclassified and are treated as attainment areas for regulatory purposes.

The PSCAA enforces air pollution regulations and sets guidelines, as contained in the Washington SIP, to attain and maintain the NAAQS and Washington State Ambient Air Quality Standards.

3.1.1.1 General Conformity Rule

As described in 40 CFR Part 51, *Determining Conformity of General Federal Actions to State or Federal Implementation Plans* (the "General Conformity Rule"), and all federal actions occurring in air basins designated in nonattainment or in a maintenance area must conform to an applicable implementation plan. Kitsap County is not designated as a non-attainment or maintenance area by the EPA (USEPA 2010b); therefore, a General Conformity Rule review would not be performed.

3.1.1.2 Hazardous Air Pollutants and Toxic Air Pollutants

In addition to the ambient air quality standards for criteria pollutants, national standards exist for HAPs. HAPs are pollutants that may cause cancer or other serious health effects and have adverse ecological or environmental effects. Examples of HAPs include benzene, which is found in gasoline, methylene chloride, which can be used as a solvent and paint stripper, and particulate matter released by diesel engines. The majority of HAPs are volatile organic compounds (VOCs) (USEPA 2009).

3.1.1.3 New Source Review and Prevention of Significant Deterioration Programs

As part of the CAA amendments of 1977, Congress established the New Source Review (NSR) program. This program is designed to ensure that air quality is not significantly degraded from the addition of new and modified factories, industrial-sized boilers, power plants, and other major industrial stationary sources. (USEPA 2010c).

The construction activities associated with the Proposed Action are temporary mobile sources and would not be evaluated with respect to Class I PSD areas. Further, no new major stationary emission sources are constructed as a result of the Proposed Action. Therefore, NSR requirements are not carried forward in the air quality analysis. However, NAVBASE Kitsap Bangor would be responsible for permitting any small stationary sources (e.g., boilers) if required by PSCAA regulations. The PSCAA is responsible for issuing Notice of Construction (NOC) permits for proposed stationary sources. The NOC permits are required for stationary air contaminant-generating equipment and air pollution control equipment. PSCAA Regulation I Section 6.03 discusses the specific type of equipment that would require permits. If a proposed project needs an NOC permit, a permit application must be filed with the PSCAA and approval from the agency must be obtained prior to construction of the stationary source.

3.1.2 Affected Environment

Air pollutant emissions from NAVBASE Kitsap Bangor are primarily from stationary sources (i.e., external combustion boilers, fuel storage and transfer operations, etc.). The sources at the installation do not have aggregate potential emissions in excess of thresholds. NAVBASE Kitsap Bangor currently operates under a Synthetic Minor Air Permit. They are required by PSCAA to do a 12-month rolling average of criteria pollutant emissions and report these emissions to PSCAA. The NAVBASE Kitsap Bangor has consistently demonstrated compliance with these facility-wide emissions limits.

Air quality is defined as the ambient air concentrations of specific pollutants determined by the EPA, Ecology, and PSCAA to be of concern to the health and welfare of the general public. The specific pollutants include the criteria pollutants and HAPs. Further detail is provided in Appendix B.

The criteria pollutants include ozone, carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter less than 10 microns in diameter (PM_{10}), particulate matter less than 2.5 microns

in diameter ($PM_{2.5}$), and lead. NAAQS have been established by the EPA for these criteria pollutants (USEPA 2010a). Further detail is provided in Appendix B.

3.1.3 Environmental Consequences

The pollutants considered in the impact analysis include the criteria pollutants and HAPs. In order to assess the air quality impacts of the Preferred Alternative or Alternative 2, emissions for each phase of construction were evaluated. Appendix B includes the detailed emission calculations used to quantitatively assess the air quality impacts of these two alternatives. For the purposes of the air quality analysis, the analysis is based upon worst case scenario that construction activities associated with the Preferred Alternative and Alternative 2 would occur for approximately three months.

The primary source of pollutant emissions is heavy marine construction equipment and associated construction vehicles. Particulate matter emissions, which are technically categorized into PM_{10} and $PM_{2.5}$, are evaluated as total particulate matter for this impact analysis. Project construction equipment would emit minor amounts of HAPs that could potentially impact public health. The main source of air emissions would occur in the form of diesel exhaust organic gases and particulates from the combustion of diesel fuel. Due to the mobile and intermittent operation of proposed diesel-powered construction equipment over a construction area and the lack of sensitive receptors in the immediate vicinity of the construction, this equipment would produce minimal ambient impacts to the localized area, and would not be expected to expose sensitive receptors to significant pollutant emissions.

Air emissions from the Proposed Action would primarily be due to the operation of heavy equipment and construction vehicles during construction activities. There would be no new long-term sources of air pollution after construction that would be introduced as part of the Proposed Action. No new stationary equipment would be used onsite during the construction activities. Therefore, the analysis is limited to mobile source emissions. The methodology and assumptions used in the air quality analysis are detailed in Appendix B.

3.1.3.1 No-Action Alternative

Under the No-Action Alternative, the construction and use of the barge mooring location for the proposed new research barge would not occur. Baseline air quality would remain unchanged. Therefore, no significant impacts to air quality would occur with implementation of the No-Action Alternative.

3.1.3.2 Preferred Alternative

Under the Preferred Alternative, emissions were calculated for the construction work period using a conservative scenario that encompasses at least 20 work days for pile driving as well as set up time. Total emissions generated were compared to the impact thresholds. As shown in Table 3-1, the estimated emissions that would result with implementation of the Preferred Alternative do not exceed impact thresholds. Therefore, no significant impact to air quality would occur with implementation of the Preferred Alternative.

Table 3-1. Estimated Emissions from Off-Road and On-Road Mobile Source Emissions under Preferred Alternative

	VOC (tons/yr)	*NOx (tons/yr)*	*CO (tons/yr)*	*SO_2 (tons/yr)*	*$PM_{(total)}$ (tons/yr)*
Preferred Alternative	0.10	0.74	3.75	0.09	0.24
Significant Impact Threshold	25	250	250	250	250
Exceed Threshold (Significant Impact)	No	No	No	No	No

3.1.3.3 Alternative 2

Alternative 2 is differentiated from the Preferred Alternative by location and by the number of mooring anchors/buoys, which would require a shorter installation period and less equipment. Emissions calculated for the construction for Alternative 2 were compared to the impact thresholds. As shown in Table 3-2, the estimated emissions that would result during the phases of Alternative 2 do not exceed impact thresholds. Therefore, no significant impacts to air quality would occur with implementation of Alternative 2.

Table 3-2. Estimated Emissions from Off-Road and On-Road Mobile Source Emissions under Alternative 2

	VOC (tons/yr)	*NOx (tons/yr)*	*CO (tons/yr)*	*SO_2 (tons/yr)*	*$PM_{(total)}$ (tons/yr)*
Alternative 2	0.003	0.01	0.05	0.005	0.14
Significant Impact Threshold	25	250	250	250	250
Exceed Threshold (Significant Impact)	No	No	No	No	No

3.2 NOISE

For this analysis, the ROI for noise is the upland portion of NAVBASE Kitsap Bangor industrial waterfront and the immediately adjacent nearshore region of the Hood Canal. Underwater noise is described in this section with impacts as they relate to fish and wildlife (including marine mammals and special-status species), are discussed in Section 3.4.3.

The threshold of significance for noise impacts would be exceedances of an applicable noise threshold at a sensitive receptor (e.g., residential land uses, nursing homes, hospitals, etc.). An example of noise threshold of significance would be construction activities exceeding 75 decibels (dB) for over an hour adjacent to a residence or hospital, which are defined as sensitive noise receptors. The noise impact analysis considers the peak noise generated at the source and then determines how this noise propagates or travels to the sensitive noise receptor including attenuation for distance and terrain. The received sound level at a sensitive noise receptor is compared to the applicable noise thresholds to determine the effects of noise.

Generally, noise is measured in units called decibels (dB); however, a number of factors affect how the human ear perceives sound: the actual level of noise, frequency, period of exposure, and fluctuations in noise levels during exposure. The dB system of measuring sound provides a simplified relationship between the physical intensity of sound and its perceived loudness to the human ear. The dB scale is logarithmic; therefore, sound intensity increases or decreases exponentially with each dB of change. For example, 10 dB yields a sound level 10 times more intense than 1 dB, while 20 dB is 100 times more intense, and 30 dB is 1,000 times more intense. Human speech is normally around the 60 dB level.

Sound levels are typically used to assess impacts to humans and thus are weighted (A-weighting) and expressed as dBA to correspond to the same frequency range that humans hear (approximately 20 hertz (Hz) to 20 kilohertz (kHz). A-weighting is typically applied to measuring noise for activities such as construction engine equipment and industrial ship yard activities. For low-frequency sounds that can cause vibrations, a C-weighting metric is used; denoted as dBC. Both metrics screen out very high and low sound frequencies that cannot be heard by humans. The perceived sound level changes as the subject's distance from the source increases. Therefore, the metrics are given in varying sound levels based on distance. Airborne noise levels are expressed in decibels relative to 20 micropascals and the units are listed as: (dB re 20 µPa).

Average noise exposure is often presented as a Community Noise Equivalent Level (CNEL). The CNEL is the energy-averaged sound level of all sound exposure values within a 24-hour period; with a 10 dB penalty assigned to noise events occurring between 10 p.m. and 7 a.m. to compensate for the increased annoyance associated with the occurrence of nighttime noise events. Most people are exposed to sound levels of 50–55 dB CNEL or higher on a daily basis. Studies conducted to determine noise impacts to various human activities have revealed that approximately 87 percent of the population is not significantly bothered by sound levels below 65 dB CNEL (FICON 1992).

3.2.1 Regulatory Overview

Section 4(b) of the Noise Control Act of 1972 (42 USC 4901 *et seq*.) directs federal agencies to comply with applicable federal, state, and local noise requirements with respect to the control and abatement of environmental noise. Washington State has standards and regulations to control and abate environmental noise. Washington Administrative Code (WAC) Chapter 173-60 updated December 2000 sets the requirements for Maximum Environmental Noise Levels. The rules are pursuant to the Noise Control Act of 1974. Vessels are exempt under WAC 173-60, but are regulated under the Washington code for recreational vessels. WAC 173-60 sets maximum permissible noise levels based on the type environmental designation for noise abatement (EDNA). There are three classes of EDNA:

- Class A: Lands where human beings reside and sleep.
- Class B: Lands involving uses requiring protection against noise interference with speech. Includes but is not limited to retail services, banks and office buildings, community services, and dining establishments.
- Class C: Lands involving economic activities of such a nature that higher noise levels are anticipated. Worker safety is protected under the Department of Labor and Industries health and safety programs. Includes but is not limited to warehouses, distribution facilities, industrial facilities, and agriculture.

The maximum permissible noise levels are shown below in Table 3-3.

WAC 173-60 lists sources exempt from the provisions of WAC 173-60 from the hours of 7:00 a.m. to 10:00pm. These sources are still required to meet requirements for Class A EDNAs listed in WAC 173-60 from 10:00 p.m. to 7:00am. These sources include but are not limited to sounds originating from temporary construction sites as a result of construction activity and sound originating from forest harvesting.

Table 3-3. WAC 173-60 Maximum Permissible Environmental Noise Levels

EDNA of Noise Source	*EDNA of Receiving Property*		
	Class A	**Class B**	**Class C**
Class A	55 dBA 45 dBA (between 10:00 p.m. and 7:00 a.m.)	57 dBA 47 dBA (between 10:00 p.m. and 7:00 a.m.)	60 dBA 50 dBA (between 10:00 p.m. and 7:00 a.m.)
Class B	57 dBA	60 dBA	65 dBA
Class C	60 dBA	65 dBA	70 dBA

Source: WAC 173-60-040

Kitsap County also has codes related to noise. Kitsap County Code Chapter 10.28 Noise includes the codes related to noise control. Kitsap County follows a designation of EDNAs very similar to WAC 173-60 and has identical Maximum Permissible Environmental Noise Levels (see Table 3-3). Kitsap County Code also exempts sounds originating from temporary construction sites as a result of construction activity from complying with the Maximum Permissible Environmental Noise Levels between the hours of 7:00a.m. and 10:00pm.

3.2.1.1 Noise Perception

Responses to noise vary widely not only according to the type of noise and the characteristics of the sound source, but also according to the sensitivity and expectations of the receptor, the time of day, and the distance between the noise source (e.g., aircraft) and the receptor (e.g., a person or animal). Noise impacts can result from perceptible changes in the overall noise environment that increase annoyance or affect human health. Annoyance is a subjective impression of noise wherein people apply both physical and emotional variables. To increase annoyance, the cumulative noise energy must increase measurably. Table 3-4 presents sound levels in dBA for typical sounds found in the environment and the reaction that might occur when a person (or receptor) is exposed to this noise.

Table 3-4. Examples of Typical Sound Levels in the Environment

Source (at a given distance)	*Sound Level (dBA)*	*Typical Reaction/Perception*
Civil Defense Air Siren (100 ft [30 m])	140	Pain
	130	
Impact Pile Driver (50 ft [15 m])	110	Maximum Vocal Effort
Vibratory Pile Driver (50 ft [15 m])	101	Very Annoying/ Discomfort
Jack Hammer (50 ft [15 m])	88	
Garbage Disposal (3 ft [0.9 m])	80	Intrusive
Alarm Clock		
Vacuum Cleaner (3 ft [0.9 m])	70	
Light Traffic (50 ft [15 m])	60	Able to Continue Normal Speech
Bird Calls (Distant)	40	Quiet
Soft whisper (5 ft [1.5 m])	30	
Human Breathing	20	Just Audible
	10	

Sources: Center for Hearing and Communication 2010; FHWA 2011b; WSDOT 2012

3.2.1.2 Effects of Noise

Prolonged exposure to very high levels of environmental noise can cause hearing loss. The EPA has established a protective level of 70 dBA, below which hearing is conserved for exposure over a 40-year

period (USEPA 1981). Environmental noise indirectly affects human welfare by interfering with sleep, thought, and conversation. The Washington State Maximum Permissible Environmental Noise Levels are based on speech interference, which is a well-documented impact that is relatively reproducible in human response studies.

Noise sources occur in two forms:

- Point sources, such as stationary equipment or individual motor vehicles; and
- Line sources, such as a roadway with a large number of mobile point sources (motor vehicles).

Sound generated by a stationary point source typically diminishes (attenuates) at a rate of 6 dBA for each doubling of distance from the source to the receptor at acoustically "hard" sites, and at a rate of 7.5 dBA at acoustically "soft" sites (WSDOT 2012). A "hard" or reflective site does not provide any ground-effect attenuation and is characteristic of asphalt, concrete, water, and very hard packed soils. When ground cover or normal unpacked earth exists (i.e., vegetation) between the source and receptor, the ground becomes absorptive to noise energy and "soft" site conditions are present. Construction noise behaves as a point-source and propagates in a spherical manner, with distance attenuation as previously described. Sound levels also attenuate due to barriers such as terrain, buildings, or vegetation. Construction noise would vary depending on the construction process, type, and condition of equipment used, and layout of the construction site.

3.2.1.3 Underwater Noise

A number of sources of underwater noise exist in the vicinity of the project site. Ambient noise by definition is background noise and it has no single source or point. Ambient noise varies with location, season, time of day, and frequency. Ambient noise is continuous, but with much variability on time scales ranging from less than 1 second to 1 year (Richardson et al. 1995). Sources of ambient underwater noise are typically, naturally caused and include wind, waves, precipitation, and biological sources such as shrimp, fish, and cetaceans. Noise derived from biological organisms can be absent or dominant over narrow and broad frequency ranges. Precipitation can contribute up to 35 dB to the existing sound level, and increases in wind speed of 5 to 10 knots can cause a 5 dB increase in ambient ocean noise across most frequencies (Urick 1983). The highest noise levels occur in nearshore areas where the sound of surf can increase underwater noise levels by 20 dB or more within 600 ft from the surf zone in the 200 Hz to 2 kHz regime (Wilson et al. 1985).

In addition to noise in the air, underwater noise can be produced by human-induced noise such as vessel operations, aircraft, dredging, filling, pile driving, and general construction activities.

3.2.1.4 Affected Environment

NAVBASE Kitsap Bangor is an active military base located adjacent to Hood Canal. The sound environment is influenced by the natural environment such as wind, surf, and marine traffic. However, the primary source of sound in the environment is military activities such as waterfront operations, movement of people and military vehicles at the base, and the various industrial activities that occur at the shoreline facilities. The baseline airborne noise levels that occur at NAVBASE Kitsap Bangor on the waterfront range from 60 to 104 dBA, with an average of approximately 64 dBA (Navy 2010c). The majority of the daily ambient sound at the base that is considered noise is generated by human activities and is typical of an industrial area. The industrial area would be considered an EDNA Class C. Activities include

movement of marine vessels and heavy trucks, operation of equipment (such as cranes, forklifts, and other mechanized equipment), various industrial activities occurring at the shoreline and upland facilities, and general traffic. Evening and nighttime levels ranged from 64 to 96 dBA, with an average level of approximately 64 dBA (Navy 2010c). Measured levels were comparable to estimated noise levels from literature. Per published literature, presuming multiple sources of noise may be present at one time; maximum combined levels may be as high as 99 dBA. This assumes that two similar sources combined together will increase noise levels by 3 dB over the level of a single piece of equipment by itself (WSDOT 2012). These maximum noise levels are intermittent in nature and not present at all times. Existing maximum baseline noise conditions at the waterfront during a typical work week are expected to be approximately 99 dBA due to typical truck, forklift, crane, and other industrial activities. Average baseline noise levels are expected to be in the 70-90 dBA range, consistent with urbanized or industrial environments where equipment is operating.

There are residences, which would be considered sensitive noise receptors (Class A EDNA), approximately 3,700 feet south of the Proposed Action area and that are somewhat blocked by an upland outcropping into Hood Canal. These residences would be considered sensitive receptors for noise analysis purposes. The nearest Class B EDNA potential receptor is approximately 3,100 feet to the south of the Proposed Action area and also would be considered receptor for noise analysis purposes.

3.2.2 Environmental Consequences

3.2.2.1 No-Action Alternative

Under the No-Action Alternative, the construction and use of the barge mooring location for the proposed new research barge would not occur. Baseline noise levels in the project area would remain unchanged. Therefore, there would be no changes in the noise environment with implementation of the No-Action Alternative.

3.2.2.2 Preferred Alternative

There are no sensitive receptors directly in the vicinity of the Preferred Alternative location (within 50 feet). The pile driving and all other construction and installation activities associated with this alternative would occur between 7:00 a.m. and 10:00 p.m., unless otherwise specified for impact minimization to nesting marbled murrelets (see Section 2.5.2). Proposed activities would be short-term and would not exceed 8 weeks/40 workdays for the in-water work window with a projected 20 days for pile driving activity. In addition, only personnel directly associated with the project would be within a distance where appropriate ear protection would be required and used.

Proposed pile driving would result in increased airborne noise in the vicinity of the construction site. Maximum peak levels would be generated during impact pile driving, estimated to be 105 dBA re 20 µPa at a distance of 50 ft (15 m) from the pile. Other construction activities or equipment, such as cranes, diesel trucks, and generators would also cause noise; however, this noise level would be lower compared to noise produced by the impact pile driver (WSDOT 2012). In the absence of pile driving noise, maximum construction noise would be 94 dBA re 20 µPa at a distance of 50 ft (15 meters) from the activity, computed as the summation of noise of all equipment operating simultaneously (WSDOT 2012). The closest sensitive receptor is a residential neighborhood approximately 0.5 mile (2,640 ft/805 m) south of the proposed construction activity. Impact pile driving would generate the most noise disturbance to these sensitive noise receptors. This construction activity is considered a point source activity that would

generate noise over a hard site (i.e., water) to sensitive noise receptors. Using the attenuation rate described above (Section 3.2.1.2), sound generated by a stationary point source typically diminishes (attenuates) at a rate of 6 dBA for each doubling of distance from the source to the receptor at acoustically "hard" sites, and at a rate of 7.5 dBA at acoustically "soft" sites. Therefore, impact pile driving noise would attenuate down to approximately 70 dBA at 0.5 miles (2,640 ft/805 meters) from impact pile driving activity (Table 3-5) which is consistent with the EPA's established protective level (USEPA 1981).

Table 3-5. Estimated Received Airborne Sound Levels over Water from Impact Pile Driving a 48-inch Steel Pile

Distance ft (m)	*Received Sound Level (dBA)*
50 (15)	105
100 (30)	99
200 (61)	93
400 (122)	87
800 (244)	81
1,600 (488)	75
3,200 (975)	69

All installation activities associated with the Preferred Alternative would follow the general intent of Washington State noise regulations concerning Maximum Permissible Noise Levels. Construction activities associated with the Preferred Alternative would occur between the hours of 7:00 a.m. and 10:00 p.m. Monday through Saturday (except when otherwise noted for the protection of marbled murrelet foraging; see Section 3.4 - Biological Resources). Based on the short term nature of the construction and the construction activities occurring within the noise level exemption times of 7:00a.m. to 10:00pm, no significant impacts to sensitive noise receptors from airborne noise would occur under the Preferred Alternative.

3.2.2.3 Alternative 2

Under Alternative 2, potential noise impacts would be substantially lower as pile driving activity would not be required. Noise generated would come from barges and cranes used to install the anchor clumps. As with the Preferred Alternative, there are no sensitive receptors within the vicinity of the Alternative 2 location. Proposed construction activities would be short-term and in-water would not exceed 10 days. In addition, only personnel directly associated with the project would be within a distance where appropriate ear protection may be required and used. Construction activities would occur between the hours of 7:00 a.m. and 10:00 p.m. meeting the requirements for exemption from WAC 173-60 Maximum Permissible Environmental Noise Levels. Therefore, there would be no impacts to sensitive receptors from airborne noise with implementation of Alternative 2.

3.3 WATER QUALITY AND MARINE SEDIMENTS

The ROI for water quality and marine sediments is the eastern shoreline of Hood Canal, WRIA 15. Hood Canal is a saltwater inlet of Puget Sound with currents driven primarily by costal and inter-waterway tides, but is also affected by winds, freshwater inflow, and water density differences.

The threshold of significance of adverse effects on water quality and marine sediments are defined by the CWA, the Washington State Sediment Management Standards (SMS), and the Marine Sediment Quality Standard (SQS), (e.g., temperature, dissolved oxygen, turbidity, and pH). For marine sediment, identified chemical breakdown, grain size of sediments and level of turbidity (e.g., less than 5 nephelometric turbidity units) are applied in assessing marine sediment impacts.

3.3.1 Regulatory Overview

Water quality describes the chemical and physical composition of water as affected by natural conditions and human activities. The Federal Water Pollution Control Act Amendments of 1972, as amended in 1977 and 2002, and commonly known as the CWA, established the basic structure for regulating discharges of pollutants into waters of the United States. The CWA contains the requirements to set water quality standards for all contaminants in surface waters. The EPA is the designated regulatory authority to implement pollution control programs and other requirements of the CWA. However, EPA has delegated regulatory authority for the CWA to Ecology for the implementation of pollution control programs, as well as other CWA requirements.

The SMS (WAC 173-204) provides the framework for the long-term management of marine sediment quality. The purpose of the SMS is to reduce and ultimately eliminate adverse biological impacts and threats to human health from sediment contamination. The SMS establishes standards for the quality of sediments as the basis for management and reduction of pollutant discharges by providing a management and decision making process for contaminated sediments.

The Marine SQS (WAC 173-204) established by the SMS includes numeric criteria using bulk contaminant concentrations and biological impacts criteria based on sediment bioassays that define the lower limit of sediment quality expected to cause no adverse impacts to biological resources in Puget Sound. The SMS Cleanup Screening Levels (CSL) (WAC 173-204) consist of numeric chemical concentration and biological impacts criteria that represent cleanup thresholds. Bulk sediment concentrations between the SQS and CSL values require further investigation to determine whether actual adverse impacts exist at a site due to contaminated sediments.

3.3.2 Affected Environment

NAVBASE Kitsap Bangor includes two main watersheds. The smaller Clear Creek watershed drains the southeastern portion of the installation. All runoff from this watershed flows into Clear Creek, which discharges into Dyes Inlet approximately three miles downstream of the base. The larger Hood Canal watershed streams flow westward into several steep drainages that empty into Hood Canal (van Heeswijk and Smith 2002).

Freshwater inflow into Hood Canal consists of groundwater, stormwater outfalls, and creeks and rivers. Principal rivers discharging to Hood Canal are the Dosewallips and the Duckabush (south and southwest of NAVBASE Kitsap Bangor). Five small streams discharge to Hood Canal from the base, three of which flow through Cattail Lake, Hunter's Marsh and Devils Hole Lake. A series of stormwater outfalls discharge much of the overland flow from the western portion of the installation to Hood Canal.

Artesian seeps along the shore cliff faces of NAVBASE Kitsap Bangor provide additional freshwater input to Hood Canal. These seeps have a positive effect on water quality and tend to reduce salinity levels along the NAVBASE Kitsap Bangor shoreline (Kahle 1998).

3.3.2.1 Water Quality

Temperature

Monthly mean surface water temperatures along the NAVBASE Kitsap Bangor waterfront were measured between July 2005 and June 2006 (except the months of October to November) (Phillips et al. 2009). Temperatures for the nearshore locations (water depth ranging from 1 to 60 m) met extraordinary quality standards during the winter months (January to May 2006) and excellent quality standards during the summer months (July to September 2005 and June 2006).

Hood Canal was designated as an extraordinary quality water body by Ecology. Because of this designation, Ecology requires any action (federal, state, local, and/or private) to maintain the standards shown in Table 3-6.

Table 3-6. Hood Canal Water Quality Classification and Criteria

Water Quality Classification	***Water Quality Criteria***			
Aquatic Life	*Temperature*[1]	*Dissolved Oxygen*[2]	*Turbidity*[3]	*pH*
Extraordinary Quality[4]	13°C (55°F)	7.0 mg/L	+5 NTU or +10%[4]	7.0 – 8.5[6]
Excellent Quality [5]	16°C (61°F)	6.0 mg/L	+5 NTU or +10%[4]	7.0 – 8.5[7]
Good Quality [6]	19°C (66°F)	5.0 mg/L	+10 NTU or +20%[5]	7.0 – 8.5[7]
Fair Quality [7]	22°C (72°F)	4.0 mg/L	+10 NTU or +20%[5]	6.5 – 9.0[7]
Coliform Bacteria				
Shellfish Harvesting	Geometric mean not to exceed 14 MPN/100 mL fecal coliforms[8]			
Recreation				
Primary Contact	Geometric mean not to exceed 14 MPN/100 mL fecal coliforms[8]			
Secondary Contact	Geometric mean not to exceed 70 MPN/100 mL enterococci[9]			

Notes:

°C - degrees Celsius, °F - degrees Fahrenheit, mg/L - milligrams per liter, mL – milliliters, NTU - nephelometric turbidity units

1. 1-day maximum (°C). Temperature measurements should be taken to represent the dominant aquatic habitat of the monitoring site. Measurements should not be taken at the water's edge, the surface, or shallow stagnant backwater areas.
2. 1-day minimum (mg/L). When dissolved oxygen (DO) is lower than the criteria or within 0.2 mg/L, then human actions considered cumulatively may not cause the DO to decrease more than 0.2 mg/L. DO measurements should be taken to represent the dominant aquatic habitat of the monitoring site. Measurements should not be taken at the water's edge, the surface, or shallow stagnant backwater areas.
3. Measured in NTU; point of compliance for non-flowing marine waters — turbidity not to exceed criteria at a radius of 150 ft from activity causing the exceedances.
4. 5 NTU over background when the background is 50 NTU or less; or 10% increase in turbidity when background turbidity is more than 50 NTU.
5. 10 NTU over background when the background is 50 NTU or less; or 20% increase in turbidity when the background turbidity is more than 50 NTU.
6. Human-caused variations within range must be less than 0.2 units.
7. Human-caused variations within range must be less than 0.5 units.
8. No more than 10% of all samples used to calculate geometric mean may exceed 43 most probable number (MPN)/100 milliliters (mL); when averaging data, it is preferable to average by season and include five or more data collection events per period.
9. No more than 10% of all samples used to calculate geometric mean may exceed 208 MPN/100 mL; when averaging data, it is preferable to average by season and includes five or more data collection events per period.

Source: WAC 173-201A as amended in November 2006.

Dissolved Oxygen

Concentrations of dissolved oxygen (DO) in extraordinary quality marine surface waters, such as those in northern Hood Canal, should exceed 7.0 milligrams per liter (mg/L) of DO, allowing for only 0.2 mg/L reductions in the natural condition by human-caused activities (WAC 173-201A).

The 2008 CWA Section 303(d) list includes five segments within northern Hood Canal impaired by low DO levels. Two of these segments are located along the NAVBASE Kitsap Bangor waterfront. The low DO for both of those segments is believed to be due to or influenced by human actions (Ecology 2009). However, these stations are offshore in deep water and would not necessarily be representative of nearshore conditions at the NAVBASE Kitsap Bangor waterfront.

Although some waters along the NAVBASE Kitsap Bangor waterfront are on the 303(d) list, mean DO measurements during July 2005 through June 2006 indicate that nearshore stations at the waterfront consistently met extraordinary quality standards for DO. From July 2005 through June 2006 and January 2007 through April 2008, DO levels met the extraordinary standard for surface waters (0 to 20 ft in depth) year round and for deep water (66 to 197 ft in depth) most of the year. (Deeper waters can drop to only a fair standard for DO in late summer). However, in late summer-early fall, DO levels drop from typical ranges of approximately 6 to 10 mg/L to a range of 4.7 to 9.1 mg/L (Phillips et al. 2009). The variation in mean DO measurements for deeper waters (66 to 197 ft in depth) near the project site was consistent with DO patterns within the rest of Hood Canal. During the late summer and early fall period (July through September 2005), mean DO measurements met fair to excellent quality standards. At 66 to 197 ft in depth, these measurements are on the upper range of low DO conditions measured historically throughout Hood Canal during the late summer and fall periods. Mean DO measurements at 66 to 197 ft in depth from March through May 2006 met extraordinary quality standards (HCDOP 2011).

Turbidity

Washington State-designated extraordinary quality marine surface waters should have an average turbidity reading of less than 5 nephelometric turbidity units (NTU) (WAC 173-201A). Turbidity measurements were collected along the NAVBASE Kitsap Bangor waterfront, including the vicinity of the project site, from July 2005 through May 2006, except for October to December 2005 (Phillips et al. 2009). These mean monthly turbidity measurements for both nearshore and offshore waters ranged from 0.7 to 3 nephelometric turbidity units and were consistently within the Washington State standards for extraordinary quality.

3.3.2.2 Marine Sediments

Marine sediments at NAVBASE Kitsap Bangor may be derived from several sources, including the identified runoff from the above referenced five local streams at the base that discharge to Hood Canal, stormwater discharges, and erosion of shoreline areas not protected by bulkheads (URS Consultants, Inc. 1994). In-water structures (i.e., wharves, piers, floats, ramps, and groins) can alter long shore sediment transport by decreasing water velocity, resulting in sediment accumulation along one side of an obstruction. Offshore structures that alter wave energy (i.e., breakwaters, floats, and moored vessels) reduce erosion along the shore and allow drift sediment to accumulate. As natural wave and current action gradually move fine sediment from intertidal to subtidal elevations, the upper intertidal substrate gradually coarsens, and its slope steepens without new sources of sediment to replace the finer material (Downing 1983). This condition is present along portions of the NAVBASE Kitsap Bangor shoreline,

where coarse gravel and cobble beaches occur throughout intertidal elevations and finer sands and silts occur within subtidal elevations.

Information on existing sediment quality within the action area is based on grain size measurements and chemical analyses of sediments collected during sediment investigation studies during 2007. In general, marine sediments along the NAVBASE Kitsap Bangor shoreline are composed of gravelly sands with some cobbles in the intertidal zone, transitioning to silty sands in the subtidal zone (Hammermeister and Hafner 2009).

Existing Marine Sediment Quality

Sediment parameters, such as total organic carbon (TOC), metals, and organic contaminants, were used to characterize sediment quality at NAVBASE Kitsap Bangor. TOC, which provide a measure of how much organic matter occurs in the sediments, was less than 1 percent near the project site. A range of 0.5 to 3 percent is typical for Puget Sound marine sediments, particularly those in the main basin and in the central portions of urban bays (PSWQST-PSEP 1997).

Concentrations of metals in sediments found near the project area are comparable to background levels for Puget Sound and below sediment quality guidelines (e.g., SQS and CSL values) (Hammermeister and Hafner 2009). In addition, concentrations of polycyclic aromatic hydrocarbons (PAHs) were below the corresponding SQS and CSL values.

Concentrations of other classes of organic contaminants, such as chlorinated aromatics, phthalate esters, phenols, and other miscellaneous extractable compounds, typically were at or below the analytical detection limits and consistently below the SQS and CSL values. Results from the 2007 sediment investigation confirm that, with a few exceptions, sediment quality at NAVBASE Kitsap Bangor is within SQS standards (Hammermeister and Hafner 2009).

3.3.2.3 Hazardous Materials in Marine Sediment

As related to water quality, hazardous materials can impact sediments and DoD developed the Installation Restoration (IR) Program in 1986 to identify, assess, characterize, and clean up or control contamination from past hazardous waste disposal operations and hazardous materials spills at Navy installations. Currently there are no known active IR Sites on NAVBASE Kitsap Bangor or within the waterfront vicinity of the Proposed Action area. However, two known Superfund cleanup sites are located on NAVBASE Kitsap Bangor. The first site, Bangor Ordnance Disposal (USEPA ID# WA7170027265), is located approximately 5 miles northeast of the project area. The second Superfund site, NAVBASE Kitsap Bangor (USEPA ID# WA5170027291), is located approximately 3 miles southeast of the project area. Cleanup has been conducted at both sites and they have been classified as *Construction Complete*, meaning cleanup has been completed. Although human exposure hazards are completely remediated at both sites, on-going groundwater monitoring continues due to residual contamination (USEPA 2011a, b).

3.3.3 Environmental Consequences

3.3.3.1 No-Action Alternative

Under the No-Action Alternative, the construction and use of the barge mooring location for the proposed new research barge would not occur. Baseline conditions for water quality and marine sediments would remain unchanged. Therefore, no significant impacts to water quality and marine sediments would occur with the implementation of the No-Action Alternative.

3.3.3.2 Preferred Alternative

Construction-related impacts to water quality with implementation of the Preferred Alternative would be short-term, temporary, and localized changes associated with re-suspension of bottom sediments from pile installation and tug operations, such as anchoring and propeller wash, as well as accidental losses or spills of construction materials or fuel into Hood Canal. These changes would be spatially limited to the construction area, including areas potentially impacted by anchor drag and areas immediately adjacent to the Service Pier. Potential effects would be plumes of re-suspended bottom sediments that are not expected to violate applicable state or federal water quality standards.

During the vibratory and impact pile driving activities, BMPs (See Section 2.5) would be used to avoid and minimize deleterious materials from entering the water. NAVBASE Kitsap Bangor has an approved Spill Management Plan (Navy 2006) and a regional Integrated Spill Contingency Plan (Navy 2010a) currently in place. Accidental spills or discharges of deleterious materials would not be expected to significantly impact marine water and sediment quality in the project area with implementation of these plans.

Minor and localized sediment disturbance would occur and subsequently result in short-term suspended sediments in the water column. The use of a vibratory hammer and impact hammer could cause the very fine, soft, sandy silt layers located above the hard glacial deposits to be susceptible to disturbance and suspension. However, the sediments would likely settle back quickly to the bottom of the project area or be carried out with tidal flow and currents following conclusion of pile driving operations.

Construction activities would not result in the release of wastes containing metals or otherwise alter the concentrations of trace metals in bottom sediments. Nor would construction activities result in the discharge of high levels of contaminants or otherwise alter the concentrations of organic contaminants in bottom sediments. However, because the magnitude of metal and organic compound concentrations in sediment can vary as a function of grain size (higher concentrations typically are associated with fine-grained sediments due to higher interior surface areas), small changes to grain size associated with construction-related disturbances to bottom sediments could result in minor changes in metal and organic compound concentrations. This would mainly occur during the placement of piles. These changes would not cause chemical constituents to violate SQS due to the small number of piles and the general lack of sediment contaminants in the project area. The construction activities would not result in persistent increases in turbidity levels or decreases in dissolved oxygen or cause changes that would violate water quality standards because processes that generate suspended sediments, which result in turbid conditions, would be short-term and localized to the pile placement area. Suspended sediments would disperse with tidal flow and currents and/or settle rapidly (within a period of minutes to hours after construction activities cease) within the construction area.

Since fine-grained sediments have a greater affinity for some metal and organic contaminants from both local and regional sources, the spatial distribution of contaminants in bottom sediments may change relative to existing distributions in the long-term. Specifically, the fine-grained sediments trapped by the mooring piles could have higher contaminant concentrations. However, these changes would only be expected immediately adjacent to the pile.

Therefore, no significant impacts to marine water and sediment quality would occur with the implementation of the Preferred Alternative.

3.3.3.3 Alternative 2

Installation of anchor clumps and buoys under Alternative 2 would result in minor suspension of bottom sediments. This suspension would be caused by placing of the mooring anchors and buoy anchors on the seafloor. Similar to the Preferred Alternative, the construction activities would not result in persistent increases in turbidity levels or decreases in dissolved oxygen. Suspended sediments would disperse with tidal flow and currents and would likely settle rapidly (within a period of minutes to hours after construction activities cease) within the construction area. Therefore, no significant impacts to marine water and sediment quality would occur with the implementation of Alternative 2.

3.4 BIOLOGICAL RESOURCES

The ROI for biological resources is specific to the nearshore marine environment of Hood Canal along NAVBASE Kitsap Bangor's waterfront. For aquatic mobile species, the ROI extends further based on the extent of underwater noise generated under the Preferred Alternative. In this case, the ROI extends to Toandos Peninsula, encompassing approximately 16.1 square kilometers (km^2) of Hood Canal (See Figure 3-1 for general vicinity and ROI).

The threshold of significance is defined as impacts to biological resources causing the loss of high value habitat for fish and wildlife and population of species, including injury or noise harassment impacts as the result of the Proposed Action.

3.4.1 Regulatory Overview

The analysis of biological resources focuses on the potential impacts to fish and wildlife under the following regulatory laws:

- MBTA (16 USC 703-712);
- Bald and Golden Eagle Protection Act (16 USC 668-668d)
- ESA (16 USC 1531 et seq.);
- MSA (16 USC 1801-1882); and
- MMPA (16 USC 668-668c).

3.4.1.1 Migratory Bird Treaty Act

Migratory birds are any species or family of birds that live, reproduce or migrate within or across international borders at some point during their annual lifecycle. The MBTA was enacted in the United States in 1918 in order to establish federal protection for migratory birds. The MBTA prohibits the taking, killing, or possessing of migratory birds unless permitted. The list of bird species protected by the MBTA appears in 50 CFR 10.13. NAVBASE Kitsap Bangor is located in western Washington State which generally falls within the potential pathway of the Pacific Migratory flyway. Birds use this flyway primarily in fall and spring during their southward and northward migrations, respectively.

3.4.1.2 Bald and Golden Eagle Protection Act

The bald eagle is afforded continued federal protection by the Bald and Golden Eagle Protection Act even though it has been delisted from the ESA. This law prohibits anyone from taking, possessing, or transporting a bald eagle or golden eagle, or the parts, nests, or eggs of such birds without prior authorization. This includes inactive nests as well as active nests. "Take" means to pursue, shoot, shoot at,

poison, wound, kill, capture, trap, collect, destroy, or disturb. "Disturb" is further defined as to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with the normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior. Bald eagles regularly occur in Hood Canal.

3.4.1.3 Endangered Species Act

Federally threatened and endangered species are those listed for protection under the federal ESA. The USFWS and the NMFS jointly administer the ESA and are also responsible for the listing of species (i.e., the listing of a species as either threatened or endangered). The USFWS has the primary management responsibility for management of terrestrial and freshwater species, while NMFS has primary responsibility for marine species and anadromous fish species. As discussed in Section 3.4.2.3, ten ESA-listed species potentially occur within the vicinity of the project area.

The ESA also allows the designation of geographic areas as critical habitat for threatened and endangered species. The final rule designating critical habitat for 12 evolutionarily significant units (ESUs)/distinct populations segments (DPS) of salmonids in Washington, Oregon, and Idaho was published on September 2, 2005 (70 Federal Register [FR] 52630). Under this rule, NMFS identified six primary constituent elements (PCEs) to be essential for the conservation of these listed salmonids (including Puget Sound Chinook and Hood Canal summer-run chum). All lands identified as essential and designated as critical habitat contain one or more of the PCEs (see Appendix D, Section 7.4 for complete list). Although critical habitat occurs in Hood Canal waters adjacent to the base, NAVBASE Kitsap Bangor is excluded from critical habitat designation for ESA-listed Puget Sound Chinook salmon and Hood Canal summer-run chum salmon by federal law (70 FR 52630). The PCE defined as, *"Nearshore marine areas free of obstruction and excessive predation with: (i) Water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and (ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels."* is the only PCE present within the closest designated critical habitat located immediately north and south of the NAVBASE Kitsap Bangor base boundary. If federal activities could potentially affect ESA-listed species and/or their designated critical habitat, agencies are required to consult with USFWS and/or NMFS.

3.4.1.4 Magnuson-Stevens Fishery Conservation and Management Act

The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), requires that the regional Fishery Management Councils (FMCs), through federal fishery management plans (FMPs), describe and identify Essential Fish Habitat (EFH) for each federally managed species; minimize, to the extent practicable, adverse effects on such habitat caused by fishing; and identify other actions to encourage the conservation and enhancement of such habitats. Congress defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 USC 1802[10]). The term "fish" is defined in the MSA as "finfish, mollusks, crustaceans, and all other forms of marine animals and plant life other than marine mammals and birds." The regulations for implementing EFH clarify that "waters" include all aquatic areas and their biological, chemical, and physical properties, while "substrate" includes the associated biological communities that make these areas suitable fish

habitats (50 CFR 600.10). Habitats used at any time during a species' life cycle (i.e., during at least one of its life stages) must be accounted for when describing and identifying EFH (NMFS 2002).

Authority to implement the MSA is given to the Secretary of Commerce through the NMFS. The MSA requires that EFH be identified and described for each federally managed species. The MSA also requires federal agencies to consult with the NMFS on activities that may adversely affect EFH or when the NMFS independently learns of a federal activity that may adversely affect EFH. The MSA defines an adverse effect as "any impact that reduces quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions" (50 CFR 600.810).

Pursuant to the MSA, the Pacific Fishery Management Council (PFMC) has designated EFH for federally managed species within the waters of Washington, Oregon, and California. The waters of the greater Puget Sound are designated EFH for coastal pelagic, Pacific salmon, and groundfish species (PFMC 2011a, b, 2012).

3.4.1.5 Marine Mammal Protection Act

The MMPA of 1972 established, with limited exceptions, a moratorium on the "taking" of marine mammals in waters or on lands under United States jurisdiction. The term "take", as defined in Section 3 (16 USC 1362) of the MMPA, means "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal. "Harassment" was further defined in the 1994 amendments to the MMPA, which provided two levels of "harassment," Level A (potential injury) and Level B (potential disturbance).

Section 101(a) (5) of the MMPA directs the Secretary of the Department of Commerce (the Secretary) to allow, upon request, the incidental (but not intentional) taking of marine mammals by United States citizens who engage in a specified activity (exclusive of commercial fishing), if certain findings are made and regulations are issued. Permission will be granted by the Secretary for the incidental take of marine mammals if the taking will have a negligible impact on the species stock and will not have an immitigable adverse impact on the availability of such species or stock for taking for substance uses.

3.4.2 Affected Environment

This section describes the terrestrial and aquatic species that occur within the location of the Proposed Action and in the ROI vicinity where potential direct or indirect impacts to biological resources may occur. For the purposes of this EA, biological resources are divided into four major categories: terrestrial wildlife, aquatic species, special-status species, and EFH. Because the Proposed Action occurs in water, the discussion of terrestrial wildlife species is restricted to birds (shorebirds, seabirds, and raptors). Aquatic species discussed include marine vegetation, benthic invertebrates, and marine fish. Special-status species include species listed as threatened or endangered by USFWS or NMFS under the ESA as well as species not listed but afforded federal protection under the MBTA, Bald and Golden Eagle Protection Act, or the MMPA. Lastly, EFH is summarized and analyzed as required under NEPA; however, a more detailed analysis, as required under the MSA, is included in Appendix D, *Biological Assessment and Essential Fish Habitat Assessment*.

3.4.2.1 Terrestrial Wildlife

A diverse population of birds composed of approximately 100 different species occurs at NAVBASE Kitsap Bangor. Resident and migratory birds are common within the Service Pier waterfront and the adjacent upland forested areas (Navy 2001). There are approximately 16 bird species comprising shorebirds, wading birds, waterfowl, seabirds/marine birds and raptors that were observed within or adjacent to the project area (Table 3-7). These are all protected under the MBTA. The bald eagle is afforded federal protection under the MBTA and Bald and Golden Eagle Protection Act and marbled murrelet is listed under the ESA. A more detailed discussion for these two species can be found in *Section 3.4.2.3, Special-Status Species*.

Surveys were conducted between March and September at NAVBASE Kitsap Bangor and therefore outside the wintering period of late fall and winter when species abundance is expected to be higher (Agnes and Tannenbaum 2009a). The closest documented nest to the project area was an osprey nest located approximately 0.5 mile northeast of the project area (WDFW 2010a).

Table 3-7. Marine Birds within Vicinity of Project Area (Mar-Sept)

Species	*Total Sighted*	*Months Sighted*
Great Blue Heron	1	April, May
Surf scoter	6	March, April
Common merganser	2	March, April
Common goldeneye	1	March, June
Barrow's goldeneye	2	March, April
Eared grebe	1	March, April, May
Canada goose	2	June
Common loon	1	March
Pelagic cormorant	1	March
Glaucous-winged gull	131	March, April, May, August
Caspian tern	2	August
Pigeon guillemot	29	March, April, May, August
Marbled murrelet	8	April, May
Bald eagle	1	June, August
Belted kingfisher	3	August
Killdeer	5	March, April

Source: Agnes and Tannenbaum 2009a.

3.4.2.2 Aquatic Species

Marine Vegetation

The primary marine vegetation that occurs along the approximate 4.5 to 5 miles of NAVBASE Kitsap Bangor nearshore habitat includes eelgrass and macroalgae.

Eelgrass

Aquatic vegetation at the project site is composed of intertidal and subtidal species, as well as floating and attached species. Eelgrass is high quality aquatic habitat and is most abundant in low-energy areas. Eelgrass occurs in the lower intertidal and shallow subtidal photic zone where organic matter and nutrients are abundant (Johnson and O'Neil 2001). Within the project area, eelgrass is absent from the

north side of the trestle and an approximate 60 ft wide bed is present on the south side of the trestle, at the base of Carlson Spit, in depths less than -10 ft below MLLW (SAIC 2009). This small presence of eelgrass provides important habitat for waterfowl, raptors, migratory birds, and a variety of marine invertebrates and fishes, including salmonid species.

Macroalgae

Three species of macroalgae occur within the NAVBASE Kitsap Bangor nearshore marine environment. These include brown algae, red algae, and green algae with dominant growth occurring from April through August. Macroalgae provides food for many species of sea birds, fish, mollusks and crustaceans. It also provides shelter for several species of perch, greenling, and crustaceans (Simenstad et al. 1991). The most dominant macroalgae species that occur within the project area include green (*Ulva*) and brown (*Laminaria* and *Gracilaria*). Dense coverage occurs within depths less than 15 ft below MLLW particularly within the vicinity of the pier structures (SAIC 2009). These species play an important role in marine trophic systems, linking primary production to higher trophic levels (Mauchline 1998; Sackmann 2000; Mumford 2007).

Benthic and Epibenthic Communities

The soft-bottom benthic community at the project site is dominated by polychaetes, crustaceans, and mollusks across tidal zones, although in the intertidal zone, other minor taxa (e.g., nemerteans, nematodes, oligochaetes) also may be numerically abundant (Weston Solutions, Inc. 2006; Ecology 2007). Species composition and abundance are variable along the NAVBASE Kitsap Bangor waterfront. A recent survey of four different areas along the waterfront found consistently greater benthic community development in the subtidal zone compared to the intertidal zone (waterfront piers and shoreline area) and variable community development within and among survey areas (Weston Solutions, Inc. 2006).

A study conducted in the late 1970s investigated the epibenthic community at two locations along the waterfront and an additional site directly across Hood Canal on the Toandos Peninsula (Simenstad et al. 1980). The study found that harpacticoid copepods were the numerically dominant organism in the epibenthic community, accounting for 56 to 67 percent of the total number of epibenthic organisms captured. Gammarid amphipods dominated the total biomass, representing 12 to 31 percent of the total epibenthic biomass.

Eelgrass beds along the NAVBASE Kitsap Bangor waterfront support species such as gammarid amphipods, brittle stars, and shore crabs (Pentec 2003). Eelgrass provides substrate for invertebrates, such as copepods, amphipods, and snails that might otherwise not be found on soft sediments (Mumford 2007). Two annelid species (*Exogene lourei* and *Galathowenia oculata*) are abundant in the nearshore area within the vicinity of the project (Ecology 2007). Hard shell clam (*Leukoma staminea*), geoduck (*Panopea generosa*), and Dungeness crab (*Cancer magister*) are abundant in the subtidal areas just beyond the project area. Pacific oyster (*Crassostrea gigas*) and Olympia oyster (*Ostrea lurida*) occur sporadically along the intertidal of the project area (SAIC 2009; WDFW 2010a).

Marine Fish

Hood Canal has a diverse array of marine fish consisting of salmonids, forage fish, groundfish, and many species of game and non-game fish in general. Approximately 42 different species of marine fish were represented during beach seining surveys conducted along NAVBASE Kitsap Bangor waterfront (SAIC 2006; Bhuthimethee et al. 2009a). Of the 42 species, 22 of these were identified from site-specific data

collected during surveys within the vicinity of the project area in 2006. The most abundant species collected were Pacific herring, chum salmon, Pacific sand lance, and shiner surfperch (Table 3-8).

Surveys showed peaks in salmon collection from April through late May with numbers drastically reduced in early June. This peak occurred within weeks following hatchery releases of Chinook, chum, pink, coho, and steelhead. Very few steelhead and cutthroat trout were collected during sampling in each year, but still spiked in numbers during the April and May timeframe. Bull trout were not collected during any of the surveys and only one sockeye was captured in 2006.

Like salmonids, forage fish (Pacific herring, surf smelt, and Pacific sand lance) were also the most abundant during the April and May timeframe (Bhuthimethee et al. 2009a). Forage fish are important prey for a large variety of other marine organisms, including birds, fish, marine mammals, and salmonids. Sand lance spawning habitat has been documented along the NAVBASE Kitsap Bangor waterfront (Figure 3-1). Although surf smelt spawning has not been documented along the waterfront, this species may likely use sand lance habitat. All three forage fish species may occur within the nearshore areas of the Proposed Action throughout the year.

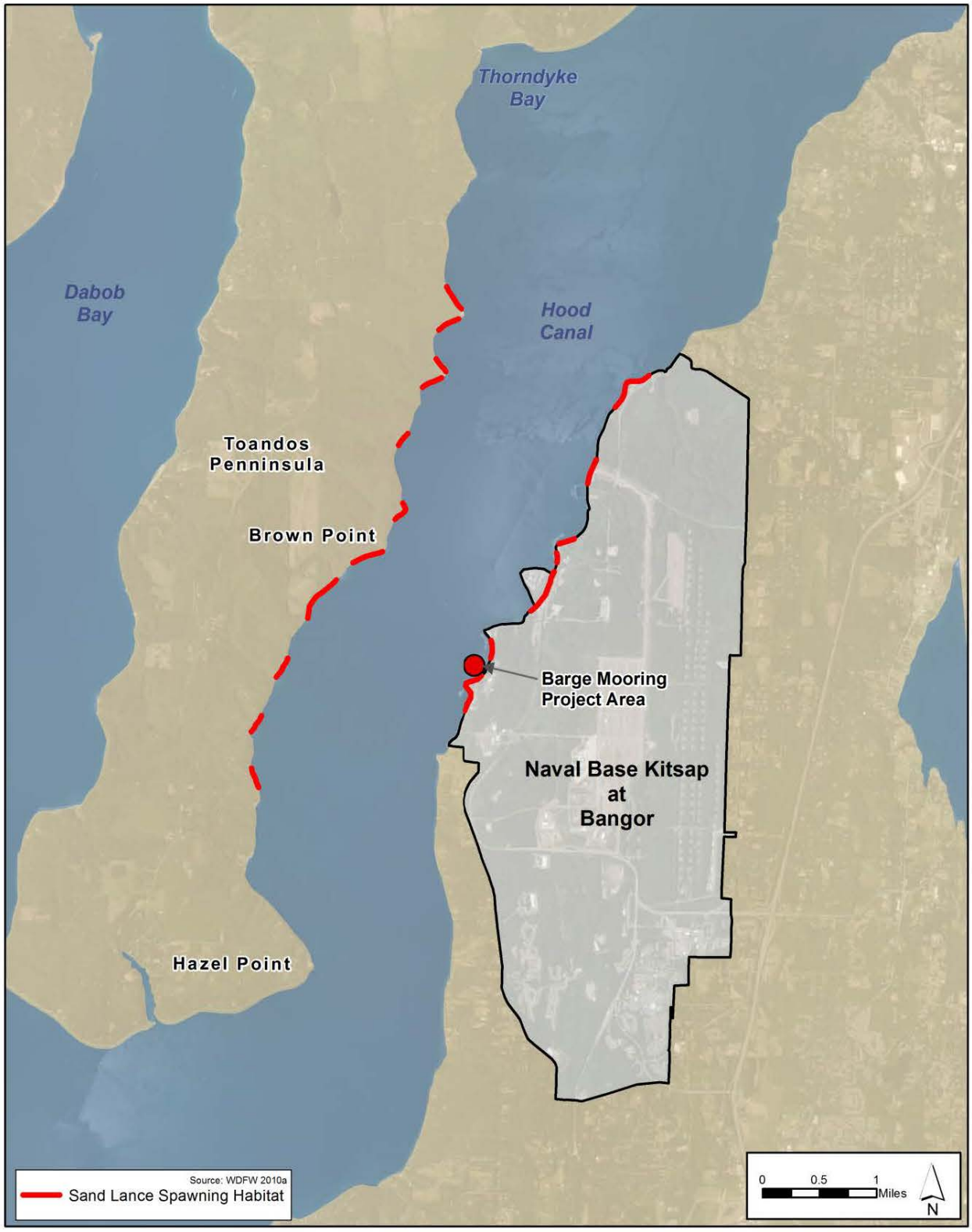
Table 3-8. Survey Total of All Fish Species Caught within the Vicinity of the Project Area

Species	*Percent of Catch*
Pacific Herring	74.1
Chum salmon	9.7
Pacific sand lance	8.4
Shiner surfperch	2.8
Coho salmon	2.0
Surf smelt	1.2
Pink salmon	0.7
Threespine stickleback	0.32
Chinook salmon	0.28
Greenling (juv)	0.16
Cutthroat trout	0.1
Pacific staghorn sculpin	<0.1
Bay pipefish	
Sculpin spp.	
Sockeye salmon	
Lingcod	
Rockfish (juv)	
Buffalo sculpin	
Gunnel	
Rex sole	
Tubesnout	
White spotted greenling	

Source: SAIC 2006

Note: Does not total 100 percent due to rounding.

Figure 3-1. Sand lance Spawning Habitat within the Vicinity of the Action Area



3.4.2.3 Special-Status Species

ESA-Listed Species and Critical Habitat

Ten ESA-listed species either occur or have the potential to occur in Hood Canal, within the vicinity of the NAVBASE Kitsap Bangor waterfront: four salmonid species, three rockfish species, two marine mammal species, and one marine bird species. Critical habitat occurs in Hood Canal waters, adjacent to the base, for ESA-listed Puget Sound Chinook salmon and Hood Canal summer-run chum salmon. However, NAVBASE Kitsap Bangor is excluded from critical habitat designation by federal law (70 FR 52630). The status of the species and presence of critical habitat (if designated) within the vicinity of the Proposed Action is provided in Table 3-9.

Additional information regarding all species distribution and likely presence within the vicinity of the Proposed Action is discussed in the following sections.

Table 3-9. ESA Species and Critical Habitat Potentially Present within Vicinity of Proposed Action

Common Name/ *Scientific Name*	***ESA Status (Source)***	***Presence in Hood Canal***	***Critical Habitat in Hood Canal***
Fish			
Puget Sound Chinook Salmon ESU/*Oncorhynchus tshawytscha*	T (NMFS 2005a) CH (NMFS 2005b)	Present	Designated along the shoreline to depth of -30 meters except not along the NAVBASE Kitsap Bangor waterfront.
Puget Sound Steelhead DPS/ O. mykiss	T (NMFS 2007)	Present	Proposed (NMFS 2013)
Hood Canal Summer-run Chum Salmon ESU/*O. keta*	T (NMFS 1999) CH (NMFS 2005b)	Present	Designated along the shoreline to depth of -30 meters except not along the NAVBASE Kitsap Bangor waterfront.
Bull Trout DPS/Salvelinus confluentus	T (USFWS 1999) CH (USFWS 2010)	Present along southwest shorelines of Hood Canal; not expected within the NAVBASE Kitsap Bangor waterfront.	Designated along the shoreline to depth of -10 meters (-33 feet). The closest critical habitat occurs along the western and northern shores of Dabob Bay beyond Hazel Point, at the southern tip of Toandos Peninsula, outside of the area affected by the Proposed Action.
Puget Sound/Georgia Basin Bocaccio Rockfish DPS/ Sebastes paucispinis	E (NMFS 2010)	Possible, but uncertain.	In development
Puget Sound/Georgia Basin Canary Rockfish DPS/ S. pinniger	T (NMFS 2010)	Possible, but uncertain.	In development
Puget Sound/Georgia Basin Yelloweye Rockfish DPS/ S. ruberrimus	T (NMFS 2010)	Possible, but uncertain.	In development
Marine Mammals			
Humpback Whale/Megaptera novaeangliae	E (NMFS 1970)	Possible, but rare.	Not designated
Eastern Steller Sea Lion DPS/ Eumetopias jubatus	T (NMFS 1990) CH (NMFS 1993)	Present at the NAVBASE Kitsap Bangor waterfront in late fall through	Not present

Table 3-9. ESA Species and Critical Habitat Potentially Present within Vicinity of Proposed Action

Common Name/ *Scientific Name*	*ESA Status (Source)*	*Presence in Hood Canal*	*Critical Habitat in Hood Canal*
		spring.	
Birds			
Marbled Murrelet/ Brachyrhamphus marmoratus	T (USFWS 1992) CH (USFWS 1996)	Present	Not present

Notes:
CH = critical habitat, DPS = Distinct Population Segment, E = endangered, ESU = Evolutionary Significant Unit, T = threatened.

Puget Sound Chinook Salmon ESU

Puget Sound Chinook were federally listed as threatened under the ESA on March 24, 1999, with the threatened listing reaffirmed in 2005 (NMFS 2005a). The ESU is composed of both naturally spawning populations and a number of hatchery stocks. The boundary of the Puget Sound Chinook salmon ESU extends from the Nooksack River in the north to southern Puget Sound, including Hood Canal, and extends westerly out the Strait of Juan de Fuca to the Elwha River. There are currently 22 independent populations of Chinook salmon which is drastically reduced from a believed historical number of 30 to 37 independent populations prior to federal protection (Fresh 2006; NOAA 2007). The two populations likely occurring near NAVBASE Kitsap Bangor are the Skokomish and the Mid-Hood Canal populations. These populations typically enter Hood Canal in July. The age of return to the rivers for these two populations is between 2 and 5 years of age with a majority at age 4. These populations spawn in the Skokomish, Hamma Hamma, Dosewallips, and Duckabush River systems from September to October.

A final designation of Puget Sound Chinook salmon critical habitat was published on September 2, 2005, with an effective date of January 2, 2006 (NMFS 2005b). Nearshore marine waters within Hood Canal were included as part of this designation. Although critical habitat occurs in northern Hood Canal waters adjacent to the installation, NAVBASE Kitsap Bangor is excluded from critical habitat designation for ESA-listed Puget Sound Chinook salmon by federal law (70 FR 52630). As a result, no Puget Sound Chinook salmon critical habitat occurs in the immediate vicinity of the project area. The closest critical habitat occurs immediately beyond the northern and southern base boundaries as shown in Figure 3-2.

Very small numbers of Chinook were collected near the project area during fish surveys conducted between 2005 and 2008. Of those collected, peak presence was from late May to early July (SAIC 2006; Bhuthimethee et al. 2009a).

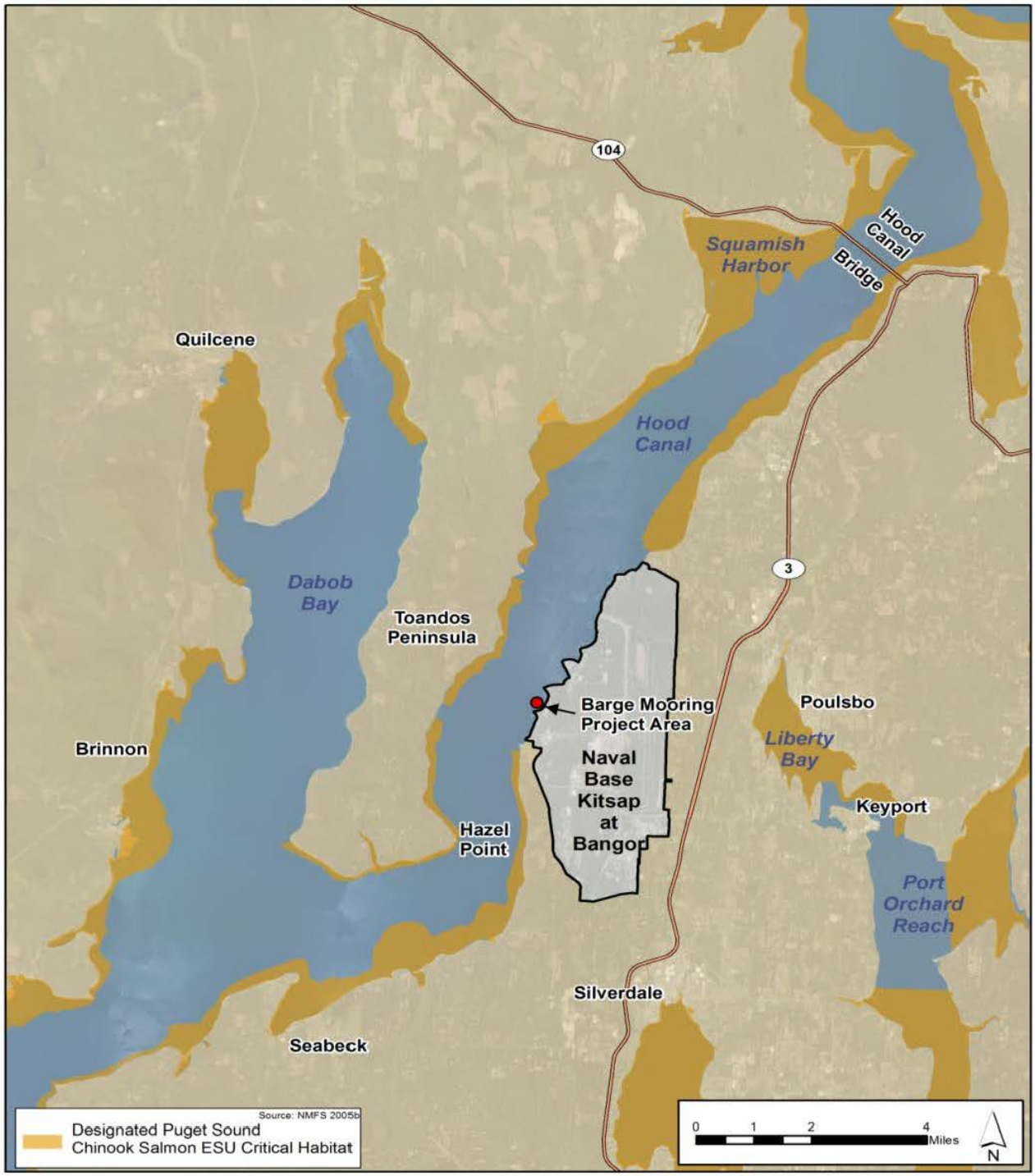
Puget Sound Steelhead Trout (DPS)

Puget Sound steelhead DPS was federally listed as threatened under the ESA on May 11, 2007 (NMFS 2007). The DPS includes mainly winter-run populations and to a lesser extent, summer-run populations. Winter-run are more predominant in Puget Sound than summer-run stocks as the summer-run stocks are small and occupy limited habitat (NMFS 2011). Some stocks of Puget Sound steelhead in Hood Canal (i.e., hatchery supplementation or hatchery releases to non-native streams) may not be considered part of the DPS (NMFS 2006).

No critical habitat for Puget Sound steelhead DPS has been designated, but it is currently proposed for the Hood Canal Subbasin including the following watersheds: Lower West Hood Canal Frontal, Hamma Hamma River, Duckabush River, Dosewallips River, Big Quilcene River, Upper West Hood Canal

Frontal, and West Kitsap (NMFS 2013). These proposed areas are not within the proposed action area. In addition, any streams on DoD lands have been excluded from proposed designation (NMFS 2013).

Figure 3-2. Chinook Salmon Critical Habitat within Vicinity of Project Area



There are eight stocks of winter-run steelhead in Hood Canal and these include the Dewatto, Dosewallips, Duckabush, Hamma Hamma, Quilcene, Skokomish, Tahuya, and Union. Adults enter freshwater December through April with spawning taking place March through June (Hard et al. 2007). Juvenile steelhead forage for 1 to 4 years before migrating to the sea as smolts, typically from April to mid-May. It is generally understood that smolts move quickly offshore, bypassing the extended estuary transition stage.

Steelheads do not occur in large numbers along the NAVBASE Kitsap Bangor waterfront. Very few steelhead were collected during fish surveys that took place along the waterfront from 2005 – 2008 and of the small numbers collected, peak catch was in late spring and summer months (SAIC 2006; Bhuthimethee et al. 2009a).

Hood Canal Summer-run Chum Salmon (ESU)

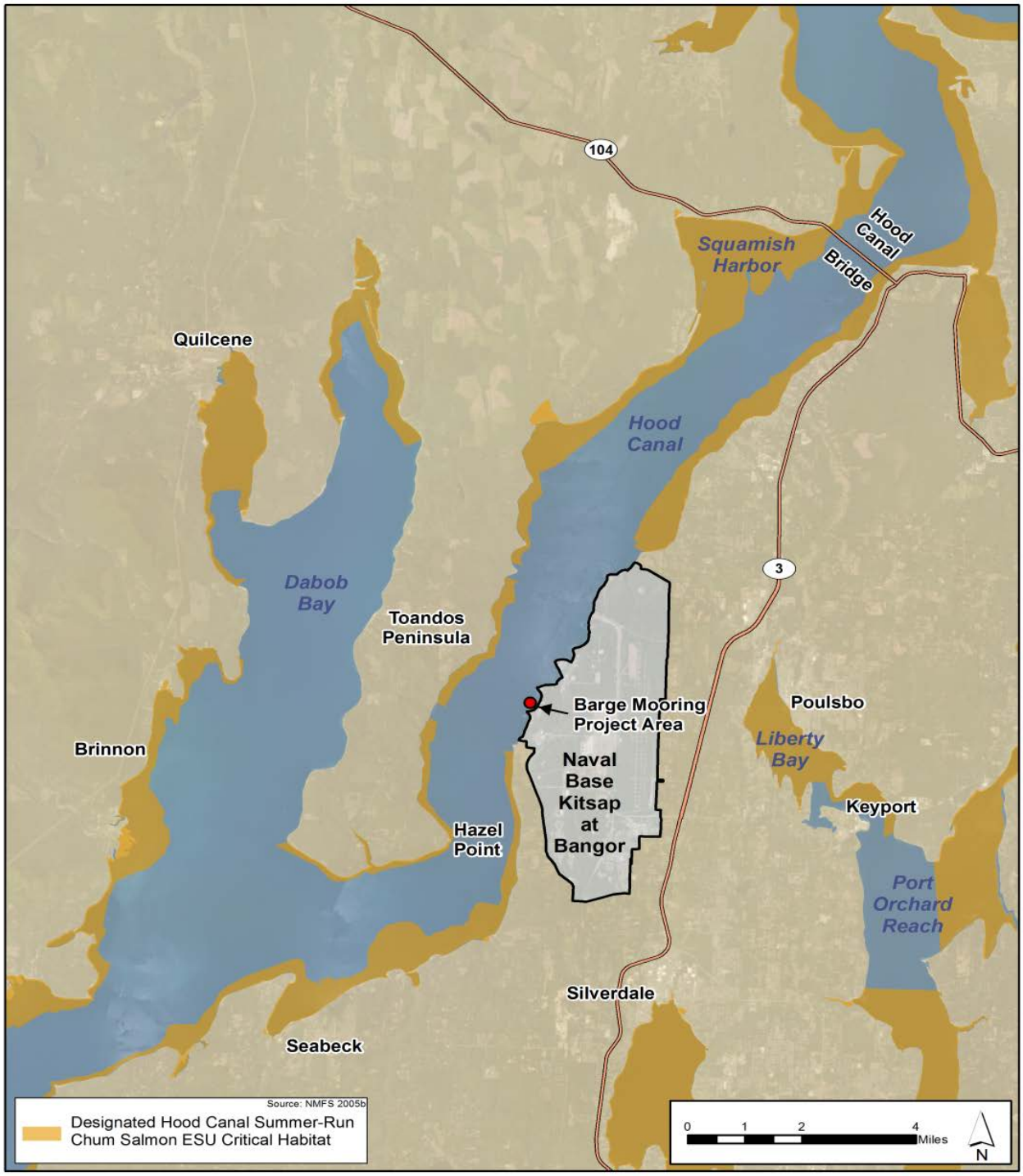
Hood Canal summer-run chum salmon were listed as threatened on March 25, 1999 (NMFS 1999) and the threatened listing was reaffirmed on June 28, 2005 (NMFS 2005b). The ESU includes all naturally spawned populations of summer-run chum salmon in Hood Canal and its tributaries. The only active fish hatchery that currently provides summer-run chum salmon to Hood Canal is the Quilcene National Fish Hatchery.

Historically, there were 16 stocks within the Hood Canal summer-run chum ESU, eight of which are extant (6 in Hood Canal and 2 in the eastern Strait of Juan de Fuca) with the remaining 8 extinct (71 FR 47180). The Hood Canal population spawns in Big and Little Quilcene, Dosewallips, Duckabush, Hamma Hamma, and Lilliwaup watersheds on the western side of Hood Canal and Union River as the only river on the eastern side of Hood Canal with a spawning population (Sands et al. 2009). Summer chum salmon enter rivers from mid-August through mid-October (Johnson et al. 1997). Spawning peaks from mid-September to mid-October with fry emergence beginning in January. Fish immediately migrate to the estuary where they rear for a few days or weeks.

A final designation of Hood Canal summer-run chum salmon critical habitat was published on September 2, 2005, with an effective date of January 2, 2006 (NMFS 2005b). Nearshore marine waters within Hood Canal were included as part of this designation. Although critical habitat occurs in northern Hood Canal waters adjacent to the base, NAVBASE Kitsap Bangor is excluded from critical habitat designation for ESA-listed Hood Canal summer-run chum salmon by federal law (70 FR 52630). As a result, no Hood Canal summer-run chum salmon critical habitat occurs in the immediate vicinity of the project area. The closest critical habitat occurs immediately beyond the northern and southern base boundaries as shown in Figure 3-3.

Fish surveys conducted along the NAVBASE Kitsap Bangor waterfront resulted in high numbers of juvenile chum (all populations) collected as compared to other salmonids collected during the surveys. Peak numbers were in March and April (SAIC 2006; Bhuthimethee et al. 2009b).

Figure 3-3. Hood Canal Summer-Run Chum Critical Habitat within Vicinity of Project Area



Coastal-Puget Sound Bull Trout (DPS)

Currently, all populations of bull trout in the lower 48 states are listed as threatened under the ESA. Bull trout are in the char subgroup of salmonids and have both resident and migratory life histories. The Coastal-Puget Sound bull trout DPS reportedly contains the only occurrence of anadromous bull trout in the contiguous United States (USFWS 1999); The Coastal-Puget Sound DPS is composed of two management units, the Puget Sound Management Unit and the Olympic Peninsula Management Unit. The Olympic Peninsula Management Unit includes all watersheds within the Olympic Peninsula and the nearshore marine water of the Pacific Ocean, Strait of Juan de Fuca, and Hood Canal (USFWS 2004).

Critical habitat was designated for bull trout on September 26, 2005 (70 FR 56212) with a final revision to this habitat published in 2010 (USFWS 2010). However, although both the original and revised final bull trout critical habitats occur in Hood Canal, neither designates waters north of Hazel Point, at the southeastern tip of Toandos Peninsula (Figure 3-4). Therefore, no bull trout critical habitat occurs at NAVBASE Kitsap Bangor.

All Hood Canal bull trout originate in the Skokomish River (WDFW 2004). They are not known to occur in any tributary systems at NAVBASE Kitsap Bangor (Bhuthimethee et al. 2009b). Further, no bull trout were collected during nearshore fish surveys conducted along the NAVBASE Kitsap Bangor waterfront in 2005 through 2008 (SAIC 2006; Bhuthimethee et al. 2009a). Bull trout require snow-fed glacial streams, and, since there are none on the Kitsap Peninsula, they would not be expected in any streams at NAVBASE Kitsap Bangor or in any other streams on the Kitsap Peninsula. Therefore, their occurrence within the vicinity of the project area is limited to the marine waters.

Figure 3-4. Bull Trout Critical Habitat within Vicinity of Project Area

Rockfish Species (DPS)

Three Puget Sound/Georgia Basin DPS populations of rockfish are listed under the ESA. These include Bocaccio (endangered status), canary rockfish (threatened status), and yelloweye rockfish (threatened status) (NMFS 2010). The designation area for these populations encompasses inland marine waters east of the central Strait of Juan de Fuca and south of the northern Strait of Georgia. A summary of life history and occurrence of each DPS within the vicinity of the project area is described below. A more comprehensive review for each species can be found in Appendix D. Critical habitat is not designated for any of these species at this time.

Puget Sound/Georgia Basin Bocaccio (DPS).

Bocaccio range from Punta Blanca, Baja California, to the Gulf of Alaska, Alaska (Love et al. 2002). They are believed to have commonly occurred along steep walls in most of Puget Sound prior to fishery exploitations, although they are currently very rare in these Puget Sound habitats (Love et al. 2002). Little is known about the habitat requirements of most rockfishes despite the years of research already performed. Even less is known about bocaccio in Puget Sound (Drake et al. 2008; Palsson et al. 2009). Much of the information presented below on bocaccio life history and habitat use is derived from other areas where bocaccios occur.

Adult bocaccio inhabit waters at depths ranging from approximately 40 to 1,570 ft, but are most common at depths of 160 to 820 ft (i.e., greater than the project depth). Although bocaccios are typically associated with hard substrate, they may wander into mud flats presumably because they can be located as much as 98 ft off the bottom. Bocaccio release larvae in January, continuing through April off the coast of Washington. Larval and pelagic juvenile bocaccios drift into the nearshore, near the water surface, and are associated with drifting kelp mats (Love et al. 2002). The young bocaccio settle the nearshore environment at 3 to 4 months of age, where the species prefer shallow waters over algae-covered rocks, or in sandy areas where eelgrass beds or drift algae are present (Love et al. 1991; Love et al. 2002). As juveniles, bocaccio rockfish inhabit relatively shallow water, compared to adults, and are often found in large schools (Eschemeyer et al. 1983). Young bocaccios are preyed upon by least terns, lingcod, other rockfish, Chinook salmon, and harbor seals (Love et al. 2002).

Bocaccios have never been observed during WDFW bottom trawl, video, or dive surveys in Puget Sound (Moulton and Miller 1987; Palsson et al. 2009). However, Palsson et al. (2009) investigated historic fish catch records and reported only 2 known instances of bocaccio captures in Hood Canal. It is important to note that recreational fishing records reflect observed frequencies, not observed densities. Although there have been no confirmed observations of bocaccio in Puget Sound for approximately 7 years (74 FR 18516), Drake et al. (2008) concluded that it is likely that bocaccio occur in low densities.

No more than four juvenile rockfish were captured per year over a 4-year fish survey study along NAVBASE Kitsap Bangor Waterfront (SAIC 2006; Bhuthimethee et al. 2009a). It is not known if they were juvenile bocaccio as those collected by seine were not identified to species.

Puget Sound/Georgia Basin Canary Rockfish (DPS).

Canary rockfish range from Punta Blanca, Baja California, to the Shelikof Strait of Alaska, and are abundant from British Columbia to central California. Canary rockfish were once considered fairly common in the greater Puget Sound area (Holmberg et al. 1967; Kincaid 1919); however, little is known about their habitat requirements in these waters (Drake et al. 2008; Palsson et al. 2009). Much of the

information presented below on canary rockfish life history and habitat use is derived from research from other areas where canary rockfish are more abundant.

Adults release larvae between September and March with peaks in December and January off the Oregon and Washington coasts (Wyllie Echeverria 1987). Larvae and pelagic juveniles are found in the upper 330 ft of the water column from January until about March when they start to move into intertidal areas (tide pools, rocky reefs, kelp beds, cobble areas), although some juveniles remain pelagic in much deeper water until July (Love et al. 2002). Juveniles may occupy rock-sand interfaces near 50-65 ft during the day, and then move to sandy areas at night.

An approximate estimate of canary rockfish abundance in Puget Sound Proper was only 300 individuals during the 1980s (NMFS 2010). Drake et al. (2008) concluded that canary rockfish occur in low and decreasing abundances in Puget Sound.

As noted in the prior section, no more than 4 juvenile rockfish were captured per year over a 4-year fish survey study along NAVBASE Kitsap Bangor waterfront (SAIC 2006; Bhuthimethee et al. 2009a). It is not known if they were juvenile canary or bocaccio as those collected by seine were not identified to species.

Puget Sound/Georgia Basin Yelloweye Rockfish (DPS).

Yelloweye rockfish are found from Ensenada, Baja California, to the Aleutian Islands in Alaska. They are abundant from southeast Alaska to central California. Yelloweye rockfish are more common in northern Puget Sound compared with southern Puget Sound presumably because rockier habitat is available in northern Puget Sound. An approximate estimate of yelloweye rockfish abundance in Puget Sound Proper was only 1,200 individuals during the 1980s (NMFS 2010).

Yelloweye rockfish is a deep-water species that is relatively sedentary living in association with high relief rocky habitats and often near steep slopes (Palsson et al. 2009; Love et al. 2002; Wang 2005). Yelloweyes move into deeper water as they grow into adults, continuing to associate with caves and crevices and spending large amounts of time lying on the substratum, sometimes at the base of rocky pinnacles and boulder fields (Love et al. 2002). Adult yelloweye rockfish inhabit waters from 80-1,560 ft, but they are most common at depths of 300 to 590 ft (i.e., greater than the project depth). They are typically solitary, but sometimes form aggregations near rocky substrate.

Hood Canal has the greatest frequency of yelloweye rockfish observed in both trawl and scuba surveys conducted by WDFW (Palsson et al. 2009). Juvenile rockfish were captured during fish surveys conducted along NAVBASE Kitsap Bangor waterfront in 2005 through 2008. No more than 4 fish total per-year were collected (SAIC 2006; Bhuthimethee et al. 2009a). Although the specific species was not identified, these could have been yelloweye given the frequency of past WDFW surveys.

<u>Humpback Whale</u>

Humpback whales were listed as endangered under the Endangered Species Preservation Act of 1966 (35 FR 1222) due to commercial whaling and this protection threshold was transferred to the ESA in 1973. The recovery plan for humpback whales was finalized in November 1991 (NMFS 1991). The California/ Oregon/Washington Stock is defined to include humpback whales that feed off the west coast of the continental United States and individuals potentially occurring within the vicinity of the project area would belong to this stock. Critical habitat is not designated for this species.

Humpback whales were one of the most common large cetaceans in the inland waters of Washington in the early 1900s (Scheffer and Slipp 1948). Humpback whale sightings were infrequent in Puget Sound and the Georgia Basin through the late 1990s, and prior to 2003 the presence of only three individual humpback whales was confirmed (Falcone et al. 2005). However, in 2003 and 2004, 13 individuals were sighted in the inland waters of Washington, mainly during the fall (Falcone et al. 2005). Records available for April 2001 to February 2012 include observations in the Strait of Juan de Fuca, the Gulf Islands and the vicinity of Victoria, British Columbia, Admiralty Inlet, the San Juan Islands, Hood Canal, and Puget Sound (Orca Network 2012). For the areas listed above, Orca Network records shows humpback whale presence in one of the areas listed above in all months from May through November in 2009; in all months but January, March, April, May, and August in 2010; and from March through November in 2011.

In Hood Canal, humpback whale sightings occurred several times in January and February 2012 (Orca Network 2012). Review of the sightings information indicated they were of one individual (Calambokidis pers. comm. 2012). Prior to these sightings, there were no confirmed reports of humpback whales entering Hood Canal (Calambokidis pers. comm. 2012). No other reports of humpback whales in the Hood Canal were found in the Orca Network database, the scientific literature, or agency reports. Construction of the Hood Canal Bridge occurred in 1961 and could have contributed to the lack of historical sightings (Calambokidis pers. comm. 2010). Only a few records of humpback whales near Hood Canal (but north of the Hood Canal Bridge) are in the Orca Network database. Two were from the northern tip of Kitsap Peninsula (Foulwater Bluff/Point No Point) and a few others from Port Madison Bay in Puget Sound. Therefore, it is unlikely that humpback whales would occur within the vicinity of the project area during relatively short duration of the project activities.

Eastern Steller Sea Lion (DPS)

The Steller sea lion was federally listed as threatened on November 26, 1990 (NMFS 1990). In 1997, the NMFS reclassified the Steller sea lion into two DPSs based on demographics and genetics (NMFS 1997). The population was divided into two recognized management stocks (eastern and western), separated at 144º W longitude (Loughlin 1997). The western stock was listed as endangered on May 4, 1997, and the eastern stock retained the threatened classification. The eastern DPS includes the species distribution in southeast Alaska, Canada, Washington (including inland waters), Oregon, and California (NMFS 1997). Only the eastern stock is considered in this EA because the western stock occurs outside of the ROI. In addition, NMFS has recently proposed removing the Eastern DPS from the ESA (NOAA Fisheries 2012). However, until a final rule is issued, the Eastern DPS is still recognized as threatened and is addressed as a special-status species in this document.

Critical habitat was designated for this species as a 20 nautical mile buffer around all major haul-outs and rookeries in Alaska, California and Oregon, including associated terrestrial, air and aquatic zones, and three offshore foraging areas (NMFS 1993). Critical habitat did not include areas or waters in Washington.

A recovery plan released by NMFS for both the eastern and western DPS showed that the eastern DPS has actually been increasing in numbers approximately 3 percent each year since the 1970s with the current populations ranging from 58,334 to 72,223 (Allen and Angliss 2011). The highest breeding season Steller sea lion count at Washington haul-out sites was 847 individuals during the period from 1978 to 2001 (Pitcher et al. 2007). The closest breeding rookery to the project area is at Carmanah Point near the

western entrance to the Strait of Juan de Fuca (Bigg 1985; Olesiuk 2008). Non-breeding season surveys of Washington haul-out sites reported as many as 1,458 individuals between 1980 and 2001 (NMFS 2008b). The nearest haulout to Bangor is at a rock near Marrowstone Island (NMFS 2010b)

Steller sea lions occur in Hood Canal October through May. The earliest arrival of Stellers was on September 30 when 5 individuals were observed at Delta Pier (less than 1 mile north of the project site). During 2011 monitoring activities for the Test Pile Program, Steller sea lions were documented arriving on October 8. Steller sea lions are not likely to be present within the vicinity of the Proposed Action during the time period of proposed construction activities (i.e., July-September).

Marbled Murrelet

The Washington, Oregon, and California population of the marbled murrelet was federally listed as threatened on October 1, 1992 (USFWS 1992). Marbled murrelets are seabirds that spend most of their life in the marine environment and nest in mature and old-growth forests (USFWS 1997). They use the marine environment in Hood Canal for courtship, loafing, and foraging. Murrelets can occur year-round in Puget Sound and Hood Canal, although their flock size, density, and distribution vary by season (Nysewander et al. 2005; Falxa et al. 2009).

Critical habitat for nesting marbled murrelets was designated in 1996 (USFWS 1996) and was proposed for revision in 2008 (USFWS 2008). Only critical habitat in Oregon and California was revised in the final rule (USFWS 2011). Designated critical habit in Washington remains unchanged from the 1996 ruling and hence, the project area is not within designated critical habitat (USFWS 1996, 2011). The closest designated critical habitat to Hood Canal includes forest lands west and south of Dabob Bay.

In Hood Canal, marbled murrelet breeding season is asynchronous (i.e., pairs do not nest at the same time) between April 1 and September 23 (USFWS 2012). During the breeding season, murrelets tend to forage in well-defined areas along the shoreline in relatively shallow marine waters. Murrelets forage at all times of the day and in some cases at night (Strachan et al. 1995). During the pre-basic molt phase, flightless murrelets must select foraging sites that provide adequate prey resources within swimming distance (Carter and Stein 1995). During the non-breeding season, murrelets typically disperse and are found farther from shore (Strachan et al. 1995).

Murrelet presence in Hood Canal has been documented through a number of sources and survey efforts. The most accurate information comes from the consistent sampling used to estimate population size and trends under the Northwest Forest Plan Murrelet Effectiveness Monitoring Program (Raphael et al. 2007). Other survey data were generated through the Puget Sound Ambient Monitoring Program (PSAMP), conducted by the WDFW. Recent surveys showed a total of eight observations of marbled murrelet pairs during April and May. All were observed to be in breeding plumage and actively diving and foraging off of Carlson Spit (500 ft offshore) on four separate occasions. One specific instance was noted, at the end of May, where a murrelet was observed holding a fish cross-wise in its bill which indicates chick-rearing stage. At this stage, adult fish-holders do not typically return to the nest until night-fall (Agness and Tannenbaum 2009a). During surveys conducted in 2007, marbled murrelets were not sighted near pier structures but were detected in all nearshore scan areas with the exception of a survey area immediately south of Marginal Wharf (Agness and Tannenbaum 2009a).

In January 2009, the Navy conducted marbled murrelet monitoring during the installation of five steel piles for the Carderock Division Research Facility Wave Deflection System at the south side of Carlson

Spit, immediately south of the Proposed Action. During each of the five pile driving days, 1 to 8 marbled murrelets were frequently observed within a 1,000-m zone defined as the "area of potential behavioral effect," with intermittent sightings of 12 to 31 murrelets recorded. No marbled murrelet sightings occurred within the 300-m zone known as the "area of potential injury."

During recent fall 2011 repairs to the Explosives Handling Wharf (EHW) -1, no marbled murrelets were observed near EHW-1 during any pile driving activity (only vibratory pile driving occurred). Marbled murrelets were never observed within the restricted area at any time despite nearly daily observations over a four week period during October 2011 (Navy 2012a). Monitoring for marbled murrelets also occurred during the nearby Test Pile program in the summer and fall of 2011. No marbled murrelets were observed in the restricted area during any pile driving activity (impact and vibratory) at any time over the eight week observation period during the Test Pile Program (Navy 2012b).

Marbled murrelets were observed on several occasions during Hood Canal and Dabob Bay baseline surveys conducted during non-piling driving days during the Test Pile Program. There were 50 sightings over an eight week period, with the majority of the sightings (90 percent) occurring in late October (Navy 2012b). Most of the marbled murrelets sightings occurred at the southern tip of the Toandos Peninsula between Hazal Point and Dabob Bay with 78 percent of all observations at this location (Navy 2012b). On one occasion, a single pair of marbled murrelets was observed within 315 meters of the Carderock Pier, located approximately 0.2 kilometers south of the Service Pier (Navy 2012b).

Bald Eagle

Bald eagles are protected by both state and federal law. In July 2007, the bald eagle was removed from protection under the ESA but is still protected under the MBTA and Bald and Golden Eagle Protection Act. These laws provide protection to prevent harassment and provide buffer zones around nesting and roosting sites (WDFW 2010b). Bald eagles are regularly observed at NAVBASE Kitsap Bangor. They are likely to be present flying over the project area either to forage or to nesting sites. Bald eagle nesting period is from July 16 through August 15. The closest documented bald eagle nesting site is approximately 0.35 miles (560 m) north of the project area (Yasenak 2012).

Marine Mammals

All marine mammals are protected under the MMPA. The MMPA prohibits, with certain exceptions (i.e., tribal subsistence and permitted and authorized scientific research), the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the United States.

California sea lions, Steller sea lions, harbor seals, Dall's porpoise, harbor porpoise, humpback whale and transient killer whales may be present near the project area. Distribution and occurrence of pinnipeds (California sea lions and harbor seals), Dall's porpoise, and harbor porpoise as well as rare occurrences of transient killer whales are discussed below.

California Sea Lion

California sea lions breed on islands located in southern California, western Baja California, and the Gulf of California during the summertime. Large numbers of adult and sub adult male and juvenile sea lions migrate north post-breeding and winter from central California to Washington State (Jeffries et al. 2000).

California sea lions feed on a variety of fish and shellfish, including salmon, steelhead, herring, mackerel, and squid. It has been documented that salmon and steelhead comprise 10 to 30 percent of their diet in Washington State (WDFW 2010c). The U.S. population of California sea lions is considered to be near the highest level the environment can sustain (Carretta et al. 2011).

California sea lions are present in Hood Canal in fall, winter, and spring. Recent marine mammal surveys conducted along the NAVBASE Kitsap Bangor waterfront documented an abundance of California sea lions (Agness and Tannenbaum 2009b). A majority of the sea lions sighted were either hauled out or swimming near Delta pier located approximately 1 mile north of the Proposed Action (Figure 3-5).

Harbor Seal

Harbor seals inhabit coastal and estuarine waters off Baja California, north along the western coasts of the continental United States, British Columbia, and Southeast Alaska west through the Gulf of Alaska and Aleutian Islands (Carretta et al. 2011). They are generally non-migratory and remain local with changes in the tides, weather, season, reproduction, and food availability as the primary factors for movement. Harbor seals generally haul-out on rocks, reefs, and beaches during the day and forage in marine and estuarine waters during the morning and evenings. They haul out at low and high tide (in Hood Canal) to digest food, rest, give birth, or nurse young. Harbor seals eat crustaceans, squid, mollusks, and a variety of fish (Carretta et al. 2011). Pupping for harbor seals in Hood Canal takes place from July through September (Ecology 2011b).

Harbor seals have been observed hauled out on manmade structures (i.e., floating security fence, buoys, barges, marine vessels, and logs) along NAVBASE Kitsap Bangor's waterfront. The closest harbor seals have been observed near the project area approximately 0.25 mile north swimming in the nearshore areas (Figure 3-5). A majority of the sightings have been at Delta Pier and north of the Pier (Agness and Tannenbaum 2009b).

Figure 3-5. Pinniped Haul out Sites within Vicinity of Project Area

Dall's Porpoise

Dall's porpoise within the Pacific United States exclusive economic zone (EEZ) are divided into two discrete, noncontiguous areas: 1) waters off California, Oregon, and Washington, and 2) those in Alaskan waters (Carretta et al. 2011). Only individuals from the California, Oregon, or Washington stock may occur within the vicinity of the Proposed Action.

The Dall's porpoise is found from northern Baja California, Mexico, north to the northern Bering Sea and south to southern Japan (Jefferson et al. 1993). The species is only common between 32°N and 62°N in the eastern North Pacific (Morejohn 1979; Houck and Jefferson 1999). North-south movements in California, Oregon, and Washington have been suggested. Dall's porpoises shift their distribution southward during cooler-water periods (Forney and Barlow 1998). Seasonal movements have been noted off Oregon and Washington, where higher densities of Dall's porpoises were sighted offshore in winter and spring and inshore in summer and fall (Green et al. 1992).

In Washington, Dall's porpoise are year-round residents with distributions more abundant in offshore waters (Green et al. 1992). Dall's porpoise are observed throughout the year in the Puget Sound north of Seattle and are seen occasionally in southern Puget Sound. They can be opportunistic feeders but primarily consume schooling forage fish. Groups of Dall's porpoise generally include fewer than 10 individuals and are fluid, probably aggregating for feeding (Jefferson 1990, 1991; Houck and Jefferson 1999). Breeding and calving typically occurs in the spring and summer (Angell and Balcomb 1982). Resident Dall's porpoise breed in Puget Sound from August to September.

Dall's porpoises may occasionally occur in Hood Canal (Navy 2011b). Nearshore habitats used by Dall's porpoise could include the marine habitats found in the inland marine waters of Hood Canal. A Dall's porpoise was observed in the deeper water at NAVBASE Kitsap Bangor in summer 2008 (Agness and Tannenbaum 2009b).

Harbor Porpoise

There are eight stocks of harbor porpoise identified by NMFS in the Northeast Pacific Ocean. Only individuals from the Inland waters of Washington stock may occur in the project area. Harbor Porpoise are generally found in cool temperature to subarctic waters over the continental shelf in both the North Atlantic and North Pacific (Read 1999). This species is seldom found in waters warmer than 17°C (63°F) (Read 1999). Harbor porpoises can be found year-round primarily in the coastal shallow waters of harbors, bays, and river mouths (Green et al. 1992).

Harbor porpoise are non-social animals usually seen in small groups of 2 to 5 animals. Little is known about their social behavior. Harbor porpoise can be opportunistic feeders but primarily consume schooling forage fish (Osmek et al. 1996; Bowen and Siniff 1999; Reeves et al. 2008). Along the coast of Washington, harbor porpoise primarily feed on Pacific herring, market squid and smelts (Gearin et al., 1994). Females may give birth every year for several years in a row; calves are born in late spring (Read 1990; Read and Hohn 1995). Dall's and harbor porpoise appear to hybridize relatively frequently in the Puget Sound area (Willis et al. 2004).

Harbor porpoise are known to occur in Puget Sound year round (Carretta et al. 2011), and may occasionally occur in Hood Canal (Navy 2011b). Harbor porpoise observations in northern Hood Canal have increased in recent years (Navy 2011b). A harbor porpoise was seen in deeper water at NAVBASE Kitsap Bangor during 2010 field observations.

West Coast Transient Killer Whale

There are three distinct forms of killer whales, termed residents, transients, and offshores that are recognized in the northeastern Pacific Ocean. The transient population is further broken up into three stocks: 1) Gulf of Alaska, Aleutian Islands, and Bering Sea transients, 2) AT1 transients, and 3) West Coast transients (Carretta et al. 2011). The West Coast transient stock, which occurs from southern California to southeastern Alaska, may be present within the vicinity of the project area. The west coast stock spends a majority of their time along the outer coast, but has been observed coming into Hood Canal to feed on harbor seals between the months of January and July (London 2006).

In 2003, 11 transients from three separate pods spent almost two months in Hood Canal feeding on harbor seals primarily in the area between the Skokomish River and Quilcene Bay (London 2006). In 2005, six transient killer whales entered Hood Canal to prey upon harbor seals, remaining for 172 days between January and June. No other instances of this killer whale population in Hood Canal were found in the literature or the Orca Network (2012) database.

3.4.2.4 Essential Fish Habitat

The PFMC has designated EFH for each of the four primary fisheries that they manage within their FMPs: Pacific Coast groundfish, Pacific Coast salmon, coastal pelagic species, and West Coast highly migratory species (PFMC 2011a-c, 2012). Of these fisheries, only three (Pacific Coast groundfish, coastal pelagic species, and Pacific Coast Salmon) contain species for which EFH has been designated within Hood Canal or in the vicinity of NAVBASE Kitsap Bangor. The federally managed species, lifestages, and habitats, as indicated by PFMC FMPs are summarized for Hood Canal and the project vicinity in Table 3-10.

Essential Fish Habitat Designations

Pacific Coast Groundfish EFH is designated for species and lifestages and includes the following primary habitats:

Epipelagic zone of the water column, including macrophyte canopies and “drift algae”;

- Unconsolidated sediments consisting of mud, sand, or mixed mud/sand;
- Hard bottom habitats composed of boulders, bedrock, cobble, gravel, or mixed gravel/cobble;
- Mixed sediments composed of sand and rocks; and
- Vegetated bottoms consisting of algal beds, macrophytes, or rooted vascular plants (PFMC 2011a).

The groundfish FMP provides habitat suitability maps indicating probability of occurrence of over 90 species in Puget Sound (PFMC 2005a, b; 2011a). This list was refined for evaluation of the project vicinity to a total of 26 groundfish species based on review of habitat suitability maps specific to Hood Canal. Those species with a habitat suitability probability percentage of less than one percent were not included for analysis as their presence within the habitat would be very rare and the Proposed Action resulting in adverse effects to their EFH would be unlikely.

Site-specific nearshore surveys at NAVBASE Kitsap Bangor confirmed occurrence of eight groundfish species (dover sole, English sole, kelp greenling, lingcod, Pacific sanddab, rex sole, sand sole, and starry flounder) as well as unidentified flatfishes/sole species, and unidentified juvenile rockfish (*Sebastes spp.)* (Bhuthimethee et al. 2009a). As indicated above, this confirms the nearshore occurrence of these species

but is not intended to indicate the lack of occurrence of the other groundfish species, particularly based on the shallow-water limits of the surveys.

Coastal pelagic EFH consists of all estuarine and marine waters from the shoreline along the coasts of California, Oregon, and Washington offshore to the limits of the EEZ and above the thermocline where sea surface temperatures range from 10ºC to 20ºC (degrees Celsius) (PFMC 2011b). These boundaries include the waters of Hood Canal. The Coastal Pelagic FMP includes four finfish (Pacific sardine, Northern anchovy, Pacific [chub] mackerel, and jack mackerel). Also included are 1 invertebrate (market squid) and all euphausiid (krill) species that occur in the West Coast EEZ. The 4 finfish species are treated as a single species complex because of similarities in life histories and habitat requirements. Anchovy and market squid are expected to occur within Hood Canal (Table 3-10).

Northern anchovy (*Engraulis mordax*) are small, short-lived fish that are typically found in schools near the surface. They eat phytoplankton and zooplankton and spawn year-round with peaks from February to April. All life stages are preyed upon by a variety of predators, including salmon and numerous fishes. Northern anchovy were collected in the vicinity of the project site in low numbers in the 2007 surveys (19 individuals), confirming occurrence of this species in the nearshore zone.

Market squid (*Loligo opalescens*) are harvested near the surface, but they can occur at great depths as well. They prefer the salinity of the ocean and are rarely found in estuaries, bays, or river mouths. They feed on copepods as juveniles and feed on euphausiids, other small crustaceans, small fish, and other squid as they grow. Habitat requirements for spawning are not well understood, although documented spawning areas along the coast consist of shallow, semi-protected nearshore areas with sandy or mud bottoms adjacent to submarine canyons. Spawning occurs during most of the year, typically beginning in late summer off Washington. Eggs are attached to the substrate in capsules and take up to three months to hatch depending on water temperature. They are important as forage foods to many fish such as Chinook salmon, coho salmon, lingcod, and rockfish. Market squid are commonly seen by sport divers in Hood Canal. In addition, market squid egg masses trawled from Hood Canal waters have been used as a source for laboratory rearing (Mackie 2008). However, only one market squid was captured in the nearshore beach seine surveys from 2005 to 2009, suggesting their presence may be limited in the nearshore waters in the vicinity of the Proposed Action.

Pacific Coast salmon EFH includes all estuarine and marine environments extending from nearshore and tidal submerged environments within state territorial waters out to the full extent of the EEZ (200 nautical miles) offshore (PFMC 2012). In addition to the marine and estuarine waters, salmon species have a defined freshwater EFH, which includes all lakes, streams, ponds, rivers, wetlands, and other bodies of water that have been historically accessible to salmon including waters of NAVBASE Kitsap Bangor. Chinook, coho, and pink salmon are the salmon species with designated EFH. Although there are no streams within the project area that support spawning habitat for these three salmon species, the nearshore waters where they discharge to the estuarine nearshore environment is protected as EFH based on the functions they provide, including nutrient loads, terrestrial and aquatic prey, chemical buffering, salinity buffering, and habitat structure (e.g., large woody debris). The nearest discharge is located 0.7 mile north of the Service Pier.

Juvenile salmon were well-represented in the site-specific surveys, confirming substantial yearly use of the NAVBASE Kitsap Bangor shallow nearshore zone by juvenile Chinook, coho salmon, and pink salmon (Bhuthimethee et al. 2009a, b).

Table 3-10. Fish Species with Designated EFH in Hood Canal

Species	*Applicable Life Stages*	*Habitat*
Groundfish Species		
Arrowtooth flounder	E, L	Epipelagic zone.
Black rockfish	A, J	Vegetated bottom, hard bottom, Unconsolidated sediment.
Blue rockfish	A, L	Vegetated bottom, hard bottom, epipelagic zone.
Butter sole	A	Muddy or silty sediment.
Cabezon	A	Hard bottom.
California skate	E	Unconsolidated sediments.
China rockfish	J	Vegetated bottoms (kelp).
Dover sole	J	Epipelagic, muddy bottom.
English sole	A, J, L	Unconsolidated bottom, epipelagic zone.
Flathead sole	J	Unconsolidated sediments.
Kelp greenling	L	Epipelagic zone.
Lingcod	A, E, J	Unconsolidated sediments, epipelagic zone.
Longnose skate	A, E, J	Mixed sediments.
Pacific cod	E	Unconsolidated sediments.
Pacific Grenadier (formerly Pacific rattail)	E, L	Unconsolidated sediments, epipelagic zone.
Pacific Hake (formerly Pacific whiting)	A	Epipelagic zone.
Petrale sole	J	Unconsolidated sediments, epipelagic zone.
Quillback rockfish	A, J	Artificial structure, mixed bottom, vegetated bottom, epipelagic zone.
Rex sole	J	Unconsolidated sediments, 30 – 70 m deep.
Rock sole	A	Hard bottom.
Sablefish	A, E	Unconsolidated sediments, epipelagic zone.
Sand sole	A, J, L	Unconsolidated sediments, epipelagic zone.
Soupfin shark	A, J	Unconsolidated sediments, epipelagic zone.
Spiny dogfish	A, J	Unconsolidated sediments, epipelagic zone.
Splitnose rockfish	L	Epipelagic zone.
Starry flounder	A, J, E	Unconsolidated sediments, epipelagic zone.
Coastal Pelagic Species		
Anchovy	A, L, E	All estuarine waters above the thermocline and falling between 10 and 20 ºC.
Market squid		Same as above.
Pacific Salmonid Species		
Coho	A, J	Estuarine waters and substrates, including the nearshore and tidal submerged environments, and most freshwater bodies historically accessible to salmon (except above certain impassable natural barriers.
Chinook	A, J	Same as above.
Pink	A, J	Same as above.

Notes:
A = adult, E = eggs, J = juvenile, L = larvae, m = meters
Source: PFMC 2005a, b; 2011a, b; 2012

Habitat Areas of Particular Concern

In addition to EFH designations, areas called Habitat Areas of Particular Concern (HAPCs) are also designated by the regional FMCs. Designated HAPCs are discrete subsets of EFH that provide extremely important ecological functions or are especially vulnerable to degradation (50 CFR 600.805-600.815). Regional FMCs may designate a specific habitat area as an HAPC based on one or more of the following reasons: (1) importance of the ecological function provided by the habitat; (2) the extent to which the

habitat is sensitive to human-induced environmental degradation; (3) whether, and to what extent, development activities are, or would be, stressing the habitat type; and (4) rarity of the habitat type (NMFS 2002). Categorization as an HAPC does not confer additional protection or restriction to the designated area.

Out of the four fisheries managed by the PFMC, HAPCs have only been identified for groundfish. The four HAPCs designated for these species include sea grass, canopy kelp, rocky reef, and estuarine habitats along the Pacific coast, including Puget Sound. Two of these HAPCs, estuarine habitats and seagrass, are located within the vicinity of the Proposed Action.

Description of Habitats

The existing conditions of EFH designated habitat are described in more detail in Appendix D of this EA or in the following resources sections of this EA: *Section 3.2 – Noise (Airborne)*, *Section 3.3 – Water Quality and Marine Sediments*, and *Section 3.4.2.2 – Aquatic Species*.

3.4.3 Environmental Consequences

Impacts to biological resources would be considered significant if there was a loss of high value habitat for fish and wildlife and/or injury to special-status species would result from the Proposed Action.

The evaluation of impacts to biological resources and their habitats considers whether the species is listed under the ESA or afforded federal protection under other regulations (i.e., MMPA, Bald and Golden Eagle Protection Act, and MBTA). Also considered is whether the species has a particular sensitivity to stressors of the Proposed Action and/or a substantial or important component of the species' habitat would be lost as a result of the Proposed Action. A primary construction element of the Preferred Alternative would be installing 16 steel piles using both a vibratory and impact pile driver. There could be 4 additional steel piles to replace piles that do not meet engineering standards. Those pile failing engineering standards would be removed or cut-off and there would be no more than 16 in the final configuration. Before all environmental consequences of this alternative are discussed for biological resources, a summary of underwater noise and evaluation criteria for marine birds, fish, and marine mammals is introduced below. For specific noise definitions, please refer to *Appendix E, Fundamentals of Sound*.

Noise level Criteria for Evaluation of Impacts

In addition to human noise-sensitive receptors (discussed in Section 3.2), habitat for certain wildlife or aquatic species is also considered. It's important to understand the criteria currently in place for terrestrial and aquatic species before evaluating impacts from the Proposed Action.

Both airborne and underwater noise would be generated from pile driving activities. As described in *Section 3.2 Noise (Airborne)*, levels measured in the air are typically used to assess impacts on humans and are A-weighted to reduce the contribution of low and high frequencies and correspond to how humans hear. While noise pressures in air are weighted and measured in dB re 20 µPa (approximate threshold of human audibility), the reference pressure for water is 1 µPa. Noise levels underwater are not weighted and therefore measure unaltered frequency ranges that may extend above and below the audible range of many organisms (Caltrans 2009; WSDOT 2012).

Fish

The degree to which an individual fish exposed to underwater sound would be affected depends on a number of variables, including:

- species of fish;
- size of fish;
- presence of a swim bladder;
- physical condition of the fish;
- maximum sustained sound pressure and frequency;
- shape of the sound wave (rise time),
- depth of the water;
- depth of the fish in the water column;
- amount of air in the water;
- size and number of waves on the water surface;
- bottom substrate composition and texture;
- effectiveness of bubble curtain sound/pressure attenuation technology; and
- tidal currents.

Depending on these factors, effects on fish can range from changes in behavior to immediate mortality. There has been no documented injury or mortality resulting from the use of vibratory pile drivers; however, fish injury from impact hammers has been documented.

Three metrics are commonly used to evaluate noise impacts to fish (Caltrans 2009):

- *Peak Sound Pressure level (Lpeak)* – Peak sound pressure level based on the largest absolute value of the instantaneous sound pressure over the frequency range from 20 to 20,000 Hz; pressure is unweighted and measured as dB re 1µPa;
- *Root Mean Square (rms)* – rms level is the square root of the energy divided by a defined time period; and
- *Sound Exposure Level (SEL)* – Constant level over 1 second that has the same amount of acoustic energy, as indicated by the square of the sound pressure, as the original sound.

The Fisheries Hydroacoustic Working Group (FHWG) is a multi-agency group that includes members from California Transportation Department (Caltrans), Oregon Department of Transportation, Ecology, Federal Highway Administration (FHWA), NMFS, USFWS, California Department of Fish and Wildlife, and USACE. This technical working group is responsible for generating underwater noise effects criteria for fish exposed to pile driving activities. The FHWG developed the Agreement in Principal for *Interim Criteria for Injury to Fish from Pile Driving Activities* that establishes a 206 dB-peak and 187 dB cumulative SEL for all listed fish except those that are less than 2 g. In that case, the criterion for the cumulative SEL is 183 dB (FHWG 2008).

Marine Mammals

The NMFS has used generic sound exposure thresholds to determine when an activity in the ocean that produces sound might result in impacts to a marine mammal such that a take by harassment might occur (70 FR 1871). These thresholds are used to determine compliance with the MMPA (16 USC § 1362 Sec. 3 (13)) and the ESA (7 USC § 36 and 16 USC § 1531 et seq.), but the effects determinations and language used to report exposure to harmful noise levels are different for the two statutes. As described in Section 3.4.1, the MMPA imposes a moratorium on the taking of marine mammals, where "take" means to harass, among other actions. The MMPA defines two levels of harassment, each of which has been assigned a noise exposure threshold:

- Cetaceans and pinnipeds exposed to impulsive sounds of 180 and 190 dB rms or above, respectively (i.e., injury threshold levels, and higher than impact or vibratory pile driving sounds), are considered to have been taken by injury (Level A harassment). Injury thresholds are applied to a situation where the noise has the potential to injure a marine mammal or marine mammal stock in the wild (16 USC §1362 Sec. 3 (18) (A) (i)).
- Marine mammals exposed to sounds at or above 160 dB rms for impulse sounds (e.g., impact pile driving) and 120 dB rms for continuous noise (e.g., vibratory pile driving), but below injurious thresholds are considered to have been taken by behavioral/disturbance (Level B harassment).
- Behavioral disturbance thresholds are applied to situations where the noise "has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavior patterns, including, but not limited to, migration, breathing, nursing, breeding, or sheltering (16 USC §1362 Sec. 3 (18)(A)(ii)). The application of the 120 dB rms threshold can sometimes be problematic because this threshold level can be either at or below the ambient noise level of certain locations. As a result, these levels are considered precautionary (74 FR 41684). NMFS is developing new science-based thresholds to improve and replace the current generic exposure level thresholds, but the criteria have not been finalized (Southall et al. 2007).

Marine Birds

Little is known about the general airborne hearing or underwater hearing capabilities of birds but research is ongoing. What has been determined is that there are three classes of potential effects identified for birds from noise (i.e., traffic or construction). These are:

1. physiological and behavioral effects;
2. damage to hearing from acoustic over-exposure; and
3. masking of important bioacoustics and communication signals (Dooling and Popper 2007).

Research has shown that birds hear between 1 and 5 kHz, with best sensitivity approaching 0 – 10 dB Sound Pressure Level (SPL) at the most sensitive frequency, which is the region of 2-4 kHz. This region is the spectral region of a bird's vocalization and where noise generated would have a greater masking effect on detection of communication signals than noise outside this range (Dooling and Popper 2007). Studies have not been specific to marine birds and these levels more reflect research done on other avian species (i.e., owls and songbirds) until recent guidance provided by the Marbled Murrelet Science Panels became available.

The first Marbled Murrelet Science panel evaluated injury from underwater noise impacts on foraging murrelets. An underwater auditory injury criterion of 202 dB SEL re 1µPa-sec cumulative was accepted by USFWS and only applies to impact pile driving (cumulative strikes over a 24-hour period). There is currently no threshold for vibratory installation of piles.

Airborne noise from pile driving can generate noise that could potentially result in masking of communication between foraging marbled murrelets when on the water. The second Marbled Murrelet Science Panel was convened to evaluate the onset of non-injurious threshold shift (TTS) in the marbled murrelet. After review of the relevant literature on marbled murrelet behavior and hearing in birds, the Panel identified communication during foraging as a critical hearing demand that could be affected by underwater pile driving. However, the sound levels at which this could occur is dependent upon site specific, temporally variable factors, ambient noise levels, and the source sound level. The panel's sample calculation of 168 meters was specific to the Bangor waterfront and a pile producing 94 dBA at 15 meters based on the Navy's Test Pile Project data. The USFWS has not applied a threshold and masking has not been calculated for other projects or sites to date. However, due to the close location and similarity of the Moorings project to what was calculated during the second Marbled Murrelet Science Panel, 168 meters was used as the distance from the pile at which masking could potentially occur. This distance is conservative because seven piles would be installed that are smaller in size, and thus quieter to install, than was calculated for the Test Pile Project. Therefore, this would reduce the area of the masking zone. A conservative approach was used to select source levels for analyzing impacts to species. Available information from various pile driving studies (vibratory and impact) was reviewed and the most relevant to the proposed project in terms of pile type and size, water depth, and substrate was used.

Airborne and underwater noise injury and disturbance thresholds for fish, marine mammals, and marbled murrelet are presented in Table 3-11.

Table 3-11. Airborne and Underwater Noise Injury and Disturbance Thresholds for Marine Mammals, Fish, and Marbled Murrelets

Airborne Noise Thresholds (Impact and Vibratory Pile Driving) (dB re 20 µPa unweighted)		***Underwater Noise Thresholds for Vibratory Pile Driving (dB re 1 µPa)***		***Underwater Noise Thresholds for Impact Pile Driving (dB re 1 µPa)***	
Hearing Group	***Airborne Sound Pressure Level***	***Injury Threshold***	***Behavioral Harassment Threshold***	***Injury Threshold***	***Behavioral Harassment Threshold***
Cetaceans (whales, dolphins, porpoises)	NA	180 dB rms	120 dB rms	180 dB rms	160 dB rms
Pinnipeds (sea lions)	100 dB rms	190 dB rms	120 dB rms	190 dB rms	160 dB rms
Harbor seal	90 dB rms				
Fish ≥ 2 grams	NA	150 dB rms	150 dB rms	187 dB Cumulative SEL	150 dB rms
Fish < 2 grams				183 dB Cumulative SEL	
Fish all sizes				Peak 206 dB	
Foraging Marbled Murrelets	Masking: variable depending on spectrum level ambient levels.	NA	NA	202 dB SEL	150 dB rms (guideline)

Notes: NA = not applicable, no established threshold;
Source: FHWG 2008; WSDOT 2012.

Estimated Underwater Noise Levels

In order to estimate the SPLs which could potentially be generated by pile driving, data from previous pile driving efforts most relevant to the project in terms of location, pile type and size, pile driver type, substrate, and water depth were identified. Due to the project similarities, SPL measurements recorded during the Navy's Test Pile Program at the Bangor waterfront were used as source data for this analysis (Table 3-12). Using this data, it was determined that impact pile driving under the Proposed Action could generate peak sound levels of approximately 210 dB re 1 µPa, average SEL levels of 180 dB re 1 µPa and average rms levels of approximately 196 dB re 1 µPa all at a distance of 10 m, without the use of attenuation (Illingsworth and Rodkin 2012). Vibratory pile driving is expected to produce lower noise levels of approximately 172 db rms re 1 µPa at 10 meters (Illingsworth and Rodkin 2012).

Table 3-12 Summary of Sound Levels During the Test Pile Program

Installation Method	*Steel Pipe Pile Size*	*Peak dB*[1]	*dB rms*[1]	*Singe Strike SEL*[2]
Impact	24-inch	193	180	167
	36-inch	210	196	177
	48-inch	209	194	180
Vibratory	24-inch	-	160	-
	36-inch	-	169	-
	48-inch	-	172	-

Notes:

1 Measured at 10 m; referenced to 1 µPa.

2 Measured at 10 m; referenced to 1 µPa2*sec.

Source: Illingsworth and Rodkin 2012.

Sound Attenuation Techniques

A bubble curtain would be used to minimize the noise generated by impact pile driving. Bubble curtains emit a series of bubbles around a pile to introduce a high-impedance boundary through which pile driving noise is attenuated. Bubble curtains can be unconfined or confined. A confined bubble curtain uses a flexible or rigid shroud around the bubble curtain to hold air bubbles near the pile.

Noise reduction results from bubble curtains indicate a wide variance with very little measurable attenuation in some cases (less than 6 dB), and high attenuation (greater than 15 dB) in other cases (Caltrans 2009, WSDOT 2012). Caltrans observed that bubble curtain attenuation levels for 24-inch diameter or smaller steel or concrete piles generally reduced sound levels by 5 dB and attenuation levels for 24-inch to 48-inch diameter steel piles were generally reduced by 10 dB (Caltrans 2009). They noted noise reduction may be more difficult to achieve in harder substrates, which may transmit ground-borne noise and propagate it into the water column, while softer substrate may allow for a better seal of the curtain on the substrate (Caltrans 2009). WSDOT reported attenuation levels from unconfined bubble curtains ranged from 0 to 32 dB with a mean of 11.9 dB (standard deviation [s.d.] 8.7) (WSDOT 2012). Two recent Puget Sound projects at the Anacortes and Mukilteo Ferry Terminals, which drove 36-inch diameter steel piles, reported mean attenuation levels of 15 dB at approximately 10 meters (s.d. 10.6, range 7 to 22 dB) and 8 dB at approximately 10 meters (s.d. 3.10, range of 3 to 11), respectively (WSDOT 2012). At the Mukilteo site, attenuation was noted to decrease with range from the pile resulting in a significant drop in attenuation by 1,100 meters (MacGillivray et al. 2007). Both of these projects were located in sand and silt substrates.

A bubble curtain would be used during impact pile driving. Based on the information above from Caltrans and WSDOT, an average SPL reduction of 8 dB measured at 10 meters was conservatively chosen as an achievable level of attenuation for the 24-inch to 48-inch diameter piles. For the 20-inch piles, an average peak SPL reduction of 5 dB measured at 10 meters was chosen.

3.4.3.1 No-Action Alternative

Under the No-Action Alternative, the construction and use of the barge mooring location or the proposed new research barge would not occur. Baseline biological resources would remain unchanged. Therefore, there would be no significant impacts to biological resources from implementation of the No-Action Alternative.

3.4.3.2 Preferred Alternative

Terrestrial Wildlife

As discussed in Section 3.2, the highest noise levels at the base are produced along the waterfront and at the ordnance handling areas with an estimated noise level range from 70 to 90 dBA and potentially peaking intermittently at 99 dBA. Proposed pile driving would result in increased airborne noise in the vicinity of the construction site. Maximum peak levels would be generated during impact pile driving using an impact hammer, estimated to be 105 dBA re 20 µPa at a distance of 15 meters from the pile, and 97 dB rms re 20 µPa at 160 meters (unweighted; Blackwell et al. 2004); vibratory pile driving would create noise levels of 95 dBA re 20 µPa at 15 m, and unweighted noise levels of 97 dB rms re 20 µPa at 12 meters (WSDOT 2012). Other construction activities or equipment, such as cranes, heavy trucks, and generators would also cause noise; however, this noise level would be much lower compared to noise produced by the impact hammer (WSDOT 2012). In the absence of pile driving noise, maximum construction noise would be 94 dBA re 20 µPa at a distance of 15 meters from the activity, computed as the summation of noise of all equipment operating simultaneously (WSDOT 2012). Terrestrial wildlife along Hood Canal adjacent to the project site would be affected by construction noise. Airborne noise due to impact pile driving would be the most noticeable to terrestrial wildlife. Noise impacts due to other construction activities would be minimal.

A majority of the birds were observed within the nearshore area of Carlson Spit at a distance of approximately 500 ft (150 m) from proposed pile driving activities. Since noise levels decrease by approximately 6 dBA with each doubling of distance (WSDOT 2012), the average sound levels at a distance of 500 ft would be estimated at 95 dBA re 20 µPa for impact pile driving. Wildlife species occurring within the industrial areas of NAVBASE Kitsap Bangor waterfront have likely acclimated to the ambient noise levels that occur on a daily basis and are not expected to be impacted during pile driving operations, particularly marine birds occurring at Carlson Spit.

Construction noise can also deter many birds from nesting. Both an osprey and bald eagle nesting site are located approximately 0.5 miles from the project area. Following the 6 dBA per doubled distance decrease, noise would be expected to attenuate down to approximately 85 dBA which is within the range of baseline noise levels generated on a day-to-day basis. Therefore, no significant impacts to osprey or bald eagle nesting sites or nesting activity would result.

Construction would occur 6 days per week between July 16 and September 30, with restrictions on in-water work from July 16 to September 23 permitted between 2 hours after sunrise to 2 hours before sunset to minimize disturbance to foraging marbled murrelets. The in-water work window restriction would be

adjusted from September 24th to September 30th to allow construction from sunrise to sunset. These timeframes would also coincide with the time in which migratory bird presence would be low by avoiding the wintering time period. Non-pile driving construction activities could last until 10:00 p.m. in accordance with the WAC noise guidelines. Pile driving activities would not exceed 20 days. Temporary and short-term noise disturbance to terrestrial birds would like occur but would not be significant as these species are likely acclimated to the elevated noise levels typically produced along the industrial waterfront on a daily basis. No significant impacts to terrestrial species would occur with implementation of the Preferred Alternative.

Aquatic Species

Marine Vegetation

Eelgrass is not present within the project area and therefore would not be directly impacted. Appropriate minimization measures would be implemented (see Section 2.5) in order to avoid any impacts to the small patch of eelgrass located approximately 175 ft south of the proposed relocated Port Operations float. Macroalgae (green and brown) are more abundant within the shallower depths of 15 ft and less where proposed pile driving activity would take place. Temporary and localized impacts are expected during construction as a reduction of light (shade from construction vessels) would lead to a temporary reduction in species abundance. Macroalgae are part of the forage fish diet and therefore a reduction in forage fish prey could lead, indirectly, to a temporary reduction in prey availability for adult salmon that feed primarily on forage fish. However, construction is anticipated to be completed within 8 weeks/40 workdays and these species of macroalgae are expected to return to unshaded areas following construction. Taking into account the existing gangway and mooring dolphin that would be removed, the new float sections, and transformer pad there would be a net decrease of 75 ft^2 of new shaded area for new infrastructure. However, no significant impacts to macroalgae as a population are expected. Therefore, no significant impacts to marine vegetation would be expected with implementation of the Preferred Alternative.

Benthic Invertebrates

The project area encounters frequent boat and in-water operations activity and is not a high abundance area for invertebrates. No construction or staging would occur in the intertidal area so impacts to invertebrates in this area are not expected. Proposed in-water work would disturb bottom substrates during pile installation. No more than 16 steel piles would be placed at depths less than or equal to -30 ft MLLW. Benthic organisms within the footprint of the new piles and moorings location would be lost. However, the area of disturbance is minor in comparison to the rest of NAVBASE Kitsap Bangor's nearshore environment and re-colonization following construction is anticipated. Therefore, no significant impacts to invertebrates would be expected with implementation of the Preferred Alternative.

Marine Fish

Construction activities associated with the Preferred Alternative would result in increased underwater noise levels in Hood Canal, due primarily to pile driving activity. Some noise would also be generated from support vessels and barge mounted equipment (i.e., generators). However, the most significant in-water noise potentially affecting marine fish would be from pile driving using an impact hammer pile driver. In some cases where difficult geological conditions are encountered, it may be necessary to use an impact hammer to drive certain piles for part of all of their required depth. It is anticipated that a maximum of 4 piles could be driven per day with an average of 500 strikes per pile, resulting in a

maximum of 2,000 pile strikes per day. The total duration of in-water pile driving would be approximately 20 days.

The sequence of pile installation is unknown. However, if four 36-inch to 48-inch piles were impact driven in a day, this scenario would represent the worst-case for evaluating noise impacts. The maximum number of days this could occur would be up to three and half (five 36-inch piles and eight 48-inch piles for a total of 13 piles, which if driven at the rate of four piles per day, results in three days of impact pile driving for the loudest piles). If one or more of the 36-inch to 48-inch piles were driven on the same day as the 20-inch to 24-inch piles, the area of impact for the day would be less. And on days when only 24-inch and/or 20-inch piles were driven, the area of impact would also be smaller.

The calculated distances to the marine fish threshold criteria and the area affected for the impact and vibratory installation of 48, 36, 24, 20-inch diameter piles are provided in Table 3-13. Figure 3-6 and Figure 3-7 illustrate representative views of the area of effect for impact and vibratory driving of various pile sizes for each of the noise thresholds for marine fish.

A majority of the pile driving would be initially conducted using a vibratory pile driver. This method would be used until either the pile hits refusal and necessitates an impact hammer to reach required depth or depth is achieved with only impact proofing necessary. Since vibratory pile drivers typically generate noise levels from 10 to 20 dB lower than impact hammer pile driving, impacts on fish are typically not observed in association with vibratory pile driving (WSDOT 2012). Only behavioral disturbance from vibratory pile driving would be anticipated (Table 3-13).

Table 3-13. Maximum Range to Fish Sound Criteria Thresholds from Pile Driving

Type of Pile Driving and Pile Size	*Criteria Threshold per Pile Type and Pile Driving Method (all distances given in meters)*			
	206 dBPEAK (injury)	*187 dB Cumulative SEL for a fish>2g (injury)*	*183 dB Cumulative SEL for fish <2g (injury)*	*150 dB rms (behavioral)*
48-inch[1,2]				
Impact	5	148	273	3,415
Vibratory	N/A	N/A	N/A	293
36-inch[2]				
Impact	5	93	173	3,415
Vibratory	N/A	N/A	N/A	185
24-inch[1]				
Impact	0	20	37	293
Vibratory	N/A	N/A	N/A	46
20-inch[3]				
Impact	1	32	59	464
Vibratory	N/A	N/A	N/A	46

Notes:

All sound pressure levels expressed in dB re 1 µPa; SEL are expressed in dB re 1 μPa^2*sec.

Practical spreading loss model (15 log R, or 4.5 dB per doubling of distanced) used for calculations.

Cumulative SEL calculated as Single Strike SEL + 10 * log (# of pile strikes).

1 Source levels based on measurements taken during the Test Pile Program and 8 dB of attenuation was applied for 48-24-inch piles.

2 The 36-inch peak and rms source level measurements were louder than the 48-inch measurements and were used for both piles sizes to provide a conservative estimate.

3 The 24-inch source level measurement during Test Pile Program was used for the 20-inch pile estimate and 5 dB of attenuation was applied.

Source levels from Table 3-12 were used to model noise threshold impacts to fish. The underwater noise threshold criterion for fish injury from a single impact hammer strike occurs at a SPL of 206 dBpeak re 1 µPa. The Navy anticipates that no more than 2000 strikes of the impact hammer would occur per day. Assuming 50 strikes per minute, it is likely that maximum daily duration of impact pile driving each day would be approximately 35-40 min. This assumption is from industry standard for impact hammer, which range from 35 to 52 strikes per minute (min) (Hammer & Steel 2012). Due to the necessity of multiple strikes, the analytical approach for determining underwater sound effects from impact pile driving on fish requires using an accumulated SEL as the threshold; therefore, a single strike analysis does not apply. For the values selected for the analysis, (210 peak, 180 SEL, and 196 rms) and assuming a 8 and 5 dB reduction from a sound attenuation device, the distance to the injury threshold for 187 SEL is 148 meters (485 feet) from the pile and the distance to the injury 183 SEL is 273 meters (895 feet). Injury from peak levels would occur very close to the pile (within 5 meters) where the fish are not expected to be present due to human activity (Figure 3-6). Behavioral harassment was calculated to occur as far as 3.4 kilometers (2 miles) from the pile being driven (Figure 3-7).

Fish behave differently in their reaction to noise. Some fish are active swimmers and are likely to swim away from a disturbing noise source. Other fish that are resident to the area may not move away and thus would be exposed to the noise levels for the duration of the pile driving activity (Hastings and Popper 2005).

During impact pile driving, a bubble curtain would be used to attenuate noise. In addition, the bubble curtain would be turned on prior to initiation of pile strikes in an effort to flush fish away from the injury zone near the pile. All pile driving activities would be conducted during the allowable in-water work period to reduce potential impacts to juvenile salmon and forage fish. NAVBASE Kitsap Bangor fish surveys in the 1970s and 2005 to 2008 indicate that greater than 95 percent of the juvenile salmonids in this part of Hood Canal occur during the closure period and thus least likely to be present during the allowable in-water work period (Schreiner et al. 1977; Salo et al. 1980; Bax 1983; SAIC 2006; Bhuthimethee et al. 2009a/2009b).

Turbidity in the water column would occur during pile driving activities, creating temporary and localized disturbance to water quality (reduced DO concentrations and resuspension of sediments). Suspended sediments are anticipated to settle back down to the seafloor shortly after pile driving commences. Water quality impacts would be short-term and localized and would not result in significant long-term impacts to fish that may be present in the area at the time of construction.

With implementation of BMPs and minimization measures described in Section 2.5, no significant impacts to marine fish are anticipated with implementation of the Preferred Alternative.

Figure 3-6. Distance to Underwater Sound Thresholds for Fish during Impact Pile Driving (48-inch steel piles)

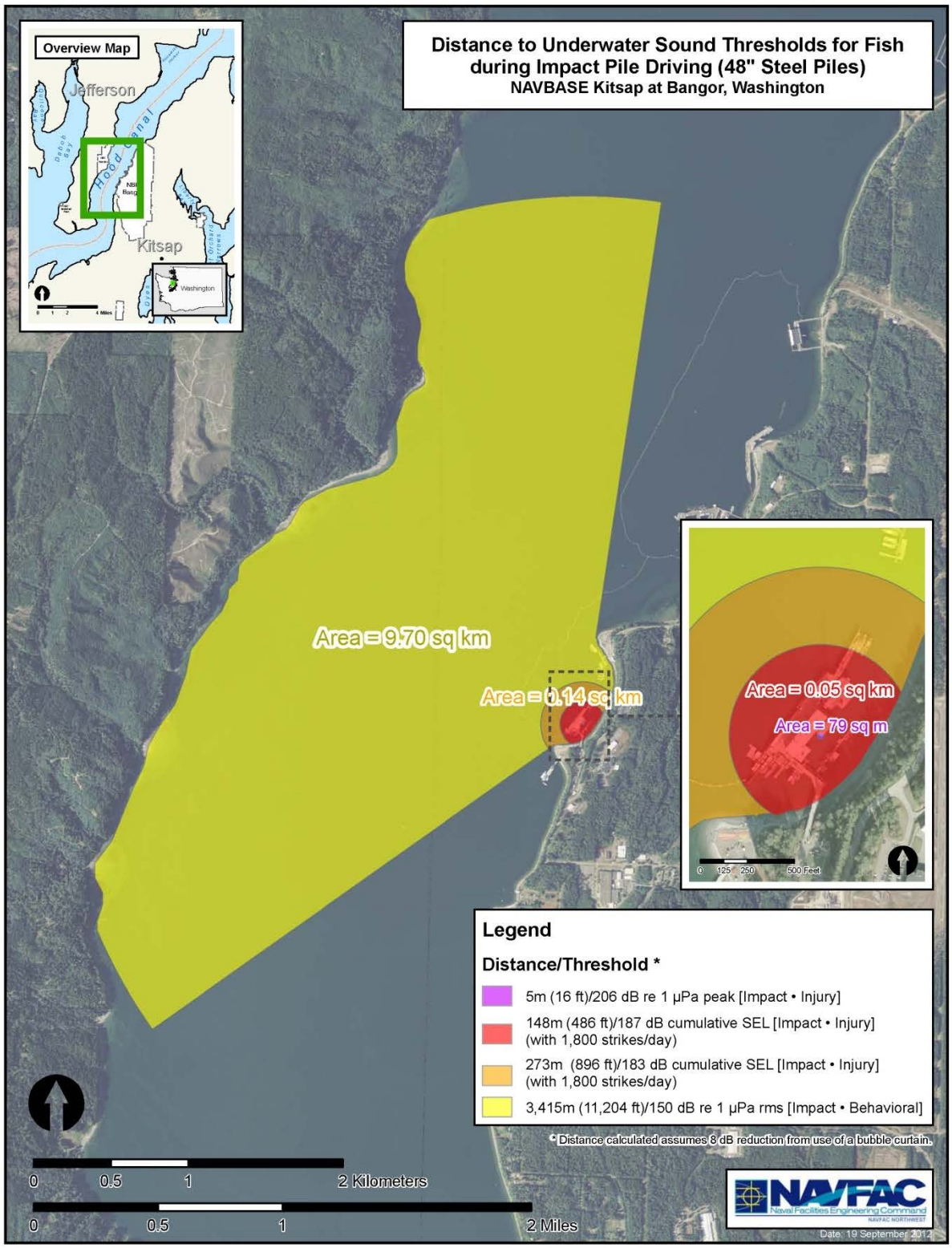
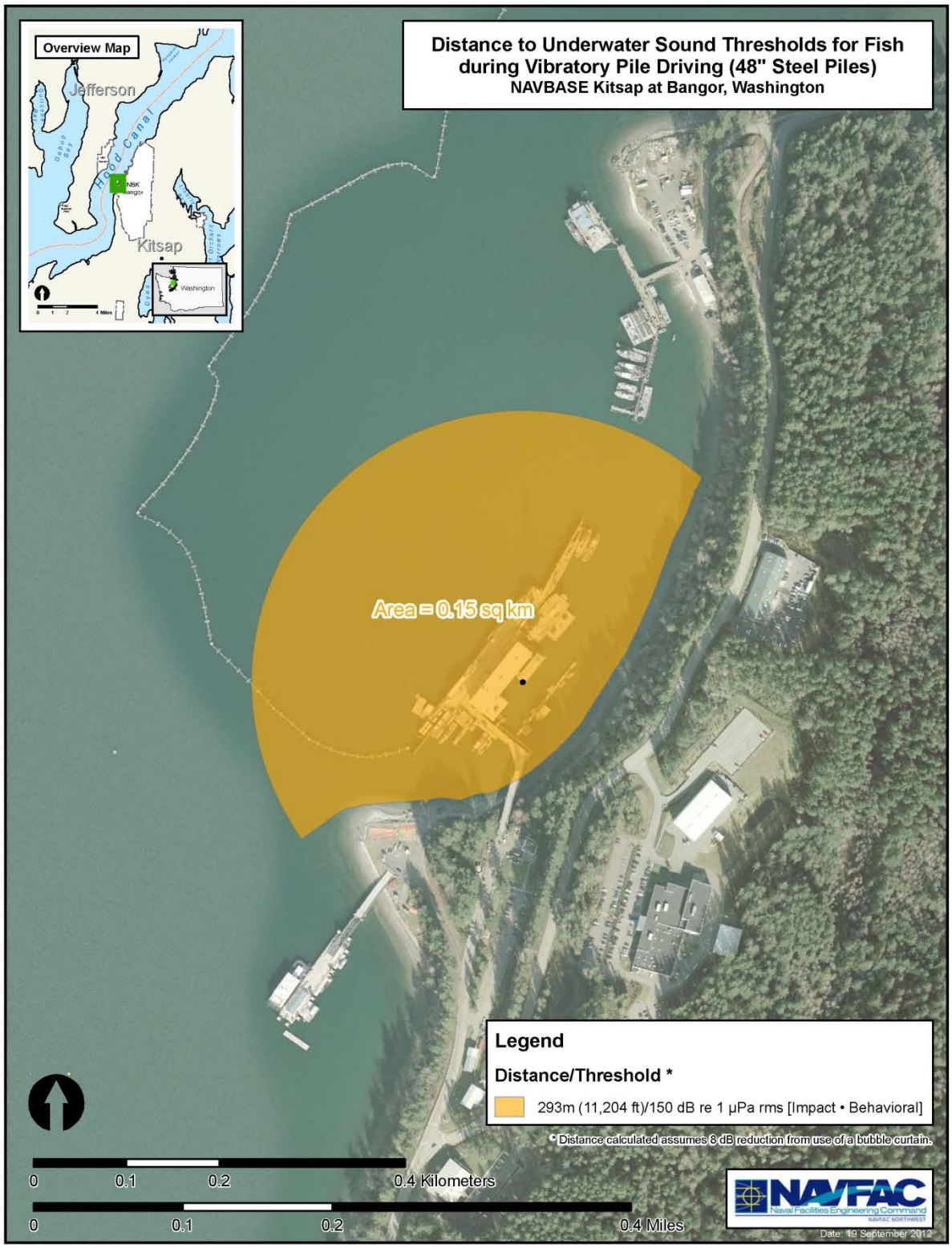


Figure 3-7. Distance to Underwater Sound Threshold for Fish during Vibratory Pile Driving (48-inch steel piles)



Special-Status Species

ESA-listed Species and Critical Habitat

Impacts summarized above and detailed in the Biological Assessment (Appendix D) for fish species would also apply to ESA-listed Puget Sound Chinook salmon, Hood Canal summer-run chum salmon, Puget Sound steelhead, bull trout and the Puget Sound/Georgia Basin DPSs of bocaccio, canary, and yelloweye rockfish. Pile driving would increase underwater noise above established thresholds for fish. However, pile driving would occur during the in-water work window when juvenile salmonids are least likely to be present and adult salmonids would likely avoid the area temporarily or use it primarily as a migration corridor. As discussed in *Section 3.4.2.3 - Rockfish*, little is known about actual population densities of ESA-listed rockfish species within the project area. Juvenile rockfish have been captured during fish surveys along the NAVBASE Kitsap Bangor waterfront so it is possible these ESA-listed rockfish species could be present. The small marine vegetated areas within and adjacent to the project area provide habitat for juvenile canary and bocaccio rockfish and thus a few of these juveniles may be present within the project area during construction. It is also possible that a few larval yelloweye rockfish, canary rockfish, and bocaccio occur within the water column of the project area or adjacent to and would be injured or killed by the effects of pile driving, but these numbers would be very low. The closest adult ESA-listed rockfish are likely several thousand feet away within waters deeper than 120 ft, and are not expected to be affected by project activities due to the distance of the project and attenuation of sound.

The project would be very short in duration and timing constrained (July 16 to Sept 30) to ensure that very few individuals of ESA-listed salmonids and rockfish would be exposed to effects of the Proposed Action. Daily pile driving activities would be separated by overnight rest periods when migration can precede uninhibited. Adult in-migration of Chinook and chum salmon would not be significantly delayed.

In summary, impacts from sediment disturbance, underwater noise, and general changes to water quality would be temporary, localized, and short-term and therefore not significant with implementation of the Preferred Alternative. The Navy concludes that the appropriate ESA effects determination for Puget Sound Chinook salmon, Hood Canal summer-run chum salmon, Puget Sound steelhead trout, bull trout, and Puget Sound/Georgia Basin bocaccio, canary, and yelloweye rockfish is “may affect, not likely to adversely affect.”

Only Puget Sound Chinook and Hood Canal Summer-run chum salmon have critical habitat known to occur within the vicinity of the project area. However, NAVBASE Kitsap Bangor is excluded from critical habitat designation for these two species by federal law (70 FR 52630). As a result, no Puget Sound Chinook salmon or Hood Canal summer-run chum salmon critical habitat occurs in the immediate vicinity of the project area. However, the closest critical habitat occurs on the west side of Hood Canal (approximately 2,500 meters from the project area), to the north of the base boundary (approximately 4,600 m), and to the south of the base boundary (approximately 1,100 m) where noise generated from impact pile driving (most noise-producing activity) may cause temporary behavioral disturbance to these species using those critical habitat areas. Because the in-water work would be conducted when these ESA-listed species are least likely to be present, the Navy concludes that an effects determination of “may affect, not likely to adversely affect” Puget Sound Chinook salmon and Hood Canal summer-run chum salmon critical habitat is appropriate. A “no effect” determination is appropriate for Coastal-Puget Sound Bull trout critical habitat as the closest designated area is in Dabob Bay located on the west side of Toandos Peninsula.

Humpback Whale

Table 3-14 presents the calculated distance to and areas encompassed by the underwater marine mammal thresholds during pile driving 48-inch piles under the Preferred Alternative. The predicted area exceeding the threshold assumes a field free of obstruction, which is unrealistic, however, because Hood Canal does not represent open water conditions (free field) and therefore, sounds would attenuate as they encountered land masses or bends in the canal. As a result, some of the distances and areas of impact calculated cannot actually be attained at the project area. The actual distance to the behavioral disturbance thresholds for pile driving may be shorter than the calculated distance due to the irregular contour of the waterfront, the narrowness of the canal, and the maximum fetch (furthest distance sound waves travel without obstruction [i.e., line of site]) at the project area. These distances are presented in Table 3-14. Figure 3-8 and Figure 3-9 graphically depict the representative areas of each underwater sound threshold for sound threshold for marine mammals (cetaceans, such as Humpback whales, and pinnipeds in the vicinity of the project area.

Table 3-14. Distance to Marine Mammal Exposure Thresholds

Pile Size	***Type of Pile Driving***	***Marine Mammals (meters)***			
		Injury Pinnipeds	***Injury Cetaceans***	***Behavioral Disturbance from Impulse Noise***	***Behavioral Disturbance from Continuous Noise***
		190 dB rms	***180 dB rms***	***160 dB rms***	***120 dB rms***
48-inch	Impact	7	34	736	N/A
	Vibratory	1	3	N/A	29,286*

Notes:

All sound levels expressed in dB re 1 µPa rms.

Practical spreading loss (15 log, or 4.5 dB per doubling of distanced) used for calculations.

Sound pressure levels used for calculations were: 196 dB rms re 1 µPa @ 10m for impact and 172 dB rms re1 µPa @ 10 meters for vibratory.

8 db of attenuation was applied to source sound pressure levels.

*Range calculated is greater than what would be realistic. Hood Canal average width at site is 2.4 km, and is fetch limited from N to S at 20.3 km.

Humpback whales are very rare in Hood Canal. Although several sightings of a humpback whale occurred in January and February of 2012, it turned out to be the same individual whale each time (Calambokidis pers. comm. 2012). Prior to these sightings, there were no confirmed reports of humpback whales entering Hood Canal (Calambokidis pers. comm. 2012). No other reports of humpback whales in the Hood Canal were found in the Orca Network database, the scientific literature, or agency reports. Construction of the Hood Canal Bridge occurred in 1961 and could have contributed to the lack of historical sightings (Calambokidis pers. comm. 2010). Due to the absence of any regular occurrence of humpbacks adjacent to or within the vicinity of the project site, no more than 20 days estimated for pile driving, and implementation of marine mammal monitoring, no impacts to humpback whales are anticipated with implementation of the Preferred Alternative. The Navy concludes that the appropriate ESA effects determination for humpback whale is “may affect, not likely to adversely affect.”

Figure 3-8. Area Exceeding Underwater Sound Thresholds for Marine Mammals during Impact Pile Driving (48-inch steel piles)

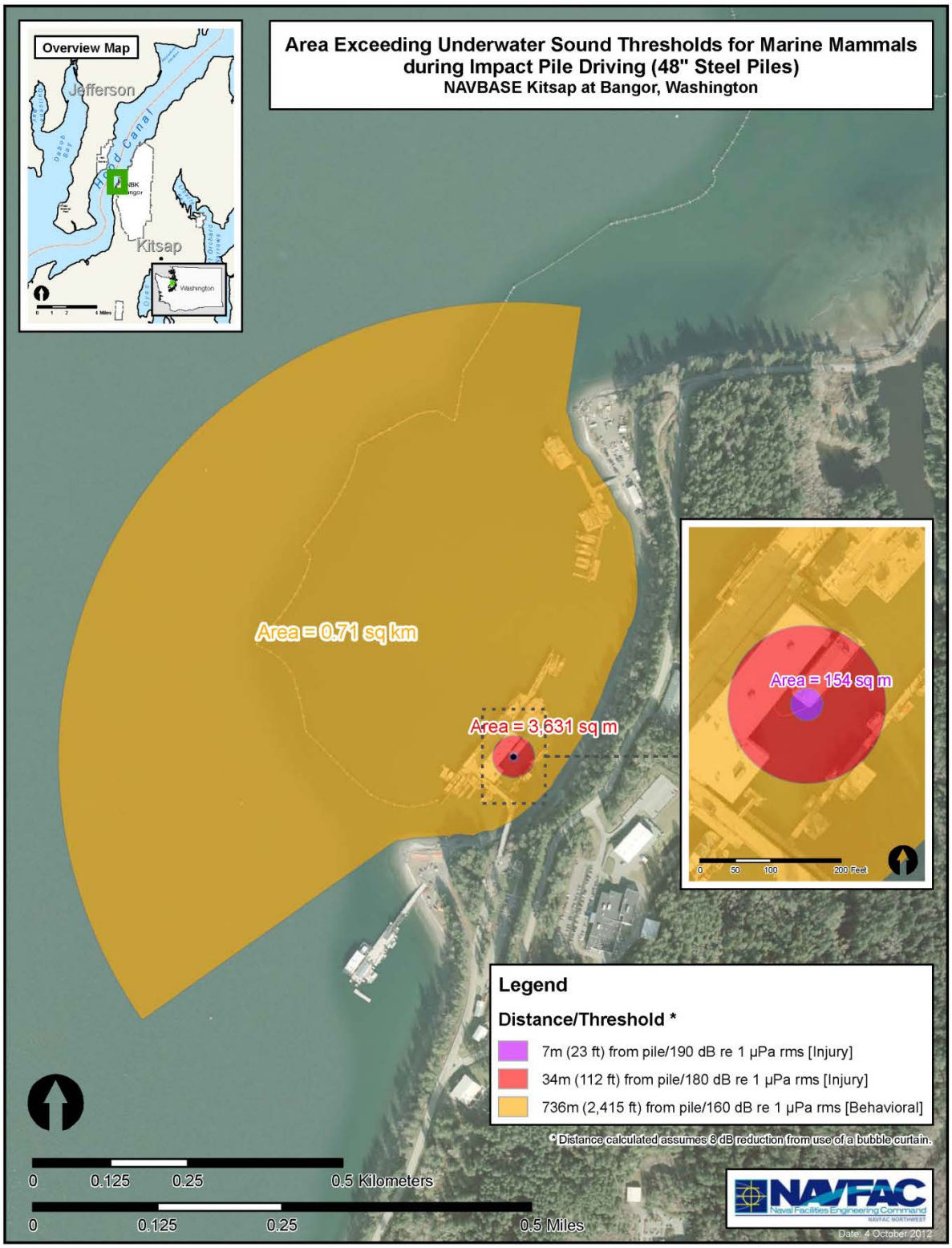
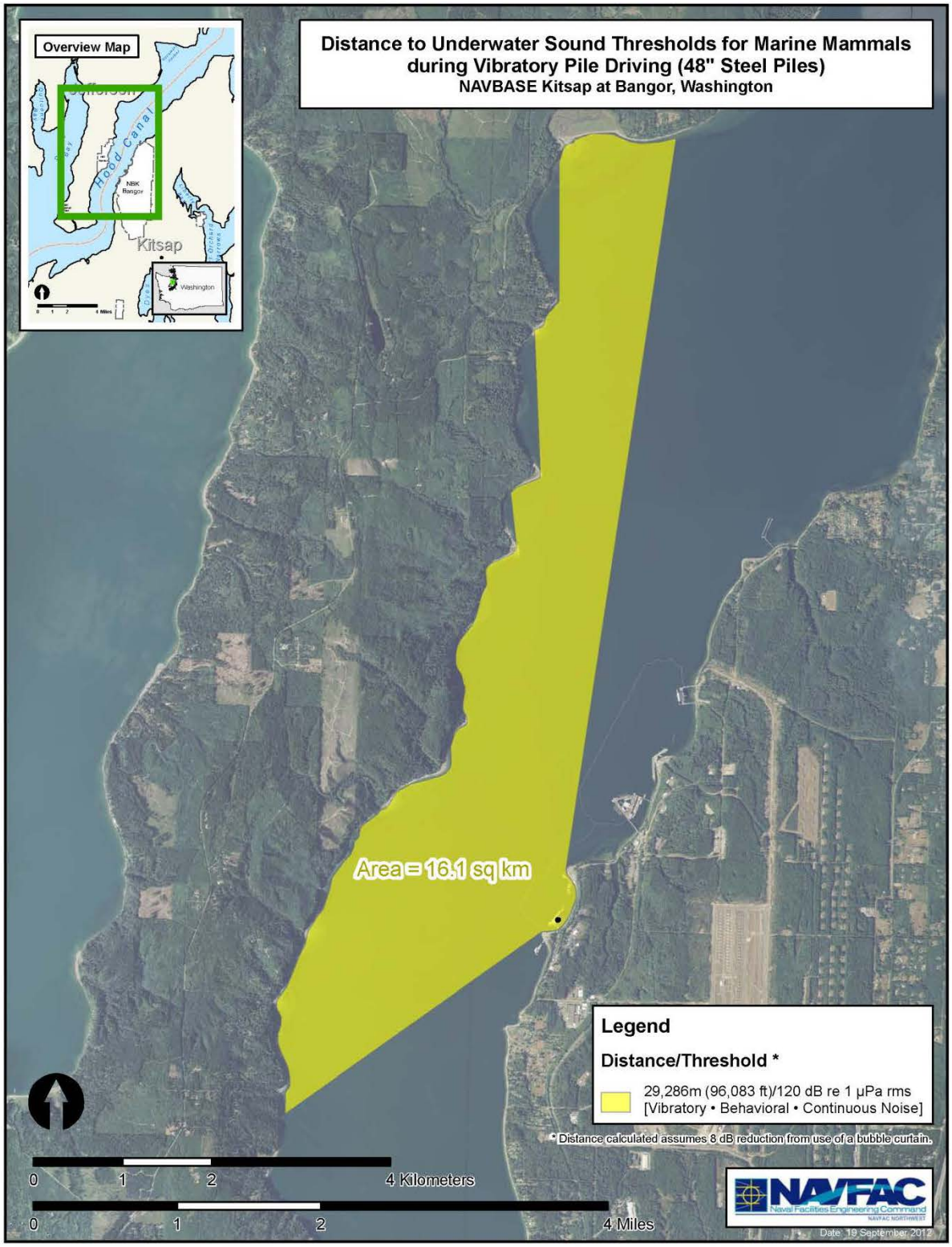


Figure 3-9. Distance to Underwater Sound Thresholds for Marine Mammals during Vibratory Pile Driving (48-inch steel piles)



Steller Sea Lion

Steller sea lions are present in the Hood Canal, but are only expected in the project area during October through May. The earliest documented occurrence of Steller sea lions along NAVBASE Kitsap Bangor occurred on September 30, 2010 when 5 individuals were observed at Delta Pier during daily surveys. During 2011 monitoring activities for the Test Pile Program, Steller sea lions were documented arriving on October 8 and were seen during surveys every day of the remaining 12 days of the project. Up to 4 individuals were sighted either hauled out at the submarines docked at Delta Pier or swimming in the waters just adjacent to the base.

The proposed project would occur between July 16 and September 30. It is anticipated that pile driving would begin July 16, or shortly thereafter, be limited to 20 actual days of pile driving, and be completed by September 30. Since Steller sea lions are not likely to be present in the project area during this time, no significant impacts to Steller sea lions would result with implementation of the Preferred Alternative.

The Navy concludes that an effects determination of "may affect, not likely to adversely affect" for Steller sea lions is appropriate.

Marbled Murrelet

Marbled murrelet have been observed foraging and resting within 450 feet (tip of Carlson Spit) of the project area and out to 500 ft offshore. The underwater injury criterion for the marbled murrelet only applies to impact pile driving, and the distance to the injury criterion is dependent upon the number of strikes of the impact hammer that are carried out within a 24-hour period. The distances were calculated based on an assumption of 2,000 pile strikes per day. However, this number is the worst-case scenario and it is unlikely this number of strikes would occur each day of the 20 days of pile driving, if at all. In order to be conservative, the Navy carried out the noise exposure analysis assuming that all pile driving days could require the maximum number of pile driving strikes (e.g., 2,000) per day.

Based on the above analysis, it is estimated that marbled murrelets could be exposed to injurious sound pressure levels if they were within 15 meters of a 48-inch pile during impact pile driving. Since the cumulative SEL formula takes into account all impact pile strikes within a 24-hour period, the areas shown in Table 3-15 and depicted in Figure 3-10 are the size of the injury zone as it has increased to its maximum extent through the course of the pile driving day. As a result, during the early portion of the construction day, the injury zone would be smaller and would only gradually increase out to a distance of 15 meters after all strikes have been completed.

It is expected marbled murrelets would not be exposed to injurious underwater sound pressure levels under the Preferred Alternative. Based on 2,000 strikes per day, it is likely that the impact pile driving that would only occur for 35-40 min per day. The project location is located between the east side of the Service Pier and the shoreline, with the deepest pile driving occurring at approximately -30 MLLW. Numerous piles and structures, including a wave screen, are located between the shoreline and deeper waters. Additionally, the Service Pier is a location that experiences activities such as marine traffic, equipment use, and other human activities that could deter marbled murrelet presence in the area. Construction activities would occur outside of the forage fish spawning season which would contribute to a lower potential occurrence of foraging marbled murrelets in the injury zone. All pile driving would begin 2 hours after sunrise and cease 2 hours before sunset to minimize effects to foraging marbled murrelets during the nesting season. All impact pile driving would occur with the use of a bubble curtain to attenuate sound and, when turned on, could startle birds causing them to leave the area. Additionally,

the Navy intends to monitor for marbled murrelets during impact pile driving in order to ensure no exposures to injurious sound pressure levels occur. The duration of monitoring would take place from 15 min prior to initiation through 15 min post-completion of pile driving to ensure marbled murrelet are absent from the area. Should a marbled murrelet enter the shutdown zone, pile driving would be immediately halted until the murrelet has left the area.

Table 3-15. Distance from Piles Where Underwater Noise for Impact Pile Driving Exceeds Marbled Murrelet Threshold

202 dB Cumulative SEL Underwater Injury Threshold Distances by Pile Size	
Pile Size	***Distance (m)***
48-inch[1,2]	15
36-inch[2]	9
24-inch[3]	2
20-inch[3]	3

Notes:

Cumulative SEL calculated as Single Strike SEL + 10 * log (# of pile strikes) and expressed in dB re 1 µPa2*sec.

1 Source levels based on measurements taken during the Test Pile Program and 8 dB of attenuation was applied for 48-24-inch piles.

2 The 36-inch peak and rms source level measurements were louder than the 48-inch measurements and were used for both piles sizes to provide a conservative estimate.

3 The 24-inch source level measurement during Test Pile Program was used for the 20-inch pile estimate and 5 dB of attenuation was applied.

Pile driving can generate airborne noise that could potentially result in disturbance to marbled murrelets. The USFWS has not issued a threshold for marbled murrelet communication masking as a result of pile driving. The distance to which masking may occur at the Bangor waterfront was calculated during the second Marbled Murrelet Science Panel using the Test Pile Program data. Since the Proposed Action is located near the Test Pile Program location and would be driving the same sized piles under the Preferred Alternative, the distance to the masking threshold is expected to be the same as that calculated by the panel. The distance to the marbled murrelet airborne threshold was estimated at 168 meters (551 ft) for impact pile driving 36-inch piles at the Bangor waterfront. All other construction noise associated with the project is not expected to exceed the masking zone. Figure 3-11 shows the distance graphically depicted on the landscape.

Masking of marbled murrelet vocalizations due to in-air pile driving noise has the potential to affect foraging behavior and efficiency because murrelets forage in pairs (Navy 2012c). However, it is likely that marbled murrelets would continue foraging, even if masking occurs (USFWS 2011); therefore, measureable effects to foraging due to potential masking effects are not anticipated. It is likely that marbled murrelets, like other marine birds, have habituated to the ambient noise levels of NAVBASE Kitsap Bangor's waterfront that occur on a daily basis. Therefore, no significant impacts to marbled murrelets from airborne noise are expected.

Although murrelets are present year round in Hood Canal, densities of murrelets are anticipated to be reduced during the in-water work window. For marbled murrelet monitoring, there would be implementation of a noise attenuation device for the limited impact pile driving conducted between 2 hours after sunrise to 2 hours before sunset from July 16 to September 23 with the in-water work window restrictions. The in-water work window hours from September 24 to September 30 would be revised to

occur from sunrise to sunset. The duration of monitoring would take place from 15 min prior to initiation through 15 min post-completion of pile driving to ensure marbled murrelet are absent from the area. Should a marbled murrelet enter the shutdown zone, pile driving would be immediately halted until the marbled murrelet has left the area. With such BMPs and the short duration of in-water work anticipated (20 days), potential disturbance to marbled murrelets would be reduced and thus no significant impacts to marbled murrelets with implementation of the Preferred Alternative are anticipated. The Navy concludes that an effects determination of "may affect, not likely to adversely affect" marbled murrelet is appropriate.

Figure 3-10. Distance to Underwater Sound Thresholds for Marbled Murrelet during Impact Pile Driving (36” and 48” Steel Piles)

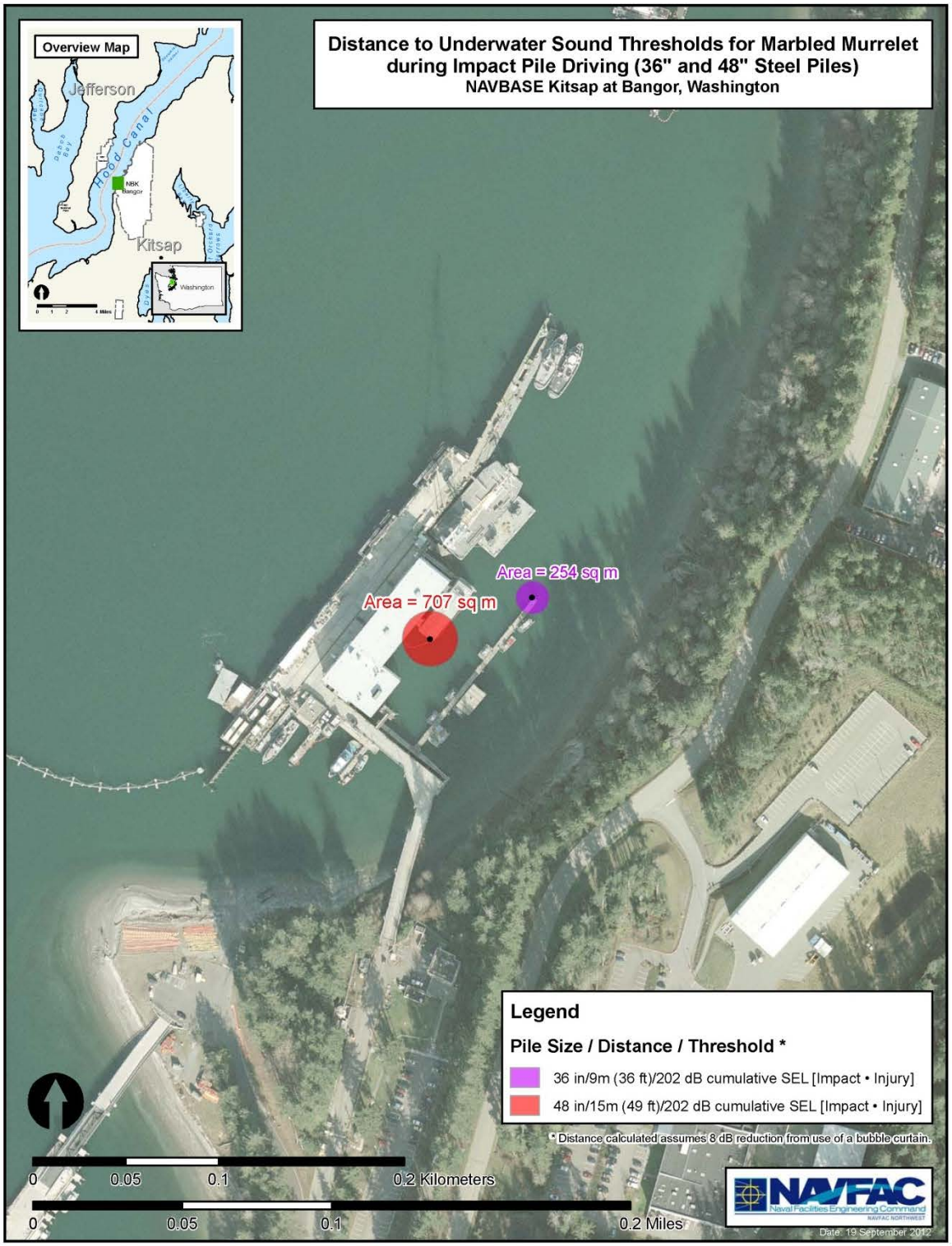
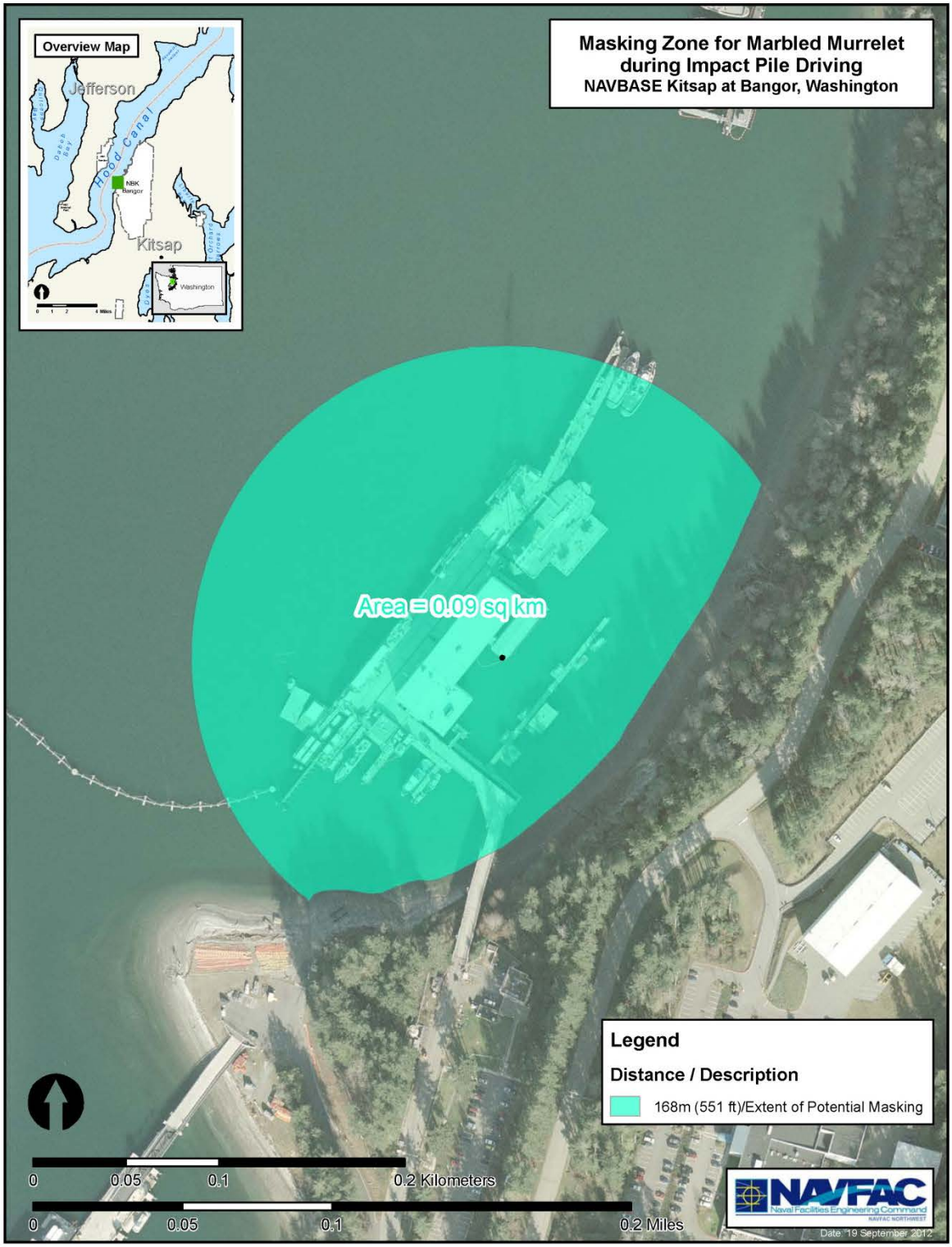


Figure 3-11. Masking Zone for Marbled Murrelet during Impact Pile Driving



Bald Eagle

Although bald eagles are regularly observed at NAVBASE Kitsap Bangor and more specifically at Carlson Spit, they are not likely to be disturbed by pile driving. Airborne noise levels generated during pile driving would be much higher than ambient noise levels that occur along the waterfront on a daily basis. However, pile driving noise is expected to attenuate down to approximately 85 dBA (see Table 3-5) at the bald eagle nesting site located approximately 0.35 miles (560 m) north of project area. The time of construction would coincide with bald eagle nesting season (July 15 through August 15). The baseline airborne noise levels that occur at NAVBASE Kitsap Bangor on the waterfront range from 70 to 90 dBA (Navy 2010c) and hence, the expected attenuation level of 85 dBA falls within baseline noise levels at the base. Nesting activity is not expected to be effected by the construction as annual nesting has likely occurred uninterrupted and undisturbed at these noise levels in years past. With the expected attenuation level of noise at the nesting location and short duration of construction (40 days of in-water work, 20 pile driving days), no significant impacts to bald eagles would occur with the implementation of the Preferred Alternative.

Marine Mammals (Non ESA-Listed Marine Mammals)

California Sea Lion

California sea lions are abundant at NAVBASE Kitsap Bangor's waterfront and would likely be present during the in-water work window. Given the limited amount of structures within the project area for California sea lions to haul out on and the majority of sightings of hauled-out sea lions have been on and surround Delta Pier located approximately a mile north of the project area, airborne noise from pile driving is not anticipated to have significant impacts to hauled-out sea lions (Table 3-16, Figure 3-12, and Figure 3-13). There is potential for sea lions to come in to the nearshore portion of the project area to forage and thus be exposed to injurious threshold levels (Table 3-14, Figure 3-8). Noise from pile driving could potentially cause disturbance or injury if sea lions are present within the project area. However, the time of which pile-driving would occur would be when primary prey (i.e., salmonids) are not likely to be present in large numbers. With implementation of a noise attenuation device, marine mammal monitoring and shutdown zones, and the short duration of in-water work anticipated, no significant impacts to California sea lions are expected with implementation of the Preferred Alternative.

Table 3-16. Calculated Distances to and the Area(s) Encompassed by the Non-ESA listed Marine Mammal Noise Thresholds In-Air from Pile Driving Steel Piles

Species	*Threshold*	*Airborne Behavioral Disturbance*		
		Distance (m)	*Distance (km)*	*Area (km^2)*
Pinnipeds (except harbor seal)	100 dB rms (impact disturbance)	42	0.042	0.005542
Harbor seal	90 dB rms (impact disturbance)	134	0.134	0.05641
Pinnipeds (except harbor seal)	100 dB rms (vibratory disturbance)	19	0.019	0.001134
Harbor seal	90 dB rms (vibratory disturbance)	60	0.06	0.01131

Notes:

All sound pressure levels are reported re 20 µPa rms (unweighted). Airborne ranges based on a spherical spreading model

m = meters

Figure 3-12. Area Exceeding Airborne Sound Thresholds for Pinnipeds during Impact Pile Driving (48" Steel Piles)

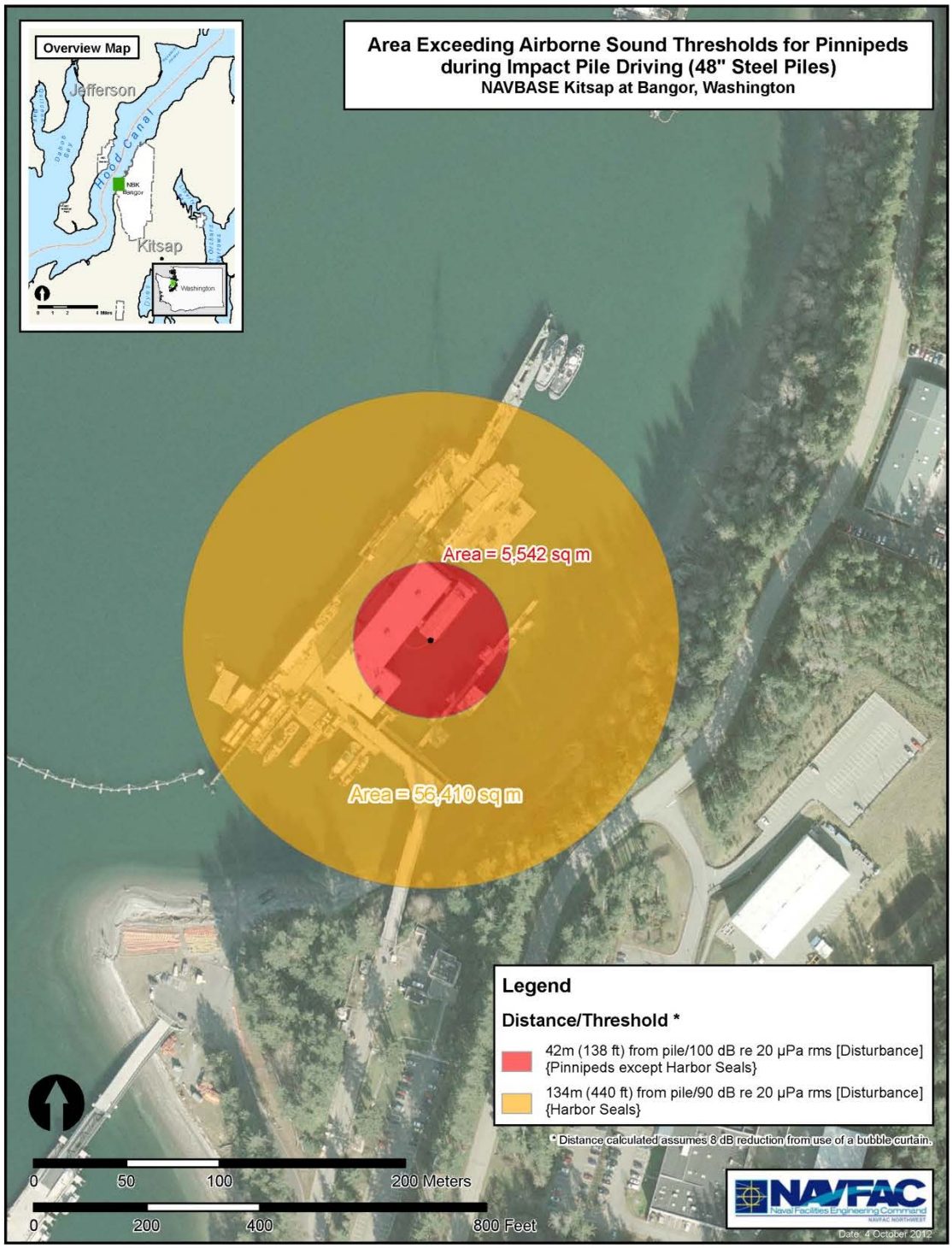
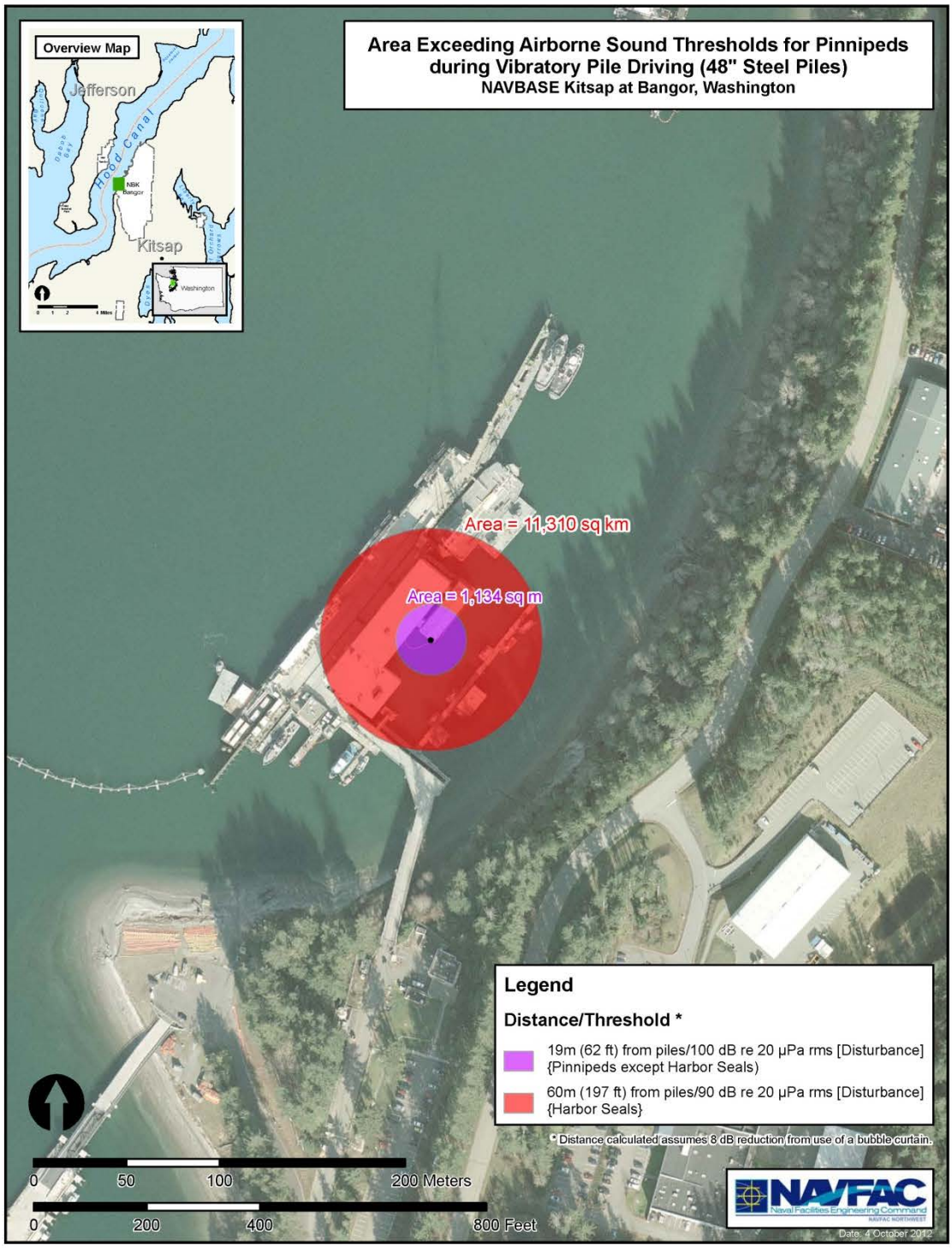


Figure 3-13. Area Exceeding Airborne Sound Thresholds for Pinnipeds during Vibratory Pile Driving (48" Steel Pile)



Harbor Seal

Harbor seals are present year-round and may be occurring in or very near the project area during in-water work. Takes are a possibility as noise generated would cause harbor seals to avoid the area and be temporarily displaced. With implementation of a noise attenuation device, marine mammal monitoring and shutdown zones, and the short duration of in-water work anticipated, potential takes by disturbance would have negligible short-term effects on individual harbor seals and would not result in population-level impacts. Therefore, no significant impacts to harbor seals would result with implementation of the Preferred Alternative.

Dall's Porpoise and Harbor Porpoise

Dall's and harbor Porpoise are not expected within injurious exposure distances to pile driving but may be exposed to behavioral noise disturbance thresholds (Figure 3-9). It is estimated that only a small number of these porpoise species may be affected as compared to the size of the entire stock. With implementation of a noise attenuation device, marine mammal monitoring and shut down zones, and the short duration of in-water work (20 days of pile driving activity), no significant impacts to Dall's or harbor porpoise would result with implementation of the Preferred Alternative.

West Coast Transient Killer Whale

Transient killer whales are uncommon visitors but have been observed within Hood Canal between January and July (London 2006) feeding on harbor seals. As occurrences of transient killer whales in Hood Canal are infrequent, they would be considered rare during the timeframe of when the in-water work would take place. Should transient killer whales happen to be present during pile driving, take involving disturbance would likely happen as the whales would move further away from the nearshore areas for noise avoidance and potentially impacting their foraging behavior. With implementation of a noise attenuation device, marine mammal monitoring and shutdown zones, and the short duration of in-water work anticipated (20 days of pile driving activity), potential takes by disturbance would have negligible short-term effects on individual transient killer whale and would not result in population-level impacts. Therefore, no significant impacts to West Coast transient killer whales would result with implementation of the Preferred Alternative.

Essential Fish Habitat

The potential effects of the Preferred Alternative activities to fish and EFH in the context of the MSA were analyzed. To help identify Navy activities falling within the adverse effect definition for EFH and determination of affect, the EFH Final Rule (NMFS 2002) and 50 CFR § 600.910(a) were used as guidance.

Effects on EFH would be the same habitat effects as those described for listed salmonids and rockfish that occur within the nearshore areas as described under the ESA-Listed Species and Critical Habitat section. In summary, the project would affect fish habitat during in-water pile driving activities through bottom disturbance, localized increases in turbidity, a slight reduction in water quality, and temporary elevated noise levels. These effects would be minimized by implementing conservation measures designed to protect ESA-regulated species that would similarly protect and conserve Pacific Coast groundfish EFH, coastal pelagic species EFH, and Pacific Coast salmon EFH.

There would be no impacts to existing eelgrass HAPC located adjacent to the project area and potentially used by juvenile and larval groundfish as minimization measures (Section 2.5) would be implemented to

protect it. In addition, the Navy would use an attenuation device (e.g., bubble curtain) during all impact pile driving operations to reduce the transmission of increased sound through the water column.

Because of short-term duration of impacts to water quality, vegetation, water column, and sediment, no significant impacts to EFH would result with implementation of the Preferred Alternative. Due to these temporary impacts, however, the Navy concludes that an EFH effects determination of "may adversely affect" Pacific Coast groundfish, Pacific Coast salmon, and coastal pelagics EFH is appropriate.

3.4.3.3 Alternative 2

Terrestrial Wildlife

The distance from where a majority of marine birds were observed to the Alternative 2 location is approximately 900 ft. Impacts to marine birds with implementation of Alternative 2 would be insignificant as pile driving would not be required and construction noise generated would not differ significantly from baseline conditions along the NAVBASE Kitsap Bangor waterfront.

Aquatic Species

Marine Vegetation

There would be no impacts to eelgrass as it is not present within the Alternative 2 location. Other marine flora and fauna may be destroyed as the overwater structure would prevent light penetration and impede or prevent future growth. Given the small area affected in comparison to the habitat available along the waterfront in general, no significant impacts to marine vegetation would occur with implementation of Alternative 2.

Benthic Invertebrates

Installation of anchor clumps would disturb bottom substrates and may inadvertently destroy less mobile invertebrates within the footprint of the anchor clumps. Hard shell subtidal clam occur within the project location but only a small localized area would be disturbed and would have no significant impacts to the rest of the hard shell clam populations occurring within the area. Filter feeding organisms adjacent to anchor clump installation may be affected by turbidity from bottom sediment disturbance. This would be temporary as the sediments would settle back down shortly after the clumps are secured.

Marine Fish

Noise would not be a concern as piles would not be driven under Alternative 2. There would be some noise from the construction barge and equipment over the water but would not be expected to exceed ambient underwater noise levels of 114 dB re 1 µPa (Slater 2009).

Special-Status Species

The location of Alternative 2 would be at a depth (-40 ft MLLW) deeper than where out-migrating juvenile salmon would normally occur and during a timeframe when juvenile presence is at its lowest for the area (July 16 – October 14). Steller sea lions have been documented at NAVBASE Kitsap Bangor from October through May. There may be some minor disturbance to California sea lions and harbor seals foraging in the nearshore environment but the time at which the project would be implemented would be during a time of low abundance for both species. Noise would also not be a factor to special-status species in general as noise generated from installing anchor clumps is not anticipated to exceed ambient

underwater noise levels. Therefore, no significant impacts to special status species would occur with the implementation of Alternative 2.

Essential Fish Habitat

Placement of the overwater structure would prevent light penetration and thus impede or prevent growth of vegetation and leading to reduced prey availability. In addition, anchor clump installation would displace unconsolidated sediment EFH potentially used by Pacific Coast groundfish. The area impacted is very small in comparison to the EFH available immediately adjacent to the Alternative 2 location and the remainder of the waterfront in general. Installation of the anchor clumps may cause some turbidity but the action would be brief and temporary. The Navy concludes that implementation of Alternative 2 would have "no adverse effect" to Pacific Coast groundfish, coastal pelagic species, and Pacific Coast salmon EFH.

3.5 MARINE TRAFFIC AND TRANSPORTATION

3.5.1 Regulatory Overview

Several DoD directives apply to transportation planning and implementation at military bases, including:

- DoD Directive 4500.9 Transportation and Traffic Management;
- DoD Directive 4510.11 Transportation Engineering; and
- DoD 4500.9-R Defense Transportation Regulation.

For maritime traffic, the Protection of Naval Vessels rule (33 CFR 165.2010) issued under the authority in 14 USC 91 provides protective measures for both vessels and bases. This regulation establishes naval vessel protection zones surrounding Navy vessels in navigable waters of the U.S. Within a Naval Vessel Protection Zone, no vessel or person is allowed within 100 yards of a Navy vessel unless authorized by the U.S. Coast Guard or the Navy officer in command.

3.5.2 Affected Environment

For purposes of this analysis, the ROI for marine traffic and transportation is defined as Hood Canal, the internal roadway system at NAVBASE Kitsap Bangor, and the surrounding street network adjacent to the base. The transportation resources include the various modes of transportation to, from, and within NAVBASE Kitsap Bangor, such as vehicles (e.g., cars and trucks), marine vessels, and public transit. Primary terrestrial transport is by automobile (including private passenger vehicles and taxis), although bus service to the base is available from some parts of Kitsap County. Primary access to the installation is via the primary roads of NW Luoto Road and NW Trigger Avenue which have a daily average traffic volume of 23, 721 vehicles and projected increase to daily average of 26,069 by 2016 (Navy. 2011a).

Existing civilian marine traffic on Hood Canal is recreational and commercial in nature, and involves vessels of various sizes. The majority of the recreational and commercial boating is seasonal, with the highest concentrations during spring and summer months. Commercial marine traffic includes fishing vessels, barges, tugboats, cargo vessels and other types of boats and ships.

Any support boat or barge used during in-water construction activities would generally be located in NAVBASE Kitsap Bangor restricted areas, away from normal navigational activities. Standard U.S. Coast Guard safety precautions would be used by all contractors.

Transportation impacts would be considered significant if the Proposed Action would cause a substantial increase in marine traffic that would impede Navy operations, other government marine traffic or civilian recreational marine traffic. For land-based traffic, the Proposed Action would cause a significant impact if additional traffic generated by the project would result in substantial traffic congestion at streets and intersections in the ROI. This would include increased congestion in the on the NAVBASE Kitsap Bangor street network, or on adjacent roadways located off the base.

3.5.3 Environmental Consequences

3.5.3.1 No-Action Alternatives

Under the No-Action Alternative, the construction and use of the barge mooring location for the proposed new research barge would not occur. Baseline transportation resources would remain unchanged. Therefore, there would be no significant impacts to land or marine transportation from implementation of the No-Action Alternative.

3.5.3.2 Preferred Alternative

During construction, the Proposed Action would cause a temporary increase in marine traffic involving the pile driving barge, tugboats, the new research barge, small craft for observation and management, and 3 supply barges per week. Additionally, other marine supply deliveries would take place using small craft during the construction period. Because of the relatively minor amount of marine traffic resulting from construction and operation of the Preferred Alternative, no significant adverse impact to marine traffic is expected.

Because they would be scheduled to avoid peak weekday commute periods, the three additional weekly barge trips and associated bridge openings would result in negligible delays (on average 30 min per opening for a total of 90 min per week) for motorists traveling on State Route 104. The increase in weekly barge trips and associated bridge openings would not appreciably increase vessel traffic levels in the project area. This level of vessel traffic is not expected to adversely impact vessel transit routes in Hood Canal or Puget Sound. Based on a review of data on Hood Canal Bridge openings, the bridge typically opens 400 to 450 times per year for an average opening of just over once per day. June through October represents the period with the majority of openings due to an increase in pleasure boat traffic. As discussed above, impacts to motorists would be minimized by avoiding barge trips through the Hood Canal Bridge opening during peak commute hours of 6:00 a.m. to 8:30 a.m. and 3:30 p.m. to 6:00 p.m., Monday through Friday.

There would be some limited truck traffic associated with the construction supplies and workers to the barge mooring location; this is not anticipated to exceed more than 10 trips daily and would not affect the baseline traffic volumes at NAVBASE Kitsap Bangor or the surrounding area. The primary access roads of NW Luoto and NW Trigger operate at acceptable levels of service and have capacity for the future level of traffic without reducing the existing level of service on these roadways. Further, because construction activities are often scheduled before typical peak commute hours, the impacts associated with construction vehicles are expected to be negligible. Therefore, no significant impacts to land transportation would occur with the implementation of the Preferred Alternative.

3.5.3.3 Alternative 2

Alternative 2 would result in similar marine and land based transportation impacts as the Preferred Alternative. Unlike the Preferred Alternative, Alternative 2 would involve daily government marine

traffic, estimated at 12 inter-tidal area marine vessel trips per day, from the waterfront to the barge for the personnel working on the barge. This inter-tidal marine traffic would be within the restricted security zone and not affect recreational or commercial boating in Hood Canal. Therefore, similar to the Preferred Alternative, no significant impacts to transportation would occur with the implementation of Alternative 2.

3.6 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

The ROI for socioeconomics and Environmental Justice is Kitsap County, the installation, and the restricted project area. Kitsap County demographics, which include unincorporated Silverdale and the cities of Bremerton and Poulsbo, are analyzed and compared to Washington State demographics in framing existing conditions for the socioeconomic and Environmental Justice analyses.

The threshold of significance is defined by identification of "disproportionately high and adverse" effects on minority and low-income populations from implementation of a proposed federal action.

3.6.1 Regulatory Overview

In 1994, the President issued EO 12898, *Federal Actions to Address Environmental Justice and Minority Populations and Low-income Populations*. The EO requires NEPA environmental documentation to include an examination of the demographics of project areas to identify and avoid "disproportionately high and adverse" effects on minority and low-income populations from implementation of a proposed federal action.

Another applicable regulation is EO 13045, Protection *of Children from Environmental Health Risks and Safety Risks*. The project areas are in a restricted area and not within any populated area. Due to the project location, this regulation is not discussed further in this discussion, as there are no schools or family housing areas, or other facilities for children located within the restricted areas of the NAVBASE Kitsap Bangor. All schools and attending children are off-base with the closest school Cougar Valley Elementary School, 3.26 miles from the industrial area and Proposed Action project site.

3.6.2 Affected Environment

NAVBASE Kitsap Bangor is located in Kitsap County with a population of 251,133 (US Census Bureau 2010) Within Kitsap County, the installation is bracketed by three communities:

- Silverdale, an unincorporated community, located south and adjacent to the installation with a population of 19,204;
- City of Poulsbo, located north of the installation with a population of 9,200; and
- City of Bremerton, located south of the installation with a population 37,729.

NAVBASE Kitsap Bangor employs 11,500 military personnel and 14,900 DoD civilians (Kitsap Economic Development Alliance 2010).

Outside of NAVBASE Kitsap Bangor, in Kitsap County, there is a total work force of approximately 127,418, the federal government and Navy are the primary employers with 15,615 active duty personnel and 11,490 DoD civilian between Puget Sound Naval Shipyard Bremerton and Naval Undersea Warfare Center Keyport (WAESD 2011).

The median household income in 2010 for Kitsap County was $59,549.00, higher than the Washington State median of $58,081.00. Home ownership and owner-occupied housing was higher in Kitsap County at 68.4 percent than the Washington State rate of 62.8 percent. Kitsap County has a lower percentage of persons living below poverty level at 9.4 percent compared to Washington State at 13.9 percent (U.S. Census Bureau 2010).

The racial profile of Washington, Kitsap County, including Silverdale, Poulsbo, and Bremerton are summarized below from U.S. Census estimates and other sources in Table 3-17.

Table 3-17. Racial Profiles for Washington State, Kitsap County, and Key Cities

Race	*Washington*	*Kitsap County*	*Silverdale*	*Poulsbo*	*Bremerton*
Caucasian	72.5%	79.6%	72.3%	78.3%	69.5%
Hispanic	11.2%	6.2%	6.3%	9.2%	9.6%
Two or More Races	3.7%	4.8%	5.7%	4.5%	6.2%
Asian	7.1%	4.8%	10.8%	5.6%	5.4%
Black	3.9%	2.5%	3.1%	1.1%	6.3%
American Indian	1.3%	1.4%	0.8%	0.9%	1.6%
Pacific Islander[1]	0.6%	0.9%	0.9%	0.3%	1.2%
Other Races	0.2%	0.2%	0.1%	0.3%	0.2%

Notes: [1] Native Hawaiian and other Pacific Islanders *Sources*: U.S. Census Bureau 2010 DP-1 Fact Finder

On average, Kitsap County had a similar racial profile when compared to Washington State with a lower percentage of Hispanic, Asian, and Black. There were slightly higher percentage, but not considered significant, in the Asian, American Indian, the Hawaiian and Pacific Islanders and two or more races populations as defined by the U.S. Census Bureau.

3.6.3 Environmental Consequences

3.6.3.1 No-Action Alternative

Under the No-Action Alternative, the construction and use of the barge mooring location for the proposed new research barge would not occur. Baseline socioeconomic conditions would remain unchanged. Therefore, no significant impacts to socioeconomics or environmental justice would occur with implementation of the No-Action Alternative.

3.6.3.2 Preferred Alternative

The Preferred Alternative is located in a restricted area and not within any populated area. The construction workforce would be predominantly from local sources, which would result in a short-term beneficial socioeconomic benefit for the regional economy. It is not anticipated that construction of the barge mooring location or the continued operation of the barge for research purposes would lead to any appreciable change to employment, population, racial composition, or socioeconomics in the area. Implementation of the Preferred Alternative would occur entirely on restricted Navy areas.

As discussed in preceding sections, the Preferred Alternative would not result in any significant air quality, water quality, transportation, public health and safety, or socioeconomic impacts. Further, there are no low-income or minority communities within the Proposed Action project area, and the ROI has a higher median household income and lower concentration of minorities than the state as a whole. Therefore, there would not be a disproportionately high and adverse effect on these communities with implementation of the Preferred Alternative.

3.6.3.3 Alternative 2

Alternative 2 is within the same general project area and is in the same affected environment as the Preferred Alternative. There are no air quality, water quality, transportation, public health and safety, or socioeconomic impacts identified that would disproportionately affect low-income or minority populations in Kitsap County and the surrounding communities. Implementation of Alternative 2 would comply with EO 12898, as no low-income or minority communities exist at the project location or vicinity, and there would not be a disproportionately high and adverse effect on these communities with implementation Alternative 2.

3.7 CULTURAL RESOURCES

For purposes of this analysis, the Area of Potential Effects (APE) is a focused area on the east side of the Hood Canal within the NAVBASE Kitsap Bangor waterfront. The submerged portion of the project would take place in areas already disturbed and therefore is not considered for further analysis. The Navy has initiated Section 106 consultation with the Tribes; comments and input are noted in correspondence in Appendix A. Consultation with the SHPO will be initiated at the conclusion of the Tribal consultations.

Cultural resources consist of prehistoric and historic districts, sites, buildings, landscapes, structures, artifacts, or any other physical evidence of human activity considered important to a culture, subculture, or community for scientific, traditional, religious, or other reasons. Cultural resources can be divided into three major categories: archaeological resources, architectural resources, and traditional cultural properties.

Archaeological resources (prehistoric and historic), are locations where human activity measurably altered the earth or left deposits of physical remains (e.g., stone flakes, arrowheads, or bottles). Archaeological resources can include campsites, trails, dumps, habitation sites, logging camps, cooking hearths, tool fragments, trash middens, and a variety of other features.

Architectural resources include standing buildings, dams, canals, bridges, cemeteries, landscapes, and other built-environment resources of historic or aesthetic significance.

Traditional cultural properties can include archaeological resources, buildings, neighborhoods, prominent topographic features, habitats, plants, animals, and minerals that Native Americans and other groups consider essential for the continuance of traditional cultures. Traditional cultural properties are discussed in section 3.8.

3.7.1 Regulatory Overview

Cultural resources on federal lands are managed in accordance with the National Historic Preservation Act (NHPA) of 1966, as amended. The threshold of significance of cultural resources is evaluated in the context of specific criteria established by the National Register of Historic Properties (NRHP). Under the NHPA, as amended, only significant cultural resources, known or unknown, warrant consideration with regard to adverse impacts from a proposed action. Architectural resources generally must be more than 50 years old to be considered for protection under the NHPA. However, more recent structures, such as Cold War-era military buildings, may warrant protection if they are “exceptionally important.” To be considered a historic property, archaeological or architectural resources must meet one or more criteria as defined in 36 CFR 60.4 for inclusion on the National Register of Historic Places (NRHP). These criteria include association with an important event, association with a famous person, properties that embody the distinctive characteristics of a type, period, or method of construction, or that have yielded, or may be

likely to yield, information important in prehistory or history. Resources must also possess integrity (i.e., their important historic features must still be present and recognizable).

Section 106 of the NHPA requires that, when a federal agency proposed an undertaking, it must: (1) identify historic properties (cultural resources) that could be affected; (2) evaluate what the effect on historic properties would be; and (3) in consultation with the State Historic Preservation Officer (SHPO), avoid, minimize, or mitigate any adverse effects on historic properties. The undertaking would be to install mooring at the Service Pier under the Preferred Alternative; and, placement of an anchored mooring location in-water and south of Carderock Pier under Alternative 2. Indirect effect takes into consideration the effect impacts on historic properties and the addition of a new element within the view shed of neighboring historic properties may have on that property (ies).

3.7.2 Affected Environment

3.7.2.1 Archeological Resources

The Navy conducted a field reconnaissance survey of various tracts of land within the installation in 1992 to create a probabilistic model of cultural resources within NAVBASE Kitsap Bangor boundaries (Lewarch et al. 1993). The field effort involved intensive pedestrian survey of the entire coastline with subsurface inspection conducted at every 10 to 20 m, due to a high probability for precontact resources. Areal sampling was conducted along flat and gently sloping shoreline and every 25 m along waterfront bluffs. The overall waterfront was included in the intensive sampling. This survey resulted in the identification of shell-midden sites within the NAVBASE Kitsap Bangor (Lewarch et al. 1993), including one 45KP108 located within 400 meters of the Service Pier.

Prior survey reports mentioned that shell midden deposits had been observed on sand spits and stream mouths during Navy construction. The staff concluded that these areas, and the sites within them, had likely undergone much disturbance with leveling, filling, and general construction occurring along the shore (Lewarch et al. 1993).

The shell middens identified in the 1992-3 surveys were further evaluated in 1997. Of the shell middens further evaluated, the Navy determined that only (45KP108); the Carlson Spit Shell Midden was eligible for listing in the NRHP (Lewarch et al. 1997). As the submerged portion of the shoreline was previously disturbed it was not further analyzed.

In 2005, the proposed construction of a new pier (Carderock) near the Carlson Spit Shell Midden led to further delineation of the shell midden to confirm that the pier project was outside of the area of potential effect. While the midden remained outside of the project boundaries, further investigations determined that the site extended beyond the previously known boundary (Butler and Bowden 2005). The Preferred Alternative site is located on the north side of Carlson Spit (365 meters), but not on the Carlson Spit. Alternative 2 is in the water and south of Carlson Spit (345 meters) and is also not on Carlson Spit.

3.7.2.2 Architectural Resources

Recent cultural resource surveys conducted by the Navy inventoried Building 7101 (Port Operations Building), upland from the proposed project area and associated with the Service Pier constructed in 2003. In 2012 the Navy determined that Building 7101 was not eligible for listing in the NRHP because it was constructed in the post-Cold War period. Other structures in this area were also constructed in the post-Cold War period.

3.7.3 Environmental Consequences

3.7.3.1 No-Action Alternative

Under the No-Action Alternative, the construction and use of the barge mooring location for the proposed new research barge would not occur. Baseline cultural resources would remain unchanged. Therefore, no significant impacts to cultural resources would occur with implementation of the No-Action Alternative.

3.7.3.2 Preferred Alternative

The shell midden site (45KP108) is the closest NRHP eligible property to the Preferred Alternative and is 365 meters away; therefore, construction of the barge mooring would not have a direct or indirect impact to cultural resources. As such, no significant impacts to cultural resources would occur with implementation of the Preferred Alternative.

3.7.3.3 Alternative 2

The shell midden site (45KP108) is the closest NRHP eligible property to Alternative 2 and is 345 meters away; therefore, construction of the barge mooring would not have a direct or indirect impact to cultural resources. As such, no significant impacts to cultural resources would occur with implementation of Alternative 2.

3.7.3.4 Inadvertent Discovery Protocols

In the unlikely event historic properties or cultural materials such as archaeological deposits or human remains are encountered during construction, ground disturbing activities in the vicinity of the find will immediately cease and the Navy will initiate consultation with the SHPO and affected tribes, as appropriate.

3.8 AMERICAN INDIAN TRADITIONAL CULTURAL RESOURCES

Traditional cultural property is a property that has association with the cultural practices and beliefs that are (1) rooted in the history of a community, and (2) are important to maintaining the continuity of that community's traditional beliefs and practices. These can be evaluated for NRHP eligibility. However, even if a traditional cultural property is determined to be not eligible for the NRHP, it may still be significant to a Native American tribe and protected under other laws and regulations. The significance of a traditional cultural property is usually determined by consulting with the appropriate entity.

3.8.1 Regulatory Overview

Several other federal laws and regulations have been established to manage cultural resources, including the Archaeological and Historic Resources Preservation Act, the American Indian Religious Freedom Act (1978), the Archaeological Resources Protection Act, and the Native American Graves Protection and Repatriation Act (NAGPRA). Indian Sacred Sites; EO 13175, Consultation and Coordination with Indian Tribal Governments; the presidential memorandum dated November 5, 2009, emphasizing agencies' need to comply with EO 13175.

3.8.1.1 Native American Tribal Treaty Rights and Resources

The Navy has implemented a policy for consultation with federally recognized Indian Tribes, on actions with the potential to impact protected tribal resources, tribal rights, or Indian lands. This policy, included in Secretary of the Navy Instruction 11010.14A (Navy 2005) and Commander, Navy Region Northwest Instruction 11010.14 (Navy 2009), describes the Navy's process and responsibilities during consultation.

Federally recognized American Indian Tribes that have adjudicated tribal treaty rights in Hood Canal that include the project area are: Skokomish, Port Gamble S'Klallam, Jamestown S'Klallam, Lower Elwha Klallam, and Suquamish Tribes.

3.8.1.2 Usual and Accustomed Fishing Grounds and Stations

A federal court ruling in United States v. Washington (aka the Boldt Decision) established that Western Washington tribes who were parties to various treaties with the United States have a right of access to their "usual and accustomed fishing grounds and stations" and up to 50 percent of the fin and shellfish in the treaty area. The Skokomish have primary U&A rights in the project area. The Suquamish Tribe has secondary U&A in the project area. Secondary U&A means that the tribe cannot exercise their tribal treaty rights south of the Hood Canal Bridge (that includes the project area) without the express permission of the Skokomish Tribe. To date, that permission has not been granted.

3.8.1.3 Government to Government Consultation

In accordance with Executive Order 13287 and DOD and Navy instructions, the Navy is conducting Government-to-Government consultation regarding the Proposed Action and potential impacts to tribal treaty rights with the Skokomish, Port Gamble S'Klallam, Jamestown S'Klallam, Lower Elwha Klallam, and Suquamish Tribes (Appendix A).

3.8.2 Affected Environment

The Tribes have identified shellfish as resources located at Bangor that are of particular traditional importance. In a cooperative agreement of 1997, signed between the Navy and the Skokomish, Port Gamble S'Klallam, Jamestown S'Klallam, Lower Elwha Klallam Tribes, the parties agreed the signatory Tribes would have exclusive access to one Bangor beach for the purposes of shellfishing and the Navy would have the other beaches. This tribal beach is located approximately 2,700 feet northeast of the project area. No tribal finfishing is permitted within the Naval Restricted Area.

3.8.3 Environmental Consequences

3.8.3.1 No-Action Alternative

Under the No-Action Alternative, the construction and use of the barge mooring location for the proposed new research barge would not occur. Baseline Native American Indian resources and Indian use of Bangor would remain unchanged. Therefore, no significant impacts to Indian resources or treaties rights would occur with implementation of the No-Action Alternative.

3.8.3.2 Preferred Alternative

Under the Preferred Alternative, access to the waterfront area would remain unchanged. The quantity of fish and shellfish inventories would not be significantly impacted. Accordingly, the impacts to Indian resources and tribal treaty rights would be less than significant.

3.8.3.3 Alternative 2

Any impacts associated with implementation of Alternative 2 would be the same as those previously described under the Preferred Alternative.

3.9 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

As summarized in Table 3-18, implementation of the Preferred Alternative 1, Alternative 2, or the No-Action Alternative would not result in significant impacts to any resource area when considered individually in the context of NEPA, including both direct and indirect impacts.

Table 3-18. Summary of Potential Environmental Consequences by Resource

Resource	*Alternative 1(Preferred)*	*Alternative 2*	*No Action Alternative*
Air Quality	Based on the level of emissions from the construction vehicles, this alternative would not exceed EPA, Ecology, or PSCAA thresholds or GHG reporting thresholds. This Alternative would not result in significant impacts to air quality.	Based on the level of emissions from the construction vehicles, this alternative would not exceed EPA, Ecology, PSCAA thresholds or GHG reporting thresholds. This Alternative would not result in significant impacts to air quality.	No Impact
Noise	Short-term (40 days) of increased airborne noise (20 days associated with impact pile driving) above ambient noise levels at NAVBASE Kitsap Bangor. This alternative would not result in significant impacts to sensitive noise receptors (e.g., residences, hospitals, nursing homes, etc.) as attenuation would likely be achieved before noise would reach these receptors. See Biological Resources for evaluation of underwater noise. Exempt from meeting Maximum Permissible Environmental Noise Levels as required by WAC 173-60 as long as construction occurs from 7:00a.m. to 10:00pm. This alternative would not result in significant impacts from noise.	Short-term (10 days) of increased barge and crane activity would generate noise impacts; however, sensitive noise receptors would not be impacted as noise would be localized and attenuate long before reaching sensitive noise receptors. Exempt from meeting Maximum Permissible Environmental Noise Levels as required by WAC 173-60 as long as construction occurs from 7:00a.m. to 10:00pm. This alternative would not result in significant impacts from noise.	No Impact
Water Quality and Marine Sediment	Short term sedimentation disturbance would occur. There would be some sediment transport during the construction activity; however, the resulting turbidity would settle in the project area in a short term (within hours). This would be a short term impact and not result in significant impacts to water quality and marine sediments.	Short term sedimentation disturbance would occur, during the installation of anchor buoy. However, the turbidity would be less the Preferred Alternative and the turbidity would settle within hours. This disturbance is short term and this alternative would not result in significant impacts to water quality and marine sediments.	No Impact
Biological Resources	There would be temporary (20 days) noise disturbance (airborne and underwater) that could potentially expose ESA-listed species to injurious noise levels from impact pile driving. Resident and migratory birds that occur at NAVBASE Kitsap Bangor waterfront have likely acclimated to existing baseline noise levels that are not much lower than anticipated airborne noise from pile driving. Eelgrass is only present adjacent to the project area and would be avoided during construction. Some macroalgae and benthic invertebrates may inadvertently be destroyed by piles and overwater shade but no long-term impacts to the population along the waterfront are expected. Fish would likely avoid the area during pile driving and work would be conducted within the in-water work window when juvenile salmonids are not expected. Whales and porpoises are	There would be no impacts to terrestrial wildlife (birds). Short-term water quality impacts would occur during installation of the anchor clumps that may cause fish to temporarily avoid the area. However, work would be conducted within allowable work window when juvenile salmonids are least likely to be present and adults would likely navigate by without delay. Therefore, no impacts to ESA-listed salmonids are expected. There would be no significant impacts to marine mammals or marbled murrelet. Temporary disturbance to water quality may affect EFH and installation of anchor clumps would displace unconsolidated sediment EFH potentially used by Pacific Coast groundfish. Areas displaced are small in comparison to adjacent available EFH and no significant	No Impact

Table 3-18. Summary of Potential Environmental Consequences by Resource

Resource	*Alternative 1(Preferred)*	*Alternative 2*	*No Action Alternative*
	not documented in the construction areas and not anticipated to be exposed to injurious noise threshold exposure. Pinnipeds (California sea lions and harbor seals) could be exposed to injurious or behavioral noise thresholds due to their common occurrence at the installation. Steller sea lions are not expected during the construction period. Temporary and localized disturbance to water quality during pile driving and new overwater shade would result in a small reduction of macroalgae, but no long-term impacts to EFH are expected. With implementation of BMPs, in-water work window, marine mammal and marbled murrelet monitoring, and noise attenuation, no significant impacts to biological resources are expected.	impacts to habitat (EFH) would result. With implementation of BMPs and project minimization measures, no significant impacts to biological resources are expected.	
Marine Traffic and Transportation	The Preferred Alternative would not adversely affect existing recreational or commercial marine traffic as the existing security barrier currently restricts traffic up to 2,500 ft from the installation shoreline. The additional marine traffic associated with the Preferred Alternative is estimated at three construction barges per week, which would result in 30-minute cycles for the opening and closing of the Hood Canal Bridge. Each barge, accessing the installation via Hood Canal Bridge, would be scheduled to avoid morning and afternoon peak traffic periods (i.e., 6:00 to 8:30 a.m. and 3:30 to 6:00 p.m.). During construction, the Preferred Alternative would result in short-term increases in vehicular traffic on the surrounding road network and on base internal roadways. There is no change in the existing operations; therefore, there is no anticipated increase in vehicular or marine traffic for future operations. While the Preferred Alternative would cause some limited increase in construction vehicles, it would not result in significant impacts to the installation's land transportation network or the adjacent Hood Canal marine transportation network during construction.	Alternative 2 would have similar impacts, with shorter-term vehicular construction traffic. This alternative, similar to the Preferred Alternative, would add up to three construction barge trips a week transiting the Hood Canal Bridge. From an operational perspective, there would be more daily Navy vessel traffic with boat trips to the barge for personnel and materials. However, these daily trips would not result in significant impacts to the marine transportation network due to that marine traffic contained within the restricted area.	No Impact
Socioeconomics and Environmental Justice	Review of the census data and the demographics in the area determined there would be no disproportionate impacts to minority, low income, schools or children with the implementation of this alternative. There would be no environmental justice impacts from the Proposed Action.	Review of the census data and the demographics in the area determined there would be no disproportionate impacts to minority, low income, schools or children with the implementation of this alternative. There would be no environmental justice impacts from the Proposed Action.	No Impact

Table 3-18. Summary of Potential Environmental Consequences by Resource

Resource	*Alternative 1(Preferred)*	*Alternative 2*	*No Action Alternative*
Cultural Resources	The shell midden site (45KP108) is the closest NRHP eligible property to the Preferred Alternative and is 365 meters away; therefore, construction of the barge mooring would not have a direct or indirect impact to cultural resources. As such, no significant impacts to cultural resources would occur with implementation of the Preferred Alternative.	The shell midden site (45KP108) is the closest NRHP eligible property to Alternative 2 and is 345 meters away; therefore, construction of the barge mooring would not have a direct or indirect impact to cultural resources. As such, no significant impacts to cultural resources would occur with implementation of Alternative 2.	No Impact
American Indian Traditional Resources	Under the Preferred Alternative, access to the waterfront area would remain unchanged. The quantity of fish and shellfish inventories would not be significantly impacted. Accordingly, the impacts to Indian resources and tribal treaty rights would be less than significant.	Under the Alternative 2, access to the waterfront area would remain unchanged. The quantity of fish and shellfish inventories would not be significantly impacted. Accordingly, the impacts to Indian resources and tribal treaty rights would be less than significant.	No Impact

CHAPTER 4.0 CUMULATIVE IMPACTS

CEQ regulations implementing the procedural provisions of NEPA define cumulative impacts as:

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

Each resource, ecosystem, and human community must be analyzed in terms of its ability to accommodate additional effects, based on its own time and space parameters. Therefore, cumulative effects analysis normally would encompass a ROI or geographic boundaries beyond the immediate area of the Proposed Action, and a time frame including past actions and foreseeable future actions, to capture these additional effects.

For the Proposed Action to have a cumulatively significant impact to an environmental resource, two conditions must be met. First, the combined effects of all identified past, present, and reasonably foreseeable projects, activities, and processes on a resource, including the effects of the Proposed Action, must be significant. Second, if there is a significant cumulative impact, the Proposed Action must make a substantial contribution to that significant cumulative impact. In order to analyze cumulative effects, an ROI must be identified for which effects of the Proposed Action and other past, present, and reasonably foreseeable actions would occur.

4.1 PAST, PRESENT, AND REASONABLY FORESEEABLE PROJECTS

For purposes of the cumulative effects analysis, the ROI is NAVBASE Kitsap Bangor for all resources except water resources (which use the watershed basin WRIA 15 as the ROI) and air quality (which uses Kitsap County as the ROI). NAVBASE Kitsap Bangor is restricted from public access. The impacts associated with the Proposed Action are localized and would generally only contribute to cumulative impacts in the immediate vicinity of the project.

The Proposed Action consists of in-water work. Although nearby actions with only terrestrial impacts are noted in the past, present, future projects, they are included to establish the general baseline and are not discussed in the resource sections, as there is no cumulative effect related to the Proposed Action.

This cumulative impacts analysis depends on the availability of data and the relevance of effects of past, present, and future actions. Although certain data may be available for extensive periods in the past, other data (e.g., water quality) may be available for much shorter periods. Because specific information and data on past projects and action are usually scarce, the analysis of past effects is often qualitative (CEQ 1997).

Past, present, and reasonably foreseeable future actions in the ROI are briefly described in Table 4-1.

Table 4-1. Past, Present, and Reasonably Foreseeable Future Projects at NAVBASE Kitsap Bangor and the ROI

Project	*Project Description*	*Project Timeframe*		
		Past	*Present*	*Future*
Road Improvement	Road clearing and grading are continuous. Potential loss of vegetation and habitat can be expected from road improvements, including those for the D5 Road and Transfer Facilities and Missile Haul Road.	X	X	X
Mission Support Facilities	Mission support facilities may include activities or projects such as the addition of power booms, installation of emergency power generation capability, and other activities to support facilities or operations.	X	X	X
Navy Surface Warfare Center Carderock Division Detachment Bremerton Command Consolidation	Construction of in-water facilities included a new access pier (8,800 ft^2), pontoon (21,600 ft^2), vessel overwater footprint (13,623 ft^2) and associated pier mooring components and 102 new steel piles. Project tasks also included road improvements to Carlson Spit Access Road, a 23,000 ft^2 building, and the addition of 100 workers. The Pier provides location support to the Carderock Division for its missions.	X		
Waterfront Restricted Area and Security Barriers	This project includes construction of enclave fencing for the entire NAVBASE Kitsap Bangor Waterfront Restricted Area and an associated parking lot. Project entails the removal of 55 acres of forest stands, 9 acres of non-forest vegetation, fill 1.8 acres of wetlands, and create 23 acres of impervious surfaces. Mitigation action would restore tidal influence to Cattail Lake, thereby increasing intertidal habitat and providing a benefit to the natural environment.		X	X
Electromagnetic Measurement Range	The proposed project includes installation of sensor equipment, including an underwater instrument array, data/power cables, a pile-supported platform, an on shore navigation aid, and an upland monitoring system.			X
Service Pier Extension	Homeporting of Two Additional Seawolf-class Submarines at Bangor. Construction of an extension to the Service Pier at (33,000 ft^2), a new Pier Services and Compressor Building (2,100 ft^2) on the existing pier, upland Maintenance Support Facility (50,000 ft), and a 421-car parking lot with associated outdoor storage (4,000 ft^2). The project will be addressed in an EIS.			X
Explosive Handling Wharf 1 (EHW-1) Maintenance	Maintenance over multiple years to replace deteriorated piles; the most recent phase proposes to install 29 30-inch steel piles. Phased repair of this structure is expected to continue until 2024.		X	X
Explosives Handling Wharf (EHW-2)	Construction and operation of a second EHW adjacent to the existing EHW. The main wharf would lie approximately 600 ft offshore with piles at a depth of 60-100 ft and would include an operations support building and facility support equipment such as heavy duty cranes, power utility booms, six lightning protection towers, and camels. Pile supported entrance and exit trestles connecting the wharf to shore would also be constructed. The Navy prepared an EIS for this action; the Record of Decision was signed in May 2012.		X	X

Table 4-1. Past, Present, and Reasonably Foreseeable Future Projects at NAVBASE Kitsap Bangor and the ROI

Project	*Project Description*	*Project Timeframe*		
		Past	*Present*	*Future*
Force Protection and Weapons Security Measures	Installation and operation of security measures including: construction of an Auxiliary Reaction Force Facility (14,000 ft^2), an Armored Fighting Vehicle Operational Storage Facility (16,146 ft^2), altering two buildings for a new armory (2,500 ft^2), and replacing an Alert Force Garage (2,530 ft^2) with new paved access road.	X	X	X
Transit Protection System	Construction of pier and shore facilities at KB dock to support vessels and personnel that protect Navy submarines transiting to and from the Bangor waterfront.			X
Waterfront Restricted Area Land-Water Interface	Objective is to provide security upgrades for the Waterfront Restricted Area by constructing two Waterfront Restricted Area Land-Water Interface barriers, which would connect both ends of the Waterfront Restricted Area enclave to the existing floating barriers. The Land-Water Interface barriers would extend from the high water mark to the terminations of the Port Security Barriers. This project will be addressed in an EIS.			X
Pile Repair and Replacement Program	Under the Pile Repair and Replacement Program, the Navy plans to repair or replace structurally unsound piles at various Navy installations in the Puget Sound areas over a five-year period beginning October 2013. At NAVBASE Kitsap Bangor up to 143 piles would be replaced/repaired under planned repair and replacement projects at KB Dock and EHW-1, as well as emergent repair projects over the five year project. Though there are no planned repairs at the Service Pier, emergent repairs may be conducted as they arise over the five year period.		X	X
Northwest Training Range Complex	A wide variety of military training activities are conducted in the W-237 operating area west of Washington, including training exercises in anti-air, anti-surface, and anti-submarine warfare; electronic combat exercises; mine countermeasures training; naval special warfare training; and various support operations. The Navy has developed policies and procedures to avoid harm and to minimize the effects of Navy training on terrestrial and marine species and habitats. This action involves activities at Floral Point, which is within the ROI for this cumulative analysis. The Navy prepared an EIS for this action; the Record of Decision was signed in October 2011.	X	X	X

In addition to these identified projects, non-Navy shoreline development along Hood Canal over the last 20 years has been relatively intense. The area is primarily residential, with some scattered commercial uses. Future general development in the Hood Canal watershed would increase impervious surface and affect vegetation and soils, with potential impacts to water quality of streams and Hood Canal.

4.2 ASSESSMENT OF CUMULATIVE IMPACTS BY RESOURCE

4.2.1 Air Quality

The ROI for air quality impacts is the Puget Sound AQCR which includes Kitsap County (40 CFR 81.32). As discussed in Section 3.1, Kitsap County is not designated as a non-attainment or maintenance area by the EPA, so a conformity review would not be performed (USEPA 2001). Past development and subsequent operation of emission sources in Kitsap County have not contributed to exceedences of the NAAQS and the region is in attainment for all applicable air quality standards. Likewise, planned future development in Kitsap County is consistent or below the emissions estimates contained in the SIP.

Several of the projects included in Table 4-1 have available estimates of potential air quality impact and can be analyzed cumulatively within the ROI.

Table 4-2 compares the 2005 emissions in Kitsap County to known present and future actions. Emissions estimated for the Pile Repair and Replacement Program, EHW-1 Maintenance, and EHW-2 at NAVBASE Kitsap Bangor are quantitatively compared to the regional emissions. The Northwest Training Range Complex has detailed emissions estimates; however the quantitative emissions estimates are aggregated for a region substantially larger than the ROI and are not available at the base or installation level, however the results indicated no significant impacts to air quality as a result of the proposed actions in any of the regions. The remaining future proposed activities do not have air quality information available at this time, but qualitative review indicates the projects would include short term construction emissions that would not be reasonably expected to impact regional air quality.

Table 4-2. Estimated Cumulative Air Emissions Using Representative Future Projects

	VOC (tons/yr)	*NOx (tons/yr)*	*CO (tons/yr)*	*SO_2 (tons/yr)*	*$PM_{(total)}$ (tons/yr)*
Kitsap County Air Quality (2005 Emissions Inventory)	20,669	8,217	67,668	1,111	1,318
Predicted Emissions for Future Projects (Worst Case Alternative Assumed)	1.71	18.19	15.15	1.17	1.27
Predicted Emissions for Future Projects with **Preferred Alternative** Added	1.80	18.80	18.22	1.25	1.35
Preferred Alternative Percent Contribution to cumulative increase in emissions in Kitsap County	0.009%	0.228%	0.027%	0.112%	0.102%
Predicted Emissions for Future Projects with Alternative 2 Added	1.74	18.42	16.34	1.19	1.3
Alternative 2 Percent Contribution to cumulative increase in emissions in Kitsap County	0.008%	0.224%	0.024%	0.107%	0.099%

As shown in Table 4-2, the Proposed Action and emissions estimates from known future actions contributes less than 1% of total emissions for all criteria pollutants. Therefore, the implementation of the Proposed Action combined with the past, present, and reasonably foreseeable future projects, would not result in significant cumulative impacts to air quality.

The potential effects of proposed GHG emissions are by nature global and cumulative impacts, as individual sources of GHG emissions are not large enough to have an appreciable effect on climate change. Therefore, an appreciable impact on global climate change would only occur when proposed GHG emissions combine with GHG emissions from other man-made activities on a global scale.

Currently, there are no formally adopted or published NEPA thresholds of significance for GHG emissions. Formulating such thresholds is problematic, as it is difficult to determine what level of proposed emissions would substantially contribute to global climate change. In the absence of an adopted or science-based NEPA significance threshold for GHGs, this EA compares GHG emissions that would occur due to implementation of the proposed action to the permitting threshold identified in the Greenhouse Gas Mandatory Reporting Rule (40 CFR Part 98).

An appreciable impact on global climate change would, if currently accepted predictions are accurate, only occur when proposed GHG emissions combine with other GHG emissions from other man-made activities on a global scale. However, individual sources of GHG emissions related to the proposed actions or nearby projects are not large enough to have an appreciable effect on climate change.

Emissions of GHGs from the proposed action alone would not cause appreciable global warming that would lead to climate changes. However, these emissions would increase the atmosphere's concentration of GHGs, and, in combination with past and future emissions from all other sources, contribute incrementally to the global warming that produces the adverse effects of climate change. At present, no methodology exists that would enable estimating the specific impacts (if any) that this increment of warming would produce locally or globally.

4.2.2 Noise

NAVBASE Kitsap Bangor, is surrounded by rural residential land uses. Completed past actions (e.g. Navy Surface Warfare Center Carderock Division Detachment Bremerton Command Consolidation) would not contribute cumulatively to the noise environment within the ROI. The current and reasonably foreseeable future projects would contribute to the noise environment primarily during construction, and secondarily during operations.

Construction noise would come primarily from pile driving activities, as well as supporting equipment (e.g., cranes, truck traffic). Airborne noise tends to extend over limited distances, while underwater noise travels for longer distances. The Service Pier Extension, EHW-1 Maintenance, EHW-2, pile repair and replacement program, and other construction projects would all have noise impacts similar to the Proposed Action. After construction, operations at these facilities would be similar to existing operations, and no significant change to current airborne and underwater sound is anticipated. The Preferred Alternative would generate some underwater noise levels, but for a short duration with limited range of impacts. Alternative 2 would generate less underwater noise with the placement of the anchor clumps and buoys.

Overall, the proposed construction activities for either alternative combined with known present and future projects would be short term, would be limited to daytime hours, and would be exempt from WAC 173-60-040 noise limits due to their temporary nature. Due to the limited duration of construction activities and anticipated consistency with current operations, the Proposed Action in combined with known past, present, and future actions would not have a significant adverse noise impact. See Section 4.2.5 for a discussion of the project's cumulative impacts to biological resources resulting from airborne and underwater noise emissions.

4.2.3 Water Quality

Water quality in Hood Canal and its tributaries has been and is being impacted by past and present upland actions. Upland development has caused localized deterioration in the water quality, mainly from

uncontrolled stormwater runoff, failing septic systems, and mismanagement of animal wastes. Stormwater runoff can carry contaminants, such as heavy metals and oils from hard surfaces such as roads, and nitrogen and phosphorus from lawn fertilizers into streams that empty into Hood Canal. While irregular in nature, stormwater-related inputs to water quality may be relatively intense during storm events. Contaminants in the stormwater runoff can adversely impact DO, temperature, pH, and other water quality parameters in localized areas. Past, present, and reasonably future events have impacted and will impact water quality in the ROI, as described above. However, due to the temporary and localized extent of the Proposed Action, including implementation of BMPs to avoid or minimize any potential water quality impacts, it would not make a substantial contribution to cumulative adverse impacts to water quality.

4.2.4 Marine Sediments

The Proposed Action would result in short-term localized increases in total suspended solids and turbidity as bottom sediments are disturbed during construction. However, these disturbances would be limited in space and time, and sediments would settle upon completion of the construction for either alternative.

Projects with future in-water construction elements include the Waterfront Restricted Area and Security Barriers, Electromagnetic Measurement Range, Service Pier Extension, EHW-1 Maintenance, EHW-2, Transit Protection System, Waterfront Restricted Area Land-Water Interface, and the Pile Repair and Replacement Program. All of these projects would have impacts to marine sediments similar to those discussed for the Proposed Action, and all would implement sediment controlling BMPs. With implementation of BMPs, any disturbance to marine sediments would be local and temporary. Therefore, implementation of the Preferred Alternative or Alternative 2 combined with the past, present, and reasonably foreseeable future projects, would not result in significant cumulative impacts to marine sediments.

4.2.5 Biological Resources

4.2.5.1 Marine Vegetation

Marine vegetation in Hood Canal has been or is currently disturbed by past and present placement of in-water structures such as piles and anchors, dredging, underwater fills, and construction of overwater structures. These impacts include temporary and/or permanent loss of marine vegetation, reduced productivity, and changes in type, abundance, or vegetation species. Important marine habitat, such as eelgrass, has decreased over time in Hood Canal as indicated by recent trend data: eelgrass coverage in Hood Canal declined between 8 and 15 percent in every year between 2001/2 and 2004/5 (PSAT 2007a).

Although dense to moderate densities of eelgrass occur approximately 300 ft south of the project area (SAIC 2009), eelgrass is not present within the project area itself. Since there would be no net increase in overwater coverage, the Proposed Action or Alternative 2 would not have a long-term impact to macroalgae. Therefore, implementation of the Preferred Alternative or Alternative 2 would not make a substantial contribution to cumulative adverse impacts to marine vegetation.

4.2.5.2 Benthic Invertebrates

Past and present Navy and non-Navy actions, including marinas, residential docks, boat ramps, and piers involving placement of pilings and anchors have resulted in the direct loss of the natural benthic soft-bottom habitat, which has further reduced the invertebrate population. This habitat is replaced by the hard surfaces of piles and anchors, and as a result, the types of benthic organisms have changed and are

changing in these localized areas. Hard surfaces create sites for colonization by species adapted to these surfaces such as mussels and sea anemones. Thus, the impact of in-water structures has been to replace native soft-bottom habitat with hard-surface habitat over time. This has adversely impacted some species (including prey species for juvenile salmonids), while benefiting others. It is estimated that approximately 2.4 acres of benthic soft-bottom habitat has been lost and converted to hard-surface habitat due to placement of in-water structures along the NAVBASE Kitsap Bangor waterfront.

Projects with in-water construction elements include the Navy Surface Warfare Center Carderock Division Detachment Bremerton Command Consolidation, Waterfront Restricted Area and Security Barriers, Electromagnetic Measurement Range, Service Pier Extension, EHW-1 Maintenance, EHW-2, Transit Protection System, Waterfront Restricted Area Land-Water Interface, and Pile Repair and Replacement Program. These projects would all result in localized disturbance of benthic invertebrates, including a loss of sessile or slow moving benthic invertebrates. Many of the projects in the area, including the Proposed Action occur within existing developed areas.

The Navy's future in-water structures would result in a direct loss of soft-bottom habitat and it is estimated that approximately 2.5 acres of soft-bottom habitat would be replaced with hard surfaces, based on the number of piles. The overwater portions of the proposed future actions can increase shading and nighttime lighting impacts on benthic organisms. Shading can impact the abundance of some benthic organisms and lighting can increase predation rates. Shading and loss/alteration of soft bottom habitat has impacted the type and abundance of benthic organisms that occur in the vicinity of these structures. In addition, in-water structures have resulted in accretion of sediments in some areas and possibly erosion in others. Any areas of erosion would result in adverse impacts to sediment-dwelling species.

Proposed in-water work would disturb bottom substrates during pile installation or the anchor clumps and buoys. However, the area of disturbance is small, re-colonization following construction is anticipated, and no long-term loss is anticipated. Therefore, the Preferred Alternative or Alternative 2 would not make a substantial contribution to cumulative adverse impacts to benthic invertebrates.

4.2.5.3 Fish

Past actions have adversely impacted populations of salmonids (salmon, steelhead, and trout, including threatened and endangered species) in Hood Canal and tributaries through loss of foraging and refuge habitat in shallow areas, reduced function of migratory corridors, loss and degradation of spawning habitat in streams, interfering with migration, adverse impacts to forage fish habitat and spawning, contamination of water and sediments, and depletion of DO. Ongoing fish harvest has resulted in adverse impacts to salmonid abundance and the impact has been greatest on native stocks. Practically all chum salmon, most Chinook, and all sockeye salmon spawning in Hood Canal stream systems are derived from naturalized hatchery stock. Populations of pink salmon, coho salmon, bull trout, and steelhead are also in decline. The net result is that several Hood Canal salmonid species have been listed under the ESA.

The State of the Sound Report (PSAT 2007b) describes several trends that may be indicative of cumulative impacts to the growth and development of salmonids. There is an increasing trend for toxics to be concentrated in the tissues of Puget Sound Chinook and coho salmon. These salmon have been found to have 2 to 6 times the PCBs and 5 to 17 times the polybrominated diphenyl ethers in their bodies compared to other West Coast salmon populations. Wild salmon stocks have declined from 93 to 81 healthy stocks from 1992 to 2002, and during that same period seven stocks have become extinct.

Prior to the 1980s, in-water construction of docks, piers, and boat ramps in Hood Canal impacted fish species presence and abundance, particularly when it was not yet recognized that in-water construction work should not occur during spawning of forage fish species such as sand lance, Pacific herring, and surf smelt. For example, underwater noise from pile driving is intense and can cause fish mortality, as well as changes in fish behavior. Even so, underwater construction noise continues and can adversely impact the abundance and occurrence of some fish species close to the construction activities.

Existing Navy structures have affected salmonid and forage fish habitat, and have potentially impeded and continue to impede juvenile salmon migration to some degree. The placement of in-water structures by the Navy and from non-Navy actions has changed and would continue to change fish habitat in and around these structures. In-water structures can impact fish in several ways, including:

- Increasing the presence of predators that prey on juvenile fish;
- Posing a barrier to fish movement, particularly juvenile fish;
- Causing direct loss of marine vegetation such as eelgrass, which is important habitat for forage fish and other species; and
- Creating shade that reduces the productivity of aquatic vegetation and benthic organisms, which are preyed on by fish.

Water quality has been and is being impacted by past and present actions and could be impacted by potential future development; for example, depleted DO has resulted in fish kills. Many of the other types of past and ongoing impacts described above for salmonids also apply to other marine species. Trend data have shown a decrease in some fish species such as rockfish, spiny dogfish, Pacific cod, and hake, as well as increased toxics in the tissues of some species such as Chinook salmon (PSAT 2007a).

Currently, efforts are being made to reverse the decline of fish populations by regulating development and restoring fish habitat. Numerous salmon preservation and restoration groups have proposed and constructed habitat restoration projects in Hood Canal. Most of these projects are on the east and south sides of the canal, where most of the salmonid-bearing river systems are found. Efforts to reduce construction impacts to salmonids and other fish have resulted in a schedule of in-water work periods that all projects must adhere to if authorized by state (WDFW) or federal regulatory (USACE) authorities. The in-water work windows help minimize adverse impacts to fish.

Current and future waterfront projects at NAVBASE Kitsap Bangor would be designed and implemented to minimize impacts to salmonids and other fish habitat and migration. The protective measures taken to minimize impacts during construction activities, and the design elements that reduce long-term impacts to nearby habitats is expected to reduce impacts to fish populations. In addition, many regional habitat restoration projects would benefit all fish species.

Impacts from in-water construction projects may include startle responses from fish during initial stages of construction; fish would likely avoid the immediate project vicinity during construction activities. For projects requiring pile driving (e.g. the Proposed Action, EHW-1 Maintenance, and EHW-2), a vibratory hammer would be used whenever possible to drive piles to minimize underwater noise. Construction sites would further minimize noise impacts by using noise attenuation measures (e.g., a bubble curtain, which has been shown to reduce noise levels by approximately 10 dBA). All in-water construction activities for

Hood Canal projects would be conducted during the allowable in-water work period, July 16th to February 15th to reduce potential impacts to fish.

Past, present, and future development projects have had, currently have, and would continue to have the potential to result in many of the impacts to marine fish described above, and add to declining population trends. However, there are ongoing and future actions and plans intended to improve conditions for salmonids in Hood Canal as described above. Due to the temporary and localized extent of the Proposed Action, including measures to avoid and minimize impacts to salmonids and other marine fish, it would not make a substantial contribution to cumulative adverse impacts to marine fish.

4.2.5.4 Marine Mammals

Past and present Navy and non-Navy actions, including marinas, residential docks, boat ramps, and piers have resulted in increased human presence, underwater and airborne noise, boat movement, and other activities, and have likely impacted some water-dependent wildlife (e.g., marine mammals) in the area. Increased anthropogenic noise in the marine environment has the potential to cause behavioral reactions in marine mammals including avoidance of certain areas. However, the abundance and coexistence of marine mammals with existing anthropogenic activities suggests that cumulative effects have not been significant. Population trend data for Hood Canal indicate that most of the marine mammal species expected to be in the project area are either stable or increasing in recent years based on NMFS stock assessment reports despite past and present actions (Allen and Angliss 2010, Carretta et al. 2011). The MMPA regulatory process ensures that each project that could affect marine mammals is assessed in light of the status of the species and other actions affecting it in the same region.

Future Navy and non-Navy waterfront projects may have similar impacts to past and present actions including increased anthropogenic sound (both airborne and underwater), increased human presence, increased boat movements and other associated activities. These actions could result in behavioral impacts to local populations of marine mammals, such as temporary avoidance of habitat, decreased time spent foraging, increased or decreased time spent hauled out (depending on the activity), and other minor behavioral impacts. All impacts would likely be short-term and temporary in nature and unlikely to affect the overall fitness of the animals. Additionally, the projects identified in Table 4-1 are within an existing, largely developed naval base waterfront. These areas already have industrial uses with higher than normal activity and noise levels. Thus, there is little loss of habitat for marine mammals, and the marine mammals in the area may be habituated to these higher levels of ongoing activity and less impacted by ongoing waterfront development.

The primary impact of in-water construction projects, including the Proposed Action, to marine mammals is behavioral disturbance from underwater sound due to pile driving. Any marine mammals that are behaviorally disturbed may change their normal behavior patterns (i.e., swimming speed, foraging habits, etc.) or be temporarily displaced from the area of construction. Any exposures would likely have only a minor effect and temporary impact on individuals..

As discussed in 3.4.2, cetaceans (whales, dolphins, and porpoises) also use the Hood Canal. The use by cetaceans other than transient killer whales is very rare; use by transient killer whales in Hood Canal is infrequent, and considered rare during the timeframe of when the in-water work would take place.

Three species of pinnipeds, California sea lions, Steller sea lions, and harbor seals, are abundant in Hood Canal and at the NAVBASE Kitsap Bangor waterfront in particular. The seals would likely be present

during work for all of the in-water construction projects identified in Table 4-1, as well as the Proposed Action. Given the limited amount of structures within the project area for California sea lions and harbor seals to haul out on and the majority of sightings of hauled-out sea lions have been on and surround Delta Pier located within the vicinity of the project area, airborne noise from construction is not anticipated to have significant impacts to hauled-out pinnipeds, with some exceptions. Project activities at, or immediately adjacent to the Delta Pier, such as the Waterfront Security Enclave project, could potentially disturb hauled-out seals. However, this impact was determined not significant because Delta Pier seals have grown accustomed to frequent 70 to 90 dBA noise levels associated with existing Delta Pier operations. Pile driving is the loudest construction noise source anticipated within the ROI, and no pile driving is anticipated within 50 ft of the Delta Pier. Over 50 ft away from pile driving activities, sound attenuates to below 94 dBA, a level to which the seals have shown to be accustomed (WSDOT 2012).

Cumulative impacts to marine mammals have the greatest potential to occur during simultaneous pile driving exposure events from the Proposed Action and other present and future projects in the vicinity. However, implementation of avoidance and minimization measures including use of bubble curtain to reduce pile-driving noise, marine mammal monitoring and pile-driving shutdown zones, cumulative impacts to marine mammals would not be significant.

4.2.5.5 Birds

Construction and operation of past and present Navy and non-Navy actions have resulted in increased human presence, underwater and airborne noise, boat movement, and other activities that have likely deterred some water-dependent wildlife such as marine birds from these areas. Marine birds typically avoid areas with continuous activity or that produce periodic impacts such as loud noises. Birds will often return to these areas when human presence is lower or there is less activity. Some birds may use these in-water structures for roosting or nesting.

Marine bird populations within the ROI are affected by direct and indirect impacts to breeding and foraging locations on the coastal mainland and inshore areas. The single greatest concern is the loss of suitable habitat for nesting and roosting seabirds throughout coastal northwest due to land development and human encroachment. Historically, seabird populations have sustained numerous impacts from pollution and human activities within the Pacific Northwest from a variety of sources, including the discharge of hazardous chemicals and sewage.

As discussed in Section 3.5, marbled murrelets have been observed foraging and resting within 450 ft of the project area and out to 500 ft offshore. As discussed under terrestrial wildlife, the average airborne sound levels at a distance of 450 ft would be estimated at 84 dBA during impact pile driving.

Underwater noise from pile driving can cause injury and behavioral disturbance to diving marine birds, including marbled murrelets. Since the project would not impact upland bird habitat or bald eagles, it will not make any contribution to cumulative adverse impacts to upland birds or bald eagles. Cumulative impacts to marine birds have the greatest potential to occur during simultaneous construction activities. However, with implementation of avoidance and minimization measures including use of bubble curtain to reduce pile-driving noise, marine bird monitoring and pile-driving shutdown zones, cumulative impacts to marine birds from the Proposed Action and past, present, and reasonably foreseeable future actions would not be significant.

4.2.6 Marine Traffic and Transportation

For either alternative, there would be up to three construction barge trips a week, which would occur during non-peak hours to avoid disruption to vehicular traffic with openings of the Hood Canal Bridge. The approximately 10 truck trips per day for construction equipment estimated for the Preferred Alternative are within the regular anticipated traffic conditions. Similarly, the in-water traffic anticipated by Alternative 2, up to 12 inter-tidal area marine vessel trips per day, would be within the security borders of NAVBASE Kitsap Bangor and thus would not impact marine traffic within Hood Canal. There would be a short term increases in traffic volumes in truck traffic from construction of the Waterfront Restricted Area and Security Barriers, Electromagnetic Measurement Range, Service Pier Extension, (EHW-1) Maintenance, EHW-2, and Waterfront Restricted Area Land-Water Interface, and Pile Repair and Replacement Program. However, these construction activities would not occur all at the same time and the number of trips would not have a significant impact on existing traffic volumes with the existing capacity of the installation roads and access points to the public road system. Therefore, no significant cumulative impacts to marine traffic and transportation are anticipated from the Proposed Action when combined with past, present, and reasonably foreseeable projects in the ROI.

4.2.7 Socioeconomics and Environmental Justice

The Proposed Action, combined with present, and reasonably foreseeable projects could result in a short-term beneficial impact to the regional economy during construction. After construction is completed, there would be a small increase in personnel required to operate EHW-2, which could increase employment opportunities in Kitsap County. Therefore, the Proposed Action, in combination with present, and reasonably foreseeable projects would not have a cumulative adverse impact to socioeconomics.

There are no air quality, water quality, transportation, or socioeconomic impacts identified that would disproportionately affect minority, low impact populations in Kitsap County and the surrounding communities. Therefore, no significant adverse cumulative impacts to socioeconomics or to environmental justice are anticipated from the Proposed Action when combined with past, present, and reasonably foreseeable projects in the ROI.

4.2.8 Cultural Resources

Prior to implementation of past and present actions, the Navy reviewed potential cultural resources in and adjacent to the project area and addressed potential adverse impacts as required under the NHPA. The proposed Waterfront Enclave conducted full cultural resource surveys, and identified three resource sites, none of which are considered eligible for NRHP listing. The EHW-1 and Delta Piers are both potentially eligible for the National Register of Historic Places due to their Cold War context, and repairs to EHW-1 are being completed with that historical context in mind. The future projects, including the Electromagnetic Measurement Range and the Land Water Interface are currently in their early assessment stages, and the cultural resources are not yet known.

The Proposed Action is adjacent to the Carlson Spit Shell Midden cultural site; however, as discussed in Section 3.7.3, the Preferred Alternative is unlikely to directly or indirectly impact that site. Thus, the Proposed Action would not contribute to cumulative adverse impacts to cultural resources.

4.2.9 American Indian Traditional Cultural Resources

Regional tribes have expressed concern over loss of access to traditional foraging areas along the coastline of Puget Sound, especially as a result of the incremental habitat loss from construction of new piers, bulkheads, and docks. The Port Gamble S'Klallam, Jamestown S'Klallam, and Lower Elwha Klallam Tribes have expressed specific concern about loss of access to Usual and Accustomed fishing grounds and stations due to future Navy actions. The Proposed Action, combined with past, present and reasonably foreseeable future actions could impact American Indian resources due to changes in access to traditional fishing and foraging areas and loss of benthic invertebrates such as geoducks. However, the Proposed Action would not have a significant impact to tribal resources and would therefore not contribute to cumulative adverse impacts to American Indian traditional cultural resources.

4.3 CONCLUSION

Implementation of the Proposed Action would have direct impacts to the marine environment as described in Chapter 3. The Proposed Action and other present and reasonably foreseeable future projects would include measures to avoid, minimize impacts, such as in-water construction windows to minimize impacts to salmonids, use of stormwater BMPs to minimize erosion and pollution, marine mammal and bird monitoring, and pile-driving shutdown zones. Additional project-specific impact minimization measures would be required for each project. Although some resources may be subject to potential cumulative significant adverse impacts, the Proposed Action would not substantially contribute to those impacts.

CHAPTER 5.0 OTHER CONSIDERATIONS REQUIRED BY NEPA

5.1 POSSIBLE CONFLICTS BETWEEN THE PROPOSED ACTION AND THE OBJECTIVES OF FEDERAL, STATE, LOCAL, AND REGIONAL LAND USE PLANS, POLICIES, AND CONTROLS

Implementation of the Proposed Action would comply with existing federal regulations and state, regional, and local policies and programs. Table 5-1 summarizes how the Proposed Action would be in compliance or avoid conflicts with federal, state, and local plans and policies.

Table 5-1. Principal Federal and State Laws Applicable to the Proposed Action

Federal, State, Local, and Regional Land Use Plans, Policies, and Controls	*Status of Compliance*
National Environmental Policy Act (NEPA) (42 USC §4321 et seq.); Navy procedures for Implementing NEPA ((32 CFR Part 775 and OPNAVINST 5090.1CH-1)	Preparation of this EA has been conducted in compliance with NEPA and in accordance with CEQ regulations and the Navy's NEPA procedures.
Clean Air Act CAA (42 USC §7401 et seq.)	The EPA has established NAAQS for seven pollutants (ozone, CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and lead) with Washington State establishing more stringent requirements for SO_2. NAVBASE Kitsap Bangor is located in Kitsap County which is an attainment area. A formal conformity determination is not required for CO. Estimated emissions for both alternatives were calculated and deemed not significant. As a result, the project would comply with the requirements of the CAA, as amended. For a more detailed discussion of potential impacts to air quality, refer to *Section 3.1 - Air Quality*.
Clean Water Act CWA (Sections 401 and 404, 33 USC 1251 et seq. /CWA 313, 33 U.S.C. § 1323.)	Under the CWA, there are water quality standards which set site-specific allowable pollutant levels for individual water bodies, such as rivers, lakes, streams and wetlands. The installation of the piles, below the Ordinary High Water mark of the Puget Sound (U.S. Waters), would not require the section 404 or 401 permit, as this project has limited impacts with the removal of a mooring dolphins, and installation of piles. However, all chemicals, liquid products, petroleum products, and other wastes present at the construction site would be covered, contained, and protected. Any spills would be handled according to CNRNW Instruction 5090.1, *Integrated Contingency Plan* and reported pursuant to Navy protocols. For more detailed discussion of potential impacts to water quality, refer to *Section 3.4 - Water Quality*.
Rivers and Harbors Act (33 U.S.C. 401 et seq.)	A permit under Section 10 of the Rivers and Harbors Act is required. The Navy would obtain a USACE permit as required under Section 10 of the Rivers and Harbors Act prior to construction of the barge moorings project. The Navy would comply with any conditions applied to the project during the coordination process between the Navy and the USACE.
Coastal Zone Management Act CZMA (16 USC 1451 et seq.)	Washington is a coastal state and has an approved CZMA program. CZMA requires federal development activities such as the Proposed Action to be consistent to the maximum extent practicable with the enforceable policies of the Washington Coastal Zone Management Program and to consider the potential effect on coastal resources. The Navy has prepared a Coastal Consistency Determination with a conclusion of compliance and submitted it to Ecology for concurrence (Appendix C).

Table 5-1. Principal Federal and State Laws Applicable to the Proposed Action

Federal, State, Local, and Regional Land Use Plans, Policies, and Controls	*Status of Compliance*
National Historic Preservation Act NHPA (Section106, 16 USC 470 et seq.)	The NHPA requires federal agencies to identify, evaluate, inventory, and protect NRHP resources (or resources that are potentially eligible for listing in the NRHP on properties that they control (16 USC 470h-2). In accordance with Section 106 of the NHPA, the Navy has determined that no historic properties would be adversely affected by implementation of the Proposed Action, pending the completion of Native American consultation, concurrence by the Department of Archaeological and Historic Preservation Office and SHPO. In the event of inadvertent discovery of sensitive archaeological materials during construction, the Navy would ensure that measures are taken promptly to protect the find from disturbance, assess the significance of the discovery, and implement appropriate mitigating measures for significant resources. Inadvertent discovery of sensitive archaeological materials would be handled in accordance with the appropriate Standard Operating Procedures.
Native American Graves Protection Act NAGPRA (25 U.S.C. § 3001)	No Native American resources that qualify for NAGPRA have been identified in the area of potential effects. If such resources are discovered, the Navy will comply with NAGPR.
Endangered Species Act ESA (16 USC 1531 et seq.)	In accordance with ESA Section 7 requirements, the Navy also prepared a Biological Assessment (BA) and consulted informally with USFWS and NMFS regarding potential effects to ESA-listed species and critical habitat. At the conclusion of informal consultation, a letter of concurrence from NMFS and USFWS would be received (Appendix D).
Marine Mammal Protection Act MMPA (16 USC 1361-1421h, as amended)	Based on potential impacts to marine mammals, the Navy prepared an Incidental Harassment Authorization (IHA) application to request take for level "B" harassment (Appendix F). The IHA was submitted to NMFS for review and public comment. At the conclusion of the consultation, NMFS would issue an incidental take permit.
Magnuson-Stevens Fishery Conservation and Management Act MSA (16 USC 1801-1882)	The Navy prepared an EFH Assessment and submitted it to NMFS with the BA (Appendix D). At the conclusion of consultation, a letter of concurrence from NMFS would be received.
Migratory Bird Treaty Act MBTA (16 USC 703-712)	The Proposed Action is not likely to adversely affect migratory bird populations and would be in compliance with the MBTA.
Bald and Golden Eagle Protection Act (16 USC 668-668d)	The Proposed Action is not likely to have a measureable negative effect on eagle populations and would be in compliance with the Bald and Golden Eagle Protection Act.
Federal Actions to Address Environmental Justice in Minority and Low-income Populations (EO 12898)	No disproportionately high and adverse impacts to minority and low-income populations would be expected with implementation of the Preferred Alternative or Alternative 2.
Protection of Children From Environmental Health Risks and Safety Risks (EO 13045)	Children would not be disproportionately exposed to environmental health and safety risks with implementation of the Preferred Alternative or Alternative 2.

Table 5-1. Principal Federal and State Laws Applicable to the Proposed Action

Federal, State, Local, and Regional Land Use Plans, Policies, and Controls	*Status of Compliance*
Consultation and Coordination with Indian Tribal Governments (EO 13175)	The Navy has consulted with the Skokomish, Port Gamble S'Klallam, Jamestown S'Klallam, Lower Elwha Klallam, and Suquamish Tribes regarding potential impacts to Tribal U&A fishing grounds and stations. The consultations are ongoing and are conducted as required under Secretary of the Navy Instruction 11010.14A, *Department of the Navy Policy for Consultation with Federally Recognized Tribes*; DoD Instruction 4710.02, *DoD Interactions with Federally Recognized Tribes*; and DoD Policy, *American Indian and Alaska Native Policy Alaska Implementation Guidance (See Appendix G)*.
Federal Compliance with Pollution Control Standards (EO 12088)	EO 12088 requires federal facilities to comply with all applicable pollution control standards. The Proposed Action would contribute only minor amounts of pollution, primarily during the construction phase and during maintenance activities. Moreover, only minimal amounts of solid waste requiring disposal would be generated during construction and operations and would be disposed of in an environmentally safe manner. Implementation of the Preferred Alternative or Alternative 2 would be consistent with this EO.
Greening the Government through Leadership in Environmental Management (EO 13148)	This EO requires the federal government to improve its energy management for the purpose of saving taxpayer dollars and reducing emissions that contribute to air pollutions and global climate change. Federal agencies are required to: reduce GHG emissions; reduce energy consumption per square foot of facility; strive to expand use of renewable energy; reduce the use of petroleum within its facilities; and reduce water consumption. The NAVBASE Kitsap Bangor is working toward energy efficiency in their equipment, support vehicles, power generation and water conservation. This This project will include new engines that have reduced GHG emission and reduce energy consumption, which would meet the general intent of this EO.

5.2 Irreversible or Irretrievable Commitment of Natural or Depletable Resources

Resources that are irreversibly or irretrievably committed to a project are those that are used on a long-term or permanent basis. This includes the use of non-renewable resources such as metal and fuel, and other natural or cultural resources. These resources are irretrievable in that they would be used for this project when they could have been used for other purposes. Human labor is also considered an irretrievable resource. Another impact that falls under this category is the unavoidable destruction of natural resources that could limit the range of potential uses of that particular environment.

Implementation of the Preferred Alternative or Alternative 2 would involve the consumption of fuel, oil, and lubricants for construction vehicles, barge, and pile driver. Human energy invested in construction would be irretrievably lost. Since the reuse of these resources may not be possible, they would be irreversibly and irretrievably committed as part of the Proposed Action.

5.3 Relationship Between Local Short-Term Use of the Human Environment and Maintenance and Enhancement of Long-Term Natural Resource Productivity

The NEPA process requires an analysis of the relationship between a project's short-term impacts on the environment and the effects that these impacts may have on the maintenance and enhancement of the long-term productivity of the affected environment. Impacts that narrow the range of beneficial uses of the environment are of particular concern. This refers to the possibility that choosing one development

option reduces future flexibility in pursuing other options, or that giving over a parcel of land or other resources to a certain use often eliminates the possibility of other uses being performed at that site.

In the short-term, effects to the human environment with implementation of the Preferred Alternative or Alternative 2 would primarily relate to the in-water construction activity itself. Air quality, water quality and marine sediment, and noise would all expect to be impacted in the short-term. In the long-term, productivity of the area would remain the same, as the moorings locations are supporting the replacement of an existing barge and that would not change the overall productivity of the area. The Preferred Alternative or Alternative 2 would not result in any impacts that would reduce environmental productivity or permanently narrow the range of beneficial uses of the environment.

5.4 MEANS TO MITIGATE AND/OR MONITOR ADVERSE ENVIRONMENTAL IMPACTS

The construction and installation of the barge mooring locations as described under the Preferred Alternative and Alternative 2 would not result in any significant adverse environmental impacts with implementation of the BMPs and design minimization measures described in Section 2.5. These measures are summarized below.

- All pollutants, including waste materials, would be handled and disposed of in a manner that does not cause contamination of stormwater. Construction activities would comply with Navy Stormwater Pollution Prevention Plan and CNRNW Instruction 5090.1, *Integrated Contingency Plan.*
- In-water work would only be conducted during an abbreviated in-water work window (July 16 through September 30) when juvenile ESA-listed salmonids and forage fish are least likely to be present.
- Pile driving activities would occur up to 6 days per week within the in-water work window and impact pile driving would occur between 2 hours after sunrise and 2 hours before sunset (July 16 through September 23) to protect foraging marbled murrelets. The in-water work window would be adjusted between September 24 and September 30, with work occurring from sunrise and sunset.
- To the maximum extent practicable, a vibratory hammer would be used for the majority of pile driving actions.
- A noise attenuating device (bubble curtain) would be used during impact pile driving operations.
- Developed in coordination with the NMFS and USFWS and approved by these agencies prior to initiation of in-water work, a Marine Mammal Monitoring Plan and a Marbled Murrelet Monitoring Plan would be prepared and finalized. Monitoring specific to marbled murrelets would adhere to the current USFWS protocol (USFWS 2012). Monitoring for marine mammals and marbled murrelets would occur within pre-determined shutdown zones for purposes of avoiding injurious effects. Marine mammal monitoring would take place from 15 minutes prior to initiation through 15 minutes post-completion of pile driving. Marbled Murrelet monitoring would take place from 30 minutes prior to initiation through 30 minutes post-completion of impact pile driving.
- If a marbled murrelet or marine mammal approaches/enters the shutdown zone, prior to the start of, or during the course of, pile driving operations, pile driving will be halted and delayed until

either the animal has voluntarily left and been visually confirmed beyond the shutdown zone, or 30 minutes have passed without re-detection of the animal.

5.5 ANY PROBABLE ADVERSE ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED AND ARE NOT AMENABLE TO MITIGATION

With implementation of BMPs and design minimization measures described in Section 2.5, implementation of the Preferred Alternative or Alternative 2 would not result in adverse environmental effects and therefore mitigation measures are not necessary.

[This page intentionally left blank.]

CHAPTER 6.0 REFERENCES

Agness, A. and B.R. Tannenbaum. 2009a. Naval Base Kitsap Bangor Marine Bird Resource Report. Prepared by Science Applications International Corporation, Bothell, WA for BAE Systems Applied Technologies, Inc., Rockville, MD.

Agness, A., and B.R. Tannenbaum. 2009b. Naval Base Kitsap Bangor Marine Mammal Resource Report. Prepared by Science Applications International Corporation, Bothell, WA for BAE Systems Applied Technologies, Inc., Rockville, MD.

Allen, B.M. and R.P. Angliss. 2011. Alaska Marine Mammal Stock Assessments, 2010. U.S. Dep. Commerce, NOAA Technical Memorandum NMFS-AFSC-223, 301 p.

Angell, T. and K.C. Balcomb III. 1982. Marine birds and mammals of Puget Sound. University of Washington Press: Seattle, 145 pp.

Bax, N.J. 1983. The early marine migration of juvenile chum salmon (Oncorhynchus keta) through Hood Canal: Its variability and consequences. Ph.D. dissertation, University of Washington, Seattle, WA.

Bax, N.J., E.O. Salo, B.P. Snyder, C.A. Simenstad, and W.J. Kinney. 1978. Salmonid outmigration studies in Hood Canal. Final report, Phase III, January to July 1977. FRI-UW- 7819. Fisheries Research Institute, College of Fisheries, University of Washington. Seattle, WA.

Bhuthimethee, M., C. Hunt, G. Ruggerone, J. Nuwer, and W. Hafner. 2009a. NAVBASE, Kitsap Bangor 2007-2008 Fish Presence and Habitat use Field Survey Report. Prepared by Science Applications International Corporation, Bothell, WA for BAE Systems Applied Technologies, Inc., Rockville, MD.

Bhuthimethee, M., G. Ruggerone, and C. Hunt. 2009b. NAVBASE Kitsap Bangor freshwater fish survey report, combined phase I and II. Prepared by Science Applications International Corporation, Bothell, WA, and Natural Resources Consultants, Inc., Seattle, WA for BAE Systems Applied Technologies, Inc., Rockville, MD.

Bigg, M.A. 1985. Status of the Steller sea lion (*Eumetopias jubatus*) and California sea Lion (*Zalophus californianus*) in British Columbia. Vol. 77, Canadian Special Publication of Fisheries and Aquatic Sciences. Ottawa: Dept. of Fisheries and Oceans.

Blackwell, S.B., J.W. Lawson, and M.T. Williams. 2004. Tolerance by ringed seals (Phoca hispida) to impact pipe-driving and construction sounds at an oil production island. Journal of the Acoustical Society of America 115:2346-2357.

Bowen, W.D., and D.B. Siniff. 1999. Distribution, population biology, and feeding ecology of marine mammals. In Biology of marine mammals, ed. Reynolds, J.E. and S.A. Rommel. Washington: Smithsonian Institution Press. 423-484.

Butler, Justin and Bradley Bowden. 2005 Final Report Archaeological Survey Modification 2 Environmental Assessment, NSWCCD Detachment Bremerton Consolidation, Puget Sound, Washington. Prepared for Adolfson Associates by Historical Research Associates (HRA), Inc. On File at NAVFAC, NAVBASE Kitsap Bangor.

Calambokidis, J. 2010. John Calambokidis, senior marine mammal biologist and co-founder of Cascadia Research, Olympia, WA. September 15, 2001. Personal communication with Chris Hunt, Marine Scientist, Science Applications International Corporation, Bothell, WA, re: the rare occurrence of large whales (e.g., gray/humpback whales) occurring south of the Hood Canal Bridge since its construction.

Calambokidis, J. 2012. John Calambokidis, senior marine mammal biologist and co-founder of Cascadia Research, Olympia, WA. February 16, 2012. Personal communication with Sharon Rainsberry, Biologist, Naval Facilities Engineering Command, U.S. Navy, Bangor WA. re: Information and number of humpback whales present in Hood Canal from January/February 2012 sightings and other documented sightings of humpback whales in Hood Canal.

Caltrans. 2009. Final Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish. Prepared by ICF Jones & Stokes, Sacramento, CA, and Illingworth and Rodkin, Inc., Petaluma, CA. February.

Carretta, J.V., K.A. Forney, M.S. Lowry, E. Oleson, K. Martien, M.M. Muto, M.S. Lowry, J. Barlow, J. Baker, B. Hanson, D. Lynch, L. Carswell, R.L. Brownell Jr., J. Robbins, D.K. Mattila, K. Ralls, and M.C. Hill. 2011. U.S. Pacific Marine Mammal Stock Assessments: 2010. NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-476. National Marine Fisheries Service, Southwest Fisheries Science Center, La Jolla, CA.

Carter, H.R. and J.L. Stein. 1995. Molts and plumages in the annual cycle of marbled murrelet. National Biology Service. U.S. Department of the Interior. California Pacific Science Center. Dixon, CA.

Center for Hearing and Communication. 2010. Common Environmental Noise Levels. http://www.chchearing.org/noise-center-home/facts-noise/common-environmental-noise-levels. Accessed 13 December.

Council on Environmental Quality (CEQ). 2007. CEQ Regulations Part 1508 Available http://ceq.hss.doe.gov/nepa/regs/ceq/1508.htm

CEQ. 1997. Considering Cumulative Effects Under the National Environmental Policy Act. Washington, DC. January.

CEQ. 2010. Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions. Memorandum for Heads of Federal Departments and Agencies from Nancy H. Sutley, Chair, Council on Environmental Quality, Washington, DC. February 18.

City Data. 2007 – Summary of local census information by City, http://www.localcensus.com/city/Silverdale/Washington (Includes Poulsbo & Bremerton) Accessed Feb 1, 2011.

COMNAVREG NW-8203.2A – Department of Navy Technical Memorandum – Guide to Ordnance Handling in the Navy Region Northwest Area of Responsibility. (January 2009).

Danish Environmental Protection Agency. 1999. Tributyltin. Environmental Project No. 451. Ministry of Environment and Energy, Copenhagen, Denmark. http://www2.mst.dk/Udgiv/publications/1999/87-7909-223-3/pdf/87-7909-223-3.pdf.

Dooling, R.J., and A.N. Popper. 2007. The Effects of Highway Noise on Birds. Prepared for the California Department of Transportation, Division of Environmental Analysis. Sacramento. CA.

Downing, J. 1983. The Coast of Puget Sound: Its Processes and Development. Washington Sea Grant, University of Washington, Seattle, WA.

Drake, J., E. Berntson, J. Cope, R. Gustafson, E. Holmes, P. Levin, N. Tolimieri, R. Waples, and S. Sogard. 2008. Preliminary and Scientific Conclusions of the Review of the Status of 5 Rockfish: Bocaccio (Sebastes paucispinis), Canary Rockfish (Sebastes pinniger), Yelloweye Rockfish (Sebastes ruberrimus), Greenstriped Rockfish (Sebastes elongatus), and Redstripe Rockfish (Sebastes proriger) in Puget Sound, Washington. NMFS, Northwest Fisheries Science Center, Seattle, WA. http://www.nwr.noaa.gov/Other-Marine-Species/Puget-Sound-Marine-Fishes/upload/PSrockfish-review-08.pdf.

Eschmeyer, W.N., E.S. Herald, and H. Hammann (Illustrator). 1983. Field Guide to Pacific Coast Fishes of North America: from the Gulf of Alaska to Baja, California. Peterson Field Guide Series. Houghton Mifflin, Boston, MA.

Falcone, E., J. Calambokidis, G. Steiger, M. Malleson, J. Ford. 2005. Humpback whales in the Puget Sound/Georgia Strait Region. Proceedings of the 2005 Puget Sound Georgia Basin Research Conference.

Falxa, G.A., J. Baldwin, D. Lynch, S.K. Nelson, S.L. Miller, S.F. Pearson, M.G. Raphael, C. Strong, T. Bloxton, B. Galleher, B. Hogoboom, M. Lance, and R. Young. 2009. DRAFT Marbled murrelet effectiveness monitoring, Northwest Forest Plan: 2008 summary report. Dated May 28, 2009.

Federal Highway Administration (FHWA). 2011a. Highway Traffic and Construction Noise – Problems and Response. Table 9. Noise Abatement Criteria. http://www.fhwa.dot.gov/environment/noise/regulations_and_guidance/probresp.cfm#threepart. Accessed July 26, 2012.

FHWA. 2011b. Construction Noise Handbook. http://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/handbook09.cfm. Accessed June 20, 2012.

Federal Interagency Committee on Noise (FICON). 1992. Federal Agency Review of Selected Airport Noise Analysis Issues. Washington, DC. August.

Fisheries Hydroacoustic Working Group (FHWG). 2008. Memorandum of agreement in principle for interim criteria for injury to fish from pile driving. In coordination with the Federal Highway Administration.

Forney, K.A. and J. Barlow. 1998. Seasonal patterns in the abundance and distribution of California cetaceans, 1991-1992. Marine Mammal Science 14(3), 460-489.

Fresh, K.L. 2006. Juvenile Pacific Salmon in Puget Sound. Puget Sound Nearshore Partnership Report No. 2006-06. Published by Seattle District, U.S. Army Corps of Engineers, Seattle, Washington.

Gearin, P.J., S. R. Melin, R.L. DeLong, H. Kajimura, and M.A. Johnson. 1994. Harbor porpoise interations with a Chinook salmon set-net fishery in Washington State. Rep. Int. Whal. Commn. Special Issue 15:427-438.

Green, G.A., J.J. Brueggeman, R.A. Grotefendt, C.E. Bowlby, M.L. Bonnell, and K.C. Balcomb III. 1992. Cetacean distribution and abundance off Oregon and Washington, 1989-1990. Pages 1-1 to

1-100 in Brueggeman, J.J., ed. Oregon and Washington marine mammal and seabird surveys. OCS Study MMS 91-0093. Los Angeles, California: Minerals Management Service.

Hammer & Steel. 2012. Pile Driving Equipment Specifications. Available at: http://www.hammersteel.com/pile-driving-specifications.html. Accessed 9-23-2012.

Hammermeister, T., and W. Hafner. 2009. Naval Base Kitsap Sediment Quality Investigation: Data Report. Prepared by Science Applications International Corporation, Bothell, WA for BAE Systems Applied Technologies, Inc., Rockville, MD.

Hard, J.J., J.M. Myers, M.J. Ford, R.G. Cope, G.R. Pess, R.S. Waples, G.A. Winans, B.A. Berejikian, F.W. Waknitz, P.B. Adams, P.A. Bisson, D.E. Campton, and R.R. Reisenbichler. 2007. Status review of Puget Sound steelhead (Oncorhynchus mykiss). NOAA Tech Memo, Seattle, WA.

Hastings, M.C., and A.N. Popper. 2005. Effects of sound on fish. Prepared by Jones & Stokes. Prepared for California Department of Transportation, Sacramento, CA. http://www.dot.ca.gov/hq/env/bio/files/Effects_of_Sound_on_Fish23Aug05.pdf.

Hood Canal Dissolved Oxygen Program (HCDOP) 2011. Hood Canal Dissolved Oxygen Program: Historical comparisons. http://www.hoodcanal.washington.edu/observations/historicalcomparison.jsp. Accessed 2 February 2011.

Holmberg, E.K., D. Day, N. Pasquale, and B. Pattie. 1967. Research report on the Washington trawl fishery 1962-64. Technical Report. Washington Department of Fisheries, Research Division.

Houck W.J. and T.A. Jefferson. 1999. Dall's porpoise (Phocoenoides dalli) True, 1885. In: Handbook of Marine Mammals (Ridgway SH, Harrison SR Eds.) Vol. 6: The second book of dolphins and porpoises. pp. 443-472.

Illingworth & Rodkin, Inc. 2012. Naval Base Kitsap Bangor Test Pile Program, Bangor, Washington. Final Acoustic Monitoring Report. Prepared for Naval Facilities Engineering Northwest, Silverdale, WA. April 2012.

Jefferson, T.A. 1990. Sexual dimorphism and development of external features in Dall's porpoise (Phocoenoides dalli). Fishery Bulletin, 88, 119-132.

Jefferson, T.A. 1991. Observations on the distribution and behaviour of Dall's porpoise (Phocoenoides dalli) in Monterey Bay, California. Aquatic Mammals, 17(1):12-19.

Jefferson, T.A., S. Leatherwood, and M.A. Webber. 1993. FAO species identification guide. Marine mammals of the world. Rome, Italy: Food and Agriculture Organization of the United Nations.

Jeffries, S.J., P.J. Gearin, H.R. Huber, D.L. Saul, and D.A. Pruett. 2000. Atlas of Seal and Sea Lion Haul-out Sites in Washington. Washington State Department of Fish and Wildlife, Wildlife Science Division, Olympia, WA.

Johnson, O. W., W. S. Grant, R. G. Kope, K. Neely, F. W. Waknitz, and R. S. Waples. 1997. Status review of chum salmon from Washington, Oregon, and California. NOAA Tech. Memo. NMFS-NWFSC-32.

Johnson, D.H. and T.A. O'Neil. 2001. Wildlife-Habitat Relationships in Oregon and Washington. Oregon State University Press, Corvallis, OR.

Kahle, S.C. 1998. Hydrogeology of Naval Submarine Base Bangor and Vicinity, Kitsap County, Washington. U.S. Geological Survey Resource Investigation Report No. 97-4060.

Kincaid, T. 1919. An Annotated List of Puget Sound Fishes. Washington Department of Fisheries, Olympia, WA.

Kitsap Economic Development Alliance. 2010. Kitsap County Public Sector Employment 2010. http://www.kitsapeda.org/pdfs/2010%20Top%20Employers%20Public.pdf.

Lewarch, Dennis E., Leonard Forsman, Lynn L. Larson. 1993. Cultural Resources Overview and Probabilistic Model for Sub Base NAVBASE Kitsap and Camp Wesley Harris, Kitsap County, Washington. Prepared by Larson Anthropological and Archaeological Services (LAAS) for Parametrix. On File at NAVFAC, NAVBASE Kitsap Bangor.

Lewarch, Dennis E., Lynn L. Larson, Leonard A. Forsman, and Robin Moore 1997 *Cultural Resource Evaluation of Shell Midden Sites 45KP106, 45KP107, and 45KP108, Naval Submarine Base, Bangor, Kitsap County, Washington, Final Report*. LAAS Technical Report # 97-03. Larson Anthropological/Archaeological Services, Seattle, Washington.

London, J.M. 2006. Harbor seals in Hood Canal: Predators and prey. Ph.D. dissertation, University of Washington, Seattle, WA.

Loughlin, T. R. 1997. Using the phylogeographic method to identify Steller sea lion stocks. Pages 329-341 in A. Dizon, S. J. Chivers, and W. Perrin, eds. Molecular genetics of marine mammals, incorporating the proceedings of a workshop on the analysis of genetic data to address problems of stock identity as related to management of marine mammals. Society of Marine Mammalogy, Special Report No. 3.

Love, M.S., M.H. Carr, and L.J. Haldorson. 1991. The ecology of substrate-associated juveniles of the genus Sebastes. Environmental Biology of Fishes 30:225-243.

Love, M.S., M. Yoklavich, and L.K. Thorsteinson. 2002. The Rockfishes of the Northeast Pacific. University of California Press, Berkeley, CA.

MacGillivray, A., Ziegler, E. and Laughlin, J. 2007. Underwater Acoustic Measurements from Washington State Ferries 2006 Mukilteo Ferry Terminal Test Pile Project. Technical Report prepared by JASCO Research, Ltd. for Washington State Ferries and Washington State Department of Transportation, 27 pp.

Mackie, G.O. 2008. Immunostaining of peripheral nerves and other tissues in whole mount preparations from hatchling cephalopods. Tissue and Cell 40:21-29.

Mauchline J. 1998. Biology of Calanoid Copepods. Academic Press, San Diego, CA.

Morejohn, G.V. 1979. The natural history of Dall's porpoise in the North Pacific Ocean. Pages 45–83 in Behavior of Marine Animals, Vol. 3, Cetaceans. H.E. Winn and B.L. Olla (Eds). Plenum Press, New York.

Moulton, L.L and B.S. Miller. 1987. Characterization of Puget Sound Marine Fishes: Survey of Available Data. For Washington Sea Grant Program in Cooperation with the U.S. Environmental Protection

Agency, Water Division, Office of Puget Sound. Fisheries Research Institute, School of Fisheries, University of Washington. FRI-UW-8716.

Mumford, T.E. 2007. Kelp and Eelgrass in Puget Sound. Puget Sound Nearshore Partnership Report No. 2007-05. Published by U.S. Army Corps of Engineers, Seattle District, Seattle, WA.

Navy. 1994. Construction of Supporting Shore and Waterfront Facilities for USS Parche; Environmental Assessment and Finding of No Significant Impact. May.

Navy. 2001. Integrated Natural Resources Management Plan. Naval Submarine Base Bangor, Silverdale, WA.

Navy. 2005. SECNAV Instruction 11010.14A – Department of Navy Policy for Consultation with Federally Recognized Indian Tribes. 11 October.

Navy. 2006a. Naval Base Kitsap Bangor Silverdale, Washington Oil Spill Prevention, Control, and Countermeasure Plan. May.

Navy.2009. COMNAVREG NW Instruction 11010.14. Policy for Consulation with Federally-Recognized American Indian and Alaska Native Tribes. November.

Navy. 2010a. COMNAVREG NW Instruction 5090.1B. Oil and Hazardous Substance Integrated Contingency Plan. January.

Navy. 2010b. Regional Hazardous Material Control and Management Program, Commander- Navy Region Northwest (COMNAVREG NW) 5090.6A.

Navy 2010c. Technical Memorandum on Waterfront Noise Measurements conducted on 19 October 2010 at Naval Base Kitsap Bangor.

Navy. 2011a – Explosive Handling Wharf 2 Draft Environmental Impact Statement, Transportation, March 2011.

Navy. 2011b. Biological assessment for the TRIDENT Support Facilities Explosives Handling Wharf, Naval Base Kitsap Bangor. Prepared by Naval Facilities Engineering Command Northwest for U.S. Department of the Navy, Naval Base Kitsap Bangor. February.

Navy. 2012a. Naval Base Kitsap Bangor EHW-1 Pile Replacement Project, Bangor, Washington. Final Marbled Murrelet Monitoring Report. Prepared by Hart Crowser & HDR. April 2012.

Navy. 2012b. Naval Base Kitsap Bangor Test Pile Program, Bangor, Washington. Final Marbled Murrelet Monitoring Report. Prepared by Hart Crowser & HDR. April 2012.

Navy. 2012c. Final Summary Report Marbled Murrelet Hydroacoustic Science Panel II. Panel Conducted March 28–30, 2012. Prepared by Science Applications International Corporation Bothell, Washington September 4, 2012.

NMFS National Marine Fisheries Service (NMFS). 1970. Listing Humpback Whale. 35 FR 1222-12225, July 30. From 35 FR 18319 Part 17 of Title 50 CFR adding additional name to list of foreign endangered species.

NMFS. 1990. Listing of Steller Sea Lions as Threatened under the Endangered Species Act; Final Rule. Federal Register 55:49204-49240.

NMFS. 1991. Final recovery plan for the humpback whale (*Megaptera novaeangliae*). Prepared by Humpback Whale Recovery Team. Prepared for National Marine Fisheries Service, Silver Spring, MD. 120 pp.

NMFS. 1993. Designation of Critical Habitat for the Steller Sea Lion. Final Rule. Federal Register 58:45269-45285.

NMFS. 1997. Threatened Fish and Wildlife; Change in Listing Status of Steller Sea Lions under the Endangered Species Act; Final Rule. Federal Register 62:24345-24355.

NMFS. 1999. The habitat approach: implementation of Section 7 of the Endangered Species Act for actions affecting the habitat of Pacific anadromous salmonids. Memorandum for NMFS/NWR Staff. Prepared by the Northwest Region, Habitat Conservation and Protected Resources Divisions. August 26.

NMFS. 2002. The Final Rule for Essential Fish Habitat. Federal Register 67:2343-2383.

NMFS. 2005a. Endangered and Threatened Species: Final Listing Determinations for 16 ESUs of West Coast Salmon, and Final 4(d) Protective Regulations for Threatened Salmonid ESUs; Final Rule. Federal Register 70:37160-37204.

NMFS. 2005b. Endangered and Threatened Species; Designation of Critical Habitat for 12 Evolutionarily Significant Units of West Coast Salmon and Steelhead in Washington, Oregon, and Idaho; Final Rule. Federal Register 70:52630-52858.

NMFS. 2006. Listing endangered and threatened species and designating critical habitat: 12-month finding on petition to list Puget Sound Steelhead as an endangered or threatened species under the Endangered Species Act. Proposed Rule. Federal Register 71:15666-15680.

NMFS. 2007. Endangered and Threatened Species: Final Listing Determination for Puget Sound Steelhead; Final Rule. Federal Register 72:26722-26735.

NMFS. 2008a. Recovery Plan for Southern Resident Killer Whales (Orcinus orca). National Marine Fisheries Service, Northwest Region. Seattle, WA.

NMFS. 2008b. Recovery Plan for the Steller Sea Lion (Eumetopias jubatus). Revision. National Marine Fisheries Service, Silver Spring, MD. 325 p.

NMFS. 2010. Endangered and Threatened Wildlife and Plants: Threatened Status for the Puget Sound/Georgia Basin Distinct Population Segments of Yelloweye and Canary Rockfish and Endangered Status for the Puget Sound/Georgia Basin Distinct Population Segment of Bocaccio Rockfish; Final Rule. Federal Register 75:22276-22290.

NMFS. 2010b. Endangered Species Act Section 7 Formal Consultation, Port Townsend ferry terminal dolphin replacement, Biological Opinion and Essential Fish Habitat Consultation. National Marine Fisheries Service Northwest Region, Seattle, WA. July 20, 2010.

NMFS. 2011. Endangered and Threatened Species: Designation of Critical Habitat for Threatened Lower Columbia River Coho Salmon and Puget Sound Steelhead. Advance Notice of Proposed Rulemaking. Federal Register. 76: 1392-1399.

NOAA. National Oceanic and Atmospheric Administration (NOAA) 2007. Puget Sound Salmon Recovery Plan. Shared Strategy for Puget Sound and NOAA Fisheries, Seattle, WA. http://www.sharedsalmonstrategy.org/plan/toc.htm.

NOAA Fisheries. 2012. NOAA Proposes Removing Eastern Steller Sea Lions from Endangered Species List – Agency Seeks Public Comment. News Release, Julie Speegle, Alaska Regional Office. 12 April.

Nysewander, D.R., J.R. Evenson, B.L. Murphie, and T.A. Cyra. 2005. Report of marine bird and marine mammal component, Puget Sound ambient monitoring program, for July 1992 to December 1999 period. Prepared for the Washington State Department of Fish and Wildlife and Puget Sound Action Team by the Washington State Department of Fish and Wildlife, Wildlife Management Program, Olympia, WA. January 31.

Olesiuk, P.F. 2008. Abundance of Steller sea lions (*Eumetopias jubatus*) in British Columbia. Research Document 2008/063. Canadian Science Advisory Secretariat, Ottawa.

Orca Network. 2012. Review of Orca Network Marine Mammal Sighting Record Archives. http://www.orcanetwork.org/. Accessed June 2012.

Osmek, S.D., J. Calambokidis, J. Laake, P. Gearin, R. Delong, J. Scordino, S. Jeffries, and R. Brown. 1996. Assessment of the status of harbor porpoise (Phocoena phocoena) in Oregon and Washington Waters. December 1996. NOAA Technical Memorandum NMFS-AFSC-76.

Palsson, W.A., T.-S. Tsou, G.G. Bargmann, R.M. Buckley, J.E. West, M.L. Mills, Y.W. Cheng, and R.E. Pacunski. 2009. The biology and assessment of rockfishes in Puget Sound, Technical Report. Marine Resources Unit.

Pacific Fishery Management Council (PFMC). 2005a. Pacific Coast Groundfish Fishery Management Plan, for the California, Oregon, and Washington Groundfish Fishery. Appendix B, Part 4 Habitat Suitability Probability Maps for Individual Groundfish Species and Life History Stages.

PFMC. 2005b. Pacific Coast Groundfish Fishery Management Plan, for the California, Oregon, and Washington Groundfish Fishery. Appendix B, Part 2 Groundfish Life History Descriptions.

PFMC. 2011a. Pacific Coast Groundfish Fishery Management Plan for the California, Oregon, and Washington Groundfish Fishery.

PFMC. 2011b. The Coastal Pelagic Species Fishery Management Plan; As Amended Through Amendment 13.

PFMC. 2011c. Fishery Management Plan for the U.S. West Coast Fisheries For Highly Migratory Species as Amended through Amendment 2.

PFMC. 2012. Pacific Coast Salmon Fishery Management Plan , for Commercial and Recreational Salmon Fisheries Off the Coasts of Washington, Oregon, and California as Revised through Amendment 16.

Pentec. 2003. Final Report. Marine and terrestrial resources, Security force facility and enclave fencing at Naval Submarine Base Bangor, WA. Prepared by Pentec Environmental for SRI International. November 18.

Phillips, C., B. Dolan, and W. Hafner. 2009. Naval Base Kitsap Bangor Water Quality 2005 and 2006 Field Survey Report. Prepared by Science Applications International Corporation, Bothell, WA for BAE Systems Applied Technologies, Inc., Rockville, MD.

Pitcher, K. W., P. F. Olesiuk, R. F. Brown, M. S. Lowry, S. J. Jeffries, J. L. Sease, W. L. Perryman, C. E. Stinchcomb, and L. F. Lowry. 2007. Status and trends in abundance and distribution of the eastern Steller sea lion (Eumetopias jubatus) population. Fishery Bulletin 107:102-115.

Puget Sound Action Team (PSAT). 2007a. 2007 Puget Sound Update. Puget Sound Assessment and Monitoring Program. Olympia, WA.

PNPTC 2010, Point No Point Treaty Council, 2010 - http://www.pnptc.org

PSAT. 2007b. State of the Sound 2007. Puget Sound Action Team. Publication No. PSAT 07-01. Office of the Governor, Olympia, WA. March 2007.

PSCAA. 2011. About Us. http://www.pscleanair.org/about/. Accessed 2 February 2011.

Puget Sound Water Quality Action Team and Puget Sound Estuary Program (PSWQAT-PSEP). 1997. Recommended Guidelines for Measuring Organic Compounds in Puget Sound Water, Sediment, and Tissue Samples. Organics Chapter. Prepared for U. S. Environmental Protection Agency, Region 10, Seattle, WA.

Raphael, M.G., J. Baldwin, G.A. Falxa, M.H. Huff, S.L. Miller, S.F. Pearson, C.J. Ralph, C. Strong, and C. Thompson. 2007. Regional population monitoring of the marbled murrelet: field and analytical methods. Gen. Tech. Rep. PNW-GTR-716. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 70 pp.

Read, A.J. 1990. Reproductive seasonality in harbour porpoises (Phocoena phocoena) from the Bay of Fundy. Canadian Journal of Zoology 68, 284-288.

Read, A.J., 1999. Harbour porpoise (Phocoena phocoena) Linnaeus, 1758. Pages 323-355 in Ridgway, S.H. and R. Harrison, eds. Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. San Diego, California: Academic Press.

Read, A.J. and A.A. Hohn. 1995. Life in the fast lane: The life history of harbor porpoises from the Gulf of Maine. Marine Mammal Science 11(4), 423-440.

Reeves RR, Dalebout ML, Jefferson TA, Karczmarski L, Laidre K, O'Corry-Crowe G, Rojas-Bracho L, Secchi ER, Slooten E, Smith BD, Wang JY, Zhou K. 2008..

Richardson, W. J., Greene, C. R., Jr., Malme, C. I., & Thomson, D. H. 1995. Marine mammals and noise. New York: Academic Press.

Sackmann, B. 2000. Variability in egg production of natural populations of Calanus pacifica from Puget Sound, Washington. Senior Thesis, University of Washington, School of Oceanography.

Salo, E.O., N.J. Bax, T.E. Prinslow, C.J. Whitmus, B.P. Snyder, and C.A. Simenstad. 1980. The effects of construction of Naval facilities on the outmigration of juvenile salmonids from Hood Canal, Washington. Final report. Prepared by Fisheries Research Institute, College of Fisheries, University of Washington, Seattle, WA for the U.S. Navy, OICC Trident. April.

Scheffer, V.B., and J.W. Slipp. 1948. The whales and dolphins of Washington State with a key to the cetaceans of the west coast of North America. American Midland Naturalist. 39(2):257-337.

Science Applications International Corporation (SAIC). 2006. Naval Base Kitsap Bangor fish presence and habitat use Combined Phase I and II Field Survey Report. Prepared for BAE Systems Applied Technologies, Inc. Rockville, MD.

SAIC. 2009. Naval Base Kitsap, Bangor. Comprehensive Eelgrass Survey Field Survey Report. Prepared for BAE Systems Applied Technologies, Inc. Rockville, MD.

SAIC. 2011. Environmental Science Panel for Marbled Murrelet Underwater Noise Injury Threshold, Final Summary Report. Panel Conducted July 27-29. Lacy, WA.

Sands, N.J., K. Rawson, K.P. Currens, W.H. Graeber, M.H. Ruckelshaus, R.R. Fuerstenberg, and J.B. Scott. 2009. Determinations of independent populations and viability criteria for the Hood Canal summer chum salmon evolutionarily significant unit. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-NWFSC-101, 58 p.

Schreiner, J.U. 1977. Salmonid outmigration studies in Hood Canal, Washington. Master's thesis, University of Washington, Seattle, WA.

Simenstad, C.A., W.J. Kinney, S.S. Parker, E.O. Salo, J.R. Cordell, and H. Buechner. 1980. Prey community structure and trophic ecology of outmigrating juvenile chum and pink salmon in Hood Canal, Washington: A synthesis of three years' studies, 1977-1979. FRI-UW-8026. Fisheries Research Institute, College of Fisheries, University of Washington, Seattle, WA.

Simenstad, C.A., C.D. Tanner, R. M. Thom, and L. L. Conquest. 1991. Estuarine Habitat Assessment Protocol. Environmental Protection Agency, Puget Sound Estuary Program.

Simenstad, C.A., R.J. Garono, T. Labbe, A.C. Mortimer, R. Robinson, C. Weller, S. Todd, J. Toft, J. Burke, D. Finlayson, J. Coyle, M. Logsdon, and C. Russell. 2008. Assessment of intertidal eelgrass habitat landscapes for threatened salmon in the Hood Canal and Eastern Strait of Juan de Fuca, Washington State. Technical Report 08-01. Point No Point Treaty Council, Kingston, WA. 152 pp. Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene, Jr., D. Kastak, D.K. Ketten, J.H. Miller, P.E. Nachtigall, W.J. Richardson, J.A. Thomas, and P.L. Tyack. 2007. Marine mammal noise exposure criteria: initial scientific recommendations. Aquatic Mammals 33:412-522.

Slater, M.C. 2009. Naval Base Kitsap Bangor baseline underwater noise survey report. Prepared by Science Applications International Corporation, Bremerton, WA for BAE Systems Applied Technologies, Inc., Rockville, MD.

Strachan, G., M. McAllister, and C.J. Ralph. 1995. Marbled murrelet at-sea and foraging behavior. Pages 247-53. In: Ralph, C.J., G.L. Hunt, M.G. Raphael, and J.F. Piatt (eds). Ecology and conservation of the marbled murrelet. PSW-GTR-152. U.S. Department of Agriculture, Albany, CA. 420 pp.

Southall, B.L., Bowles, A.E., Ellison, W.T., Finneran, J.J., Gentry, R.L., Greene, C.R. Jr., Kastak, D., Ketten, D.K., Miller, J.H., Nachtigall, P.E., Richardson, W.J., Thomas, J.A. and Tyack, P.L. 2007. Marine mammal noise exposure criteria: initial scientific recommendations. Special Issue of Aquatic Mammals. 33(4): 412-522.

URS Consultants, Inc. 1994. Final Remedial Investigation Report for the Comprehensive Long-Term Environmental Action Navy (CLEAN) Program, Northwest Area. Remedial Investigation for Operable Unit 7, CTO-0058, SUBASE Bangor, Bremerton, WA. Prepared by URS Consultants, Inc., Seattle, WA for Naval Facilities Engineering Command, Engineering Field Activity Northwest, Silverdale, WA. 13 June.

Urick, R.J. 1983. Principles of Underwater Sound. 3rd ed. McGraw-Hill, New York, NY.

U.S. Census Bureau 2009, State & County Quick Facts, Kitsap County, Washington http://quickfacts.census.gov/qfd/states/53/53035.html (Accessed Feb 1, 2011)

U.S. Army Corps of Engineers (USACE). 2010. Approved Work Windows for Fish Protection in All Marine and Estuarine Areas Excluding the Mouth of the Columbia River (Baker Bay). Available: http://www.nws.usace.army.mil/Missions/CivilWorks/Regulatory/PermitGuidebook/EndangeredSpecies.aspx

USEPA U.S. Environmental Protection Agency (USEPA). 1981. Noise Effects Handbook, A Desk Reference to Health and Welfare Effects of Noise. Office of Noise Abatement and Control. EPA 500-9-82-106.

USEPA. 2001. General Conformity Rules. Available: http://www.epa.gov/oar/genconform/

USEPA. 2009. Hazardous Air Pollutants: Pollutants and Sources. http://www.epa.gov/ttn/atw/pollsour.html. Last updated 23 March 2009; accessed 3 February 2011.

USEPA. 2010a. National Ambient Air Quality Standards (NAAQS). http://www.epa.gov/air/criteria.html. Last updated 3 June 2010; accessed 2 February 2011.

USEPA. 2010b. Air Data: Washington, Monitoring, Maps. http://www.epa.gov/air/data/repsst.html?st~WA~Washington. Last updated 2 July 2010; accessed 2 February 2011.

USEPA. 2010c. New Source Review (NSR) Prevention of Significant Deterioration (PSD) Basic Information. http://www.epa.gov/nsr/psd.html. Last updated 10 November 2010; Accessed 2 February 2011.

USEPA. 2010d. Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act. 26 October. http://www.epa.gov/climatechange/endangerment.html. Accessed 2 February 2011.

USEPA 2010e. Criteria Pollutant Area Summary Report. http:// epa.gov/airquality/greenbk/ancl2.html. Last updated 15 June 2010; accessed 2 February 2011.

USEPA. 2011a. Superfund Site Progress Profile: Bangor Ordnance Disposal (USNAVY) (EPA ID# WA7170027265). http://cfpub2.epa.gov/supercpad/cursites/csitinfo.cfm?id=1001206. Last updated 7 February; accessed 7 February.

USEPA. 2011b. Superfund Site Progress Profile: Bangor Naval Submarine Base (USNAVY) (EPA ID# WA5170027291). http://cfpub2.epa.gov/supercpad/cursites/csitinfo.cfm?id=1001121. Last updated 7 February; accessed 7 February.

USFWS. 1992. United States Fish and Wildlife Service (USFWS), Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Washington, Oregon, and California Populations of the Marbled Murrelet; Final Rule. Federal Register 57:45328-45337.

USFWS. 1996. Endangered and Threatened Wildlife and Plants; Final Designation of Critical Habitat for the Marbled Murrelet; Final Rule. Federal Register 61:26256-26320.

USFWS. 1997. Recovery plan for the threatened Marbled Murrelet (Brachyramphus marmoratus) in Washington, Oregon, and California. Portland, Oregon. Region 1, Portland, OR.

USFWS. 1999. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for Bull Trout in the Coterminous United States; Final Rule. Federal Register 64:58910-58933.

USFWS. 2004. Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout (Salvelinus confluentus). Volume II (of II), Olympic Peninsula Mangement Unit. Portland, OR.

USFWS 2008. Endangered and Threatened Wildlife and Plants; Revised Critical Habitat for the Marbled Murrelet; Proposed Rule. Federal Register 73: 44678-44701.

USFWS. 2010. Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for Bull Trout in the Coterminous United States; Final Rule. Federal Register 75:63898-64070.

USFWS. 2011. Endangered and Threatened Wildlife and Plants; Revised Critical Habitat for the Marbled Murrelet; Final Rule. Federal Register 76: 61599-61621.

USFWS. 2011b. Endangered Species Act-Section 7 Consultation Biological Opinion for the Second Explosives Handling Wharf at Naval Base Kitsap Bangor. Reference #13410-2011-F-0164. 16 November.

USFWS. 2012. Modification of Marbled Murrelet Nesting Season Definition in Washington and its application in section 7 consultation. June 20.

Van Heeswijk, M. and D.T. Smith. 2002. Simulation of the Ground-Water Flow System at Naval Submarine Base Bangor and Vicinity, Kitsap County, Washington. U.S. Geological Survey Resource Investigation Report No. 02-4261.

WAC. Washington Administrative Code Chapter 173-204– Washington State Sediment management standards

Wang, S.S. 2005. Groundfish habitat associations from video survey with a submersible off the Washington State coast. Master of Science Thesis, University of Washington. 299 p.

Washington State Department of Ecology (Ecology). 2007. Relationships between the Composition of the Benthos and Sediment and water Quality Parameters in Hood Canal. Task IV – Hood Canal, Dissolved Oxygen Program. Department of Ecology Publication No. 07-03-040.Ecology 2008. Washington State Toxic Air Pollutants Priorities Study. 12 November.

WDOE. 2009. Washington State's Water Quality Assessment for 2008. Final 2008 Section 303(d) map for NAVBASE Kitsap Bangor waterfront. http://www.ecy.wa.gov/programs/wq/303d/index.html. Accessed 12 February 2011.

WDOE. 2011a. Washington State Criteria Pollutants and Standards. http://www.ecy.wa.gov/programs/air/other/Criteria_Stnds.htm. Accessed 2 February.

WDOE. 2011b. Puget Sound Shoreline species. Harbor Seal (Phoca vitulina). http://www.ecy.wa.gov/programs/sea/pugetsound/species/seal.html. Accessed 9 February.

Washington Department of Fish and Wildlife (WDFW). 2004. Washington State salmonid stock inventory. Bull trout/dolly varden. October. http://wdfw.wa.gov/fish/sassi/bulldolly.pdf.

WDFW. 2010a, Priority Habitats and Species Maps for Bangor. 7.5 –Minute Quadrangle Name: Poulsbo; 17 November. Olympia, WA.

WDFW. 2010b. Bald Eagle Management & protection in Washington State. http://wdfw.wa.gov/conservation/bald_eagle. Accessed 13 December.

WDFW. 2010c. Columbia River Sea Lion Management, California Sea Lion Fact Sheet. http://wdfw.wa.gov/conservation/sealions/facts.html. Accessed 13 December.

Washington State Employment Security Department (WAESD), Kitsap County Profile, February 2011, Dr. Elizabeth Scott. http://www.workforceexplorer.com/article.asp?ARTICLEID=10993

Wilson, O.B.J., S.N. Wolf, and F. Ingenito. 1985. Measurements of acoustic ambient noise in shallow water due to breaking surf. Journal of the Acoustical Society of America 78:190-195.

WSDOT. 2012. Washington State Department of Transportation (WSDOT), Noise Reduction Strategies. Biological assessment preparation for transportation projects advanced training manual, version 02-2012. Olympia, WA.

Weston Solutions, Inc. 2006. Benthic community assessment in the vicinity of the Bangor Naval Facility, Hood Canal, Draft report, June 2006. Prepared by Weston Solutions, Inc., Port Gamble, WA. Prepared for Science Applications International Corporation, Bothell, WA.

Willis, P.M., B.J. Crespi, L.M. Dill, R.W. Baird, and M.B. Hanson. 2004. Natural hybridization between Dall's porpoises (Phocoenoides dalli) and Harbour porpoises (Phocoena phocoena). Canadian Journal of Zoology 82, 828-834.

Wyllie Echeverria, T. 1987. Thirty-four species of California rockfish: maturity and seasonality of reproduction. Fishery Bulletin 85:229-240.

Yasenak, T. 2012. Tyler Yasenak, natural resources specialist, NAVBASE Kitsap Bangor. December 11, 2012. Personal communication with Ben Keasler, environmental planner, Naval Facilities Engineering Command, Silverdale, WA, re: bald eagle nesting locations at NAVBASE Kitsap Bangor.

[This page intentionally left blank]

CHAPTER 7.0 LIST OF PREPARERS

This EA was prepared by Cardno TEC, Inc. under the direction of NAVFAC Northwest. Members of the professional staff are listed below.

NAVFAC NW

Amy Burt, NEPA Navy Technical Representative
B.S., Environmental Engineering

Ben Keasler, NEPA Project Manager and Environmental Planner
B.S., Natural Resources Management

Tiffany Nabors, Biologist
B.S., Environmental Science

Sharon Rainsberry, Fish Biologist
M.S., Fisheries Science

Andrea Balla-Holden, Fisheries and Marine Mammal Biologist
B.S., Fisheries

CARDNO TEC, Inc.

Project Management

Bud Albee, Project Director
M.S., Biology

Michael Booth, AICP, Project Manager
B.A., Urban Planning

Quality Assurance

Bud Albee, Project Director
M.S., Biology

Technical Analysts

Jennifer Weitkamp, Biological Resources
B.S., Fisheries

Pete Heltzel, Water Quality and Marine Sediments
M.S., Marine Science

Julie Werner PE, Air/Noise,
B.S., Civil Engineering

Teresa Rudolph, Cultural Resources and American Indian Cultural Resources,
M.A., Anthropology

Erica Mignone Boulanger, Cumulative Impacts
B.S., Environmental Science

Jason Harshman, GIS and Graphic Design
B.A., Geography

[This page intentionally left blank]

APPENDIX A
AGENCY CORRESPONDENCE

[This page intentionally left blank]

Documentation will be included in this Appendix once consultations are concluded.

[This page intentionally left blank]

APPENDIX B
AIR QUALITY CRITERIA AND CALCULATIONS

[This page intentionally left blank]

Air Quality Pollutants – EPA and Ecology Criteria

The NAAQS provide definitions of the maximum concentrations of the criteria pollutants that are considered safe, with an additional adequate margin of safety, to protect human health and welfare. Short-term standards (1-, 8-, and 24-hour periods) are established for pollutants contributing to acute health effects. Long-term standards (quarterly and annual averages) are established for pollutants contributing to chronic health effects. AQCRs exist to assist in planning and monitoring to prevent air quality deterioration and achieve attainment status with all NAAQS.

Maximum concentrations may not be exceeded more than once per year. Washington State has adopted the NAAQS for all criteria pollutants except for SO_2, for which the state has adopted slightly more stringent requirements (Washington Administrative Code [WAC] 173-474). Table B-1 lists the NAAQS as well as applicable state air quality standards.

Table B-1. National and Washington State Ambient Air Quality Standards

Pollutant	*Averaging Time*	*Washington Standards*	*National Standards*	
			Primary	*Secondary*
Carbon Monoxide (CO)	8-hour	9 ppm	9 ppm	None
	1-hour	35 ppm	35 ppm	None
Lead	Quarterly Average	None	1.5 µg/m^3	1.5 µg/m^3
	Rolling 3-month Average	None	0.15 µg/m^3	0.15 µg/m^3
Nitrogen Dioxide (NO_2)	Annual Average	0.05 ppm	0.053 ppm	0.053 ppm
	1-hour	None	0.100 ppm	0.053 ppm
Particulate Matter (PM_{10})	Annual Arithmetic Mean	50 µg/m^3	None	None
	24-hour	150 µg/m^3	150 µg/m^3	150 µg/m^3
Particulate Matter ($PM_{2.5}$)	Annual Arithmetic Average	None	15.0 µg/m^3	15.0 µg/m^3
	24-hour	None	35 µg/m^3	35 µg/m^3
Ozone	8-hour (2008 standard)[(a)]	None	0.075 ppm	0.075 ppm
	8-hour (1997 standard)[(a)]	None	0.08 ppm	0.08 ppm
Sulfur Dioxide (SO_2)	Annual Average	0.02 ppm	0.03 ppm	None
	24-hour	0.10 ppm	0.14 ppm	None
	3-hour	None	None	0.50 ppm
	1-hour	0.40 ppm[(b)]	0.075 ppm[(c)]	None
Total Suspended Particulates	Annual Geometric Mean	60 µg/m^3	None	None
	24-hour average	150 µg/m^3	None	None

Notes:
µg/m^3= micrograms per cubic meter
ppm = parts per million

a 8-hour ozone standard went into effect on September 16, 1997, but implementation is limited. The 1997standard and the implementation rules for that standard would remain in place for implementation purposes as EPA undertakes rulemaking to address the transition from the 1997 to the 2008 ozone standard.

b Volume average for 1-hour period more than once per 1-year period and 0.25 ppm not to be exceeded more than two times in any 7 consecutive days.

c Final rule signed June 2, 2010. To attain this standard, the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitoring station within an area must not exceed 75 parts per billion. EPA also revoked the annual and 24-hour primary standards when enacting the 1-hour standard.

Sources: EPA 2010a, Ecology 2011a.

EMISSIONS CALCULATIONS METHODOLOGY

Non-road diesel engine emissions were calculated as follows:

$$Engine\ Emissions\ (Total)(grams) = EF \times hp \times LF \times n \times h \times t$$

Where EF = Emission Factor (g/hp-hr)

hp = engine horse power (hp)

LF = engine load factor (e.g. 79 %)

n = number of vehicles

h = hours operated per day

t = number of day of operation

NONROAD 2008 model was used to extract emissions factors from baseline documents. Those documents include:

- Construction equipment emission factors were derived from EPA Report No. NR-009c, Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling—Compression-Ignition, April 2004.
- Construction equipment SOx emission factors were derived from EPA 460/3-91-02, Nonroad Engine and Vehicle Emission Study--Report, November 1991.
- Construction equipment VOC emission factors were derived from EPA Report No. NR-002b Conversion Factors for Hydrocarbon Emission Components, April 2004 based on emission factors from EPA Report No. NR-009c.

Work-days and project duration are estimated using R.S. Means Building Construction Cost Data daily output values as well as project defined values. All materials and equipment deliveries would occur prior to the beginning of heavy construction. A diesel-powered work boat would be present on site during all in-water site work

Construction equipment load factors were derived from EPA Report No. NR-005c, *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling (NR-005d)*, July 2010. A conservative approach was taken, and the minimal emissions controls were assumed to be in use for the heavy equipment. This equates to assuming older Tier 1 engines (model year 1996 to 2000 depending on engine horsepower) are in used, but in actuality the equipment may be much newer and have better emissions reduction. However, this analysis using Tier 1 engines does not exempt contractors from following all applicable emission standard for diesel vehicles, including required upgrades.

On-road engine emissions were calculated as follows:

$$Engine\ Emissions\ (Total)(pounds) = EF \times n \times t \times d$$

Where EF = Emission Factor (pound/mile)

n = number of vehicles

t = number of days

d = distance traveled (in miles)

The EPA's Motor Vehicle Emission Simulator (MOVES) 2010 model was used to extract emissions factors from baseline documents for on-road equipment including passenger cars and light duty trucks. The number of days of operation is based on project specific construction estimates. Distance traveled is assumed to be approximately 5 miles on base. Distance traveled for construction workers does not include distance from their home to the worksite as the worker is assumed to be traveling regardless of the status of the Proposed Action.

Preferred Alternative Construction Emissions Estimates

Mooring Dolphin Construction/Demolition 54 days /year on-site maximum 407 **CY**

Equipment	*Number*	*Hr/day*	*# days*	*Hp*	*LF*	**VOC** g/hp-hr	**CO** g/hp-hr	**NOx** g/hp-hr	**SO_2** g/hp-hr	**PM** g/hp-hr	**CO_2** g/hp-hr	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM** lb	**CO_2** lb
Crane (Pile Driving/Demo Equipment)	2	6	30	120	0.43	0.3384	0.8667	5.6523	0.93	0.2799	530	14	351	2316	38	11	3,673
Tug Boat - Main	1	8	30	2000	0.6	0.21	1.9	9.7	0.14	0.22	530	132	1,186	6,163	89	142	70,210
Tug Boat - Auxiliary	1	8	30	50	0.4	0.21	1.4	7.3	0.16	0.30	536	2	14	77	2	3	1,183
Work Boat (Diesel)	2	8	30	200	0.4	0.21	1.4	7.3	0.14	0.30	530	18	115	614	12	25	4,681
Concrete truck (9 CY)	1	5	10	250	0.21	0.68	2.7	8.38	0.89	0.402	536	4	16	48	5	2	2,109
Dump truck	4	2	15	275	0.21	0.68	2.7	8.38	0.89	0.402	536	10	41	128	14	6	1,392
Delivery truck	10	1	25	180	0.21	0.68	2.7	8.38	0.89	0.402	536	14	56	175	19	8	759
Small diesel engines	2	4	35	10	0.43	0.7628	4.1127	5.2298	0.93	0.4474	587	2	11	14	2	1	594
											Total lb/year	197	1476	7450	180	200	84,601

Fugitive Dust Emissions

(From general vehicular traffic)

	PM tons/acre/mo	acres	days of disturbance	**PM** Total (tons)
2013	0.42	0.1	100	0.1

POV Emissions from Construction Workers
Assume 5 miles per day per vehicle (one vehicle per worker)

	Operating Parameters			Emission Factors						Calculated Emissions					
				VOC	NOx	CO	SO_2	PM	CO_2	VOC	NOx	CO	SO_2	PM	CO_2
	# vehicles	# days	mi/day	lb/mi	lb/mi	lb/mi	lb/mi	lb/mi	lb/mi	lb	lb	lb	lb	lb	lb
Construction Workers	5	54	5	1.9E-03	1.8E-03	3.9E-02	1.8E-05	5.5E-05	9.1E-01	3	2	53	0.02	0.1	1,232

Emission Totals: Preferred Alternative	VOC	NOx	CO	SO_2	PM	CO_2
lbs	199	1,478	7,503	180	480	85,833
tons	0.10	0.74	3.75	0.09	0.24	-
Metric tonnes	-	-	-	-	-	39

Alternative 2 Construction Emissions Estimates

Anchor Mooring Construction 25 days /year on-site maximum 19 **CY**

Equipment	*Number*	*Hr/day*	*# days*	*Hp*	*LF*	**VOC** g/hp-hr	**CO** g/hp-hr	**NOx** g/hp-hr	**SO_2** g/hp-hr	**PM** g/hp-hr	**CO_2** g/hp-hr	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM** lb	**CO_2** lb
Crane	1	6	8	120	0.43	0.3384	0.8667	5.6523	0.93	0.2799	530	2	5	31	5	2	979
Dump truck	1	2	10	275	0.21	0.68	2.7	8.38	0.89	0.402	536	2	7	21	2	1	928
Delivery truck	1	1	10	180	0.21	0.68	2.7	8.38	0.89	0.402	536	1	2	7	1	0	304
Small diesel engines	2	4	25	10	0.43	0.7628	4.1127	5.2298	0.93	0.4474	587	1	8	10	2	1	424
											Subtotal	6	22	69	10	4	2,636

Fugitive Dust Emissions

(From general vehicular traffic)		**PM** tons/acre/mo	acres	days of disturbance	**PM** Total (tons)
	2013	0.42	0.1	100	0.1

POV Emissions from Construction Workers
Assume 5 miles per day per vehicle (one vehicle per worker)

	Operating Parameters			Emission Factors						Calculated Emissions					
	# vehicles	# days	mi/day	VOC lb/mi	NOx lb/mi	CO lb/mi	SO_2 lb/mi	PM lb/mi	CO_2 lb/mi	VOC lb	NOx lb	CO lb	SO_2 lb	PM lb	CO_2 lb
Construction Workers	5	25	5	1.9E-03	1.8E-03	3.9E-02	1.8E-05	5.5E-05	9.1E-01	1	1	24	0	0	570

Emission Totals: Alternative 2		VOC	NOx	CO	SO_2	PM	CO_2
	lbs	5	18	63	5	282	2,227
	tons	0.00	0.01	0.03	0.00	0.14	-
	metric tonnes	-	-	-	-	-	1

APPENDIX C
COASTAL CONSISTENCY DETERMINATION

[This page intentionally left blank]

Documentation will be included in this Appendix once consultations are concluded.

[This page intentionally left blank]

APPENDIX D
BIOLOGICAL ASSESSMENT AND ESSENTIAL FISH HABITAT ASSESSMENT

[This page intentionally left blank]

Documentation will be included in this Appendix once consultations are concluded.

[This page intentionally left blank]

APPENDIX E:
NOISE DEFINITIONS, FUNDAMENTALS OF SOUND

[This page intentionally left blank]

FUNDAMENTALS OF SOUND

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as air or water. Sound is generally characterized by several factors, including frequency and intensity. Frequency describes the sound's pitch and is measured in hertz (Hz), while intensity describes the sound's loudness. Due to the wide range of pressure and intensity encountered during measurements of sound, a logarithmic scale is used. In acoustics, the word "level" denotes a sound measurement in dBs. A decibel (dB) expresses the logarithmic strength of a signal relative to a reference. Because the decibel is a logarithmic measure, each increase of 20 dB reflects a ten-fold increase in signal amplitude (whether expressed in terms of pressure or particle motion), i.e., 20 dB means ten times the amplitude, 40 dB means one hundred times the amplitude, 60 dB means one thousand times the amplitude, and so on. Because the decibel is a relative measure, any value expressed in decibels is meaningless without an accompanying reference. In describing underwater sound pressure, the reference amplitude is usually 1 microPascal (μPa, or 10^{-6} Pascals), and is expressed as "dB re 1 μPa." For in-air sound pressure, the reference amplitude is usually 20 μPa and is expressed as "dB re 20 μPa."

The method commonly used to quantify airborne sounds consists of evaluating all frequencies of a sound according to a weighting system that reflects that human hearing is less sensitive at low frequencies and extremely high frequencies than at mid-range frequencies. This is called A-weighting, and the decibel level measured is called the A-weighted sound level (dBA). A filtering method that reflects hearing of marine mammals has not yet been developed. Therefore, underwater sound levels are not weighted and measure the entire frequency range of interest. In the case of marine construction work, the frequency range of interest is 10 to 10,000 Hz.

Table A-1 summarizes commonly used terms to describe underwater sounds. Two common descriptors are the peak sound pressure level (SPL) and the root mean square (rms) SPL (dB rms) during the pulse or over a defined averaging period. The peak pressure is the maximum absolute value of the instantaneous pressure observed during each pulse or sound event and is presented in Pascals (Pa) or dB referenced to a pressure of one microPascal (dB re 1 μPa). The rms level is the square root of the energy divided by a defined time period. All underwater sound levels throughout the remainder of this application are presented in dB re 1 μPa unless otherwise noted.

Table E-1. Definitions of Acoustical Terms

Term	Definition
Decibel, dB	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for water is 1 microPascal (µPa) and for air is 20 µPa (approximate threshold of human audibility).
Sound Pressure Level, SPL	Sound pressure is the force per unit area, usually expressed in microPascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure. Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	Frequency is expressed in terms of oscillations, or cycles, per second. Cycles per second are commonly referred to as hertz (Hz). Typical human hearing ranges from 20 Hz to 20,000 Hz.
Peak Sound Pressure (unweighted), dB re 1 µPa	Peak sound pressure level is based on the largest absolute value of the instantaneous sound pressure over the frequency range from 20 Hz to 20,000 Hz. This pressure is expressed in this application as dB re 1 µPa.
Root-Mean-Square (rms), dB re 1 µPa	The rms level is the square root of the energy divided by a defined time period. For pulses, the rms has been defined as the average of the squared pressures over the time that comprise that portion of waveform containing 90 percent of the sound energy for one impact pile driving impulse.[4]
Sound Exposure Level (SEL) dB re 1 μPa^2 sec	Sound exposure level is a measure of energy. Specifically, it is the dB level of the time integral of the squared-instantaneous sound pressure, normalized to a 1-second period. It can be an extremely useful metric for assessing cumulative exposure because it enables sounds of differing duration, to be compared in terms of total energy.
Waveforms, µPa over time	A graphical plot illustrating the time history of positive and negative sound pressure of individual pile strikes shown as a plot of µPa over time (i.e., seconds).
Frequency Spectra, dB over frequency range	A graphical plot illustrating the 6 to 12 Hz band-center frequency sound pressure over a frequency range (e.g., 10 to 5,000 Hz in this application).
A-Weighting Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A- or C-weighting filter network. The A-weighting filter de-emphasizes the low and high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective human reactions to noise.
Ambient Noise Level	The background sound level, which is a composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.

[4] Underwater sound measurement results obtained by Illingworth & Rodkin (2001) for the Pile Installation Demonstration Project in San Francisco Bay indicated that most impact pile driving impulses occurred over a 50 to 100 millisecond (ms) period. Most of the energy was contained in the first 30 to 50 ms. Analyses of that underwater acoustic data for various pile strikes at various distances demonstrated that the acoustic signal measured using the standard "impulse exponential time-weighting" on the sound level meter (35-ms rise time) correlated to the rms level measured over the duration of the pulse.

DESCRIPTION OF NOISE SOURCES

Underwater sound levels are comprised of multiple sources, including physical noise, biological noise, and anthropogenic noise. Physical noise includes waves at the surface, earthquakes, ice, and atmospheric noise. Biological noise includes sounds produced by marine mammals, fish, and invertebrates. Anthropogenic noise consists of vessels (small and large), dredging, aircraft over flights, and construction noise. Known noise levels and frequency ranges associated with anthropogenic sources similar to those that would be used for this project are summarized in Table A-2. Details of each of the sources are described in the following text.

Table E-2. Representative Noise Levels of Anthropogenic Sources

Noise Source	*Frequency Range (Hz)*	*Underwater Noise Level (dB re 1 µPa)*	*Reference*
Small vessels	250 – 1,000	151 dB rms at 1 meter (m)	Richardson et al. 1995
Tug docking gravel barge	200 – 1,000	149 dB rms at 100 m	Blackwell and Greene 2002
Vibratory driving of 30-inch Steel Pipe pile	10 – 1,500	~168 dB rms at 10m	WSDOT 2010a, 2010b
Impact driving of 30-inch Steel Pipe pile	10 – 1,500	~193 dB rms at 10m	WSDOT 2005, 2008; Caltrans 2007; Reyff 2005

In-water construction activities associated with the Project would include the use of a vibratory pile driver and a pneumatic chipping hammer. The sounds produced by construction equipment fall into one of two sound types: pulsed and non-pulsed (defined below). Impact pile driving produces pulsed sounds, while vibratory pile driving and pneumatic chippers produce non-pulsed (or continuous) sounds. The distinction between these two general sound types is important because they have differing potential to cause physical effects, particularly with regard to hearing (e.g., Ward 1997 as cited in Southall et al. 2007).

Pulsed sounds (e.g., explosions, gunshots, sonic booms, seismic airgun pulses, and impact pile driving) are brief, broadband, atonal transients (ANSI 1986; Harris 1998) and occur either as isolated events or repeated in some succession (Southall et al. 2007). Pulsed sounds are all characterized by a relatively rapid rise from ambient pressure to a maximal pressure value followed by a decay period that may include a period of diminishing, oscillating maximal and minimal pressures (Southall et al. 2007). Pulsed sounds generally have an increased capacity to induce physical injury as compared with sounds that lack these features (Southall et al. 2007).

Non-pulse (intermittent or continuous sounds) can be tonal, broadband, or both (Southall et al. 2007). Some of these non-pulse sounds can be transient signals of short duration but without the essential properties of pulses (e.g. rapid rise time) (Southall et al. 2007). Examples of non-pulse sounds include vessels, aircraft, machinery operations such as drilling or dredging, vibratory pile driving, pneumatic chipping, and active sonar systems (Southall et al. 2007). The duration of such sounds, as received at a distance, can be greatly extended in highly reverberant environments (Southall et al. 2007).

[This page intentionally left blank]

APPENDIX F
INCIDENTAL HARASSMENT AUTHORIZATION

[This page intentionally left blank]

Documentation will be included in this Appendix once consultations are concluded.

[This page intentionally left blank]

APPENDIX G
TRIBAL GOVERNMENT TO GOVERNMENT CORRESPONDENCE

[This page intentionally left blank]

Documentation will be included in this Appendix once consultations are concluded.

[This page intentionally left blank]