4 Cumulative Impacts

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

There are no figures in this section.

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4 CUMULATIVE IMPACTS

4.1 INTRODUCTION

The analysis of cumulative impacts (or cumulative effects)[1] presented in this section follows the requirements of the National Environmental Policy Act (NEPA) and Council on Environmental Quality guidance (Council on Environmental Quality 1997). The Council on Environmental Quality regulations (40 Code of Federal Regulations [C.F.R.] §§ 1500-1508) provide the implementing regulations for NEPA. The regulations define cumulative impacts as:

> "…the impact on the environment which results from the incremental impact of the action when added to the 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 C.F.R. § 1508.7)."

While a single project may have minor impacts, overall impacts may be collectively significant when the project is considered together with other projects on a regional scale. A cumulative impact is the additive effect of all actions in the geographic area. The Council on Environmental Quality provides guidance on cumulative impact analysis in *Considering Cumulative Impacts under the National Environmental Policy Act* (Council on Environmental Quality 1997). This guidance further identifies cumulative impacts as those environmental impacts resulting "from spatial and temporal crowding of environmental perturbations. The impacts of human activities will accumulate when a second perturbation occurs at a site before the ecosystem can fully rebound from the impacts of the first perturbation." This guidance observes that "no universally accepted framework for cumulative impacts analysis exists…" while noting that certain general principles have gained acceptance. The Council on Environmental Quality provides guidance on the extent to which agencies of the federal government are required to analyze the environmental impacts of past actions when they describe the cumulative environmental effect of an action. This guidance provides that an analysis of cumulative impacts might encompass geographic boundaries beyond the immediate area of an action and a timeframe that includes past actions and foreseeable future actions. Thus, the Council on Environmental Quality guidelines observe, "[it] is not practical to analyze cumulative impacts of an action on the universe; the list of environmental impacts must focus on those that are truly meaningful."

4.2 APPROACH TO ANALYSIS

4.2.1 OVERVIEW

Cumulative impacts were analyzed for each resource addressed in Chapter 3 (Affected Environment and Environmental Consequences) for the No Action Alternative, Alternative 1, and Alternative 2 (the alternatives) in combination with past, present, and reasonably foreseeable future actions. The cumulative impacts analysis included the following steps, described in more detail below:

1. Identify appropriate level of analysis for each resource.
2. Define the geographic boundaries and timeframe for the cumulative impacts analysis.
3. Describe current resource conditions and trends.

[1] Council on Environmental Quality regulations provide that the terms "cumulative effects" and "cumulative impacts" are synonymous (40 C.F.R. § 1508.8[b]); the terms are used interchangeably by various sources, but the term "cumulative impacts" will be used in this document except for quotations, for continuity.

4. Identify potential impacts of each alternative that might contribute to cumulative impacts.
5. Identify past, present, and other reasonably foreseeable future actions that affect each resource.
6. Analyze potential cumulative impacts.

4.2.2 Identify Appropriate Level of Analysis for Each Resource

In accordance with guidance set forth by the Council on Environmental Quality, the cumulative impacts analysis focused on impacts that are "truly meaningful" (Council on Environmental Quality 1997). The level of analysis for each resource was commensurate with the intensity of the impacts identified in Chapter 3 (Affected Environment and Environmental Consequences). The rationale for the level of analysis applied to each resource is described in Section 4.4 (Resource-Specific Cumulative Impacts).

4.2.3 Define the Geographic Boundaries and Timeframe for Analysis

The geographic boundaries for the cumulative impacts analysis include the entire Northwest Training and Testing (NWTT) Study Area (Study Area) (see Figure 2.1-1). The geographic boundaries for cumulative impacts analysis for marine mammals and sea turtles were expanded to include activities outside the Study Area that might impact migratory marine mammals and sea turtles. Primary considerations from outside the Study Area include impacts associated with maritime traffic (e.g., vessel strikes and underwater noise) and commercial fishing (e.g., bycatch and entanglement).

Determining the timeframe for the cumulative impacts analysis requires estimating the length of time the impacts of the Proposed Action would last and considering the specific resource in terms of its history of degradation (Council on Environmental Quality 1997). The Proposed Action includes ongoing and anticipated future training and testing activities. While the United States (U.S.) Department of the Navy (Navy) training and testing requirements change over time in response to global events, geopolitical events, or other factors, the general types of activities addressed by this Environmental Impact Statement (EIS)/Overseas EIS (OEIS) are expected to continue into the reasonably foreseeable future, along with the associated impacts. Likewise, some non-military activities addressed in this cumulative impacts analysis (e.g., oil and gas production, maritime traffic, commercial fishing) are expected to continue into the reasonably foreseeable future. Therefore, the cumulative impacts analysis is not bounded by a specific future timeframe. For past actions, the cumulative impacts analysis only considers those actions or activities that have ongoing impacts.

While the cumulative impacts analysis is not limited by a specific timeframe, it should be recognized that available information, uncertainties, and other practical constraints limit the ability to analyze cumulative impacts for the future. Navy environmental planning and compliance for training and testing activities is an ongoing process. The Navy intends to submit applications to the National Marine Fisheries Service (NMFS) for Marine Mammal Protection Act (MMPA) authorizations supported by this EIS/OEIS. The anticipated effective dates for these MMPA authorizations would be a 5-year period from October 2015 through October 2020. Future Federal actions that are unrelated to the action are not considered in this section because they require separate consultation pursuant to section 7 of the Endangered Species Act (ESA). Similarly, and in accordance with 40 C.F.R. § 1502.9, if the Navy makes substantial changes in the preferred alternative or there are significant new circumstances or information that are relevant to environmental concerns, the Navy must supplement the Final Environmental Impact Statement. Future environmental planning documents will include cumulative impacts analysis based on information available at that time.

4.2.4 DESCRIBE CURRENT RESOURCE CONDITIONS AND TRENDS

Chapter 3 (Affected Environment and Environmental Consequences) describes current resource conditions and trends, and they discuss how past and present human activities influence each resource. The aggregate impacts of past and present actions are reflected in the baseline information presented in Chapter 3 (Affected Environment and Environmental Consequences). This information is used in the cumulative impacts analysis to understand how past and present actions are currently impacting each resource and to provide the context for the cumulative impacts analysis.

4.2.5 IDENTIFY POTENTIAL IMPACTS OF THE ALTERNATIVES THAT MIGHT CONTRIBUTE TO CUMULATIVE IMPACTS

Direct and indirect impacts of the alternatives, presented in Chapter 3 (Affected Environment and Environmental Consequences), were reviewed to identify impacts relevant to the cumulative impacts analysis. Key factors considered included the current status and sensitivity of the resource and the intensity, duration, and spatial extent of the impacts for each stressor. In general, long-term rather than short-term impacts and widespread rather than localized impacts were considered more likely to contribute to cumulative impacts. For example, for biological resources, population-level impacts were considered more likely to contribute to cumulative impacts than were individual-level impacts. Negligible impacts were not considered further in the cumulative impacts analysis. For marine mammals, any stressor that is expected to result in Level A harassment or Level B harassment, as defined by MMPA, was considered in the cumulative impacts analysis. The vast majority of impacts expected from sonar exposure and underwater detonations are behavioral in nature, temporary and comparatively short in duration, relatively infrequent, and not of the type or severity that would be expected to be additive for the small portion of the stocks and species likely to be exposed either annually or in the reasonably foreseeable future. For ESA-listed species, any stressor that may affect and is likely to adversely affect the species was considered in the cumulative impacts analysis. Stressors that were determined by the Navy to have no effect or that may affect but are not likely to adversely affect ESA-listed species were not analyzed in detail in the cumulative impacts analysis.

4.2.6 IDENTIFY OTHER ACTIONS AND OTHER ENVIRONMENTAL CONSIDERATIONS THAT AFFECT EACH RESOURCE

A list of other actions was compiled for the Study Area and surrounding areas based on information obtained during the scoping process (Appendix I, Public Participation), communications with other agencies, a review of other military activities, literature review, previous NEPA analyses for actions not included in this document, and other available information. Identified future actions were reviewed to determine if they should be considered further in the cumulative impacts analysis. Factors considered when identifying other actions to be included in the cumulative impacts analysis included the following:

- Whether the other action is reasonably foreseeable, rather than merely possible or speculative
- The timing and location of the other action in relation to proposed training and testing activities
- Whether the other action and each alternative would affect the same resources
- The current conditions, trends, and vulnerability of resources affected by the other action
- The duration and intensity of the impacts of the other action
- Whether the impacts have been truly meaningful, historically significant, or identified previously as a cumulative impact concern

In addition to identifying reasonably foreseeable future actions, other environmental considerations for the cumulative impacts analysis were identified and described. These other considerations include

major stressors or issues (e.g., ocean pollution, ocean noise, coastal development, etc.) that tend to be widespread and arise from routine human activities and multiple past, present, and future actions. Including these other environmental considerations allows an analysis of the current aggregate impacts of past and present actions, as well as reasonably foreseeable actions.

4.2.7 Analyze Potential Cumulative Impacts

The impacts of past and present actions and the anticipated impacts of reasonably foreseeable future actions were characterized and summarized. The incremental impacts of each alternative were then added to the combined impacts of all other actions to describe the cumulative impacts that would result if the No Action Alternative, Alternative 1, or Alternative 2 were implemented. The cumulative impacts analysis considered additive, synergistic, and antagonistic impacts. A qualitative analysis was conducted in most cases based on the available information. The analysis in Chapter 3 (Affected Environment and Environmental Consequences) indicates that the direct and indirect impacts of the No Action Alternative, Alternative 1, and Alternative 2 would be similar for many of the stressors. Therefore, much of the cumulative impacts discussion applies to all three alternatives. Specific differences between the alternatives are discussed when appropriate.

4.3 Other Actions Analyzed in the Cumulative Impacts Analysis

4.3.1 Overview

Table 4.3-1 lists the other actions and other environmental considerations identified for the cumulative impacts analysis. Descriptions of each action and environmental consideration carried forward for analysis are provided in the following sections. The Keyport and Northwest Training Range Complex activities and analysis are incorporated into the NWTT proposed action and analysis. Thus, the Keyport and Northwest Training Range Complex are not considered or analyzed as cumulative impacts.

Table 4.3-1: Other Actions and Other Environmental Considerations Identified for the Cumulative Impacts Analysis

#	Name of Action	Lead Agency or Proponent	Location in the Study Area	Timeframe	Retained for Further Analysis?
Restoration, Research, and Conservation Projects and Programs					
1	Hood Canal Bedlands Encroachment Protection Easement	U.S. Department of the Navy	Hood Canal	Present and future	Retained
2	Readiness and Environmental Protection Integration Program/Encroachment Protection Partnering Agreement Transactions-Hood Canal	U.S. Department of the Navy	Hood Canal and Dosewallips River	Present and future	Retained
3	Hood Canal In-Lieu Fee Mitigation Program	Hood Canal Coordinating Council	Hood Canal	Present and future	Retained
4	The Crescent Harbor Salt Marsh and Salmon Restoration Project	U.S. Department of the Navy	Crescent Harbor Marsh on Whidbey Island in Puget Sound	Past, present, and future	Dismissed because of negligible to minor impacts on resources in the area affected by this activity and the Proposed Action
5	Maylor Beach Restoration Program	U.S. Department of the Navy	Crescent Harbor and Maylor Beach	Past, present, and future	Dismissed because of negligible to minor impacts on resources in the area affected by this activity and the Proposed Action
6	Hood Canal Dissolved Oxygen Program	Partnership of 28 Organizations (local, state, federal, and tribal government)	Hood Canal	Past, present, and future	Dismissed because this is a program and not a specific action
7	Deep Sea Corals Study	National Center for Coastal Ocean Science	Olympic Coast National Marine Sanctuary	Past, present, and future	Dismissed because this is a study which does not have any associated actions
8	Washington Islands National Wildlife Refuge Comprehensive Conservation Plan	U.S. Fish and Wildlife Service	Flattery Rocks National Wildlife Refuge, Quillayute Needles National Wildlife Refuge, Copalis National Wildlife Refuge	Past	Dismissed because the actions associated with this plan will not affect resources affected by the Proposed Action
9	Olympic Coast National Marine Sanctuary Management Plan Update	Olympic Coast National Marine Sanctuary	Olympic Coast National marine Sanctuary	Past	Retained
10	Olympic National Park Final General Management Plan	National Park Service	Olympic National Park	Past	Retained

Table 4.3-1: Other Actions and Other Environmental Considerations Identified for the Cumulative Impacts Analysis (continued)

#	Name of Action	Lead Agency or Proponent	Location in the Study Area	Timeframe	Retained for Further Analysis?
Other Military Activities					
11	Surveillance Towed Array Sensor System Low Frequency Active Sonar	U.S. Department of the Navy	Pacific-Indian Ocean	Past, present, and future	Retained
12	U.S. Coast Guard Training	U.S. Coast Guard	Washington, Oregon, and California	Past, present, and future	Retained for Coast Guard training that is not included in the NWTT EIS/OEIS proposed action
13	Oregon Air National Guard Flight Training	Oregon Air National Guard	Offshore Area (W-93, W-570)	Past, present, and future	Retained
14	Pile Repair and Replacement Program	U.S. Department of the Navy	Inland Waters (various locations in Puget Sound)	Past, present, and future	Retained
15	NAVBASE Kitsap Bangor, Indian Island, Whidbey, Everett, and Bremerton Waterfront Facilities Maintenance	U.S. Department of the Navy	Bangor, Indian Island, Whidbey, Everett, and Bremerton waterfront	Past, present, and future	Dismissed. Maintenance of facilities includes pressure washing of piers, and repair and replacement of structures as needed; however, measures that would cause cumulative impacts are not projected.
16	Force Protection and Weapons Security Measures	U.S. Department of the Navy	Waterfront Restricted Area of NAVBASE Kitsap Bangor and other Navy waterfront facilities	Past, present, and future	Retained
17	Barge Mooring Project Environmental Assessment/Incidental Harassment Authorization	U.S. Department of the Navy	NAVBASE Kitsap Bangor	Present and future	Retained
18	Underwater Surveillance System	U.S. Department of the Navy	Restricted Area at NAVBASE Kitsap Bangor	Past, present, and future	Dismissed. The system operates at the same frequency and range (generally 50–200 kHz as a commercial “fish finder” and has been in operation since April 2006. Therefore, impacts should be negligible.

Table 4.3-1: Other Actions and Other Environmental Considerations Identified for the Cumulative Impacts Analysis (continued)

#	Name of Action	Lead Agency or Proponent	Location in the Study Area	Timeframe	Retained for Further Analysis?
Other Military Activities (continued)					
19	Waterfront Restricted Area Land-Water Interface, NAVBASE Kitsap Bangor	U.S. Department of the Navy	NAVBASE Kitsap Bangor	Present and future	Retained
20	Waterfront Restricted Area Service Pier Extension, NAVBASE Kitsap Bangor	U.S. Department of the Navy	NAVBASE Kitsap Bangor	Present and future	Retained
21	Explosives Handling Wharf 1 Maintenance	U.S. Department of the Navy	NAVBASE Kitsap Bangor	Past, present, and future	Retained
22	NAVBASE Kitsap Bangor Test Pile Program	U.S. Department of the Navy	NAVBASE Kitsap Bangor	Past	Dismissed because the duration of this project spanned only a month, and pile programs at Kitsap Bangor are discussed in the analysis of the Explosives Handling Wharf 1 Maintenance (Section 4.3.4.10).
23	Electromagnetic Measurement Ranging System Project	U.S. Department of the Navy	Hood Canal	Future	Retained
24	Breakwater Construction and Pier Demolition at Naval Air Station Whidbey Island	U.S. Department of the Navy	Crescent Harbor	Future	Retained
25	Swimmer Interdiction Security System EIS, NAVBASE Kitsap Bangor	U.S. Department of the Navy	NAVBASE Kitsap Bangor	Present and future	Retained
26	Explosives Handling Wharf 2, NAVBASE Kitsap Bangor EIS	U.S. Department of the Navy	NAVBASE Kitsap Bangor	Present and future	Retained

Table 4.3-1: Other Actions and Other Environmental Considerations Identified for the Cumulative Impacts Analysis (continued)

#	Name of Action	Lead Agency or Proponent	Location in the Study Area	Timeframe	Retained for Further Analysis?
Other Military Activities (continued)					
27	P-8A Multi-Mission Aircraft (MMA) Supplemental EIS	U.S. Department of the Navy	Naval Air Station Whidbey Island	Present and future	Retained. However, their training is covered in the proposed action of this EIS/OEIS, and other activities are not in the Study Area (e.g., take offs and landings at Ault Field
28	Environmental Assessment for Replacement of EA-6B Aircraft with EA-18G Aircraft at Naval Air Station Whidbey Island, Washington	U.S. Department of the Navy	Naval Air Station Whidbey Island	Past, present, and future	Retained. However, training requirements in the NWTT Study Area are covered in the Proposed Action of this EIS/OEIS.
29	Environmental Impact Statement for the EA-18G Growler Airfield Operations	U.S. Department of the Navy	Naval Air Station Whidbey Island	Present and future	Retained. The number of operations analyzed in this document would accommodate the operations associated with the potential increase in aircraft and aircrew training requirements within the NWTT Study Area.
30	VAQ Expeditionary Wing Environmental Assessment	U.S. Department of the Navy	Naval Air Station Whidbey Island	Past, present, and future	Retained
31	Pacific Northwest Electronic Warfare Environmental Assessment	U.S. Department of the Navy	Air space of the Olympic Peninsula	Future	Retained
32	Pier and Support Facilities for Transit Protection System at U.S. Coast Guard Air Station/Sector Field Office	U.S. Department of the Navy	Port Angeles	Future	Retained

Table 4.3-1: Other Actions and Other Environmental Considerations Identified for the Cumulative Impacts Analysis (continued)

#	Name of Action	Lead Agency or Proponent	Location in the Study Area	Timeframe	Retained for Further Analysis?
Environmental Regulations and Planning					
33	Coastal and Marine Spatial Planning	Regional Ocean Commissions	All of Study Area	Future	Retained
34	Marine Mammal Protection Act incidental take authorizations	National Marine Fisheries Service	All of Study Area	Past, present, and future	Retained
Other Environmental Considerations					
35	Gateway Pacific Terminal at Cherry Point, WA	Pacific International Terminals	Cherry Point, WA	Future	Retained
36	Hood Canal In-Lieu Fee Mitigation (HCCC ILF) Program	Hood Canal Coordinating council	Hood Canal	Past, present, and future	Dismissed. The HCCC is a non-profit organization with no regulatory authority and the HCCC ILF Program is voluntary and therefore will not impact the cumulative analysis.
37	Jefferson County Black Point Master Planned Resort	Statesman Group of Companies, LTD, and Black Point Properties, LLC	Black Point, Brinnon, and Navy Range Dabob Bay	Present and future	Retained
38	Trans-Pacific fiber optic cable	Pacific Crossing Ltd.	Olympic Coast National Marine Sanctuary/Whidbey Island	Past, present, and future	Dismissed. The trans-Pacific fiber optic cable was laid in 1999–2000 and re-buried in 2005 to comply with existing permits and mitigation. Therefore, the cable's existence in the Study Area should not have a significant impact on resources
39	Commercial and Recreational Fishing	National Marine Fisheries Service and private industry	All of Study Area and open ocean areas	Past, present, and future	Retained
40	Maritime Traffic	Not applicable	All of Study Area and open ocean areas	Past, present, and future	Retained
41	Shoreline Development	Local regulatory agencies	Inland Areas, Puget Sound	Past, present, and future	Retained
42	Oceanographic Research	Numerous	All of Study Area and open ocean areas	Past, present, and future	Retained

Table 4.3-1: Other Actions and Other Environmental Considerations Identified for the Cumulative Impacts Analysis (continued)

#	Name of Action	Lead Agency or Proponent	Location in the Study Area	Timeframe	Retained for Further Analysis?
Other Environmental Considerations (continued)					
43	Ocean Noise	Not applicable	All of Study Area and open ocean areas	Past, present, and future	Retained
44	Ocean Acidification Effects on Noise in the Ocean	Not applicable	All of Study Area and open ocean areas	Past, present, and future	Retained
45	Ocean Pollution	U.S. Environmental Protection Agency Applicable State Agencies	All of Study Area and open ocean areas	Past, present, and future	Retained
46	Washington State Department of Transportation Manette Bridge Replacement Project	Washington State Department of Transportation	Bremerton, Olympic Peninsula, Washington	Past	Dismissed, as the Bridge Replacement Project was completed in February 2012, and there are no present or future impacts to contribute to the cumulative impacts in the analysis.
47	Washington State Department of Transportation Hood Canal Bridge West-Half Retrofit and East-Half Replacement Project	Washington State Department of Transportation	Between Kitsap and Jefferson counties at the mouth of the Hood Canal	Past	Dismissed, as the Bridge Retrofit and Replacement Project was completed in June 2009 and there are no present or future impacts to contribute to the cumulative impacts in the analysis.
48	Marine Tourism and Recreation	Numerous	All of Study Area	Past, present, and future	Retained
49	Commercial and General Aviation	Not applicable	All of Study Area and open ocean areas	Past, present, and future	Retained
50	2013 Bremerton Ferry Terminal Construction by the Washington State Department of Transportation	Washington State Department of Transportation	Bremerton ferry terminal	Future	Retained

Notes: EIS = Environmental Impact Statement, kHz = kilohertz, LLC = Limited Liability Company, NAVBASE = Naval Base, NAVSEA = Naval Sea Systems Command, NUWC = Naval Undersea Warfare Center, NWTRC = Northwest Training Range Complex, OEIS = Overseas EIS, U.S. = United States, VAQ = Electronic Attack Squadron, W = Warning Area, WA = Washington

4.3.2 RESTORATION, RESEARCH, AND CONSERVATION PROJECTS AND PROGRAMS

4.3.2.1 Hood Canal Bedlands Encroachment Protection Easement

The Navy and Washington Department of Natural Resources signed a restrictive easement on 7 July 2014. The Navy paid $720,000 for the easement, which precludes construction in the easement area. The easement covers 4,804 acres (ac.) of aquatic land, which extends from the Hood Canal Bridge to just south of the Hama Hama River Delta. The easement covers a strip of land, from -18 feet (ft.) mean low low water (MLLW) down to 70 ft. MLLW. The restrictive easement will prevent construction and development in the footprint of the easement. It will not, affect public access, privately owned lands, recreational uses, aquaculture or geoduck harvest. All 4,804 ac. overlays designated critical habitat for ESA listed salmonid species. The restrictive easement area also protects large tracts of wild stock geoduck and extensive Eelgrass habitat. The easement will protect the area for 55 years. Department of Natural Resources will continue to manage the land under its aquatic lands program.

4.3.2.2 Readiness and Environmental Protection Integration Program/Encroachment Protection Partnering Agreement Transactions-Hood Canal

Under the Readiness and Environmental Protection Integration Program, the Navy has established a multi-year agreement with The Trust for Public Lands, Washington Department of Natural Resources and Jefferson Land Trust. To date, the Navy and its partners have purchased protective easements on 5,149 ac. of upland and shoreline properties around Hood Canal including protection of approximately two miles of the riparian corridor along the Dosewallips River. The Dosewallips transaction completed the protection of the riparian corridor from the shoreline of Hood Canal to the Olympic National Forest. Beyond the riparian corridor which is protected by an easement and managed by Washington State Parks, the Navy purchased a restrictive easement to maintain 3,607 ac. of working forest as a buffer and permanently protect these lands from development. Within the Dabob Bay Natural Area, the Navy and Department of Natural Resources have partnered on transactions which protect 122 ac. These areas provide protection for designated critical habitat for ESA listed salmonid species. Additional Readiness and Environmental Protection Initiative transactions are underway within the agreement area around Hood Canal.

4.3.2.3 Hood Canal In-Lieu Fee Mitigation Program

The Hood Canal In-Lieu Fee Mitigation Program is a voluntary program sponsored by the Hood Canal Coordinating Council, where entities can purchase mitigation credits to offset unavoidable adverse impacts to aquatic resources within the Hood Canal watershed. The primary goal of the Hood Canal Coordinating Council In-Lieu Fee Program for Hood Canal is to increase aquatic resource functions in the Hood Canal watershed. The Hood Canal Coordinating Council In-Lieu Fee Program is intended to ensure no net loss through the preservation, enhancement, establishment, and restoration of ecological functions within target watersheds through the establishment and management of mitigation sites. The service area for the Hood Canal Coordinating Council In-Lieu Fee Program encompasses Hood Canal and those portions of Water Resource Inventory Areas 14, 15, 16, and 17 draining to Hood Canal, defined by a line extending from Foulweather Bluff to Tala Point, south through the Great Bend to its terminus near the town of Belfair, Washington. The service area is divided into two components for the In-Lieu Fee Program: Freshwater Environment, which generally includes areas landward of the marine riparian zone including freshwater and estuarine wetlands and streams up to and excluding any National Park or National Forest Lands; and Marine/Nearshore Environment, which extends from the marine riparian area at the top of the coastal bluffs to the adjacent aquatic intertidal and subtidal zones. The mitigation strategy selected for each permitted impact will be based on an assessment of type and degree of disturbance to the landscape and/or drift cell (Hood Canal Coordinating Council 2014).

4.3.2.4 Olympic Coast National Marine Sanctuary Management Plan Update

The Olympic Coast National Marine Sanctuary Management Plan was updated in 2011. This update to the Sanctuary's management plan is dismissed from further cumulative analysis because the update did not alter regulations to Navy actions within the Sanctuary. The Management Plan Update also does not contribute to the overall cumulative impact of activities on marine resources in the Study Area, and therefore results in negligible to minor impacts on resources in the area affected by the activity and the Proposed Action. The Management Plan update is discussed further in Section 6.1.2.1 (Olympic Coast National Marine Sanctuary).

4.3.2.5 Olympic National Park Final General Plan/Environmental Impact Statement

In March 2008, the National Park Service completed a General Management Plan for Olympic National Park that provided a framework for managing the park. The plan established a direction for resource preservation and visitor use, proposed management strategies, and was developed in consultation with interested parties, including federal, state, and local agencies, tribal governments, and the public. The General Management Plan was needed to address issues, concerns, and problems related to the management of the Olympic National Park. The plan was also needed to meet the requirements of the National Parks and Recreation Act of 1978 and National Park Service policy (National Park Service 2008). A Final EIS was prepared for the Olympic National Park General Management Plan and a Record of Decision (ROD) was signed on 8 August 2008.

4.3.3 OTHER MILITARY ACTIVITIES

4.3.3.1 Surveillance Towed Array Sensor System Low Frequency Active Sonar

The NMFS published a biological opinion on the Navy's proposed use of the Surveillance Towed Array Sensor System Low Frequency Active Sonar from August 2012 through August 2017. The NMFS Office of Protected Resources promulgation of regulations pursuant to the MMPA and subsequent issuance of Letters of Authorization pursuant to the MMPA regulations for the U.S. Navy to "take" marine mammals incidental to its employment in areas of the Atlantic, Pacific, and Indian Oceans and the Mediterranean Sea happened on 13 August 2014. In August 2011, the Navy released a Draft Supplemental EIS/Supplemental OEIS that evaluated the potential environmental impacts of employing the Surveillance Towed Array Sensor System Low Frequency Active Sonar (U.S. Department of the Navy 2011). The Navy currently plans to operate up to four Surveillance Towed Array Sensor System Low Frequency Active Sonar systems for routine training, testing, and military operations. Based on current Navy national security and operational requirements, routine training, testing, and military operations using these sonar systems could occur in the Pacific Ocean (including the Study Area).

4.3.3.2 United States Coast Guard

The U.S. Coast Guard (USCG) conducts training throughout the Study Area. In California, District 11 conducts search and rescue, homeland security, law enforcement, marine safety, and aids to navigation missions over 3.3 million square miles ($mi.^2$) of water. The District 13 Coast Guard unit is located in the Pacific Northwest along the coasts of Oregon and Washington. District 13 conducts the same operational duties as the units in District 11 and covers more than 460,000 $mi.^2$ of the Pacific Ocean.

USCG activities covered by the NWTT EIS/OEIS includes Maritime Security Operations, where USCG personnel participate. Those USCG activities analyzed only for their cumulative impact as they are not analyzed in the NWTT EIS/OEIS include:

- Small- and medium-caliber weapons firing from ships, similar to the Navy's Gunnery Exercise (Surface-to-Surface) Ship.
- Flight training in W-237. This flight training includes low-altitude helicopter flights but does not include expenditure of munitions or any other materials.
- Shipboard aircraft operations, such as deck landing qualification training.
- Shipboard maneuvering and engineering training (e.g., abandon ship, anchoring, full power trials, man overboard, and flooding).
- Search and rescue training.

4.3.3.3 Oregon Air National Guard Flight Training

The Oregon Air National Guard is the primary user of W-93 and W-570 special use airspace in the Offshore Area. Oregon Air National Guard flights in W-93 and W-570 are primarily air combat maneuver training flights, similar to those conducted by the Navy and described in Chapter 2 (Description of Proposed Action and Alternatives). These flights occur throughout the year but do not include any weapons firing or release of chaff. On rare occasions, self-defense flares may be used during training.

4.3.3.4 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 5-year period beginning July 2017. A future Programmatic Environmental Assessment (EA) will be prepared for the 5-year program starting in fiscal year 2017. Installations include Naval Base (NAVBASE) Kitsap Bangor, NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, Manchester Fuel Depot, and Naval Station (NAVSTA) Everett. The Action involves pile removal, installation, and disposal, and in-place pile repair. The Action also includes individual actions currently planned and estimates for contingency requirements at Naval Air Station Whidbey Island (NASWI), NAVSTA Everett, NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, NAVBASE Kitsap Manchester, and Zelatched Point.

4.3.3.5 Force Protection and Weapons Security Measures

The Force Protection and Weapons Security Measures project involves installation and operation of facilities, including 14 ft. (4.3 m) high above-water fencing on pontoons along the Waterfront Restricted Area. It also involves the construction of an Auxiliary Reaction Force Facility (14,000 $ft.^2$ [1,300 m^2]) and an Armored Fighting Vehicle Operational Storage Facility (16,146 $ft.^2$ [1,500 m^2]). It also includes the alteration of two buildings for a new armory (2,500 $ft.^2$ [232 m^2]) and the replacement of an Alert Force Garage (2,530 $ft.^2$ [235 m^2]) that includes a new paved access road (U.S. Department of the Navy 2012a). These in-water fence structures do not contribute to habitat degradation and are maintained onshore. The repaired fence pieces are then barged out to the in-water fence and reattached. Possible habitat loss and/or barrier loss are not likely because the fence floats on the water surface and is passable by birds above the water surface. The construction of the two facilities and the paved access road will increase the impervious footprint near open surface waters, but minimal vehicle traffic and containment of other possible contaminants is likely to result in minimal contribution to the overall contaminant load within the waters of the Puget Sound.

4.3.3.6 Barge Mooring Project Environmental Assessment

Between July and September 2013, the Navy replaced an existing research barge at the Service Pier in order to support the mission and operations of Commander, Submarine Development Squadron Five at NAVBASE Kitsap Bangor. A Finding of No Significant Impact (FONSI) on Issuance of an Incidental Harassment Authorization (IHA) to the Navy for take of marine mammals incidental to a barge mooring

project was published by NMFS on 3 July 2013. The action included vibratory installation of 20 hollow steel piles that range in diameter from 18 to 48 inches (in.) (46 to 122 centimeters [cm]). The 36 in. (91 cm) diameter and 48 in. (122 cm) diameter piles were used to moor the new 260 ft. (79 m) by 85 ft. (26 m) barge, which replaced a 115 ft. (35 m) by 35 ft. (11 m) barge that was previously located at the Service Pier. To allow space for the larger barge, the existing floating pier sections used by Port Operations were relocated to the opposite side of the Service Pier trestle. Additional floating sections were attached and supported by 18 in. (46 cm) and 24 in. (61 cm) diameter steel piles. Previously existing infrastructure that was not needed to support the new Service Pier configuration was removed. The infrastructure includes a gangway, fenders, pedestals, and a mooring dolphin. The mooring dolphin has a concrete platform supported by eight 24–30 in. (61–76 cm) diameter steel piles. The platform was carefully cut into sections and removed. One 24 in. (61 cm) steel pile was removed using vibratory pile driving equipment. The remaining piles were cut off at the mudline and extracted (U.S. Department of the Navy 2012b).

Removal and installation of the pier piles would likely have disturbed the sea floor and caused elevated turbidity into the water column but this effect would be temporary and minimal to existing background turbidity levels. Sound levels from vibratory hammers are low and emit different sound frequencies than impact hammers, which are more likely to cause barotraumas and other disruptions to fish. Sound pressure levels (SPLs) from the use of the vibratory hammer are non-lethal to fish in the area and short-lived in duration.

4.3.3.7 Waterfront Restricted Area Land-Water Interface, Naval Base Kitsap Bangor

The Navy proposes to construct two land-water interface structures and modify the existing floating port security barrier system for improved protection of TRIDENT submarines. Construction of the land-water interface structures would enclose the Navy waterfront restricted area on NAVBASE Kitsap Bangor by constructing security barriers in the intertidal zone at the Bangor waterfront. Construction is anticipated to take 2 years. Construction activities occurring in the water during the first year may involve pile driving and would be conducted from July 2015 through February 2016. Once the pile driving is complete, activities other than pile driving may occur in the water up until February 2017.

4.3.3.8 Waterfront Restricted Area Service Pier Extension, Naval Base Kitsap Bangor

The Navy proposes to extend the existing service pier, construct associated support facilities, and relocate two SEAWOLF Class submarines from NAVBASE Kitsap Bremerton to join a third SEAWOLF Class submarine at NAVBASE Kitsap Bangor. The existing service pier would be extended; land-based associated support facilities would be constructed, including a maintenance support facility; and utility upgrades would include an emergency power generator and a parking lot. Shore-based facilities constructed on the pier would include a pier services and compressor building and a pier crane. Construction would occur from April 2015 to March 2017. Construction in the water is planned for July through February of each year, beginning in July 2015 and concluding in February 2017. The relocation would result in the consolidation of berthing and support for the SEAWOLF Class submarines at NAVBASE Kitsap Bangor.

4.3.3.9 Explosives Handling Wharf 1 Maintenance

The Navy is continuing a construction project to conduct necessary repairs and maintenance on the Explosive Handling Wharf 1 (EHW-1) facility. This multiyear project involves removal and replacement of deteriorated steel and/or concrete piles. NMFS has issued an IHA to the Navy to incidentally harass, by Level B harassment, five species of marine mammals incidental to pile driving and removal associated

with the project. This is the third such IHA for similar work on the same structure. Previously, the Navy received IHAs for a 2-year maintenance project at EHW-1 conducted in 2011-12 and 2012-13 (76 Federal Register (FR) 30130 and 77 FR 43049). Additional IHAs were issued to the Navy for marine construction projects on the waterfront, including the construction of a second explosives handling wharf (EHW-2) (discussed in Section 4.3.3.13, Explosives Handling Wharf 2, Naval Base Kitsap Bangor Environmental Impact Statement) immediately adjacent to EHW-1.

The next phase includes demolishing four 24-in. hollow prestressed octagonal concrete piles and installing four 30-in. concrete-filled steel piles adjacent to the demolished piles at the outboard support of the EHW-1. Additionally, the project includes replacement of structural elements such as decking and pile caps, installation of cathodic protection, repair of a concrete wetwell, and recoating of the tops of fender piles and steel mooring fittings. The next phase began in July 2015 and is to be completed in January 2016 within the allowable season for in-water work at Naval Base Kitsap Bangor. The window is established by the Washington Department of Fish and Wildlife in coordination with NMFS and U.S. Fish and Wildlife Services (USFWS) in order to protect juvenile salmon.

Phased repair of this structure is expected to continue until 2024 (U.S. Department of the Navy 2012a). The wharf is a U-shaped concrete structure built in 1977 for ordnance handling operations in support of the TRIDENT Submarine squadron, which is home ported at the NAVBASE Kitsap Bangor. The EHW-1's structural integrity is compromised due to deterioration of the wharf's piling sub-structure. The purpose of the project is to maintain the structural integrity of the wharf and ensure its continued functionality to support the operational requirements of the TRIDENT program (U.S. Department of the Navy 2012a). Direct and indirect effects that are likely to occur include periodic and temporary increases in turbidity in the water column from pile removal and installation and underwater sound; however, these effects would be intermittent and of short duration.

Mitigation measures for this action include marine mammal zones of influence or mitigation zones that would be established around each pile to prevent Level A harassment to marine mammals. The shutdown zones include all areas where the underwater sound pressure levels are anticipated to equal or exceed level A harassment criteria for marine mammals. The buffer zones include all areas where the underwater or airborne sound pressure levels are anticipated to equal or exceed level B harassment criteria for marine mammals. The shutdown and buffer zones are monitored throughout the project: if an animal enters the buffer zone, a "take" would be recorded and behaviors documented. An animal that enters or approaches the shutdown zone would cause all pile driving activities to be halted. Other mitigation measures for marine mammals include visual monitoring, sound attenuation devices, acoustic measurements, timing restrictions (to avoid migratory ESA-listed species), the soft-start procedure (a warning or innate noise before beginning pile driving), and daylight construction. Along with marine mammal mitigation measures, there are also mitigation measures in place to protect fish and the marbled murrelet in the project area (U.S. Department of the Navy 2012a).

4.3.3.10 Electromagnetic Measurement Ranging System, Hood Canal

A Draft EA was prepared for the construction and operation of an Electromagnetic Measurement Ranging System located on NAVBASE Kitsap Bangor lands and adjacent waters in Hood Canal (Hood Canal Military Operating Area North) Bangor, Washington. This future project would include construction of a 15 ft. by 15 ft. (4.5 meter [m] by 4.5 m) offshore platform with utilities, requiring installation of five 24 in. (61 cm) square batter precast concrete piles (one for each corner and one in the center of the platform). The five piles would be impact driven. The project also would include

installation of the sensor array system and approximately 8,000 ft. (2,438 m) of cable on the bottom of Hood Canal.

4.3.3.11 Breakwater Construction and Pier Demolition at Naval Air Station Whidbey Island

The Navy proposes to construct a new pile-supported breakwater; demolish an existing 536 ft. (163 m) long by 50 ft. (15 m) wide finger pier breakwater; install a fuel pier sheet pile cut-off wall at the existing fuel pier; install new anchor buoys; and dredge a 3.9 ac. (1.6-hectare [ha]) access channel at NASWI's Seaplane Base at Whidbey Island, Washington. The Action is taking place within Crescent Harbor. The new breakwater would replace the existing structurally unsound finger pier breakwater to ensure continued safe and uninterrupted jet fuel delivery for NASWI. Dredging would improve access to the fuel pier during low tides, reduce the frequency of future maintenance dredging, and enable fuel pier access for vessels with drafts of up to 16 ft. (5 m) (U.S. Department of the Navy 2014d). The Navy is applying for an IHA under the MMPA, as amended. The concurrence letter was received from the USFWS on January 16, 2014, and biological opinion was received from NMFS on May 9, 2014 (U.S. Department of the Navy 2012c). The proposed in-water work would occur between June 2015 and be completed by spring of 2016 (Reid 2014). Direct and indirect effects that are likely to occur include increases in turbidity in the water column from pile removal and installation and the dredging operations. Habitat loss from the increased amount of piles and shading of the water surface from the pier structure overhead is likely to decrease algae and zooplankton that play an integral role in the food chain.

4.3.3.12 Swimmer Interdiction Security System, Naval Base Kitsap Bangor

The Navy implemented a Swimmer Interdiction Security System at NAVBASE Kitsap Bangor, Silverdale, WA, after an EIS written in 2009 followed by the ROD (74 FR 60244) in November 2009, in order to meet the increased U.S. security requirements for military installations in response to the terrorist attacks of September 11, 2001. The Marine Mammal Alternative (the preferred alternative) is composed of human/marine mammal teams that support Navy operations and respond rapidly to security alerts. The Swimmer Interdiction Security System protects waterside Navy assets and will remain in operation as long as valuable naval assets are at NAVBASE Kitsap Bangor (U.S. Department of the Navy 2009).

Movement of watercraft in the training area of Puget Sound could possibly disturb listed marine mammals and fish, but that is not likely due to the short lengths of the trainings and the low disturbance of the training watercraft relative to other watercraft disturbances in the vicinity.

4.3.3.13 Explosives Handling Wharf 2, Naval Base Kitsap Bangor Environmental Impact Statement

The Navy is building and will operate a second Explosives Handling Wharf (EHW-2) immediately south of the existing EHW at NAVBASE Kitsap Bangor. EHW-2 will be a large pile-supported structure to support TRIDENT submarines homeported at Bangor. The in-water facility will cover 6.3 ac. (2.5 ha), and will be supported by up to 1,250 hollow steel piles. Construction began in fall 2012, and completion is expected in 2016. EHW-2 consists of in-water structures and onshore support facilities including roads, utilities, and security features. Approximately 20 existing facilities and/or structures in proximity of EHW-2 will be modified or demolished, and 4 new on-shore facilities will be constructed. Environmental impacts during construction include: disturbance to fish, bird, and marine mammals from pile driving noise; turbidity; air pollutant emissions; and temporary loss of brush and forest. Long-term impacts include shading of marine habitat, loss of seafloor due to pile placement, interference with migration of juvenile salmon, and loss of upland wetlands. The Navy obtained permits and authorizations for impacts to aquatic habitats, ESA-listed species, and marine mammals. Mitigation measures include purchase of

aquatic habitat credits from the Hood Canal In-Lieu Fee Program, use of bubble curtains and equipment procedures to reduce species impacts from pile driving noise, marine species monitoring and reporting, revegetation of temporarily disturbed upland areas, public and mariner notification of upcoming construction activities, and specific mitigation actions to compensate for impacts to tribal treaty resources (U.S. Department of the Navy 2012a).

4.3.3.13.1 Mitigation for Explosive Handling Wharf 2

The Navy will implement the following mitigation actions in the form of funded programs to compensate for impacts to tribal treaty resources.

4.3.3.13.1.1 Fishery Improvements

The Navy will provide funding for infrastructure improvements at three existing hatcheries owned and operated by Washington Department of Fish and Wildlife (Hoodsport, McKernan, and George Adams) and one existing fish capture facility owned and operated by the Skokomish Indian Tribe (Enetai Creek) to improve salmon production and associated harvest opportunities in Hood Canal. Improvements to the Washington Department of Fish and Wildlife facilities may include repair or restoration, but will not include recurring annual costs. These projects, funded by the Navy, will help improve the fisheries in the Skokomish tribal facilities, and increase the number of spawned fish available for harvest.

4.3.3.13.1.2 Shore and Benthic Improvements

Beach Enhancement

The Navy will provide funding for beach enhancements to include substrate improvements and 3 years of shellfish seeding on 24 ac. (9.7 ha) of beach. This action will occur on lands owned by the Skokomish Tribal Nation that will be transferred to the Department of Interior, Bureau of Indian Affairs to be held in trust for the tribe.

Shellfish Enhancement

The Navy will provide funding for a 5-year program for seeding of shellfish including manila clams, bagged and single Pacific oyster seed, and Olympia oysters on priority shellfish enhancement areas in Hood Canal and adjacent Admiralty Inlet. The Tribes are solely responsible for selecting the beaches to be seeded and coordinating these efforts with the land owners and responsible agencies.

Shellfish Nursery, Floating Upweller System

The Navy will provide funding for construction and operation of a 75 ft. by 30 ft. (23 m by 9 m) Shellfish Nursery, Floating Upweller System, a 30 ft. by 100 ft. (9 m by 31 m) grated work-deck attached to the Port Gamble S'Klallam Tribe's existing net pens in Port Gamble Bay, associated mooring and underwater power supply systems, and four 50 ft. by 50 ft. (15 m by 15 m) steel net pen cages to replace the existing deteriorated cages. The nursery will be capable of accommodating approximately 8–12 million shellfish seed annually. The Port Gamble S'Klallam Foundation or designated entity pursuant to the Memorandum of Agreement will acquire and comply with all required permits, leases, and entitlements as part of this project.

Subtidal Geoduck Enhancement Survey and Study

The Navy will provide funding for geoduck enhancement surveys within the Tribes' usual and accustomed fishing grounds and stations, and for a pilot research study to provide information on new locations for geoduck planting, and to develop sustainable geoduck growing, planting, and other enhancement methodologies. The majority of surveys will occur on tracts having limited survey information. Some surveys will occur on previously harvested tracts. The pilot study will include a

literature review and testing of long-term geoduck production processes and enhancement through systematic trials and a comparison of techniques. The Tribes are solely responsible for coordinating survey efforts with land owners.

4.3.3.13.1.3 Wet Lab Building and Research, Education, and Training

The Navy will provide funding to construct a shellfish wet lab, education, and training building in an upland location at Port Gamble. The research, education, and training program will be developed by the Port Gamble S'Klallam Tribe and will provide education and training for members of the Tribes and the community and research on the health of Hood Canal and marine systems and on shellfish and finfish management. The program may include field training, outreach, shoreline habitat projects, shellfish seed production, and other activities. The wet lab building will be a minimum of 40 ft. by 80 ft. (12 m by 24 m) and will provide a space for facilitating the shellfish seed planting, for equipment storage, and for the Education and Training program, including a small classroom and public meeting space and staff offices.

4.3.3.13.1.4 Land Conservation

The Navy will provide funding for the acquisition and conservation of lands on the west shore of Port Gamble Bay. The funds for the purchase of lands may be used within two designated blocks of land. The two areas include the 566 ac. (229 ha) shoreline block which includes approximately 26 parcels and the 678 ac. (274 ha) Maritime Forest Block which includes approximately 34 parcels.

4.3.3.14 P-8A Multi-Mission Aircraft

The Navy decided in 2008 to provide facilities and functions to support homebasing twelve P-8A Multi-Mission Maritime Aircraft (MMA) squadrons and one Fleet Replacement Squadron into the U.S. Navy Fleet. The P-8A MMA will replace the current maritime patrol aircraft, the P-3C Orion, at existing maritime patrol homebases. The action will result in the homebasing of six fleet squadrons (42 aircraft) at NASWI, Washington. The introduction of the MMA squadrons in the U.S. Navy Fleet was analyzed in an EIS (U.S. Department of the Navy 2008). Since the completion of the original EIS, the Navy prepared a Supplemental EIS (U.S. Department of the Navy 2014a). The change in aircraft stationed at NASWI has been incorporated into the Action. Informal consultation with the USFWS in accordance with section 7(a)(2) of the ESA for the proposed action concluded with a letter of concurrence from the USFWS on 13 May 2013. The ROD was signed in June 2014, and the transition to the P-8A aircraft is currently underway. Based on the ROD, P-8A aircraft arrive at NASWI in 2016. There will be an overall increase of 18 aircraft by 2020.

4.3.3.15 Environmental Assessment for Replacement of EA-6B Aircraft with EA-18G Aircraft

In this 2005 EA the Navy analyzed the replacement of Prowler aircraft with Growler aircraft, including the disestablishment of three expeditionary squadrons. The primary types of Airborne Electronic Attack (AEA) mission training and readiness requirements for the EA-18G remained virtually the same as those for the EA-6B that were stationed at NASWI. However, the airframe, aircraft components, and aircraft performance of the EA-18G differs from those of the EA-6B. Existing facilities and functions at NASWI were modified to accommodate the replacement airframe. Additionally, implementation of the EA for the replacement of the EA-6B squadrons with the EA-18G squadrons resulted in a decrease in the number of aircraft and personnel associated with the AEA squadrons and a reduction in flight training operations at NASWI.

4.3.3.16 Environmental Impact Statement for the EA-18G Growler Airfield Operations

Since 1970, NASWI has been home to all of the Navy's electronic attack (VAQ) squadrons in the U.S., and the need for ongoing use of Ault Field and Outlying Landing Field Coupeville will continue into the foreseeable future. The mission of VAQ has evolved over time and, in 2005, the replacement of Prowler aircraft with Growlers was analyzed in an EA. In 2009, the Department of Defense (DoD) was directed to maintain the expeditionary VAQ capabilities indefinitely, and this resulted in a 2012 EA that analyzed retaining the relocation of Andrews Air Force Base, Maryland reserve Prowler squadron and the transition of that squadron to Growlers at NASWI (U.S. Department of the Navy 2014b, e).

After conducting scoping between September 2013 and January 2014 for the potential environmental impacts associated with the addition of two new expeditionary squadrons and additional Growler aircraft, the Navy is preparing an EIS to meet current and future mission and training requirements at NASWI. The Navy is proposing to continue and increase the existing VAQ operations at NASWI's Ault Field and Outlying Field Coupeville; increase VAQ capabilities and augment the training squadron by adding up to 36 aircraft to support an expanded DoD mission for identifying, tracking, and targeting in a complex electronic warfare (EW) environment; construct and renovate facilities at Ault Field to accommodate additional aircraft; and station additional personnel at, and relocate family members to, NASWI and the surrounding community. The EIS is building upon analyses that were completed in 2005 and 2012 and will assess the noise environment as well as specific airfield operations at NASWI. The EIS will be considering public comments received during both the 2013 and 2015 public scoping periods (U.S. Department of the Navy 2014b).

4.3.3.17 VAQ Electronic Attack Squadron Expeditionary Wing Environmental Assessment

The Navy prepared an EA to analyze the transition of the Expeditionary Electronic Attack squadrons at NASWI from the aging EA-6B Prowler to the newer EA-18G Growler in the 2012–2014 timeframe (U.S. Department of the Navy 2012d). The 2012 EA analyzed retaining 3 expeditionary VAQ squadrons that operated Prowlers, and their transition to Growler, in addition to relocating a reserve squadron to NASWI, and resulted in a finding of no significant impact. Training for these Growler aircrew is included as part of the Proposed Action in the NWTT EIS/OEIS.

4.3.3.18 Pacific Northwest Electronic Warfare Environmental Assessment

The Navy published the Pacific Northwest Electronic Warfare Final EA in September 2014. The purpose and need for the proposed action is to sustain and enhance the level and type of EW training currently being conducted by Navy assets using the Northwest Training Range Complex (NWTRC), to provide the ability to accommodate growth in future training requirements, and to maximize the ability of local units to achieve their training requirements on local ranges. The EA analyzed land-based enhancements to existing EW training, including the installation of one fixed transmitter and operation of up to three mobile signal transmitter trucks. The EA supported a finding of no significant impact (U.S. Department of the Navy 2014c).

4.3.3.19 Pier and Support Facilities for Transit Protection System at U.S. Coast Guard Air Station/Sector Field Office

The Navy is preparing an EA, with the USCG as a cooperating agency, to construct a pier and support facilities at the USCG Air Station/Sector Field Office Port Angeles, which is located in Clallam County, Washington. The Description of the Proposed Action and Alternatives document was published in January 2015 for initial public and agency review and comment. The reason for the Proposed Action is to provide a staging location for Transit Protection System (TPS) crews and vessels that escort naval

submarines to and from their dive/surface points in the Strait of Juan de Fuca and NAVBASE Kitsap Bangor. The new pier and support facilities would allow the USCG to comply with requirements for underway hour (time required for USCG crews to prepare for, perform, and complete small boat operations) limitations and required crew rest between escort missions.

The Navy is proposing to construct a pier; an Alert Forces Facility (single-story sleeping and administration building); a Ready Service Armory (an ammunition and weapons storage facility); diesel fuel, marine storage tank and distribution system; and site improvements including utilities, parking, lighting, security improvements, and landscaping at the USCG AIRSTA/SFO Port Angeles to support the USCG Maritime Force Protection Unit mission. The TPS pier would be designed to provide full hotel services (hotel services include electricity, potable water, sewer, internet, phone, fire protection, pier lighting, and fueling lines) and dedicated mooring for up to seven TPS vessels. Construction of the project is anticipated to start in the summer of 2016 and last approximately 2 years. The new pier and support facilities would have a design life of 50 years (U.S. Department of the Navy 2015)

4.3.4 Environmental Regulations and Planning

4.3.4.1 Coastal and Marine Spatial Planning

Coastal and Marine Spatial Planning is a comprehensive, transparent, adaptive, and science-based process to analyze and allocate the spatial and temporal distribution of human activities in marine areas. In 2009, President Obama signed a memorandum establishing the Interagency Ocean Policy Task Force; in 2010, the task force released a set of final recommendations known as the National Policy for the Stewardship of Our Oceans, Coasts, and Great Lakes. The policy adopted an ecosystem-based approach to management and an overarching framework of regional-scale coastal marine special planning. In the Pacific Northwest, efforts in coastal and marine spatial planning include the creation of the West Coast Governor's Agreement in 2006 to cohesively manage and protect the West Coast's ocean and coastal resources. Specific projects include the updating of the Territorial Sea Plan and designating marine reserves in Oregon, and the passing of a law in Washington to create a state Marine Spatial Planning plan (NANOOS 2014).

Current projects in Washington State include the Baseline Characterization of Coastal and Ocean Recreational Use Patterns and Mapping Marine Mammals and Identifying Ecologically Important Areas. The Recreational Use Patterns project is being launched by the Surfrider Foundation and is an Internet survey for coastal and ocean recreational users to summarize the intensity with which certain coastal areas are used for recreational activities, and the specific recreational activities they participate in along the Washington coast. The Washington Department of Fish and Wildlife is continuing a forage fish survey along the Washington coast, creating a bird and mammal geodatabase while conducting marine mammal aerial surveys, and using existing data to identify Ecologically Important Areas off of the Washington Coast for the Mapping Project (Washington Marine Spatial Planning 2014).

4.3.4.2 Marine Mammal Protection Act Incidental Take Authorizations

The MMPA generally prohibits "takes" of marine mammals in U.S. waters by any person and by U.S. citizens in international waters. The National Oceanic and Atmospheric Administration (NOAA) can authorize "takes" for specific activities (National Oceanic and Atmospheric Administration 2012c). Take authorizations are expected to be issued for the Proposed Action in the NWTT Study Area. Take authorizations not related to the Navy's Proposed Action are also expected to be issued for other actions occurring inside and outside of the Study Area.

4.3.5 OTHER ENVIRONMENTAL CONSIDERATIONS

4.3.5.1 Gateway Pacific Terminal Cherry Point, Washington

A subsidiary of SSA Marine, Pacific International Terminals, is proposing to build a deep-water marine terminal at Cherry Point in Whatcom County, Washington. Cherry Point is 17 mi. (27.4 km) south of the Canadian border. The site is 1500 ac. (607.02 ha) and is located between the BP Cherry Point Refinery and the Alcoa-Intalco Works with access to industrial utilities such as BNSF Railway tracks. The proximity of naturally deep moorage would allow large vessels to access the terminal without the need to dredge (Gateway Pacific Terminal 2014). The project is in the draft stages of preparing an EIS under NEPA and the State Environmental Policy Act. The Final EIS is expected to be released in 2017 (Washington State Department of Ecology 2015).

According to the Vessel Traffic and Risk Assessment Study published in 2014, the siting of the wharf and trestle at the proposed Gateway Pacific Terminal and the potential increased anchorage use by bulkers will interfere with Lummi access to fishing sites (Environmental Research Consulting, Inc. and Northern Economies, Inc. 2014). The Study showed that the Juan de Fuca East subarea would see the greatest increase in disruption due to the time and area occupied by Gateway Pacific Terminal vessels at anchor and bunkering activity. The study also found that the disruption has the potential for loss of Lummi fishing gear due to Gateway Pacific Terminal vessel traffic (Environmental Research Consulting, Inc. and Northern Economies, Inc. 2014).

4.3.5.2 Jefferson County Black Point Master Planned Resort

On 27 November 2007 a programmatic Final EIS was issued in association with a Comprehensive Plan Amendment to re-designate the 256 acres from rural residential to Master Planned Resort. The Jefferson County Board of Commissioners approved the request on 28 January 2008 with Ordinance No. 01-0128-08, stipulating through conditions that any subsequent project level action would require a Supplemental EIS (SEIS). An optional scoping process occurred from 13 October 2009, with a Scoping Public Meeting on 28 October 2009 and Scoping Memo issued 31 March 2010. There were issues identified through the scoping process, and they are addressed in the Draft SEIS (DSEIS) that was released to the public in November 2014. The issues identified and addressed in the DSEIS include sediment and air quality—greenhouse gas emissions, plants, energy and natural resources, housing and employment, light and glare, aesthetics, and utilities and transportation.

The DSEIS was prepared by Jefferson County in compliance with the State Environmental Policy Act of 1971 (Chapter 43.21C, Revised Code of Washington) and the SEPA Rules, effective April 4, 1984, as amended (Chapter 197-11, Washington Administrative Code). The document is not an authorization for the action, nor does it constitute a decision or a recommendation for the action; in its final form, it will accompany the Proposed Actions and will be considered in making the final decisions on the proposal. The proposed Master Planned Resort is located south of Brinnon, Washington, on the Black Point Peninsula, on the western shore of the Hood Canal.

Under Alternative 1, an 18-hole golf course, 890 residential units, 49,772 ft.^{2} of commercial space, and resort-related amenities on a 231 ac. Site (with 33 ac. of natural area preserved and 2.2 million cubic yards of earthwork required for golf course grading) would be built. Alternative 2 consists of the golf course, 890 residential units, 52,650 ft.^{2} of commercial space with resort-related amenities, and 80 ac. of natural area preserved with 1 million cubic yards of earthwork for golf course grading. Finally, under the No Action Alternative, the Master Planned Resort would not be constructed. A written public

comment on the DSEIS began on 19 November 2014 and ended on 5 January 2015, for a 45-day comment period (Jefferson County 2014).

4.3.5.3 Commercial and Recreational Fishing

Commercial and recreational fishing constitutes an important and widespread use of the ocean resources throughout the Study Area. Fishing can adversely affect fish populations, other species, and habitats. Potential impacts of fishing include overfishing of targeted species, bycatch, entanglement, and habitat destruction, all of which negatively affect fish stocks and other marine resources. Bycatch is the capture of fish, marine mammals, sea turtles, seabirds, and other nontargeted species that occur incidentally to normal fishing operations. Use of mobile fishing gear such as bottom trawls disturbs the seafloor and reduces habitat structural complexity. Indirect impacts of trawls include increased turbidity, alteration of surface sediment, removal of prey (leading to declines in predator abundance), removal of predators, ghost fishing (i.e., lost fishing gear continuing to ensnare fish and other marine animals), habitat destruction, and the generation of marine debris. Lost gill nets, purse seines, and long-lines may foul and disrupt bottom habitats and have the potential to entangle or be ingested by marine animals.

Fishing can also have a profound influence on individual targeted species populations. In a study of retrospective data, Jackson et al. (2001) analyzed paleoecological records of marine sediments from 125,000 years ago to present, archaeological records from 10,000 years before the present, historical documents, and ecological records from scientific literature sources over the past century. Examining this longer-term data and information, they concluded that ecological extinction caused by overfishing precedes all other pervasive human disturbance of coastal ecosystems, including pollution and anthropogenic climatic change. Fisheries bycatch has been identified as a primary driver of population declines in several marine species, including sharks, mammals, seabirds, and sea turtles (Wallace et al. 2010). For example, entanglement in nets from the Pacific Northwest coastal salmon fisheries has been shown to increase mortality in seabirds (Hamel et al. 2009). Habitat destruction caused by bottom trawling and other fishing methods also contributes to the negative effects of commercial and recreation fishing on multiple species, such as the North American groundfish (Melnychuk et al. 2013).

4.3.5.4 Maritime Traffic

Portions of the Study Area are heavily traveled by commercial, recreational, and government marine vessels, with several commercial ports occurring in or near the Study Area. Several harbor facilities of interest to the U.S. Navy are located in the Puget Sound: NAVSTA Everett; NAVBASE Kitsap Bremerton, NAVBASE Kitsap Bangor, Naval Undersea Warfare Center Keyport, Naval Magazine Indian Island, NASWI, the Port of Seattle, and the Port of Tacoma. Maritime traffic on the Puget Sound is heavy, many large commercial vessels use the Ports of Everett, Seattle, Tacoma, and others in the area, and they enter and depart Puget Sound each day. Additional traffic on the Sound is created by the frequent runs of large Washington State vehicle and passenger ferries as they cross the Sound on generally east-west traffic routes that are perpendicular to normal inbound and outbound maritime traffic channels. Additionally, many recreational and commercial small craft operate throughout the Puget Sound and adjacent waters.

Ocean shipping is a significant component of the regional economy. Washington State handles 7 percent of the country's exports and 6 percent of its imports. The maritime Port of Seattle was the nation’s 11th-busiest waterborne freight gateway for international merchandise trade by value of shipments in 2008. More than 1,000 vessels called at the Port of Seattle in 2008 (U.S. Department of Transportation 2009). Container vessels made the most calls at the port, accounting for 64 percent, while 28 percent of

the calls were by dry-bulk ships. Seattle and Tacoma were ranked 7th and 11th, respectively, among U.S. ports for total cargo imported and exported in 2011. Taken together, these two ports make up the nation's fourth-largest container load center in the United States (American Association of Port Authorities 2012).

Large ports in Canadian Waters that contribute to traffic transiting into and out of the Strait and through the Study Area include existing ports and oil and coal terminals that may increase in size or number due to existing proposals. The Gateway Pacific Terminal in Cherry Point, Washington (discussed in Section 4.3.5.1) is the only such proposal located in the Study Area. Other proposed coal terminals are geographically outside the Study Area but could result in additional vessel traffic in the Study Area. These proposed projects are located in Vancouver B.C (Neptune and Westshore – Kinder Morgan Trans-Mountain Pipeline) and Vancouver and Grays Harbor, Washington (Tesoro-Savage Unrefined Oil-Rail Port). Additional vessels using the Canadian terminals will transit in the Study Area and have the potential to increase the cumulative impacts of ocean shipping traffic. Other key ports in the region include:

- Bellingham (Whatcom County, Washington)
- Orcas, Friday Harbor, and Lopez (San Juan County, Washington)
- Anacortes and Skagit County (Skagit County, Washington)
- Coupeville and South Whidbey Island (Island County, Washington)
- Port Angeles (Clallam County, Washington)
- Port Townsend (Jefferson County, Washington)
- Everett and Edmonds (Snohomish County, Washington)
- Olympia (Thurston County, Washington)
- Shelton, Allyn, Grapeview, Dewatto, and Hoodsport (Mason County, Washington)
- Kingston, Indianola, Keyport, Poulsbo, Brownsville, Tracyton, Waterman, Bremerton, Silverdale, and Manchester (Kitsap County, Washington)
- Grays Harbor (Grays Harbor County, Washington)
- Port of Astoria (Clatsup County, Oregon)
- Port of Newport (Lincoln County, Oregon)
- Coos Bay (Coos County, Oregon)
- Port Orford (Curry County, Oregon)
- Eureka (Humboldt County, California)

The United States has grown increasingly dependent on international trade over the past 50 years. Section 3.12 (Socioeconomic Resources) provides additional information for marine vessel traffic in the Study Area. Primary concerns for the cumulative impacts analysis include vessels striking marine mammals and sea turtles, introduction of non-native species through hull fouling and ballast water, and underwater sound from ships and other vessels.

4.3.5.5 Shoreline Development

Shoreline development adjacent to the Study Area is both intensive and extensive. Development has impacted and continues to impact coastal resources through point and nonpoint source pollution; concentrated recreational use; and intensive ship traffic using major port facilities. The Study Area also includes extensive coastal tourism development (hotels, resorts, restaurants, food industry, residential homes, etc.) and the infrastructure supporting coastal development (retail businesses, marinas, fishing tackle stores, dive shops, fishing piers, recreational boating harbors, beaches, recreational fishing facilities, etc.). The focus of this analysis is on shoreline development in Washington because of the

close proximity of the Study Area to the shores of Washington. The offshore portion of the Study Area is 12 nm off the coast of Oregon, and California, and therefore shoreline development in that part of the Study Area will have minimal impact on resources in the Study Area.

Coastal development intensifies use of coastal resources, resulting in potential impacts on water quality, marine habitat, and air quality. Coastal development is therefore closely regulated by Washington, Oregon, and California through the Coastal Zone Management Act. New development in the coastal zone requires a permit from the state or local government to which permitting authority has been delegated (Chapter 6, Additional Regulatory Considerations, provides additional information on coastal zone management in each state).

4.3.5.6 Oceanographic Research

There are currently scientific research permits and General Authorizations for research issued by NMFS for cetacean work in the North Pacific. The most invasive research involves tagging or biopsy while the remainder focuses on vessel and aerial surveys and close approach for photo-identification. Species covered by these permits and authorizations include small odontocetes, sperm whales, and large mysticetes. One permit issued to the Office of Protected Resources of NMFS allows for responses to strandings and entanglements of listed marine mammals. NMFS has also issued General Authorizations for commercial photography of non-listed marine mammals, provided that the activity does not rise to Level A Harassment of the animals. These authorizations are usually issued for no more than 1 or 2 years, depending on the project.

Three consecutive marine geophysical (seismic) surveys are authorized to be conducted in the Northeast Pacific Ocean, for the time period of June–August 2012. Three Level B harassment incidental take authorizations for marine mammals are issued to the Lamont-Doherty Earth Observatory, a part of Columbia University. The Observatory with research funding from the U.S. National Science Foundation, plans to conduct three research studies on the Juan de Fuca Plate, the Cascadia thrust zone, and the Cascadia subduction margin in waters off the Oregon and Washington coasts. The Observatory will use one source vessel, a seismic airgun array, a single hydrophone streamer, and the ocean bottom seismometers to conduct the seismic surveys. They also intend to operate a multibeam echosounder and a subbottom profiler continuously throughout the surveys (FR 77: 136 2012).

These acoustic stimuli generated during the operation of the seismic airgun arrays may have the potential to cause a short-term behavioral disturbance for marine mammals in the survey area. The surveys should provide data to characterize the evolution and state of hydration of the Juan de Fuca plate at the Cascadia subduction zone, provide information on the buried structures in the region, and assess the location, physical state, fluid budget, and methane systems of the Juan de Fuca plate boundary and overlying crust. The results of the three studies will also provide background information for generating improved earthquake hazards analyses and a better understanding of the processes that control megathrust earthquakes, which are produced by a sudden slip along the boundary between a subducting and an overriding plate (FR 77: 136 2012).

The impacts of this type of research are largely unmeasured. However, given the analysis and scrutiny given to permit applications, it is assumed that any adverse effects are largely transitory (e.g., inadvertent harassment, biopsy effects, etc.). Data to assess population level effects from research are not currently available, and it is uncertain that research effects could be separately identified from other adverse effects on cetacean populations in Pacific Northwest waters.

4.3.5.7 Ocean Noise

Noise is generally described as unwanted sound—sound that clutters and masks other sounds of interest (Richardson et al. 1995). Anthropogenic sources of noise that are most likely to contribute to increases in ocean noise are vessel noise from commercial shipping and general vessel traffic, oceanographic research, oil and gas exploration, underwater construction, and naval and other use of sound navigation and ranging (sonar).

Any potential for cumulative impact should be put into the context of recent changes to ambient sound levels in the world's oceans as a result of anthropogenic activities. However, there is a large and variable natural component to the ambient noise level as a result of events such as earthquakes, rainfall, waves breaking, and lightning hitting the ocean as well as biological noises such as those from snapping shrimp and the vocalizations of marine mammals.

Andrew et al. (2002) compared ocean ambient sound from the 1960s to the 1990s from a receiver approximately 25 mi. (40 km) west of Point Sur, California. The data showed an increase in ambient noise of approximately 10 decibels (dB) in the frequency ranges of 20–80 Hertz (Hz) and 200–300 Hz, and about 3 dB at 100 Hz over a 33-year period. Each 3 dB increase is noticeable to the human ear as a doubling in sound level. A possible explanation for the rise in ambient noise is the increase in shipping noise. There are approximately 11,000 supertankers worldwide, each operating 300 days per year, producing constant broadband noise at source levels of 198 dB (Hildebrand 2004).

Appendix F (Acoustic and Explosives Primer) provides additional information about sources of anthropogenic sound in the ocean and other background information about underwater noise. This appendix describes the different types of effects that are possible and the potential relationships between sound stimuli and long-term consequences for individual animals and populations. A variety of impacts may result from exposure to sound-producing activities. The severity of these impacts can vary greatly between minor impacts that have no real cost to the animal, to more severe impacts that may have lasting consequences. The major categories of potential impacts are: behavioral reactions, physiological stress, auditory fatigue, auditory masking, and direct trauma.

4.3.5.8 Ocean Acidification Effects on Noise in the Ocean

Since the Industrial Revolution in the mid-19th century, the world's oceans have become increasingly acidic as a result of anthropogenic emissions of carbon (e.g., carbon dioxide [CO_2]) from the burning of fossil fuels (Feely et al. 2012 Reeder and Chiu 2010). Public comments received by the Navy on recently published EISs have expressed concerns that the increase in the acidity of ocean waters could potentially lead to an increase in the propagation of underwater sound associated with Navy activities (e.g., ship noise, sonar) and then have a greater potential to acoustically impact marine species (e.g., marine mammals, fish, turtles).

Although an increase in the acidity of seawater reduces the availability of boron ions that absorb sound (see Urick 1983), the effect that ionic absorption has on sound propagation is very small and overall transmission loss is dominated by other mechanisms (see Hester et al. 2008; Ilyina et al. 2010; Reeder and Chiu 2010). Reeder and Chiu (2010) demonstrated that even if there is a continual increase in ocean acidity over decades, there would still be no significant changes to average background noise levels in the ocean. Furthermore, they conclude that even with a large increase in acidity, there would be no change in ocean noise levels in shallow water and in near surface habitats frequented by marine mammals. The Navy's proposed actions in the NWTT Study Area would not significantly contribute to ocean acidification, and the potential cumulative effects of ocean acidification would not perceptibly

change ocean noise levels; therefore, the effect of ocean acidification need not be considered further in this analysis.

4.3.5.9 Ocean Pollution

Pollution is the introduction of harmful contaminants that are outside the norm for a given ecosystem. Ocean pollution has and will continue to have serious impacts on marine ecosystem. Common ocean pollutants include toxic compounds such as metals, pesticides, and other organic chemicals; excess nutrients from fertilizers and sewage; detergents; oil; plastics; and other solids. Pollutants enter oceans from non-point sources (i.e., storm water runoff from watersheds), point sources (i.e., wastewater treatment plant discharges), other land-based sources (i.e., windblown debris), spills, dumping, vessels, and atmospheric deposition.

4.3.5.9.1 Non-Point Sources, Point Sources, and Atmospheric Deposition

Storm water runoff, wastewater, and nonpoint source pollution, are considered major causes of impairment of ocean waters. Storm water runoff from coastal urban areas and beaches carries waste such as plastics and Styrofoam into coastal waters. Sewer outfalls also are a source of ocean pollution. Sewage can be treated to eliminate potentially harmful releases of contaminants; however, releases of untreated sewage occur due to malfunctions or overloads to the infrastructure, resulting in releases of bacteria usually associated with feces, such as *Escherichia coli* and *Enterococci spp*. Bacteria levels are used routinely to determine the quality of water at recreational beaches and as indicators of the possible presence of other harmful microorganisms. In the past, toxic chemicals have been released into sewer systems. While such dumping has long been forbidden by law, the practice left ocean outflow sites contaminated. Sewage treatment facilities generally do not treat or remove persistent organic pollutants, such as polychlorinated biphenyl (PCB) and dichlorodiphenyltrichloroethane (DDT), or other toxins.

Hypoxia (low dissolved oxygen concentration) is a major impact associated with point and non-point sources of pollution. Hypoxia occurs when waters become overloaded with nutrients from pesticides such as nitrogen and phosphorus, which enter oceans from non-point source runoff, wastewater treatment plants, and atmospheric deposition. Too many nutrients can stimulate algal blooms—the rapid expansion of microscopic algae (phytoplankton). When excess nutrients are consumed, the algae population dies off and the remains are consumed by bacteria. Bacterial consumption causes dissolved oxygen in the water to decline to the point where marine life that depends on oxygen can no longer survive (Boesch et al. 1997).

Almost 200 million tons of criteria pollutants (sulfur dioxide, nitrogen dioxide, carbon monoxide, lead, volatile organic compounds, and particulate matter) were emitted into the United States Atmosphere in 1997 (U.S. Environmental Protection Agency 1998). Through the process of wet and dry atmospheric deposition, these and other pollutants can return to the earth and the waters. Wet deposition removes gases and particles from the atmosphere and deposits them on the surface of the earth through rain, sleet, snow, and fog. While dry deposition is a process through which particles and gases are deposited in the absence of precipitation, such as through dust (U.S. Geological Survey 2000). This atmospheric deposition also contributes to the buildup of pollutants in the Study Area. Non-point sources, point sources, and atmospheric deposition also contribute toxic pollutants such as metals, pesticides, and other organic compounds to the marine environment. Toxic pollutants may cause lethal or sublethal effects if present in high concentrations, and can build up in tissues over time and suppress immune system function, resulting in disease and death for marine organisms. The main causes of pollution in

the Study Area are oil spills, stormwater run-off, dairy farm run-off, hazardous waste sites, combined sewer overflows, and highway stormwater outfalls (Puget Soundkeeper Alliance 2012).

4.3.5.9.2 Marine Debris

Marine debris is any anthropogenic object intentionally or unintentionally discarded, disposed of, or abandoned in the marine environment. Common types of marine debris include various forms of plastic and abandoned fishing gear, as well as clothing, metal, glass, and other debris. Marine debris degrades marine habitat quality and poses ingestion and entanglement risks to marine life and birds (National Marine Fisheries Service 2006).

Plastic marine debris is a major concern because it degrades slowly and many plastics float, allowing the debris to be transported by currents throughout the oceans. Currents in the oceanic convergence zone in the North Pacific Subtropical Gyre act to accumulate the floating plastic marine debris. These debris carrying currents include the south-flowing California Current, and the north-flowing Gulf of Alaska Current. These currents distribute debris throughout the Study Area. Debris found in the Puget Sound (inland waters) portion of the Study Area, include pieces of hard plastic, insulation, pre-production plastic pellets, pieces of bags or wrappers, fishing line, rope, or synthetic cloth, cigarette butts and filters, glass fragments and shards, rubber, metal, and "other" unclassified debris (Kingfisher 2011).

Additionally, plastic waste in the ocean chemically attracts hydrocarbon pollutants such as PCB and DDT, which accumulate up to one million times more in plastic than in ocean water (Mato et al. 2001). Fish, marine animals, and birds can mistakenly consume these wastes containing elevated levels of toxins instead of their prey. In the North Pacific Subtropical Gyre it is estimated that the fishes in this area are ingesting 12,000–24,000 U.S. tons (10,886,216–21,772,433 kilograms [kg]) of plastic debris a year (Davison and Asch 2011).

Debris that sinks to the seafloor is also a concern for ingestion and entanglement by fish, invertebrates, sea turtles, marine mammals, and marine vegetation. Sunken debris is also a contributor to marine habitat degradation. Military expended materials will also contribute to the marine debris loading of the seafloor in the Study Area. In the U.S. west coast Groundfish Bottom Trawl Surveys of 2007 and 2008, anthropogenic debris was observed at depths of 55–1,280 m (180.5–4,199.5 ft.). The density of debris increased with depth, and the majority of the debris was plastic and metallic, while the rest of it was fabric and glass (Keller et al. 2010).

4.3.5.10 Marine Tourism and Recreation

Tourism is Alaska's second biggest industry in terms of employment, and is the main industry of many small and isolated communities. The coast and some major rivers are the center of Alaska's tourism. Sport fishing is one of the biggest industries along with the growing number of ecotourists visiting the state. In the summer of 2011 alone, there were a total of 1,556,800 visitors to the state. Cruise ship visitors make up a majority of 57 percent or 883,000 of those visitors. The second most popular activity of tourists in Alaska is wildlife viewing (52 percent), much of which occurs on the coast. Between 2006 and 2011, the percentage of visitors from the United States fell by 2 percent, while Canada and the other International categories each increased by 1 percent.

In 2009, visitors to Washington spent $14.2 billion; although this is a decrease from 2008 it was reflective of national trends at the time. Travel and tourism is Washington's fourth largest export industry which supports jobs, bolsters local economies and small businesses and contributes tax revenue for state and local governments. Seattle itself attracts about 9.9 million visitors annually, which

contributes about $463 million in state and local tax revenues. Washington attracts tourists through water trails, the Cascadia Marine Trail, and other ocean tourism ventures that are based on conservation, environmental impact, visitor management, and community relations and education (Labor 1999).

The total overnight trips to the Oregon Coast totaled 9.6 million visitors, which was about 35 percent of the total visitors in 2009. Spending on the coast in 2009 totaled $1.37 billion, with only 10 percent of that total being spent on Recreation and 36 percent on Lodging. Sixty-seven percent of visitors spent their time at the Beach or Waterfront, while 16 percent spent time swimming and 11 percent went fishing (Regional Visitor Research, Oregon 2009). The majority of the tourism industry's employment in Oregon is in accommodation and food services, while 15 percent are in travel and transportation, and the remaining 25 percent is divided between retail trade and arts, entertainment, and recreation. In 2010 there were approximately 161,900 workers in the leisure and hospitality industry, the majority of which were service workers whose wages are low, resulting in a lower average wage. The most recent employment projections forecast that leisure and hospitality will grow about 19 percent from 2010 to 2020. This $2 billion travel and tourism industry plays an important role in Oregon's economy (Jackson-Winegardner 2012).

Between 1990 and 2000, the ocean-related gross state product for California grew by 10.6 percent with one of the largest growth trends experienced in coastal recreation and tourism. California's trend reflects the international trend of coastal tourism and recreation growth which has continued in past decades while other industries have declined. Additionally, the growth is seen in the development of "services" rather than "goods-related" activities (Kildow and Colgan 2005). Stakeholders in tourism services have economical motivation to ensure positive management of marine resources on which their industries are based, therefore the impacts of marine tourism is generally localized and of small magnitude.

Rapid expansion of tourism could increase pressure for additional coastal and urban development which would result in potential indirect and cumulative effects on marine resources (Harriott 2002). The Marine Institute found that the issues relating to tourism included visitor pressures on coastal ecology; carrying capacity; information gap (i.e., insufficient data to assess impacts of tourism); anthropogenic impacts (i.e., displacement of seabirds, habitat and roosting opportunities, conflicts with users and wildlife, altering food sources); threats to ecology; development pressure; infrastructural support; user conflicts; and motorized crafts (Connolly et al. 2001). Naval ship movement in the Study Area may contribute to the cumulative effects of Marine Tourism, as discussed in Section 4.3.5.2 (Commercial and Recreational Fishing) and Section 4.3.5.3 (Maritime Traffic).

4.3.5.11 Commercial and General Aviation

Commercial and general aviation are retained for analysis and discussion due to associated emissions from aviation activities and effects on greenhouse gas. An analysis of greenhouse gas is presented in Section 4.4.4.1 (Greenhouse Gases).

4.3.5.12 2013 Bremerton Ferry Terminal Construction by the Washington State Department of Transportation

To improve, maintain, and preserve the terminals, Washington State Department of Transportation conducts construction, repair and maintenance activities as part of its regular operations. One of these projects is the replacement of wingwall structures at the Bremerton ferry terminal. The Washington State Department of Transportation has received an IHA request for in-water construction from

September 2014 to August 2015. The proposed project will occur in marine waters that support several marine mammal species. The project's timing and duration and specific types of activities (such as pile driving) may result in the incidental taking by acoustical harassment (Level B take) of marine mammals protected under the MMPA. The IHA is for Level B harassment only of six marine mammal species (harbor seal, California sea lion, Steller sea lion, killer whale, gray whale, humpback whale) that may occur in the vicinity of the projects. The current timber wingwalls at the Bremerton terminal are near the end of their design life and are being replaced with steel wingwalls to ensure safe and reliable functioning of the terminal (Washington State Ferries 2012).

4.4 Resource-Specific Cumulative Impacts

4.4.1 Resource Areas Dismissed from Cumulative Impacts Analysis

In accordance with Council on Environmental Quality guidance (Council on Environmental Quality 2010), the cumulative impacts analysis focused on impacts that are "truly meaningful." The level of analysis for each resource was commensurate with the intensity of the impacts identified in Chapter 3 (Affected Environment and Environmental Consequences). The analysis focused on marine mammals, sea turtles, and cultural resources. While each of the following resources is discussed briefly in the following sections, detailed analysis of cumulative impacts on the following resources was not necessary as the incremental contribution of Alternatives 1 and 2 to cumulative impacts would be low. Further analysis of cumulative impacts is not warranted on the following resources:

- Sediments and water quality
- Marine habitats
- Marine vegetation
- Marine invertebrates
- Public health and safety

4.4.2 Sediments and Water Quality

The analysis in Section 3.1 (Sediments and Water Quality) indicates that the alternatives could result in local, short- and long-term changes in sediment and water quality. However, chemical, physical, or biological changes to sediments or water quality would be below applicable standards, regulations, and guidelines and would be within existing conditions or designated uses (Section 3.1.1.2, Methods, lists applicable standards, regulations, and guidelines). The short-term impacts would arise from explosions and the byproducts of explosions and combusted propellants. It is unlikely these short-term impacts would overlap in time and space with other future actions that produce similar constituents. For example, training and testing with explosives would not be expected to occur near operations like the 2013 Bremerton Ferry Terminal Construction, where explosives are already being used. Therefore, the short-term impacts described in Section 3.1 (Sediments and Water Quality) are not expected to contribute to cumulative impacts.

The long-term impacts would arise from unexploded ordnance, noncombusted propellant, metals, and other materials. Long-term impacts of each alternative would be cumulative with other actions that cause increases in similar constituents. However, the incremental contribution of the No Action Alternative, Alternative 1, or Alternative 2 to long-term cumulative impacts would be negligible because

- most training and testing activities are widely dispersed in space and time;
- most components of expended materials are inert or corrode slowly;

- numerically, most of the metals expended are small- and medium-caliber projectiles; metals of concern comprise a small portion of the alloys used in expended materials, and metal corrosion is a slow process that allows for dilution;
- most of the components are subject to a variety of physical, chemical, and biological processes that render them benign; and
- potential areas of impacts would be limited to small zones immediately adjacent to the explosive, metals, or chemicals other than explosives.

Furthermore, none of the alternatives would result in long-term and widespread changes in environmental conditions, such as nutrient loading, turbidity, salinity, or pH (a measure of the degree to which a solution is either acidic [pH less than 7.0] or basic [pH greater than 7.0]).

Based on the analysis presented in Section 3.1 (Sediments and Water Quality) and the reasons summarized above, the changes in sediment or water quality would be measurable, but would still be below applicable state, federal, and U.S. Environmental Protection Agency (USEPA) standards and guidelines; therefore the incremental contribution of Alternatives 1 and 2 to cumulative impacts would be low and further analysis of cumulative impacts is not warranted.

4.4.3 AIR QUALITY

As detailed in Section 3.2 (Air Quality), increased training and testing activities conducted under Alternatives 1 and 2 would result in increased criteria pollutant emissions and hazardous air pollutant emissions throughout the Study Area. Sources of the increased emissions would include vessels and aircraft, and to a lesser extent munitions. Potential impacts include localized and temporarily elevated pollutant concentrations. Recovery would occur quickly as emissions disperse, and there would be no significant impact on air quality. The impacts of Alternatives 1 or 2 would be cumulative with other actions that involve criteria air pollutant and hazardous air pollutant emissions. However, the incremental contribution of Alternatives 1 or 2 to cumulative impacts would be low for the following reasons:

- All of the air emissions sources proposed in this EIS/ OEIS are mobile sources and do not impact the current attainment status.
- Few stationary offshore air pollutant emission sources exist within the Study Area and few are expected in the foreseeable future.
- International regulations by the International Maritime Organization require commercial shipping vessels to switch to lower-sulfur fuel near U.S. and international coasts beginning in 2012 (National Oceanic and Atmospheric Administration 2011a). The DoD has released the Operational Energy Strategy: Implementation Plan which will reduce demand, diversify energy sources, and integrate energy consideration into planning (U.S. Department of Defense 2012). The U.S. Department of the Navy policy commits to a reduction of oil consumption by 50 percent by 2015, 40 percent of the Navy's total energy will come from fossil fuel alternatives and 50 percent of its onshore energy will come from renewable sources by 2020 (Environmental and Energy Study Institute 2009; Paige 2009). Similar low-sulfur fuel regulations in California, including a voluntary state slowdown policy, were found to reduce several pollutants, including sulfur dioxide and particulate matter by as much as 90 percent (Lack et al. 2011).

Based on the analysis presented in Section 3.2 (Air Quality) and the reasons summarized above, the incremental contribution of Alternatives 1 or 2 to cumulative impacts would be low and would still be below applicable state, federal, and USEPA standards and guidelines. Therefore, further analysis of

cumulative impacts on air quality is not warranted. Regulatory framework for greenhouse gases that are related to air quality are discussed below in Section 4.4.4.1.1 (Regulatory Framework).

4.4.4 CLIMATE CHANGE

This section provides background information and an analysis of the cumulative impacts of climate change and greenhouse gas emissions for the Proposed Action. Climate change is also considered in the overall cumulative impacts analysis as another environmental consideration. The Intergovernmental Panel on Climate Change (2007) reports that physical and biological systems on all continents and in most oceans are already being affected by recent climate changes. Global-scale assessment of observed changes shows that it is likely that the increase in greenhouse gas emissions from anthropogenic activities over the last three decades has resulted in an increased temperature, which had a discernible influence on many physical and biological systems. Some of the major potential concerns for the marine environment include sea temperature rise, melting of polar ice, rising sea levels, changes to major ocean current systems, and ocean acidification.

4.4.4.1 Greenhouse Gases

Greenhouse gases are compounds that contribute to the greenhouse effect. The greenhouse effect is a natural phenomenon in which these gases trap heat within the surface-troposphere (lowest portion of the earth's atmosphere) system, causing heating (radiative forcing) at the surface of the earth. The projected warming and more extensive climate-related changes could dramatically alter the region's economy, landscape, character, and quality of life (Le Treut et al. 2007). Scientific evidence indicates a trend of increasing global temperature over the past century due to an increase in greenhouse gas emissions from human activities (U.S. Environmental Protection Agency 2012). Without greenhouse gases the planet's surface would be about 60 degrees Fahrenheit (°F) cooler than present; according to the NOAA and National Aeronautics and Space Administration data, the average surface temperature has increased by about 1.2–1.4°F since 1900. If greenhouse gases continue to increase, models predict that the average temperature at the earth's surface could increase from 2.0 to 11.5°F above the 1990 levels by the end of this century (Le Treut et al. 2007).

Predictions of long-term negative environmental impacts due to global warming include sea level rise, changing weather patterns with increases in the severity of storms and droughts, changes to local and regional ecosystems (including the potential loss of species), melting glaciers and sea ice, thawing permafrost, a longer growing season, and shifts in plant and animal ranges.

In 2009, the United States generated about 6,633.2 teragrams (Tg) (or million metric tons) of carbon dioxide (CO_2) equivalents (Co_2e) (U.S. Environmental Protection Agency 2012). The 2009 inventory data (U.S. Environmental Protection Agency 2012) show that greenhouse gases (carbon dioxide [CO_2], methane [CH_4], and nitrous oxide [N_2O]) contributed from fossil fuel combustion processes from mobile and stationary sources (all sectors) include approximately:

- 5,505.2 Tg of CO_2
- 686.3 Tg CH_4
- 295.6 Tg N_2O

The 6,633.2 Tg CO_2e generated in 2009 was a decrease from the 7,263.4 Tg CO_2e generated in 2007 (U.S. Environmental Protection Agency 2011). Among domestic transportation sources, light-duty vehicles (including passenger cars and light-duty trucks) represented 64 percent of CO_2 emissions, medium- and

heavy-duty trucks 20 percent, commercial aircraft 6 percent, and other sources 9 percent. Across all categories of aviation, CO_2 emissions decreased by 21.6 percent (38.7 Tg) between 1990 and 2009, including a 59 percent (20.3 Tg) decrease in emission from domestic military operations. To place military aircraft in context with other aircraft CO_2 emissions, in 2009, commercial aircraft generated 111.4 Tg CO_2e, military aircraft generated 14.1 Tg CO_2e, and general aviation aircraft generated 13.3 Tg CO_2e. Military aircraft represent roughly 10 percent of emissions from the overall jet fuel combustion category (U.S. Environmental Protection Agency 2012).

This section begins by providing the background and regulatory framework for greenhouse gases. It then provides a quantitative evaluation of changes in greenhouse gas emissions that would occur under the Proposed Action and analyzes the cumulative impacts of greenhouse gas emissions.

4.4.4.1.1 Regulatory Framework

This section addresses and summarizes documents that provide a framework for addressing the effects of climate change and greenhouse gas emissions on training and testing activities in the NWTT Study Area.

Executive Order (EO) 13653, *Preparing the United States for the Impacts of Climate Change*, of November 2013 directs federal agencies to improve preparedness to address the impacts of climate change on human and natural resources. Federal agencies must implement coordinated planning, including cooperation with state, local, private-sector, and non-profit stakeholders to enhance the country's resilience to the effects of climate change. Federal agencies must promote partnerships and information sharing with all levels of government, engage in risk-informed decision-making and develop tools to facilitate decision-making, employ experience-based adaptive management practices, and carry out preparedness planning.

The Department of Defense prepared a Climate Change Adaptation Roadmap in 2014 to implement the directives in EO 13653 (U.S. Department of Defense 2014). The policies and plans outlined in the Roadmap will increase the Department's resilience to the impacts of climate change, which is key to sustaining mission capabilities into the future. The Roadmap establishes three goals: (1) to identify and assess the impacts of climate change on the Department's ability to accomplish its mission, (2) to implement policies and plans to manage short- and long-term risks associated with climate change, and (3) to collaborate with internal and external stakeholders on climate change challenges. The Department identified four "lines of effort" that support these goals, one of which is training and testing, which the Roadmap describes as, "critical to maintaining a capable and ready Force in the face of a rapidly changing strategic setting. Access to land, air, and sea space that replicate the operational environment for training and testing is essential to readiness."

In fulfillment of the first goal, the Roadmap identifies four main climate related phenomena likely to impact the Department's activities: rising global temperatures, changing participation patterns, increasing frequency or intensity of extreme weather events, and sea level rise associated with storm surge. These phenomena have the potential to affect military training and testing activities by increasing the number of days activities are suspended due to adverse weather conditions, further stressing ESA-listed species and dependent ecosystems where training and testing occur, increasing health and safety risks to personnel, and increasing maintenance and repair of infrastructure and equipment used to conduct training and testing. To manage risks associated with climate change (Goal 2), the Department will continue to carry out its sustainable range program, which includes updating and revising its range complex master plans to incorporate new climate change initiatives and processes.

Climate change effects will drive collaboration with stakeholders (Goal 3) and may include shared use of training and testing assets within the military and with our allies, collaboration with maritime and land management agencies, and collaboration with the medical community to address health surveillance and disease treatment programs.

Federal agencies address emissions of greenhouse gases by reporting and meeting reductions mandated in laws, executive orders, and policies. The most recent of these is EO 13693, *Planning for Federal Sustainability in the Next Decade*, issued March 2015. EO 13693 shifts the way the government operates by establishing target greenhouse gas reduction goals for federal agencies. As outlined in the policy, goals shall be achieved by increasing efficiency, reducing energy use, and finding renewable or alternative energy solutions.

Finally, the Council on Environmental Quality Memo, *Draft NEPA Guidance on Consideration of the Impacts of Climate Change and Greenhouse Gas Emissions* states that "if a proposed action would be reasonably anticipated to cause direct emissions of 25,000 metric tons or more of CO_2e greenhouse gas emissions on an annual basis, agencies should consider this an indicator that a quantitative and qualitative assessment may be meaningful to decision makers and the public" (Council on Environmental Quality 2010).

The Navy is committed to improving energy security and environmental stewardship by reducing reliance on fossil fuels and implementing policies, plans, and programs to prepare for the impacts of climate change on the Navy's mission. The Navy is actively developing and participating in energy, environmental, and climate change initiatives that will increase use of alternative energy and help conserve the world's resources for future generations.

4.4.4.2 Cumulative Greenhouse Gas Impacts

Climate change is a global issue, and greenhouse gas emissions are a concern from a cumulative perspective because individual sources of greenhouse gas emissions are not large enough to have an appreciable impact on climate change. This greenhouse gas analysis considers the incremental contribution of Alternatives 1 and 2 to total estimated U.S. greenhouse emissions and their significance on climate change as compared to the No Action Alternative.

To estimate total greenhouse gas emissions, each greenhouse gas was assigned a global warming potential; that is, the ability of a gas or aerosol to trap heat in the atmosphere. The global warming potential rating system is standardized to CO_2, which has a value of one. For example, CH_4 has a global warming potential of 21, which means that it has a global warming effect 21 times greater than CO_2 on an equal-mass basis (Intergovernmental Panel on Climate Change 2007). To simplify greenhouse gas analyses, total greenhouse gas emissions from a source are often expressed as CO_2 Eq. The CO_2 Eq is calculated by multiplying the emissions of each greenhouse gas by its global warming potential and adding the results together to produce a single, combined emission rate representing all greenhouse gases. While CH_4 and N_2O have much higher global warming potentials than CO_2, CO_2 is emitted in much higher quantities, so it is the overwhelming contributor to CO_2 Eq from both natural processes and human activities. Global warming potential-weighted emissions are presented in terms of equivalent emissions of CO_2, using units of Tg (1 million metric tons, or 1 billion kg) of carbon dioxide equivalents (Tg CO_2 Eq).

Greenhouse gas emissions were calculated (Appendix D, Air Quality Example Calculations) for ships and aircraft, which contribute the majority of emissions associated with training and testing in the Study

Area. Greenhouse gas emissions from minor sources such as munitions, weapons platforms, and auxiliary equipment are considered negligible and were not calculated. Ship greenhouse gas emissions were estimated by determining annual ship fuel (typically diesel) use based on proposed activities and multiplying total annual ship fuel consumption by the corresponding emission factors for CO_2, CH_4, and N_2O. Aircraft greenhouse gas emissions were calculated by multiplying jet fuel use rates by the total operating hours, by the corresponding jet fuel emission factors for CO_2, CH_4, and N_2O, and by the total annual sorties. Ship and aircraft greenhouse gas emissions are compared to U.S. 2010 greenhouse gas emissions in Table 4.4-1. The estimated CO_2 Eq emissions from the No Action Alternative are 0.0016 percent of the total CO_2 Eq emissions generated by the United States in 2010. The estimated CO_2 Eq emissions from Alternative 1 and Alternative 2 would increase as a result of increased training and testing activities to about 0.0023 percent of the total CO_2 Eq emissions generated by the United States in 2010.

Table 4.4-1: Comparison of Ship and Aircraft Greenhouse Gas Emissions to United States 2010 Greenhouse Gas Emissions

Alternative	Annual Greenhouse Gas Emissions (teragrams CO_2 Eq)	Percentage of U.S. 2010 Greenhouse Gas Emissions
No Action Alternative	0.107	0.0016
Alternative 1	0.154	0.0023
Alternative 2	0.157	0.0023
U.S. 2010 Greenhouse Gas Emissions	6,821.8	

Notes: CO_2 Eq = carbon dioxide equivalent, U.S. = United States
Source: U.S. Environmental Protection Agency 2012

Based on the analysis presented in Section 3.2 (Air Quality) and the reasons summarized above, the changes in air quality would be measurable, but would still be below applicable standards and guidelines; therefore the incremental contribution of Alternatives 1 and 2 to cumulative greenhouse gas impacts would be low and further analysis of cumulative impacts is not warranted.

4.4.5 MARINE HABITATS

The analysis presented in Section 3.3 (Marine Habitats) indicates that marine habitats would be affected by acoustic stressors (underwater detonations) and physical disturbance or strikes (interactions with vessels and in-water devices, military expended materials, or seafloor devices). Potential impacts include localized disturbance of the seafloor, cratering of soft-bottom sediments, and structural damage to hard-bottom habitats. Impacts on soft-bottom habitats would be short-term, and impacts on hard bottom would be long-term. The impacts of Alternatives 1 and 2 would be cumulative with other actions that cause similar disturbances. However, the incremental contribution of Alternatives 1 or 2 to cumulative impacts would be low for the following reasons:

- Most of the proposed activities that might affect marine habitats would occur in areas where hard bottom does not occur.
- Impacts on soft-bottom habitats would be confined to a limited area, and recovery would occur quickly.

Based on the analysis presented in Section 3.3 (Marine Habitats) and the reasons summarized above, the incremental contribution of Alternatives 1 and 2 to cumulative impacts would be low. Further analysis of cumulative impacts on marine habitats is not warranted.

4.4.6 MARINE MAMMALS

4.4.6.1 Impacts of Alternatives 1 and 2 That May Contribute to Cumulative Impacts

Based on the analysis presented in Section 3.4 (Marine Mammals), impacts of Alternatives 1 and 2 that might contribute to cumulative impacts on marine mammals include injury (Level A harassment under the MMPA) and disturbance or behavioral modification (MMPA Level B harassment). Underwater explosions and sonar have the potential to cause injury or MMPA level A or B harassment, including Permanent Threshold Shift (PTS). However, NMFS has concluded that for Navy activities in the NWTT Study Area, the effects of multiple exposures to active sonar or underwater detonations are not likely to accumulate through altered energy budgets caused by avoidance behavior, physiological stress responses, or the canonical costs of changing behavioral states (National Marine Fisheries Service 2014a). Other relatively short-term activities that might inadvertently harass marine mammals meet the definition of MMPA IHAs. The remaining stressors analyzed in Section 3.4 (Marine Mammals) are not expected to result in mortality or Level A or B harassment. The incremental contribution of these remaining stressors discussed in Sections 3.4.3.3 through 3.4.3.7, to cumulative impacts on marine mammals, would be negligible. The impacts of Alternatives 1 and 2 considered in the cumulative impacts analysis of this Section 4.4.6 are summarized in Chapter 3, Section 3.4 (Marine Mammals).

4.4.6.2 Impacts of Other Actions

4.4.6.2.1 Overview

The potential impacts of other actions that are relevant to the cumulative impact analysis for marine mammals include the following:

- Mortality associated with non-Navy vessel strikes, bycatch in fisheries, and entanglement in fishing and other gear
- Injury associated with non-Navy vessel strikes, bycatch, entanglement, and underwater sound
- Disturbance, behavioral modifications, and reduced animal fitness associated with underwater noise
- Reduced animal fitness associated with water pollution

Most of the other actions and considerations retained for analysis in Table 4.3-1 would include operation of marine vessels. Exceptions include the actions listed under environmental regulations and permitting. Stressors associated with marine vessel operations that are of primary concern for the cumulative impacts analysis includes vessel strikes and underwater noise. Many of the actions would also result in underwater noise from sources other than vessels, seismic surveys, and construction activities. Rather than discussing these stressors for individual actions, their aggregate impacts are considered below as “other environmental considerations” in the maritime traffic and ocean noise subsections. Similarly, many of the actions would result in water pollution. The aggregate impacts of water pollution are addressed in the ocean pollution section (Section 4.4.6.2.5). Bycatch is associated with commercial fishing, and the primary cause of entanglement is commercial fishing. Therefore, these stressors are discussed in the commercial fishing section (Section 4.4.6.3.1).

4.4.6.2.2 Surveillance Towed Array Sensor System Low Frequency Active Sonar

Potential impacts on marine mammals from Surveillance Towed Array Sensor System Low Frequency Active Sonar operations include (1) nonauditory injury,[2] (2) permanent loss of hearing, (3) temporary loss of hearing, (4) behavioral change, and (5) masking. The potential effects from Surveillance Towed Array Sensor System Low Frequency Active Sonar operations on any stock of marine mammals from injury (nonauditory or permanent loss of hearing) are considered negligible, and the potential effects on the stock of any marine mammal from temporary loss of hearing or behavioral change (significant change in a biologically important behavior) are considered minimal. Any auditory masking in marine mammals due to low-frequency active sonar signal transmissions is not expected to be severe and would be temporary. The operation of Surveillance Towed Array Sensor System Low Frequency Active Sonar with monitoring and mitigation would result in no mortality. The likelihood of low-frequency active sonar transmissions causing marine mammals to strand is negligible (U.S. Department of the Navy 2011).

4.4.6.2.3 Maritime Traffic and Vessel Strikes

Vessel strikes have been and will continue to be a cause of marine mammal mortality and injury throughout the Study Area. A review of the impacts of vessel strikes on marine mammals is presented in Section 3.4.3.4.1 (Impacts from Vessel Strikes). In particular, certain large whales, such as the blue whale, are more prone to vessel strikes (Berman-Kowalewski et al. 2010; Betz et al. 2011). The most vulnerable marine mammals are thought to be those that spend extended periods at the surface or species whose unresponsiveness to vessel sound makes them more susceptible to vessel collisions (Gerstein 2002; Laist and Shaw 2006; Nowacek et al. 2004). Marine mammals such as dolphins, porpoises, and pinnipeds that can move quickly throughout the water column are not as susceptible to vessel strikes. Most vessel strikes of marine mammals reported involve commercial vessels and occur over or near the continental shelf (Laist et al. 2001). The literature review by Laist et al. (2001) concluded that vessel strikes likely have a negligible impact on the status of most whale populations, but that for small populations, vessel strikes may have considerable population-level impacts. The conservation status and abundance of the species struck would determine in large part whether the injury would have population-level impacts on that species (Laist et al. 2001; Vanderlaan and Taggart 2009). There has never been a Navy vessel strike to a marine mammal in the Study Area during any previous training or testing activities.

Mysticetes

Virtually all of the rorqual whale species have been documented to have been hit by vessels. This includes blue whales (Berman-Kowalewski et al. 2010; Van Waerebeek et al. 2007; Calambokidis 2012), fin whales (as recently as November 2011 in San Diego) (Van Waerebeek et al. 2007; Douglas et al. 2008), sei whales (Felix and Van Waerebeek 2005; Van Waerebeek et al. 2007), Bryde's whales (Felix and Van Waerebeek 2005; Van Waerebeek et al. 2007), minke whales (Van Waerebeek et al. 2007), and humpback whales (Lammers et al. 2003; Van Waerebeek et al. 2007; Douglas et al. 2008).

Odontocetes

Sperm whales may be exceptionally vulnerable to vessel strikes as they spend extended periods of time "rafting" at the surface in order to restore oxygen levels within their tissues after deep dives (Jaquet and Whitehead 1996; Watkins et al. 1999). There were also instances in which sperm whales approached

[2] Nonauditory injury can be defined as not relating to or functioning in hearing (Merriam-Webster 2012); this includes mortality, strike, and lung injury.

vessels too closely and were cut by the propellers (Aguilar de Soto et al. 2006). In general, odontocetes move quickly and seem to be less vulnerable to vessel strikes than other cetaceans; however, most small whale and dolphin species have at least occasionally suffered from vessel strikes including: killer whale (Visser and Fertl 2000; Van Waerebeek et al. 2007); short-finned and long-finned pilot whales (Aguilar et al. 2000; Van Waerebeek et al. 2007); bottlenose dolphin (Bloom and Jager 1994; Wells and Scott 1997; Van Waerebeek et al. 2007); white-beaked dolphin, short-beaked common dolphin, striped dolphin, Atlantic spotted dolphin, and pygmy sperm whales (*Kogia breviceps*) (Van Waerebeek et al. 2007); and spinner dolphin (Camargo and Bellini 2007; Van Waerebeek et al. 2007). Beaked whales documented in vessel strikes include: Arnoux's beaked whale (Van Waerebeek et al. 2007), Cuvier's beaked whale (Aguilar et al. 2000; Van Waerebeek et al. 2007), and several species of *Mesoplodon* (Van Waerebeek et al. 2007). However, evidence suggests that beaked whales may be able to hear the low-frequency sounds of large vessels and thus avoid collision (Ketten 1998).

Pinnipeds

Pinnipeds in general appear to suffer fewer impacts from ship strikes than do cetaceans. This may be due, at least in part, to the large amount of time they spend on land (especially when resting and breeding), and their high maneuverability in the water. However, California sea lions are often attracted to fishing vessels or when food is available onboard or nearby (Hanan et al. 1989), and this may make them somewhat more at risk of being hit by a vessel during these times. Ship strikes are not a major concern for pinnipeds in general (Antonelis et al. 2006; Marine Mammal Commission 2002; National Marine Fisheries Service 2007).

Sea Otter

Sea otter are not expected to be at risk from vessel strike since they spend the majority of time in the water in nearshore and shallow water areas where vessels generally are not present.

4.4.6.2.4 Ocean Noise

As summarized by the National Academies of Science, the possibility that anthropogenic sound could harm marine mammals or significantly interfere with their normal activities is an issue of concern (National Research Council of the National Academies 2005). Noise is of particular concern to marine mammals because many species use sound as a primary sense for navigating, finding prey, and communicating with other individuals. Noise can cause behavioral disturbances, mask other sounds (including their own vocalizations), result in injury, and in some cases, even lead to death (Tyack 2009a; Tyack 2009b; Würsig and Richardson 2008). Human-caused noises in the marine environment come from shipping, seismic and geologic exploration, military training, and other types of pulses produced by government, commercial, industry, and private sources. In addition, noise from whale-watching vessels near marine mammals has received a great deal of attention (Wartzok 2009).

NMFS currently states that underwater SPLs above 190 dB root mean square (rms) could cause injury (Level A harassment) in pinnipeds and SPLs above 180 dB rms could cause injury (Level A harassment) in cetaceans. Federal Register Notice (Vol. 70 pp. 1871-1875) established thresholds for behavioral harassment of marine mammals (Level B harassment) at 160 dB rms for pulsed sounds, such as those produced by impact pile driving, and at 120 dB rms for continuous sounds, such as those produced by vibratory pile driving. Based on the established thresholds, the pile driving and construction noise from projects in the Hood Canal and Puget Sound have the potential to impact pinnipeds and cetaceans.

Assessing whether a sound may disturb or injure a marine mammal involves understanding the characteristics of the acoustic sources, the marine mammals that may be present near the sound, and

the effects that sound may have on the physiology and behavior of those marine mammals. Although it is known that sound is important for marine mammal communication, navigation, and foraging, there are many unknowns in assessing the specific effects and significance of responses by marine mammals to sound exposures such as what activity the animal is engaged in at the time of the exposure (National Research Council of the National Academies 2003, 2005; Nowacek et al. 2007; Southall et al. 2007). Potential impacts on marine mammals from ocean noise include behavioral reactions, hearing loss in the form of Temporary Threshold Shift (TTS) or PTS, auditory masking, injury, and mortality. Section 3.4.3.1 (Acoustic Stressors) discusses these and other possible impacts of ocean noise on marine mammals.

4.4.6.2.5 Ocean Pollution

As discussed in Section 3.4.3 (Environmental Consequences), pollutants from multiple sources are present in, and continue to be released into, the oceans. Elevated concentrations of certain compounds have been measured in tissue samples from marine mammals. Long-term exposure to pollutants poses potential risks to the health of marine mammals, although for the most part, the impacts are just starting to be understood (Reijnders et al. 2008). Section 3.4.3 (Environmental Consequences) provides an overview of these potential impacts, which include organ anomalies and impaired reproduction and immune function (Reijnders et al. 2008).

Oil spills are also a risk for marine mammals. Whales, dolphins, and pinnipeds are all air breathers and must come to the surface frequently to take a breath of air. In a large oil spill, these animals may be exposed to volatile chemicals during inhalation. Cetaceans have no fur that could be oiled and do not depend on fur for insulation. They are not susceptible to the insulation effects (hypothermia); however, haired marine mammals such as fur seals or sea otters would be at risk of insulation effects. Oil and other chemicals on skin and body may result in skin and eye irritation, burns to mucous membranes of eyes and mouth, and increased susceptibility to infection. For large whales, oil can foul the baleen they use to filter-feed, thereby potentially decreasing their ability to eat. Inhalation of volatile organics from oil or dispersants can result in respiratory irritation, inflammation, emphysema, or pneumonia. Ingestion of oil or dispersants may result in gastrointestinal inflammation, ulcers, bleeding, diarrhea, and maldigestion. Finally, absorption of inhaled and ingested chemicals may damage organs such as the liver or kidney, result in anemia and immune suppression, or lead to reproductive failure or death (National Marine Fisheries Service 2010). If the health of an individual marine mammal were compromised by long-term exposure to pollutants, it is possible that this condition could alter the animal's expected response to stressors associated with Alternatives 1 and 2. The behavioral and physiological responses of any marine mammal to a potential stressor, such as underwater sound, could be influenced by a number of other factors, including disease, dietary stress, body burden of toxic chemicals, energetic stress, percentage body fat, age, reproductive state, size, and social position. Synergistic impacts are also possible. For example, animals exposed to some chemicals may be more susceptible to noise-induced loss of hearing sensitivity (Fechter 2005). While the response of a previously stressed animal might be different than the response of an unstressed animal, there are no data available at this time to accurately predict how stress caused by various ocean pollutants would alter a marine mammal's response to stressors associated with Alternatives 1 and 2.

4.4.6.3 Coastal Development

Coastal development and increased human populations in coastal areas will continue to have impacts on marine mammals such as increased tourism, non-point source pollution and runoff, power plant entrainment, and degradation of nearshore water quality and seagrass beds (see Section 3.4, Marine Mammals, for more information on impacts on marine mammals).

4.4.6.3.1 Commercial Fishing

Several commercial fisheries operate in the Study Area. Potential impacts from these activities include marine mammal injury and mortality from bycatch and entanglement. Fisheries have also resulted in profound changes to the structure and function of marine ecosystems that adversely affect marine mammals.

Numerous ports in or near the Study Area contain both commercial and commercial passenger vessel (i.e., recreational) fishing fleets that use the ocean areas within the Study Area.

Fisheries activities on a global scale remain a key threat for a number of marine mammal species; however, the best available data indicates that the majority of commercial fisheries operating within the Study Area rarely take marine mammals. In those instances where fisheries interactions rise to the level of "occasional" mortalities or serious injuries, NOAA is working to identify and reduce mortality to insignificant levels as mandated by the MMPA (78 FR 53336). In 1994, the MMPA was amended to formally address bycatch. Estimates of bycatch in the Pacific declined by a total of 96 percent from 1994 to 2006 (Geijer and Read 2013). Cetacean bycatch declined by 85 percent from 342 in 1994 to 53 in 2006, and pinniped bycatch declined from 1,332 to 53 over the same time period (Northridge 2008, Read 2008, Hamer et al. 2010; Geijer and Read 2013).

As discussed in Section 3.4.3.5 (Entanglement Stressors), entanglement in fishing gear is another major threat to marine mammals in the Study Area. Along the U.S. west coast, from 1982 to 2010, there have been 272 reported entangled whales (Saez et al. 2012). Entanglements were seen throughout the coast with concentrations near areas where there is higher human population. Identified entangling gear types have included trap/pot, bottom set longline, and gillnets. Gillnets were the entangling gear type in the majority of reports pre-2000 (64 percent) and trap/pot are the majority post-2000 (45 percent). In the late 1990s, California gillnet regulations changed, resulting in a shift and reduction of gillnet fishing effort. Gray and humpback whales are the most frequently reported entangled large whale species along the U.S. west coast. In California, there were a reported 150 gray whales, 47 humpback whales, 27 unidentified whales, 14 sperm whales, 6 minke whales, and 3 fin whales entangled in fishing gear (Saez et al. 2012).

Overfishing of many fish stocks has resulted in significant changes in trophic structure, species assemblages, and pathways of energy flow in marine ecosystems (Jackson et al. 2001; Myers and Worm 2003; Pauly et al. 1998). These ecological changes may have important and likely adverse consequences for populations of marine mammals (DeMaster et al. 2001). However, fish stocks within the Study Area are recovering from their overfished status and contributing to the overall trend of increasing abundance of U.S. marine fish stocks (National Marine Fisheries Service 2013; National Marine Fisheries Service 2014b).

In summary, future commercial fishing activities in the Study Area are expected to result in negative effects on individual animals of some marine mammal species because some injury and mortality is likely to occur for animals taken as fisheries bycatch or entangled in lost fishing gear. Fisheries-associated mortality for marine mammals within the Study Area is not expected to contribute to population declines for marine mammal species (78 FR 53336). Ecological changes brought about by commercial fishing may also adversely affect marine mammals in the Study Area.

4.4.6.4 Cumulative Impacts on Marine Mammals

The aggregate impacts of past, present, and reasonably foreseeable future actions are expected to result in significant impacts on some marine mammal species in the Study Area. The impacts are considered significant because the cumulative effects of vessel strikes, bycatch, and entanglement associated with other actions are expected to result in relatively high rates of injury and mortality that could cause population declines in some species. Alternatives 1 and 2 could also result in injury or behavioral impacts to individuals of some marine mammal species from underwater explosions and sonar. Injury that might occur under Alternatives 1 and 2 would be additive to injury and mortality associated with other actions. However, the relative contribution of the Proposed Action to the overall injury and mortality would be low compared to other actions. The Navy does not anticipate mortalities to marine mammals within the Study Area as a result of training or testing activities under any of the alternatives. While quantitative estimates of marine mammal mortality from other actions are not available, the total bycatch estimate (lethal takes and serious injuries) for marine mammals for 39 fisheries and 54 marine mammal stocks throughout the United States was 1,887 individual animals in 2005 (National Oceanic and Atmospheric Administration 2011c). Some of these mortalities likely occurred in the Study Area or affected individuals that used the Study Area seasonally.

Ocean noise associated with other actions (see Section 4.4.6.2.4, Ocean Noise) and acoustic stressors (underwater explosions and sonar) associated with Alternatives 1 and 2 would not result in additive behavioral impacts on marine mammals. The vast majority of impacts expected from sonar exposure and underwater detonations are behavioral in nature, temporary and comparatively short in duration, relatively infrequent, and not of the type or severity that would be expected to be additive for the small portion of the stocks and species likely to be exposed either annually or over the remaining period of the 5-year MMPA regulations or in the reasonably foreseeable future. Other future actions such as pier construction would be expected to result in MMPA Level B harassment. However in the Offshore Area, it is unlikely that these actions and underwater explosions or sonar use would overlap in time and space because these activities are dispersed and the sound sources are intermittent. Training and testing Activities in the Hood Canal may overlap with previously discussed construction events, such as the EHW-2 construction activities. The noise from these activities could combine with training and testing events to make impacts more intense, or cause additive impacts over time to the marine mammals in the area. However, most of these other actions are not compatible and therefore construction and training and testing activities are not likely to take place at the same time.

It is likely that distant shipping noise, which is more universal and continuous, and sound associated with underwater explosions and sonar would overlap in time and space. However, there is no evidence indicating that the co-occurrence of shipping noise and sounds associated with underwater explosions and sonar use would result in harmful additive impacts on marine mammals.

As discussed in Section 4.4.6.2.5 (Ocean Pollution), the potential also exists for the impacts of ocean pollution and acoustic stressors associated with Alternatives 1 and 2 to be additive or synergistic. It is possible that the response of a previously stressed animal would be more severe than the response of an unstressed animal.

In summary, based on the analysis presented in Section 3.4 (Marine Mammals), the current aggregate impacts of past and present actions and reasonably foreseeable future actions are expected to result in recoverable impacts to most marine mammal species, and significant impacts on some in the Study Area. Therefore, cumulative impacts on marine mammals would be significant without consideration of

the impacts of Alternatives 1 or 2. Alternatives 1 and 2 would contribute to and have the potential to increase cumulative impacts, but the relative contribution would be low compared to other actions.

4.4.7 SEA TURTLES

4.4.7.1 Impacts of Alternatives 1 and 2 That May Contribute to Cumulative Impacts

Impacts of Alternatives 1 and 2 that might contribute to cumulative impacts on sea turtles include mortality, injury, and short-term disturbance or behavioral modification. Under Alternatives 1 and 2, one sea turtle is modeled to experience TTS from the use of Sonar and Other Active Non-Impulse Acoustic Sources in the Offshore Area during training activities, and five sea turtles are modeled to experience TTS under Alternative 1 and 2 for testing activities. However, results from Navy modeling indicate no leatherback sea turtles are predicted to be exposed to impulse levels associated with the onset of mortality and gastrointestinal tract injury over any training year for explosives use in open ocean habitats. Pronounced reactions to acoustic stimuli could lead to a sea turtle expending energy and missing opportunities to forage or breed. In most cases, acoustic exposures are intermittent, allowing time to recover from an incurred energetic cost, resulting in no long-term consequence. Because model-predicted impacts are conservative and any impacts would be short-term, potential impacts are not expected to result in substantial changes to behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment, and are not expected to result in population-level impacts. Under Alternative 1, and Alternative 2, exposure to vessels used in training and testing activities may cause short-term disturbance to an individual turtle because, if a turtle were struck, it could lead to injury or death. As demonstrated by scars on all species of sea turtles, they are not always able to avoid being struck; therefore, vessel strikes are a potential cause of mortality for these species. Although the likelihood of being struck is minimal, sea turtles that overlap with Navy exercises are more likely to encounter vessels. Exposure to vessels may change an individual's behavior, growth, survival, annual reproductive success, or lifetime reproductive success (fitness). Exposure to vessels is not expected to result in population-level impacts.

The Navy's Annual Model-Predicted Impacts on Leatherback Sea Turtles (*Dermochelys coriacea*) from Explosions for Training and Testing Activities under the No Action Alternative, Alternative 1, and Alternative 2 are presented in Table 3.5-7 and are predicted to be zero for TTS, PTS, Gastrointestinal Tract Injury, Slight Lung Injury, and Mortality. Leatherback sea turtles (*Dermochelys coriacea*) are found in the Study Area while other species of sea turtle were found to be extralimital species to the Study Area. Therefore the Leatherback sea turtle would be more likely to be affected, but is still not likely to be adversely affected, by the remaining stressors analyzed in Section 3.5 (Sea Turtles). The incremental contribution of these remaining stressors to cumulative impacts on sea turtles would be negligible. Therefore, these stressors are not considered further in the cumulative impacts analysis.

4.4.7.2 Impacts of Other Actions

The potential impacts of other actions that are relevant to the cumulative impact analysis for sea turtles include the following:

- Mortality associated with vessel strikes, bycatch in fisheries, entanglement, and stressors associated with coastal development and human use of coastal environments (e.g., beach vehicular driving, power plant entrainment [sea turtles being caught in power plant outflow water], etc.)
- Injury associated with vessel strikes, bycatch, entanglement, and underwater sound

- Disturbance, behavioral modifications, and reduced animal fitness associated with underwater noise
- Reduced animal fitness associated with ocean pollution
- Habitat loss related to coastal development

Most of the other actions and considerations retained for analysis in Section 3.5 (Sea Turtles) would include operation of marine vessels. Exceptions include the actions listed under environmental regulations and planning. Stressors associated with marine vessel operations that are of primary concern for the cumulative impacts analysis includes vessel strikes and underwater noise. Many of the actions would also result in underwater noise from sources other than vessels. Rather than discussing these stressors for individual actions, their aggregate impacts are considered below as "other environmental considerations" in maritime traffic (see Section 4.4.6.2.3, Maritime Traffic and Vessel Strikes) and ocean noise (see Section 4.4.6.2.4, Ocean Noise). Similarly, many of the actions would result in ocean pollution. The aggregate impacts of water pollution are addressed below in the ocean pollution section (see Section 4.4.6.2.5, Ocean Pollution). Bycatch is associated with commercial fishing, and the primary cause of entanglement is commercial fishing. Therefore, these stressors are discussed below in the commercial fishing section (see Section 4.4.6.3.1, Commercial Fishing).

4.4.7.3 Maritime Traffic and Vessel Strikes

Maritime traffic has increased over the past 50 years, and continued increases are expected in the future. Vessel strikes have been and will continue to be a cause of sea turtle mortality and injury throughout portions of the Study Area. Though it is unlikely due to the widespread, scattered distribution of turtles and vessels at sea, strikes do occur in the Offshore Area of the Study Area where sea turtles are regularly found.

Some vessel strikes would cause temporary reversible impacts, such as diverting the turtle from its previous activity or causing minor injury. A National Research Council report qualitatively ranked the relative importance of various mortality factors for sea turtles. Vessel strikes were ranked 10th, behind leading factors of shrimp trawling and other fisheries (National Research Council 1990). Major strikes would cause permanent injury or death from bleeding, infection, or inability to feed. Apart from the severity of the physical strike, the likelihood and rate of a turtle's recovery from a strike may be influenced by its age, reproductive state, and general condition. Much of what is written about recovery from vessel strikes is inferred from observing individuals some time after a strike. Numerous living sea turtles bear scars that appear to have been caused by propeller cuts or collisions with vessel hulls, suggesting that not all vessel strikes are lethal (Hazel et al. 2007, Lutcavage et al. 1997). Conversely, fresh wounds on some stranded animals may strongly suggest a vessel strike as the cause of death. The actual incidence of recovery versus death is not known, given available data.

4.4.7.4 Ocean Noise

Potential impacts on sea turtles from ocean noise include behavioral reactions, hearing loss in the form of TTS or PTS, auditory masking, injury, and mortality. Section 3.5.3.1 (Acoustic Stressors) discusses these and other possible impacts of ocean noise on sea turtles.

4.4.7.5 Ocean Pollution

Marine debris can also be a problem for sea turtles through entanglement or ingestion. Sea turtles can mistake debris for prey; one study found 37 percent of dead leatherbacks to have ingested various types of plastic (Mrosovsky et al. 2009). Other marine debris, including abandoned fishing gear and cargo nets,

can entangle and drown turtles in all life stages. Oil spills are also a risk for sea turtles. Several aspects of sea turtles' life histories put them at risk, including the lack of avoidance behavior of oiled waters and indiscriminate feeding in convergence zones. Sea turtles are air breathers and come to the surface frequently to breathe. In a large oil spill, these animals may be exposed to volatile chemicals during inhalation (National Marine Fisheries Service 2010).

Oil and other chemicals on skin and body may result in skin and eye irritation, burns to mucous membranes of eyes and mouth, and increased susceptibility to infection. Inhalation of volatile organics from oil or dispersants may result in respiratory irritation, tissue injury, and pneumonia. Ingestion of oil or dispersants may result in gastrointestinal inflammation, ulcers, bleeding, diarrhea, and maldigestion. Absorption of inhaled and ingested chemicals may damage organs such as the liver or kidney, result in anemia and immune suppression, or lead to reproductive failure or death (National Marine Fisheries Service 2010).

4.4.7.6 Commercial Fishing

Bycatch is one of the most serious threats to the recovery and conservation of sea turtle populations worldwide (National Research Council 1990; Wallace et al. 2010). Among fisheries that incidentally capture sea turtles, certain types of trawl, gillnet, and longline fisheries generally pose the greatest threat. One comprehensive study estimated that worldwide, 447,000 turtles are killed each year from bycatch in commercial fisheries (Wallace et al. 2010). Other fisheries that result in sea turtle bycatch in the Study Area include pelagic fisheries for swordfish, tuna, shark, and billfish; purse seine fisheries for tuna; commercial and recreational rod and reel fisheries; gillnet fisheries for shark; driftnet fisheries; and bottom longline fisheries (Jannot et al. 2011).Marine waters of the Study Area are too cold for most turtle species, and the only sea turtle species that regularly occurs during warmer periods within the Study Area is the leatherback turtle, *Dermochelys coriacea*. In a report of bycatch of marine mammals, seabirds, and sea turtles in the U.S. West Coast commercial groundfish fisheries over 2002–2009, NMFS noted that one leatherback turtle had been recorded as bycatch over the 8-year study period (Jannot et al. 2011).

4.4.7.7 Coastal Development

Coastal development and increased human populations in coastal areas will continue to have impacts on sea turtles such as increased tourism, non-point source pollution and runoff, power plant entrainment, and degradation of nearshore water quality and seagrass beds (see Section 3.5, Sea Turtles, for more information on impacts on sea turtles).

4.4.7.8 Cumulative Impacts on Sea Turtles

Cumulative aggregate non-Navy impacts to sea turtles are considered significant because bycatch, vessel strikes, entanglement, and other stressors associated with other non-Navy actions may result in high rates of injury and mortality that could cause population declines or inhibit recovery of ESA-listed species, such as the leatherback sea turtle (*Dermochelys coriacea*). Modeling for the Proposed Action indicated that leatherback sea turtles would have the potential to experience only TTS from Sonar and Other Active Non-Impulse Acoustic Sources, and no injuries or mortalities from underwater explosions or sonar would occur. Although potential impacts on the leatherback sea turtle from the other activities of the Navy's Proposed Action could include injury or mortality, impacts are not expected to decrease the overall fitness or result in long-term population-level impacts on any given population. Therefore, the relative contribution of Alternatives 1 and 2 to aggregate impacts to sea turtles would be minimal compared to other non-Navy actions.

The vast majority of impacts expected from ocean noise (see Section 4.4.6.2.4, Ocean Noise) and acoustic stressors (underwater explosions and sonar) associated with Alternatives 1 and 2 are behavioral in nature, temporary and comparatively short in duration, relatively infrequent, and not of the type or severity that would be expected to be additive for the small number of turtles and species likely to be exposed either annually or in the reasonably foreseeable future. Other future actions such as operation of wave and tidal energy facilities would be expected to result in similar impacts. However, it is unlikely that these actions and underwater explosions or sonar use would overlap in time and space because all of these activities are widespread and the sound sources are intermittent. Furthermore, most of these other actions are not compatible with or could interfere with training and testing activities that involve underwater explosions and sonar use. The Navy takes appropriate steps to avoid activities that interfere with or are not compatible with training and testing.

It is likely that distant shipping noise (which is more pervasive and continuous) and sound associated with underwater explosions and sonar would overlap in time and space. However, there is no evidence indicating that the co-occurrence of shipping noise and sounds associated with underwater explosions and sonar use would result in harmful additive impacts on sea turtles. Most underwater explosions and sonar activities would consist of a limited number of detonations, and exposures would not occur over long durations; therefore, there would be an opportunity for sea turtles to recover from an incurred energetic cost of any significant behavioral reactions.

The potential also exists for the impacts of ocean pollution and acoustic stressors associated with Alternatives 1 and 2 to be additive or synergistic. It is possible that the response of a previously stressed animal would be more severe than the response of an unstressed animal. However, there are no data indicating that a sea turtle affected by ocean pollution would be more susceptible to stressors associated with Alternatives 1 and 2.

In summary, cumulative impacts on sea turtles would be significant without consideration of the impacts of Alternatives 1 and 2, which would be intermittent, allowing time for recovery and resulting in no cumulative consequence. Alternatives 1 and 2 would contribute to and have the potential to increase cumulative impacts, but the relative contribution would be low compared to other actions.

4.4.8 BIRDS

4.4.8.1 Impacts of Alternatives 1 and 2 That May Contribute to Cumulative Impacts

Impacts of Alternatives 1 and 2 that might contribute to cumulative impacts on birds include mortality, injury, and short-term disturbance or behavioral modification. Mortality or injury could be caused by underwater explosions, air strikes, or vessel strikes. Noninjurious impacts of underwater explosions and sonar use would include short-term disturbance or behavioral modification. The Navy's ESA determinations presented in Table 3.6-3 are "no effect" or "may affect, not likely to adversely affect" for the remaining stressors analyzed in Section 3.6 (Birds). The incremental contribution of these remaining stressors to cumulative impacts on Birds would be negligible. Therefore, these stressors are not considered further in the cumulative impacts analysis. The impacts of Alternatives 1 and 2 considered in the cumulative impacts analysis are summarized in Table 3.6-10 (Summary of Endangered Species Act Effects Determinations for Birds, for the Preferred Alternative).

4.4.8.2 Impacts of Other Actions

The potential impacts of other actions that are relevant to the cumulative impact analysis for birds include the following:

- Incidental mortality from interactions with commercial and recreational fishing gear
- Predation by introduced species
- Disturbance and degradation of nesting and foraging areas by humans and domesticated animals
- Noise from construction and other human activities
- Nocturnal collisions with power lines and artificial lights
- Collisions with aircraft
- Pollution such as that from oil spills and plastic debris
- Disease, storms, and harmful algal blooms
- Long-term climate change

Most of the other actions and considerations retained for analysis in Section 3.6 (Birds) would include acoustic stressors (sonar and other underwater active acoustic sources, explosive detonations, vessel noise, and aircraft noise), physical disturbance and strikes (aircraft, vessels and in-water devices, military expended materials [non-explosive]), and ingestion (military expended materials other than ordnance). Exceptions include the actions listed under environmental regulations and planning. Many of the actions would also result in noise from sources other than vessels. Rather than discussing these stressors for individual actions, their aggregate impacts are considered below as "other environmental considerations." Similarly, many of the actions would result in ocean pollution. The aggregate impacts of water pollution are addressed below in the ocean pollution section (Section 4.4.8.2.3, Ocean Pollution).

4.4.8.2.1 Maritime Traffic, Vessel Strikes, Air Traffic, and Air Strikes

Maritime traffic has increased over the past 50 years, and continued increases are expected in the future. Vessel strikes have been and will continue to be a cause of seabird mortality and injury throughout portions of the Study Area. Though it is unlikely due to the widespread, scattered distribution of seabirds and vessels at sea, strikes do occur in the offshore area of the Study Area where seabirds are regularly found.

Some vessel strikes would cause temporary reversible impacts, such as diverting the seabird from its previous activity or causing minor injury. Major strikes would cause permanent injury or death from bleeding, infection, or inability to feed. Apart from the severity of the physical strike, the likelihood and rate of a seabird's recovery from a strike may be influenced by its age, reproductive state, and general condition. Much of what is written about recovery from vessel strikes is inferred from observing individuals some time after a strike. Fresh wounds on some stranded animals may strongly suggest a vessel strike as the cause of death. The actual incidence of recovery versus death is not known, given available data.

Thousands of birds are struck each year by civilian and military aircraft. The Federal Aviation Administration annually reports at least 2,300 wildlife related strikes involving civilian aircraft, and the Air Force and Navy report at least an additional 3,000 strikes a year. Pilots and crew use the same airspace as large concentrations of birds, and in an effort to provide the safest conditions for flying possible, the DoD continually implements and improves its aviation programs. One program that it implements is called the Bird Aircraft Strike Hazard (BASH) prevention program. Radar is one of the most effective tools for detecting bird movements. Many types of radar are used at different scales; the Doppler capability of weather surveillance can show the direction and speed of migrating bird flocks up to 60 nm from an airfield during the day or the night (U.S. Department of Defense 2010).

In local airfield environments, mobile marine radars can track real-time movements of individual birds or flocks adjacent to and in a 6–8 mi. (9.7–12.9 km) radius of runways. The Air Force and Navy are developing and testing several "bird radars" to determine which models and configurations can best isolate specific locations of birds where aircraft operations can be modified and environmental management strategies applied to reduce air strikes. Computer models use radar data, historic weather conditions, Audubon Society Christmas Bird Count Data, bird strike reports, and other historical data to help predict spatial and temporal patterns of bird movements. One model, a predictive Bird Avoidance Model (BAM), was developed using geographic information system (GIS) technology as a key tool for analysis and correlation of bird habitat, migration, and breeding characteristics, combined with key environmental and geospatial data. Integral to a successful BASH program is a good working relationship with airport managers and the consistent reporting and identification of species involved in strike events. By identifying the wildlife species involved and the location of the strike, researchers and airport managers can better understand why the species is attracted to a particular area of the airport or training route (U.S. Department of Defense 2010).

4.4.8.2.2 Noise

Potential impacts on birds from ocean noise include behavioral reactions, hearing loss in the form of TTS or PTS, auditory masking, injury, and mortality. Section 3.6.3.1 (Acoustic Stressors) discusses these and other possible impacts of ocean noise on seabirds.

4.4.8.2.3 Ocean Pollution

Marine debris can also be a problem for seabirds through entanglement or ingestion. Seabirds can mistake debris for prey and 44 percent of seabirds are affected by plastic marine debris (Cousteau 2012). Other marine debris, including abandoned fishing gear and cargo nets, can entangle and drown seabirds in all life stages. Oil spills are also a risk for seabirds. Oil sticks to a bird's feathers, which causes them to mat and separate, impairing waterproofing and exposing the bird's skin to extremes in temperature. The result can be hypothermia, meaning the bird becomes cold, or hyperthermia, which results in overheating. Instinctively, birds try to get the oil off their feathers by preening, which results in the animals ingesting the oil and causes severe damage to internal organs. Many oil-soaked birds lose their buoyancy and beach themselves in their attempt to escape the cold water (International Bird Rescue 2014).

4.4.8.2.4 Coastal Development

Coastal development and increased human population in coastal areas will continue to have impacts on birds related to increased tourism, non-point source pollution and runoff, habitat encroachment, and degradation of nearshore water quality and seagrass beds (see Section 3.6, Birds, for more information on Coastal Development and its impacts on birds).

4.4.8.3 Cumulative Impacts on Birds

The aggregate impacts of past, present, and reasonably foreseeable future actions may have a significant effect on birds. These aggregate impacts are considered significant because air strikes, vessel strikes, entanglement and other stressors associated with other actions are expected to result in high rates of injury and mortality that could cause population declines to ESA-listed species or inhibit species recovery. Alternatives 1 and 2 could also result in injury and mortality to individual birds from underwater explosions, sonar, and strikes. Injury and mortality that might occur under Alternatives 1 and 2 would be additive to injury and mortality associated with other actions. However, the relative

contribution of Alternatives 1 and 2 to the overall injury and mortality would be low compared to other actions such as bycatch, storm runoff, plastic debris, and other non-military activities.

Seabird distribution, abundance, breeding, and other behaviors are affected by cyclical environmental events such as the El Niño Southern Oscillation and Pacific Decadal Oscillation in the Pacific Ocean (Vandenbosch 2000). In the long term, climate change could be the largest threat to seabirds (North American Bird Conservation Initiative 2010). Climate change effects include changes in air and sea temperatures, precipitation, the frequency and intensity of storms, pH level of sea water, and sea level. These changes could affect overall marine productivity, which could affect the food resources, distribution, and reproductive success of seabirds (Aebischer et al. 1990; Congdon et al. 2007). The projection for global sea levels rise from 2090 to 2099 is up to 1 ft. (0.3 m) relative to 1980 to 1999 levels (Church and White 2006; Solomon et al. 2007). As a result, seabird nesting colonies that occur along sections of coastlines undergoing sea level rise may experience a loss of nesting habitat (Congdon et al. 2007; Gilman and Ellison 2009; Gilman et al. 2008; Hitipeuw et al. 2007; Mullane and Suzuki 1997).

Ocean noise associated with other actions and acoustic stressors (underwater explosions and sonar) associated with Alternatives 1 and 2 could also result in additive behavioral impacts on birds. Other future actions, such as construction of wharfs, would be expected to result in similar impacts. These actions and underwater explosions or sonar use may overlap in time and space; however, all of these activities are widespread, and the sound sources are intermittent. Furthermore, most of these other actions are not compatible with or could interfere with training and testing activities that involve underwater explosions and sonar use. The Navy takes appropriate steps to avoid activities that interfere with or are not compatible with training and testing.

It is likely that distant shipping and aircraft noise (which is more pervasive and continuous) and sound associated with underwater explosions and sonar would overlap in time and space. However, there is no evidence indicating that the co-occurrence of shipping and aircraft noise, and sounds associated with underwater explosions and sonar use, would result in harmful additive impacts on birds.

The potential also exists for the impacts of ocean pollution and acoustic stressors associated with Alternatives 1 and 2 to be additive or synergistic. It is possible that the response of a previously stressed animal would be more severe than the response of an unstressed animal. However, there are no data indicating that a seabird affected by ocean pollution would be more susceptible to stressors associated with Alternatives 1 and 2.

In summary, based upon the analysis in Section 3.6 (Birds), and the reasons summarized above, the incremental contribution of Alternatives 1 and 2 to cumulative impacts to bird populations would be low. Therefore, further analysis of cumulative impacts on birds is not warranted.

4.4.9 MARINE VEGETATION

The analysis presented in Section 3.7 (Marine Vegetation) indicates that marine vegetation could be affected by acoustic stressors (underwater explosions) and physical stressors (interactions with vessels and in-water devices, military expended materials, or seafloor devices). Potential impacts include localized disturbance and mortality. Recovery would occur quickly, and population level impacts are not anticipated. The impacts of Alternatives 1 or 2 would be cumulative with other actions that cause disturbance and mortality of marine vegetation. However, the incremental contribution of Alternatives 1 and 2 to cumulative impacts would be low for the following reasons:

- Most of the proposed activities would occur in areas where seagrasses and other attached marine vegetation do not grow.
- Impacts would be localized, recovery would occur quickly, and no population level impacts would be expected.
- Alternatives 1 and 2 would not result in impacts that have been historically significant to marine vegetation. For example, Alternatives 1 and 2 would not increase nutrient loading, which can cause algal blooms, decrease light penetration, and impact photosynthesis of seagrasses. Furthermore, Alternatives 1 and 2 would not result in long-term or widespread changes in environmental conditions, such as turbidity, salinity, pH, or water temperature that could impact marine vegetation.
- The Proposed Action would have no effect on ESA-listed species of marine vegetation and would not result in the destruction or adverse modification of critical habitat.

Based on the analysis presented in Section 3.7 (Marine Vegetation) and the reasons summarized above, the incremental contribution of Alternatives 1 and 2 to cumulative impacts would be low. Further analysis of cumulative impacts on marine vegetation is not warranted.

4.4.10 MARINE INVERTEBRATES

The analysis presented in Section 3.8 (Marine Invertebrates) indicates that marine invertebrates could be affected by acoustic stressors (tactical acoustic sonar, other acoustic devices, pile driving, underwater explosions, weapons firing noise, aircraft noise, vessel noise), electromagnetic stressors, physical disturbance or strikes (vessels and in-water devices, military expended materials, seafloor devices), entanglement (cables and wires, parachutes), and ingestion (military expended materials). Potential impacts include short-term behavioral and physiological responses. Some stressors could also result in injury or mortality to a relatively small number of individuals, but not to ESA-listed corals. No population-level impacts are anticipated. Stressors from Alternatives 1 and 2 would have no effect or would be not likely to adversely affect ESA-listed corals.

Based upon the analysis in Section 3.8 (Marine Invertebrates), the invertebrate mortality impacts of Alternatives 1 and 2 would be cumulative with other actions that cause mortality (e.g., commercial fishing). However, the incremental contribution of Alternatives 1 and 2 to cumulative impacts would be negligible. Therefore, further analysis of cumulative impacts on marine invertebrates is not warranted.

4.4.11 FISH

4.4.11.1 Impacts of Alternatives 1 and 2 That May Contribute to Cumulative Impacts

Based on the analysis presented in Section 3.9 (Fish), impacts of Alternatives 1 and 2 that might contribute to cumulative impacts on fish include direct injury, hearing loss, auditory masking, and physiological stress and behavior reactions. Mortality or injury could be caused by underwater explosions or vessel strikes; however, impacts are not expected to decrease the overall fitness of any given population. The remaining stressors analyzed in Section 3.9 (Fish) are not expected to result in mortality. The incremental contribution of these remaining stressors to cumulative impacts on fish would be negligible. These stressors are discussed in Sections 3.9.3.1 through 3.9.3.6. The impacts of Alternatives 1 and 2 considered in the cumulative impacts analysis are summarized in Section 3.9 (Fish).

4.4.11.2 Impacts of Other Actions

4.4.11.2.1 Overview

The potential impacts of other actions that are relevant to the cumulative impact analysis for fish include the following:

- Mortality associated with vessel strikes, commercial fisheries, bycatch, and entanglement in fishing and other gear
- Injury associated with vessel strikes, bycatch, entanglement, and underwater sound
- Disturbance, behavioral modifications, and reduced animal fitness associated with underwater noise
- Reduced animal fitness associated with water pollution

Most of the other actions and considerations retained for analysis in Table 4.3-1 would include operation of marine vessels. Exceptions include the actions listed under environmental regulations and permitting. Stressors associated with marine vessel operations that are of primary concern for the cumulative impacts analysis includes vessel strikes and underwater noise. Many of the actions would also result in underwater noise from sources other than vessels, seismic surveys, and construction activities. Rather than discussing these stressors for individual actions, their aggregate impacts are considered below as "other environmental considerations" in the maritime traffic and ocean noise subsections. Similarly, many of the actions would result in water pollution. The aggregate impacts of water pollution are addressed in the ocean pollution section (see Section 4.4.6.2.5). Commercial fishing and overfishing is the primary cause of stress and entanglement. Therefore, these stressors are discussed in the commercial fishing section (see Section 4.4.6.3.1).

4.4.11.2.2 Surveillance Towed Array Sensor System Low Frequency Active Sonar

Potential impacts on fish from Surveillance Towed Array Sensor System Low Frequency Active Sonar operations include (1) nonauditory injury, (2) permanent loss of hearing, (3) temporary loss of hearing, (4) behavioral change, and (5) masking.

Studies have examined the effects of the sound exposures from Surveillance Towed Array Sensor System Low-Frequency Active sonar on fish hearing (Kane et al. 2010; Popper et al. 2007). Hearing was measured both immediately post exposure and for several days thereafter. Maximum received sound pressure levels were 193 dB referenced to 1 micropascal for 324 or 628 seconds. Catfish and some specimens of rainbow trout showed 10–20 dB of hearing loss immediately after exposure to the low-frequency active sonar when compared to baseline and control animals; however, another group of rainbow trout showed no hearing loss. Recovery in trout took at least 48 hours, but studies were not completed. The different results between rainbow trout groups is difficult to understand, but may be due to developmental or genetic differences in the various groups of fish. Catfish hearing returned to, or close to, normal within about 24 hours after exposure to low-frequency active sonar. Furthermore, examination of the inner ears of the fish during necropsy (note: maximum time fish were held post exposure before sacrifice was 96 hours) revealed no differences from the control groups in ciliary bundles or other features indicative of hearing loss (Kane et al. 2010).

The potential effects from Surveillance Towed Array Sensor System Low Frequency Active Sonar operations on any stock of fish from injury (nonauditory or permanent loss of hearing) are considered negligible, and the potential effects on the stock of any fish from temporary loss of hearing or behavioral change (significant change in a biologically important behavior) are considered minimal. Any auditory

masking in fish due to low-frequency active sonar signal transmissions is not expected to be severe and would be temporary. The operation of Surveillance Towed Array Sensor System Low Frequency Active Sonar with monitoring and mitigation could result in temporary or permanent hearing loss, or could not affect them at all depending on the species and proximity to the Sonar.

4.4.11.2.3 Maritime Traffic and Vessel Strikes

Vessels and in-water devices do not normally collide with adult fish, most of which can detect and avoid them. One study on fishes' behavioral responses to vessels showed that most adults exhibit avoidance responses to engine noise, sonar, depth finders, and fish finders, reducing the potential for vessel strikes (Jørgensen et al. 2004). Misund (1997) found that fishes ahead of a ship that showed avoidance reactions did so at ranges of 160–490 ft. (48.8–149.4 m). When the vessel passed over them, some fishes responded with sudden escape responses that included lateral avoidance or downward compression of the school. Conversely, Rostad et al. (2006) observed that some fishes are attracted to different types of vessels (e.g., research vessels, commercial vessels) of varying sizes, noise levels, and habitat locations. Fish behavior in the vicinity of a vessel is therefore quite variable, depending on the type of fish, its life history stage, behavior, time of day, and the sound propagation characteristics of the water (Schwartz 1985). Early life stages of most fishes could be displaced by vessels and not struck in the same manner as adults of larger species. However, a vessel's propeller movement or propeller wash could entrain early life stages. The low-frequency sounds of large vessels or accelerating small vessels caused avoidance responses among herring, but avoidance ended within 10 seconds after the vessel departed (Chapman and Hawkins 1973). Because a towed in-water device is continuously moving, most fishes are expected to move away from it or to follow behind it, in a manner similar to their responses to a vessel. When the device is removed, most fishes would simply move to another area.

4.4.11.2.4 Ocean Noise

Underwater noise is a threat to marine fishes. However, the physiological and behavioral responses of marine fishes to underwater noise have been investigated for only a limited number of species (Codarin et al. 2009, Popper 2003, Slabbekoorn et al. 2010, Wright et al. 2010, Popper and Hastings 2009a, b). In addition to vessels, other sources of underwater noise include seismic activity (Popper and Hastings 2009a). Information on fish hearing is provided in Section 3.9.2.1 (Hearing and Vocalization), with further discussion in Section 3.9.3.1 (Acoustic Stressors).

4.4.11.2.5 Ocean Pollution

Pollution primarily impacts coastal fishes that occur near the sources of pollution. However, global oceanic circulation patterns result in a considerable amount of marine pollutants and debris scattered throughout the open ocean (Crain et al. 2009). Pollutants in the marine environment that may impact marine fishes include organic pollutants (e.g., pesticides, herbicides, polycyclic aromatic hydrocarbons, flame retardants, and oil), inorganic pollutants (e.g., heavy metals), and debris (e.g., plastics and wastes from dumping at sea) (Pews Oceans Commission 2003). High chemical pollutant levels in marine fishes may cause behavioral changes, physiological changes, or genetic damage in some species (Goncalves et al. 2008, Moore 2008, Pews Oceans Commission 2003, van der Oost et al. 2003). Bioaccumulation of pollutants (e.g., metals and organic pollutants) is also a concern, particularly in terms of human health, because people consume top predators with high pollutant loads. Bioaccumulation is the net buildup of substances (e.g., chemicals or metals) in an organism directly from contaminated water or sediment through the gills or skin, from ingesting food containing the substance, or from ingestion of the substance itself (Newman 1998, Moore 2008). Entanglement in abandoned commercial and recreational

fishing gear has also caused pollution-related declines for some marine fishes; some species are more susceptible to entanglement by marine debris than others (Musick et al. 2000).

4.4.11.3 Coastal Development

Coastal development and increased human population activities in coastal areas, such as increased tourism, non-point source pollution and runoff, power plant entrainment, and degradation of nearshore water quality and seagrass beds, will continue to have impacts on fish (see Section 3.9, Fish, for more information on impacts on fish).

4.4.11.3.1 Commercial Fishing

Overfishing is the most serious threat that has led to the listing of ESA-protected marine species, with habitat loss also contributing to extinction risk (Crain et al. 2009, Kappel 2005, Cheung et al. 2007, Dulvy et al. 2003, Jonsson et al. 1999, Limburg and Waldman 2009, Musick et al. 2000). Approximately 17 percent of the United States-managed fish stocks are overfished. However, none of the U.S.-managed fish stock off the U.S. West Coast are subject to overfishing, so the 17 percent that are overfished occur elsewhere in the U.S. (National Marine Fisheries Service 2013). Overfishing occurs when fishes are harvested in quantities above a sustainable level. Overfishing impacts targeted species, and non-targeted species (or "bycatch" species) that often are prey for other fishes and marine organisms. Bycatch may also include seabirds, turtles, and marine mammals. Additionally, in recent decades the marine fishes being targeted have changed such that when higher-level predators become scarce, different organisms on the food chain are subsequently targeted; this has negative implications for entire marine food webs (Crain et al. 2009, Pauly and Palomares 2005). Other factors, such as fisheries-induced evolution and intrinsic vulnerability to overfishing, have been shown to reduce the abundance of some populations (Kauparinen and Merila 2007). Fisheries-induced evolution describes a change in genetic composition of the population that results from intense fishing pressure, such as a reduction in the overall size and growth rates of fish in a population. Intrinsic vulnerability describes certain life history traits (e.g., large body size, late maturity age, low growth rate) that result in a species being more susceptible to overfishing than others (Cheung et al. 2007).

Although these factors are a concern for fisheries worldwide, fisheries off the U.S. West Coast are managed conservatively, in keeping with the requirements of the Magnuson-Stevens Fishery Conservation and Management Act. Fish stocks within the Study Area that were historically overfished have recovered or are recovering from their overfished status and contributing to the overall trend of increasing abundance of U.S. marine fish stocks (National Marine Fisheries Service 2013, National Marine Fisheries Service 2014b).

4.4.11.4 Cumulative Impacts on Fish

The aggregate impacts of past, present, and reasonably foreseeable future actions may have a significant impact to fish. These aggregate impacts are considered significant because overfishing, vessel strikes, entanglement and other stressors associated with other actions are expected to result in high rates of injury and mortality that could cause population declines to ESA-listed species or inhibit species recovery. Alternatives 1 and 2 could also result in injury and mortality to individual fish from underwater explosions, sonar, and strikes. Injury and mortality that might occur under Alternatives 1 and 2 would be additive to injury and mortality associated with other actions. However, the relative contribution of Alternatives 1 and 2 to the overall injury and mortality would be low compared to other actions.

It is likely that distant shipping and aircraft noise (which is more pervasive and continuous) and sound associated with underwater explosions and sonar would overlap in time and space. However, there is no evidence indicating that the co-occurrence of shipping and aircraft noise, and sounds associated with underwater explosions and sonar use would result in harmful additive impacts on fish.

The potential also exists for the impacts of ocean pollution and acoustic stressors associated with Alternatives 1 and 2 to be additive or synergistic. It is possible that the response of a previously stressed animal would be more severe than the response of an unstressed animal. However, there are no data indicating that a fish affected by ocean pollution would be more susceptible to stressors associated with Alternatives 1 and 2.

In summary, based upon the analysis in Section 3.9 (Fish), the current aggregate impacts of past, present, and reasonably foreseeable future actions may have a significant effect, but are not likely to adversely affect fish. Therefore, cumulative impacts on fish would be significant without consideration of the impacts of Alternatives 1 and 2. Alternatives 1 and 2 would contribute to, and increase, cumulative impacts, but the relative contribution would be low compared to other actions. Further analysis of cumulative impacts on fish is not warranted.

4.4.12 CULTURAL RESOURCES

4.4.12.1 Impacts of Alternatives 1 and 2 That May Contribute to Cumulative Impacts

As discussed in Section 3.10 (Cultural Resources), Alternatives 1 and 2 could result in impacts on submerged prehistoric sites and previously unidentified submerged historic resources if certain training and testing activities are conducted where these resources occur. Stressors that could impact cultural resources include underwater explosions on or near the bottom, use of towed-in-water devices, and use of ocean bottom deployed devices. Because cultural resources are considered nonrenewable resources, these impacts would be considered long-term and permanent.

The Navy routinely avoids locations of known obstructions to prevent damage to sensitive Navy equipment and vessels and to ensure the accuracy of training and testing exercises. Known obstructions include some historic shipwrecks; however, it is unknown if all submerged obstructions, historic shipwrecks, or other cultural resources have yet been discovered in the Study Area.

4.4.12.2 Impacts of Other Actions

With a few exceptions, most of the other actions retained for cumulative impacts analysis (see Table 4.3-1) would involve some form of disturbance to the ocean bottom. Exceptions include environmental regulations and planning actions, ocean pollution, and most forms of ocean noise. Actions that would disturb the ocean bottom could impact submerged cultural resources. For example, ocean bottom disturbance would occur from construction related activities such as ship anchoring, and installation of wind turbine piers. Any physical disturbance on the continental shelf and ocean floor could inadvertently damage or destroy submerged prehistoric sites and submerged historic resources.

The other actions that result in ocean bottom disturbance require some form of federal authorization or permitting. Therefore, requirements of the National Historic Preservation Act (NHPA) apply to actions in territorial waters. Federal agency procedures have been implemented to identify cultural resources, avoid impacts, and mitigate if impacts cannot be avoided. For example, the Bureau of Ocean Energy Management, Regulation and Enforcement has procedures in place to identify the probability for the presence of submerged historic resources and the locations submerged prehistoric sites shoreward from

the 148 ft. (45.1 m) isobath, and for project redesign and relocation to avoid identified resources (Minerals Management Service 2007). Nonetheless, inadvertent impacts could occur if unidentified submerged cultural resources are present.

4.4.12.3 Cumulative Impacts on Cultural Resources

Impacts on submerged cultural resources from other actions would typically be avoided or mitigated through implementing federal agency programs. However, impacts could occur if avoidance or mitigation measures are not implemented or if inadvertent disturbance or destruction of unidentified resources occurs. Disturbance or destruction of submerged prehistoric sites would diminish the overall archaeological record and decrease the potential for meaningful research on Paleomarine traditions (6,500–5,000 Before Present) and early explorers of the Northwest coast (1700s–1800s) occupations. Disturbance or destruction of submerged historic sites, including shipwrecks, would diminish the overall record for these resources and decrease the potential for meaningful research on these resources. Based upon the analysis in Section 3.10 (Cultural Resources), when considered with other actions, Alternatives 1 and 2 would contribute to and increase the cumulative impacts on submerged prehistoric and historic resources. Further analysis of cumulative impacts on cultural resources is not warranted.

Olympic National Park was accepted as a World Heritage Site in 1981. Because most of the Olympic National Park is designated as wilderness, the natural soundscape is an important element and prevalent in much of the park. The National Park Service regards natural and cultural sounds as part of a web of resources that must be protected. Threats to natural soundscape come from development and other human activities inside and outside the park (National Park Service 2008). Based on the analysis presented in Appendix K (World Heritage Site Analysis), noise impacts associated with military aircraft overflight activities within the park would be minor; when considered with other actions, the contribution of Alternatives 1 and 2 to these effects would be very small. Alternatives 1 and 2 would not result in major adverse impacts (as defined in Appendix K, World Heritage Site Analysis) on key resources or the value of the Olympic National Park.

4.4.13 American Indian and Alaska Native Traditional Resources

4.4.13.1 Impacts of Alternatives 1 and 2 That May Contribute to Cumulative Impacts

As discussed in Section 3.11 (American Indian and Alaska Native Traditional Resources), Alternatives 1 and 2 could result in impacts on American Indian and Alaska Native protected tribal resources and other traditional resources, because impeding access to areas of co-use such as usual and accustomed fishing grounds, even of short duration, may prevent fishing in limited seasons. Stressors that could impact American Indian and Alaska Native Traditional resources include impeding access to usual and accustomed fishing grounds or traditional fishing areas, changes in the availability of marine resources or habitat, and loss of fishing gear.

The Navy has established protective measures to reduce potential effects on cultural and natural resources from training and testing exercises. While most of these protective measures focus on protection of the natural environment, they also benefit culturally valued natural resources, such as salmon and shellfish. Some of the protective measures include avoidance of known submerged obstructions, use of inert ordnance and passive tracking and acoustical tools, and avoidance of sensitive habitats to ensure that significant concentrations of sea life are not present.

The Navy strives to maintain safety and accommodate, to the extent possible, access to tribes' usual and accustomed areas. The Navy provides the U.S. Coast Guard with information on the locations of

potentially hazardous training or testing activities at sea so the Coast Guard can issue Notices to Mariners. In some instances, the Navy has directly notified affected American Indian tribes and nations to ensure that their activities in usual and accustomed fishing areas can avoid any potentially hazardous training or testing locations at sea. The changes in accessibility to human activities in the ocean or inland waterways would be an impact if they directly contributed to loss of income, revenue, or employment, or if cultural knowledge is lost because tribal members cannot teach their children and grandchildren to fish in areas where they were taught by their ancestors.

Impacts of Other Actions

With a few exceptions, most of the other actions retained for cumulative impacts analysis (see Table 4.3-1) would involve some form of disturbance to the ocean bottom. Exceptions include environmental regulations and planning actions, ocean pollution, and most forms of ocean noise. Actions that would disturb the ocean bottom could impact submerged American Indian and Alaska Native Traditional resources. For example, ocean bottom disturbance would occur from construction-related activities such as ship anchoring and installation of wind turbines. Any physical disturbance on the continental shelf and ocean floor (including the Inland Waters and the Western Behm Canal) could inadvertently damage or destroy submerged fishing gear, or areas of traditional or cultural significance.

The construction of the Gateway Pacific Terminal, along with other terminals outside of the Study Area, has the potential to impact American Indian Traditional Resources. The siting of the wharf and trestle at the proposed Gateway Pacific Terminal and the potential increased anchorage use by bulkers would interfere with Lummi access to fishing sites (Environmental Research Consulting, Inc. and Northern Economies, Inc. 2014). The Juan de Fuca East subarea would see the greatest increase in disruption due to the time and area occupied by Gateway Pacific Terminal vessels at anchor and bunkering activity. Furthermore, the increased vessel traffic has the potential for loss of Lummi fishing gear (Environmental Research Consulting, Inc. and Northern Economies, Inc. 2014).

The other actions that result in ocean bottom disturbance require some form of federal authorization or permitting. Therefore, requirements of the NHPA apply to actions in territorial waters. Federal agency procedures have been implemented to identify American Indian and Alaska Native Traditional resources, avoid impacts, and mitigate if impacts cannot be avoided. For example, traditional resources along with archaeological and architectural resources are protected by various laws and their implementing regulations: the NHPA of 1966 as amended in 2006, the American Indian Religious Freedom Act of 1978, and the Native American Graves Protection and Repatriation Act of 1990. Within state territorial waters (0–3 nm), the NHPA is the guiding mandate; within U.S. territorial waters (0–12 nm), the NEPA is the primary mandate. Areas beyond 12 nm in the open ocean are beyond the jurisdiction of NEPA, but they are covered by EO 12114. Nonetheless, inadvertent impacts could occur if unidentified submerged tribal or traditional resources are present.

4.4.13.2 Cumulative Impacts on American Indian and Alaska Native Traditional Resources

The success of American Indian tribal fisheries has been impacted by long-term changes in the environment that can reduce fish stocks due to impacted water quality, reduced habitat—especially spawning habitat for salmon runs, and increased commercial harvests. The Navy has an active consultation process in place and will continue to consult on a government-to-government basis with potentially affected American Indian tribes and nations regarding Navy activities that may have the potential to impact protected tribal treaty rights and resources. The Navy's other measures to prevent pollution from its own operations and sustain or improve habitat value help to offset some of the

cumulative impacts. Pursuant to the Navy's government-to-government consultation with federally-recognized American Indian and Alaska Native tribes, agreements (both formal and informal) regarding protocols or tribal mitigations may be developed to reduce or eliminate impacts on protected tribal treaty reserved rights and protected tribal resources.

4.4.14 SOCIOECONOMICS

4.4.14.1 Impacts of Alternatives 1 and 2 That Might Contribute to Cumulative Impacts

As discussed in Section 3.12 (Socioeconomic Resources), Alternatives 1 and 2 could contribute to impacts on accessibility to areas within the Study Area, physical disturbances and interactions, aircraft and vessel noise, and secondary impacts resulting from effects on marine species populations. However, impacts on socioeconomic resources are expected to be minor. Inaccessibility to areas of co-use would be localized and temporary. Direct physical interaction between the public and the Navy's proposed activities would continue to be unlikely. Aircraft and vessel noise impacts would continue to be negligible because vessel activities that produce significant noise are conducted well out to sea, far from people; aircraft activities would continue to occur either at sea far from land or, when overland, consistent with flights conducted for the past 40 years; the number of aircraft activities would be similar to those currently conducted; and proposed aircraft would continue to occur at high altitudes that result in reduced noise levels on land. Impacts on marine species critical to socioeconomic activities such as fishing, geoduck, and other marine invertebrate gathering, and tourism activities such as whale watching, are not expected. Further, there are no disproportionately high impacts or adverse effects on any low-income populations or minority populations. Cumulative impacts on socioeconomic resources in the Study Area are not expected to occur as a result of the proposed action.

4.4.14.2 Impacts of Other Actions

Portions of the Study Area are heavily traveled by commercial, recreational, and government marine vessels, with several commercial ports occurring in or near the Study Area, including the seventh and 11th ranked U.S. ports for total cargo imported and exported in 2011 (Seattle and Tacoma respectively). From September 2014 to August 2015, construction at the Bremerton ferry terminal may result in the incidental taking by acoustical harassment (Level B take) of marine mammals. However, the improved, maintained, and repaired terminals have the potential to benefit both tourism activities and commercial shipping by improving accessibility to transportation and marine resources. A proposed Master Planned Resort in Jefferson County is located south of Brinnon, Washington, on the Black Point Peninsula, on the western shore of the Hood Canal. This resort would include an 18-hole golf course, 890 residential units, and commercial space with related resort amenities. This would increase tourism in that County and be beneficial to socioeconomic resources through the creation of jobs, business growth, and increased housing.

4.4.14.2.1 Other Military Actions

The Hood Canal Conservation Easement will prevent new large-scale industrial or commercial development in the footprint of the easement, possibly negatively impacting socioeconomic development in the footprint of the easement. Beneficial effects of the easement would be the conservation of marine species for tourism and recreation locations. The Hood Canal In-Lieu Fee Mitigation Program has had a positive impact on socioeconomic resources with Navy projects in 2012 and 2013. The In-Lieu Fee Mitigation Program has beneficial impacts on socioeconomic resources by being a source of income for the local economy.

Movement of watercraft in the training area for the Swimmer Interdiction Security System at Naval Base Kitsap Bangor in the Puget Sound could possibly disturb listed marine mammals and fish during activities; however, disturbances are unlikely due to the short lengths of the trainings and low disturbance of small training watercraft relative to other watercraft disturbances in the vicinity.

Other military projects include construction of facilities for Force Protection and Weapons Security Measures along the Waterfront Restricted Area of Hood Canal. The construction of the two facilities and paved access road with minimal vehicle traffic would not contribute to overall on-land or water traffic and would not negatively impact socioeconomic resources. Other construction projects in the Study Area include the Explosives Handling Wharf 1 Maintenance, the Electromagnetic Ranging System (which is on hold), Breakwater Construction and Pier Demolition at NASWI in Crescent Harbor, Pacific Northwest EW fixed emitter at Naval Station Everett Transit Protection Systems Facilities at Naval Base Kitsap Bangor, and finally, the EHW-2 at Naval Base Kitsap Bangor. Mitigation measures to offset the cumulative effects of these construction projects are in place.

Mitigation measures, including marine mammal mitigation zones, are in place to prevent Level A and reduce Level B harassment to marine mammals. Protective mitigation measures for marine mammals during the Explosives Handling Wharf 2 activity include purchase of aquatic habitat credits from the Hood Canal In-Lieu Fee Program, use of bubble curtains and equipment procedures to reduce species impacts from pile driving noise, marine species monitoring and reporting, revegetation of temporarily disturbed upland areas, public and mariner notification of upcoming construction activities, and specific mitigation actions to compensate for impacts to tribal treaty resources. The mitigation measures in place for the protection of marine mammals and tribal treaty resources as a result of the EHW-2 activity, will also have a positive impact on socioeconomic resources in the Study Area.

Currently the Navy is proposing to continue and increase the existing VAQ operations at NASWI. This increase would add up to 36 aircraft to support expanded DoD missions to identify, track, and target in a complex EW environment. This action would potentially result in additional personnel at and relocate family members to NASWI and the surrounding community. Both adverse and beneficial socioeconomic effects would occur. Potential adverse effects relevant to resources analyzed in Section 3.12 (Socioeconomics) of the NWTT EIS/OEIS would include increased demand on public services, including infrastructure, access to recreational areas (e.g., fishing sites), competition for tourism-related activities (e.g., whale watching), and potential competition between recreational and subsistence fishers at popular nearshore sites. Beneficial effects of the population increase would be increased demand and potentially greater revenue for tourism-related and commercial fishing businesses as well as local retail business, which could lead to an increase in employment opportunities. Over time, economic adjustments to meet the additional demands of a larger population on Whidbey Island would be expected, as well as mitigation measures that minimize impacts from construction and increased vessel movement.

Other military actions in the area occur in W-93 and W-570 special use airspace in the Offshore Area by the Oregon Air National Guard. Flights in these areas are similar to those conducted by the Navy and described in Chapter 2 (Description of Proposed Action and Alternatives) and should not impact air transportation or commercial air traffic, and therefore should not have a cumulative impact on Socioeconomic Resources.

4.4.14.3 Cumulative Impacts on Socioeconomic Resources

The analysis in Section 3.12 (Socioeconomic Resources) indicates that the impacts of Alternatives 1 and 2 on socioeconomic resources would be negligible. Alternatives 1 and 2 are not expected to contribute to cumulative socioeconomic impacts. Cumulative effects on socioeconomic resources may have intermittent and short-term impacts to accessibility to areas within the Study Area, physical disturbances and interactions, airborne acoustics, and secondary impacts (e.g., to tourism) resulting from effects on marine species populations, but they are not expected to have long-term negative impacts on these resources or the economies of Northern California, Oregon, Washington, or Alaska.

4.4.15 PUBLIC HEALTH AND SAFETY

The analysis presented in Section 3.13 (Public Health and Safety) indicates that the impacts of Alternatives 1 and 2 on public health and safety would be negligible. Alternatives 1 and 2 are not expected to contribute incrementally to cumulative health and safety impacts. Therefore, further analysis of cumulative impacts on public health and safety is not warranted.

4.5 SUMMARY OF CUMULATIVE IMPACTS

American Indian and Alaska Native traditional use areas and subsistence resources, marine mammals, sea turtles, birds, and fish are the primary resources of concern for cumulative impacts analysis:

- Impacts on American Indian traditional resources could occur during training and testing activities due to short-term reduced access to tribal usual and accustomed fishing grounds in the Inland Waters. Impacts from training and testing activities would not alter fish and other marine species population levels or the availability of these resources for tribal use. Loss or damage to American Indian fishing equipment from vessel and in-water device strikes, and inadvertent snagging of military expended materials, could occur in the Offshore Area and in the Inland Waters, reducing fishing opportunities while fishing equipment is being replaced or repaired and increasing the amount of effort and resources required to catch the same amount of fish.
- Due to past and present activities, several marine mammal species, all sea turtles, one bird, and multiple fish species occurring in the Study Area are ESA-listed.
- These resources would be impacted by multiple present and reasonably foreseeable future actions.
- Explosive detonations and vessel strikes under the No Action Alternative, Alternative 1, and Alternative 2 have the potential to disturb, injure, or kill sea turtles, birds, and fish.
- The use of sonar and other non-impulsive sound sources under the No Action Alternative, Alternative 1, and Alternative 2 has the potential to disturb or injure marine mammals and sea turtles.

The aggregate impacts of past, present, and other reasonably foreseeable future actions are expected to result in significant impacts on American Indian and Alaska Native traditional use areas and subsistence resources, some marine mammals, Leatherback sea turtles (*Dermochelys coriacea*), some birds, some fish species, and socioeconomic resources in the Study Area. The No Action Alternative, Alternative 1, or Alternative 2 would contribute to cumulative impacts, but the relative contribution would be low compared to other actions. Compared to the potential mortality, stranding, and injury resulting from commercial ship strikes and bycatch, entanglement, ocean pollution and other human causes, the potential for mortality, strandings or injury resulting from Navy training and testing activities is estimated to be orders of magnitude lower (tens of animals versus hundreds of thousands of animals) (Culik 2004, International Council for the Exploration of the Sea 2005, Read et al. 2006).

The analysis presented in this chapter and Chapter 3 (Affected Environment and Environmental Consequences) indicates that the incremental contribution of the No Action Alternative, Alternative 1, or Alternative 2 to cumulative impacts on sediments and water quality, air quality (greenhouse gas emissions), marine habitats, marine vegetation, marine invertebrates, and public health and safety would be negligible. When considered with other actions, the No Action Alternative, Alternative 1, or Alternative 2 might contribute to cumulative impacts on submerged prehistoric and historic resources, if such resources are present in areas where bottom-disturbing training and testing activities take place.

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