Department of the Navy

Naval Air Warfare Center
Weapons Division

FINAL

Environmental Impact Statement/Overseas Environmental Impact Statement

Point Mugu Sea Range

March 2002

FINAL
ENVIRONMENTAL IMPACT STATEMENT/
OVERSEAS ENVIRONMENTAL IMPACT STATEMENT
POINT MUGU SEA RANGE

Lead Agency for the EIS/OEIS:	Department of the Navy
Title of Proposed Action:	Accommodate TMD Testing and Training, Additional Training Exercises, and Facility Modernization at the NAWCWPNS Point Mugu Sea Range
Affected Jurisdictions:	Ventura, Los Angeles, Santa Barbara, Orange, San Diego, and San Luis Obispo Counties
Designation:	Final Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS)

Abstract

Naval Air Warfare Center Weapons Division (NAWCWPNS) Point Mugu is located in Ventura County along the Pacific Coast of Southern California and includes a 36,000 square mile Sea Range. The NAWCWPNS Point Mugu Sea Range currently supports test and evaluation of sea, land, and air weapons systems as well as various categories of training activities. NAWCWPNS Point Mugu proposes to accommodate Theater Missile Defense (TMD) testing and training and to accommodate an increase in the current level of both Fleet training exercises and special warfare training. In addition, NAWCWPNS Point Mugu proposes to modernize facilities at Naval Air Station (NAS) Point Mugu and San Nicolas Island to enhance the Sea Range's capability to support existing and future operations. Three alternatives are analyzed in this EIS/OEIS: the No Action Alternative—continuation of current test and training activities; the Minimum Components Alternative—meets the purpose and need of the proposed action while minimizing the number of components that would be implemented; and the Preferred Alternative—proposed action for the TMD, training, and facility modernization elements.

This EIS/OEIS has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 (42 U.S. Code [U.S.C.] § 4321 et seq.); the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (Title 40 Code of Federal Regulations [C.F.R.] Parts 1500-1508); Department of the Navy Procedures for Implementing the National Environmental Policy Act (32 C.F.R. 775); and Executive Order 12114 (EO 12114), *Environmental Effects Abroad of Major Federal Actions*. Potential environmental consequences of the proposed action have been analyzed for the following resources: geology and soils; air quality; noise; water quality; marine biology; fish and sea turtles; marine mammals; terrestrial biology; cultural resources; land use; traffic; socioeconomics; hazardous materials, hazardous wastes, and non-hazardous wastes; and public safety. No significant, unmitigable environmental impacts of the Preferred Alternative were identified.

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March 2002

EXECUTIVE SUMMARY

ES.1 INTRODUCTION

This Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) analyzes potential environmental impacts that may result from actions proposed by the Naval Air Warfare Center Weapons Division (NAWCWPNS) Point Mugu. In addition to conducting current test and training operations at the NAWCWPNS Point Mugu Sea Range, NAWCWPNS Point Mugu proposes to accommodate Theater Missile Defense (TMD) testing and training, accommodate an increase in current levels of training exercises, and modernize facilities to enhance the existing testing and training capabilities at NAWCWPNS Point Mugu. This EIS/OEIS has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 (42 U.S. Code [U.S.C.] § 4321 et seq.); the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (Title 40 Code of Federal Regulations [C.F.R.] Parts 1500-1508); Department of the Navy Procedures for Implementing NEPA (32 C.F.R. 775); and Executive Order 12114 (EO 12114), *Environmental Effects Abroad of Major Federal Actions*. The NEPA process ensures that environmental impacts of proposed major federal actions are considered in the decision making process. EO 12114 requires environmental consideration (i.e., preparation of an OEIS) for actions that may significantly affect the environment outside U.S. Territorial Waters. This EIS/OEIS satisfies the requirements of both NEPA and EO 12114. The Navy is the lead agency for the decision regarding which of the proposed TMD, training, and facility modernization alternatives at NAWCWPNS Point Mugu will be implemented. The Assistant Secretary of the Navy for Installations and Environment (ASN [I&E]) will be the decision-maker.

NAWCWPNS Point Mugu is located in Ventura County along the Pacific Coast of southern California and includes a 36,000 square mile Sea Range (Figure ES-1). The NAWCWPNS Point Mugu Sea Range, operated by the Department of the Navy for more than 50 years, provides a safe, highly instrumented volume of air and sea space in which to conduct controlled tests and operational training. The Point Mugu Sea Range is used by U.S. and allied military services to test and evaluate sea, land, and air weapon systems; to provide realistic training opportunities; and to maintain operational readiness of these forces. This test and evaluation (T&E) process is critical to the successful assessment, safe operation, and improvement of the capabilities of current and future weapon systems. While operations are conducted throughout the Sea Range, range areas are used throughout the EIS/OEIS to provide the reader with a geographic reference. The geographic scope of this EIS/OEIS includes the Sea Range, Naval Air Station (NAS) Point Mugu[1], Laguna Peak, Navy-owned San Nicolas Island, San Miguel Island, and approximately 10 acres (4.1 hectares) of leased land on Santa Cruz Island (see Figure ES-1).

ES.2 PURPOSE AND NEED FOR THE PROPOSED ACTION

NAWCWPNS Point Mugu has a need to meet the established mission to conduct state-of-the-art weapons system testing and evaluation by providing a safe, operationally realistic, and thoroughly instrumented Sea Range testing environment and to maintain the level of operational readiness of our military services by providing a realistic training environment. The evolution of international threats and operational technologies has increased the number and type of military operations that require large water ranges for testing and training activities. Consequently, the role of NAWCWPNS Point Mugu as a test and training center has become even more critical. To meet the testing and training need, the purpose of the proposed action is: 1) to accommodate TMD testing and training at NAWCWPNS Point Mugu; 2) to accommodate an increase in current levels of training exercises at NAWCWPNS Point Mugu; and 3) to

[1] Naval Air Station (NAS) Point Mugu was previously called Naval Air Weapons Station (NAWS) Point Mugu. This December 1998 change reflects the transfer of the base property to the U.S. Pacific Fleet.

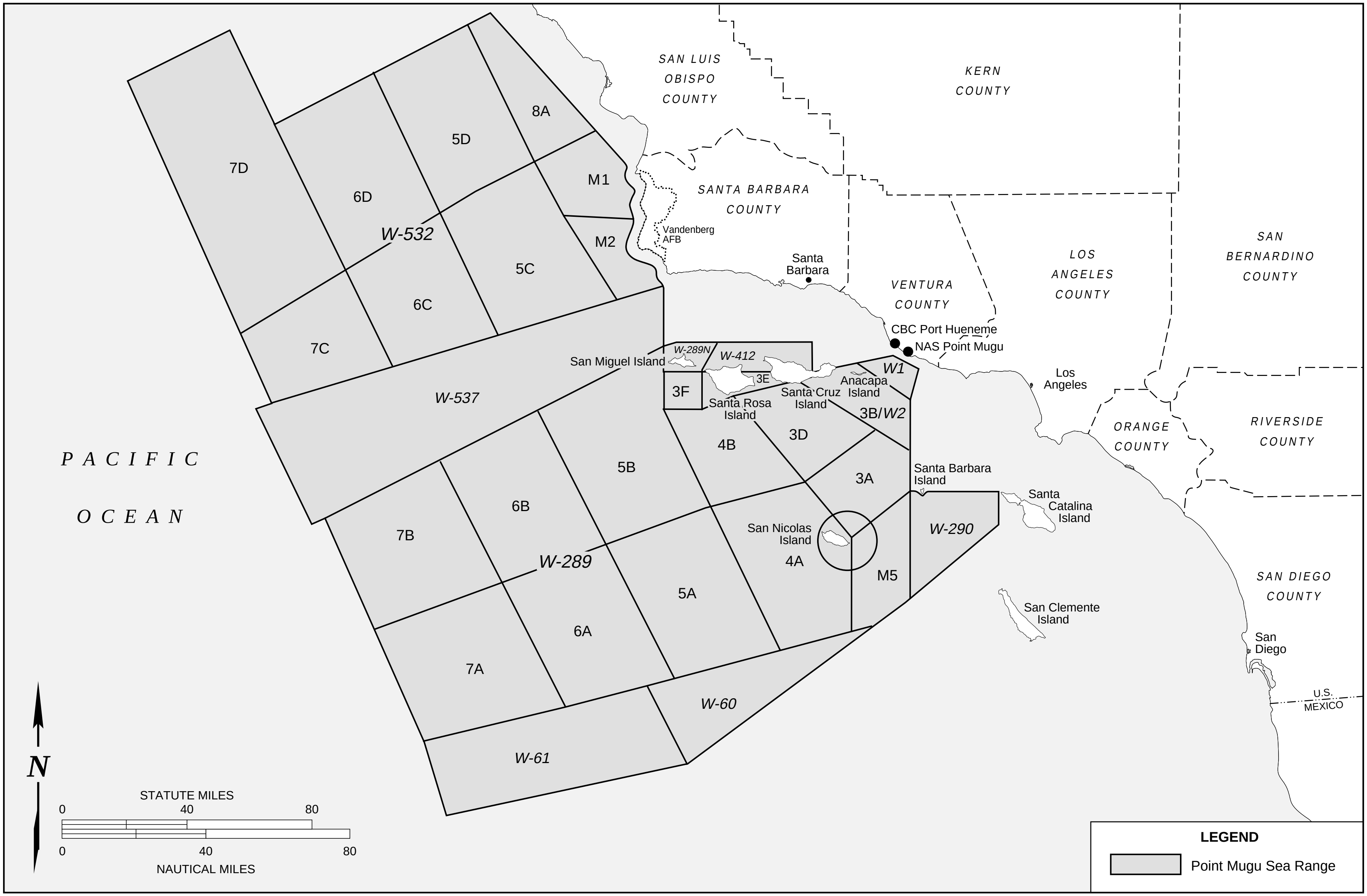

Figure ES-1
Point Mugu Sea Range

modernize facilities to enhance the existing testing and training capabilities at NAWCWPNS Point Mugu.

ES.3 SCOPING PROCESS

In accordance with NEPA, the Navy initiated a public and agency scoping process to assist in the identification of relevant environmental issues to be analyzed in this EIS/OEIS. The official Notice of Intent (NOI) to prepare the EIS was published in the Federal Register on 25 July 1997. The public and other interested parties were invited and encouraged to participate in the scoping process through the publication of newspaper advertisements, news releases, and notices placed in local groups' newsletters. Federal, state, and local agencies were also requested to provide input on relevant issues and identify specific agency concerns. A separate package was mailed to 14 agencies describing the proposed action and inviting agencies to meet individually with the Navy to receive more information and provide input to the scoping process. Subsequent to the distribution of the agency scoping package, the Navy met with representatives from the California Coastal Commission, the Channel Islands National Marine Sanctuary, the Channel Islands National Park, the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, and the Ventura County Economic Development Association.

Five public scoping meetings were held between 21 and 27 August 1997 to inform the public of the Navy's proposed action and intent to prepare the EIS, and to solicit public comment. Agencies and the public were encouraged to contribute verbal or written comments at the scoping meetings or to provide written comments throughout the 50-day scoping period. A total of 104 people attended the five meetings. In addition to verbal comments, 40 written comments were received from various agencies, environmental groups, and citizens during the scoping period. Environmental issues identified during the scoping process are addressed within this EIS/OEIS.

ES.4 PROPOSED ACTION

The NAWCWPNS Point Mugu Sea Range currently supports five general categories of tests to evaluate sea, land, and air weapons systems: 1) air-to-air tests, 2) air-to-surface tests, 3) surface-to-air tests, 4) surface-to-surface tests, and 5) subsurface-to-surface tests. The Sea Range also supports three general categories of training including: 1) Fleet training exercises, 2) small-scale amphibious warfare training, and 3) special warfare training. (Current test and training activities are described in more detail in Chapter 3 and evaluated under the No Action Alternative in Chapter 4.) In addition to the current test and training operations conducted on the Sea Range, NAWCWPNS Point Mugu proposes to accommodate TMD test and training activities and an increase in the current level of both Fleet training exercises and special warfare training. Further, NAWCWPNS Point Mugu proposes to modernize facilities at NAS Point Mugu and San Nicolas Island to increase the Sea Range's capability to support existing and future operations. The specific testing, training, and facility modernization proposals evaluated in the EIS/OEIS are based on NAWCWPNS Point Mugu's current knowledge of priorities for future testing and training, and the needs and desires of NAWCWPNS Point Mugu to attract more testing and training activity to the Sea Range. The TMD, training, and facility modernization elements that comprise the proposed action are described below.

ES.4.1 Theater Missile Defense Element

TMD is intended to protect U.S. forces and allies against the threat of both short- and long-range missiles. NAWCWPNS Point Mugu proposes that the Point Mugu Sea Range accommodate four distinct types of TMD testing and training activities: 1) boost phase intercept (up to three events per year);

2) upper tier (up to three events per year); 3) lower tier (up to three events per year); and 4) nearshore intercept at San Nicolas Island (up to eight events per year).

ES.4.2 Training Element

The Sea Range currently supports two Fleet training exercises per year, four small-scale amphibious training exercises per year, and two special warfare training exercises per year. In addition to this current level of training, NAWCWPNS Point Mugu proposes to accommodate one additional Fleet training exercise per year and two additional special warfare exercises per year (small-scale amphibious training would remain at current levels).

ES.4.3 Facility Modernization Element

Facility modernization is proposed for both NAS Point Mugu and San Nicolas Island.

ES.4.3.1 NAS Point Mugu

As part of the proposed facility modernizations, NAWCWPNS Point Mugu proposes to use two previously used launch pads to serve as new missile launch locations at NAS Point Mugu. Currently, approximately six missiles per year are launched from a truck directly in front of the Building 55 Launch Complex. Four previously used launch pads are located along the beach of NAS Point Mugu. Under the proposed action, the Bravo pad (or pad B) and the Charlie pad (or pad C) would be used for missile launches. Missiles could either be truck-launched (the truck has a self-contained launch system and would be driven to the B or C pad) or launched directly from a mobile launch system located on the B or C pad. No construction would be required since missiles could be launched off the existing pads. Use of these locations would not affect the number or types of missiles launched from NAS Point Mugu and safety and clearance procedures performed prior to missile launches would be identical to current methods.

Some of the beach launches may include the use of solid propellant boosters. Solid propellant boosters provide the initial thrust necessary until the launched vehicle can propel itself independently. The booster falls off soon after launch and would typically land in the ocean 0.25 to 0.50 mile (0.40 to 0.80 km) offshore. The solid propellant contained in the boosters burns out during the launch operation and would be completely expended prior to the booster entering the ocean.

ES.4.3.2 San Nicolas Island

The proposed San Nicolas Island modernizations include construction of additional facilities and the addition of two new target launch systems. The proposed modernizations would not require additional staff on the island. Table ES-1 summarizes the modernization proposals. Where applicable, estimated footprint areas of new construction are also shown in the table.

ES.4.4 Testing and Training Activity Under the Proposed Action

Activity levels can be subdivided into categories which include aircraft sorties; ships and boats afloat within or near the Sea Range; missile firings; and target launches. Table ES-2 presents the baseline operations tempo plus the proposed new activities. Potential environmental impacts of the proposed TMD, training, and facility modernization elements are evaluated against this baseline.

Table ES-1. Proposed New Construction for San Nicolas Island Modernization Proposals

#[1]	Modernization	Total Area of Disturbance
1	Add vertical missile launcher to existing launch pad[2]	None (build on existing pad)
2	Construct new 50K launcher for target missiles[3]	1,200 SF (111 m^2) concrete pad
3	Add new Range Support Building	12,000 SF (1,115 m^2) construction area
4	Develop five new multiple-purpose instrumentation sites	15,000 SF (1,394 m^2) construction area (each)

SF = square feet; m^2 = square meters
[1] Numbers correspond to those shown on Figure 2-3b of the EIS/OEIS.
[2] Under the proposed action, the vertical launch system would be used approximately three times per year.
[3] Under the proposed action, the 50K Launcher would be used approximately three times per year.
Source: NAWCWPNS Point Mugu 1996l.

Table ES-2. Baseline Plus Proposed Sea Range Activities

Category	Aircraft Sorties	Ships and Boats[1]	Missiles Fired/ Ordnance Deployed[2]	Targets Launched[2]
Baseline Operations	3,934	799	351	300
Proposed Action				
Theater Missile Defense	89	111	20	17
Additional Fleet Exercise	57	18	34	33
Additional Special Warfare	4	32	0	0
Total Proposed Action	**150**	**161**	**54**	**50**
Total	**4,084**	**960**	**405**	**350**

[1] Includes range support boats.
[2] The number of *Missiles Fired/Ordnance Deployed* and *Targets Launched* are not equal because their ratio of use varies by event.

ES.5 ALTERNATIVES

ES.5.1 Alternatives Development Process

To help identify reasonable alternatives to the proposed action for analysis within the EIS/OEIS, the Navy eliminated testing, training, and facility modernization proposals that would be inconsistent with the Sea Range mission and associated facilities, instrumentation, and infrastructure that support this mission. Selection criteria were developed to help identify potential alternatives and eliminate unreasonable alternatives from further consideration. Selection criteria include: 1) reasonable alternatives must fulfill the need for, and purpose of, the proposed action; 2) reasonable alternatives must be consistent with the strategic vision for NAWCWPNS Point Mugu; and 3) supporting facilities, instrumentation, and/or infrastructure must be complementary to existing Sea Range capabilities. Alternatives that do not meet one or more of these criteria were not carried forward for analysis within the EIS/OEIS.

Several alternative test, training, and facility modernization components were initially screened and evaluated to determine their ability to meet the selection criteria but were eliminated from consideration due to their inconsistency with both the mission and strategic vision for the Point Mugu Sea Range.

ES.5.2 Alternatives Addressed within the EIS/OEIS

Three alternatives are analyzed in the EIS/OEIS. These include the No Action Alternative, the Minimum Components Alternative, and the Preferred Alternative.

ES.5.2.1 No Action Alternative - Current Operations

Under the No Action Alternative, current test and training operations would continue and the Sea Range would not accommodate TMD testing and training. The ongoing five categories of tests (i.e., air-to-air tests, air-to-surface tests, surface-to-air tests, surface-to-surface tests, and subsurface-to-surface tests) would continue to be conducted on the Sea Range. In addition, the three types of training activities (i.e., Fleet training exercises, small-scale amphibious warfare training, and special warfare training) would continue at current levels, and proposed facility modernizations at NAS Point Mugu and on San Nicolas Island would not be implemented. Although selection of the No Action Alternative would not allow the Sea Range to accommodate TMD events or increase the levels of current training activities, ongoing test and training operations at the Point Mugu Sea Range would not be affected.

ES.5.2.2 Minimum Components Alternative

If the Minimum Components Alternative were selected, only one component of each proposed action element (i.e., TMD, training, and facility modernization) would be implemented. Under this alternative, in addition to current testing and training activities, the Sea Range would be able to accommodate up to eight nearshore intercept events and one additional Fleet training exercise per year. The only facility modernization component which would be implemented is the construction of five multiple-purpose instrumentation sites on San Nicolas Island. Although this alternative meets the purpose and need for the proposed action, the capability of the Sea Range to support existing and future operations would not be fulfilled to the extent it would under the Preferred Alternative.

ES.5.2.3 Preferred Alternative

In addition to the five categories of tests currently conducted at the Sea Range, under the Preferred Alternative the Sea Range would be able to accommodate TMD testing and training activities. In addition, the Sea Range would be able to accommodate an increase in the level of current Fleet training and special warfare training activities. Facility modernization components at both NAS Point Mugu and San Nicolas Island would be implemented to enhance the capability of the Sea Range to support existing and future operations. A comparison of the three alternatives analyzed in the EIS/OEIS is provided in Table ES-3.

ES.6 ENVIRONMENTAL ANALYSIS

ES.6.1 Overview

The analysis evaluates potential environmental consequences associated with the proposal to accommodate TMD testing and training activities, accommodate an increase in the current levels of training, and modernize facilities at the NAWCWPNS Point Mugu Sea Range. Potential environmental consequences of the proposed action have been analyzed for the following resources: geology and soils; air quality; noise; water quality; marine biology; fish and sea turtles; marine mammals; terrestrial biology; cultural resources; land use; traffic; socioeconomics; hazardous materials, hazardous wastes, and non-hazardous wastes; and public safety. Chapter 3 (Affected Environment) contains descriptions of the existing environment and socioeconomic conditions in the region of influence (ROI), which includes

Table ES-3. Alternatives Analyzed in the EIS/OEIS

Operational Element	Alternatives		
	No Action Alternative	Minimum Components Alternative	Preferred Alternative
Current Operations			
Air-to-Air Air-to-Surface Surface-to-Air Surface-to-Surface Subsurface-to-Surface	Current RDT&E Levels	Current RDT&E Levels	Current RDT&E Levels
TMD Element (Per Year)			
Boost Phase	0	0	3
Upper Tier	0	0	3
Lower Tier	0	0	3
Nearshore Intercept	0	8	8
Training Element (Per Year)			
FLEETEX	2	3	3
Special Warfare	2	2	4
Facility Modernization Element			
NAS Point Mugu	None	None	New Launch Locations
San Nicolas Island	None	- 5 multi-purpose instrumentation sites	- Missile Launcher - Vertical Launcher - Range Support Building - 5 multi-purpose instrumentation sites

RDT&E = Research, Development, Test and Evaluation

the Point Mugu Sea Range, NAS Point Mugu, San Nicolas Island, San Miguel Island, Santa Rosa Island, and Santa Cruz Island (see Figure ES-1).

Rather than focusing on specific operations that may occur within a limited part of the Point Mugu Sea Range, the EIS/OEIS provides a range-wide, comprehensive evaluation of proposed, as well as current, activities conducted on the Sea Range. To perform this analysis, five major types of test scenarios that are conducted on the range have been described (see Chapter 3 of the EIS/OEIS) and evaluated (see Chapter 4 of the EIS/OEIS). The five major types of ongoing test scenarios are: 1) air-to-air operations, 2) air-to-surface operations, 3) surface-to-air operations, 4) surface-to-surface operations, and 5) subsurface-to-surface operations. These five categories encompass all of the typical range operations that are currently conducted in support of testing activities. In addition, three typical types of ongoing training activities have been described and evaluated. The three major types of ongoing training activities are: 1) Fleet training exercises, 2) small-scale amphibious warfare training, and 3) special warfare training. These ongoing activities comprise the No Action Alternative, as they would continue regardless of which alternative is selected. Analysis of the No Action Alternative provides a discussion of ongoing test and training operations so that a baseline is established to address future test and training evolutions. Chapter 4 of the EIS/OEIS therefore addresses: 1) environmental impacts of current operations, and 2) potential environmental impacts of accommodating TMD testing and training, accommodating an increase in current levels of training, and modernizing Sea Range facilities.

ES.6.2 Environmental Consequences

Chapter 4, Environmental Consequences, evaluates potential impacts on the environment that would result from implementation of the proposed action or alternatives. For each impact, a determination has been made whether it would be significant or less than significant. Per CEQ regulations, the significance of impacts must be considered in terms of context and intensity (40 C.F.R. 1508.27). Mitigation measures are identified for any impacts determined to be significant. In some cases, recommendations have been provided to identify measures that would reduce environmental effects of Navy activities or to help ensure that ongoing or proposed activities would not result in significant environmental impacts.

Since this EIS/OEIS has been prepared in compliance with NEPA and EO 12114, italics have been used to differentiate each instance in which the analysis is conducted pursuant to NEPA or in which it is conducted pursuant to EO 12114; within Chapter 4 of the EIS/OEIS, impact discussions under the purview of NEPA are presented in regular text while discussions pursuant to EO 12114 are presented in italicized text. Table ES-4 provides details on impacts and mitigation measures for the No Action Alternative (current operations), the Minimum Components Alternative, and the Preferred Alternative. No significant impacts were identified for any of the alternatives.

ES.6.3 Cumulative Impacts

The analysis of cumulative impacts considers the effects of the proposed action in combination with other past, present, and reasonably foreseeable future actions taking place in the project area, regardless of what agency or person undertakes such other actions. Table ES-5 summarizes relevant past, present, and reasonably foreseeable future actions on the Point Mugu Sea Range or in the immediate vicinity of NAS Point Mugu that were evaluated for potential cumulative effects.

The potential for cumulative impacts is minimized because most of the relevant projects considered for analysis primarily affect onshore resources, while the proposed actions addressed in the EIS/OEIS primarily affect offshore resources in the Sea Range. Consequently, due to the differing characteristics of the projects, the potential for cumulative impacts is limited. For most of the actions included in Table ES-5, specific environmental documentation addressing direct and indirect effects either has been or will be conducted separately from this EIS/OEIS. Upon examination of the potential environmental impacts of these projects in consideration of the potential for additive effects when combined with the proposed activities addressed in the EIS/OEIS, the Navy determined that no cumulative impacts would occur between the proposed action and these relevant projects.

ES.6.4 Mitigation Measures

Measures identified to reduce effects or ensure no future impacts occur are summarized in Table ES-4.

ES.6.5 Other NEPA Considerations

Possible Conflicts Between the Action and the Objectives of Federal, Regional, State and Local Plans, Policies, and Controls. The proposed action would comply with existing federal regulations and with state, regional, and local policies and programs. The proposed action would be in compliance with all applicable federal acts, executive orders, and policies.

Energy Requirements and Conservation Potential of the Proposed Action and Alternatives. Energy required to successfully implement the proposed action would include fossil fuels and electricity needed to power aircraft, missiles, targets, vehicles, vessels, and equipment. Fuels and electricity are currently

Table ES-4. Impact Summary Chart

Alternative	GEOLOGY AND SOILS: NEPA (On Land→ Territorial Waters)	GEOLOGY AND SOILS: EO 12114 *(Non-Territorial Waters)*	AIR QUALITY: NEPA (On Land→ Territorial Waters)	AIR QUALITY: EO 12114 *(Non-Territorial Waters)*
NO ACTION ALTERNATIVE	Ten-year accumulation of target launch combustion products in soils, in mg per kg of soil (Mugu/San Nicolas Island): Al (11.3/26.0), Pb (0.2/ 0.5), Cu (0.05/0.1). These levels are substantially below federal soil quality guidelines and are less than 4% and 6% of respective background soil concentrations. Physical soil disturbance from JATO bottles falling on dry soil at Point Mugu and San Nicolas Island constitutes only 0.1 and 0.03% of the respective impact areas. Less than significant impact.	*No effects on sediment stability; changes to ocean bottom sediment quality are well below federal standards. Less than significant impact.*	No increases in current emissions; no change to baseline. Less than significant impacts.	*No increases in current emissions; no change to baseline. Less than significant impacts.*
MINIMUM COMPONENTS ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Ten-year accumulation of target launch combustion products in soils, in mg/kg (Mugu/San Nicolas Island): Al (12.0/34.6), Pb (0.2/ 0.7), Cu (0.06/0.2). These levels are substantially below federal soil quality guidelines and are less than 4% and 8% of respective background soil concentrations. Physical soil disturbance from JATO bottles falling on dry soil at Point Mugu and San Nicolas Island would constitute only 0.1 and 0.04% of the respective impact areas. Less than significant impact.	*No effects on sediment stability; changes to ocean bottom sediment quality would be well below federal standards. Less than significant impact.*	Net emissions change below de minimis levels; a General Conformity Determination not required. Net emissions change would not significantly affect regional air quality; less than significant impact.	*Net emissions change would not significantly affect air quality; less than significant impact.*
PREFERRED ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Ten-year accumulation of target launch combustion products in soils, in mg/kg (Mugu/San Nicolas Island): Al (12.0/47.9), Pb (0.2/ 0.9), Cu (0.06/0.2). These levels are substantially below federal soil quality guidelines and are less than 4% and 10% of respective background soil concentrations. Physical soil disturbance from JATO bottles falling on dry soil at Point Mugu and San Nicolas Island would constitute only 0.1 and 0.04% of the respective impact areas. Less than significant impact.	*No effects on sediment stability; changes to ocean bottom sediment quality would be well below federal standards. Less than significant impact.*	Net emissions change below de minimis levels; a General Conformity Determination not required. Net emissions change would not significantly affect regional air quality; less than significant impact.	*Net emissions change would not significantly affect air quality; less than significant impact.*
MITIGATION MEASURES	None.	*None.*	None.	*None.*

Table ES-4. Impact Summary Chart (continued)

Alternative	NOISE: NEPA (On Land→ Territorial Waters)	NOISE: *EO 12114 (Non-Territorial Waters)*	WATER QUALITY*: NEPA (On Land→ Territorial Waters)	WATER QUALITY*: *EO 12114 (Non-Territorial Waters)*
NO ACTION ALTERNATIVE	No change to noise contours at the NAS Point Mugu or San Nicolas Island airfields. Less than significant impact. No change from current Sea Range airborne noise levels (63.3 L_{dnmr}). Less than significant impact.	*No change from current Sea Range airborne noise levels (63.3 L_{dnmr}). Less than significant impact.*	Mugu Lagoon: short-term concentrations for metals (0.06-2.7 µg/L), fuel (0.65-2.2 µg/L), and perchlorate (3.9-13.4 µg/L) below standards. Sea Range: PAHs (4.02-193 µg/L) below standards; battery constituents from FLEETEX activities (0.01-37.6 µg/L) exceed chronic criteria resulting in localized, short-term impacts. Other activities below standards. Less than significant impact.	*PAHs (4.02-141,000 µg/L); aircraft target activities temporarily exceed standards but would quickly dissipate to levels at or below standards. Other activities below standards. Battery constituents from FLEETEX activities (0.01-37.6 µg/L) exceed chronic criteria resulting in localized, short-term impacts; other activities below standards. Less than significant impact.*
MINIMUM COMPONENTS ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	No change to noise contours at the NAS Point Mugu or San Nicolas Island airfields. Less than significant impact. No change from current Sea Range airborne noise levels (63.3 L_{dnmr}). Less than significant impact.	*No change from current Sea Range airborne noise levels (63.3 L_{dnmr}). Less than significant impact.*	Mugu Lagoon: short-term concentrations for metals (0.06-2.7 µg/L), fuel (0.65-2.2 µg/L), and perchlorate (3.9-13.4 µg/L) below standards. Sea Range: PAHs (4.02-193 µg/L) below standards. Battery constituents from nearshore intercept and FLEETEX activities (7.1-37.6 µg/L) would exceed chronic criteria resulting in localized, short-term impacts. Less than significant impact.	*PAHs (4.02-141,000 µg/L); aircraft target activities would temporarily exceed standards but would quickly dissipate to levels at or below standards. Other activities below standards. Battery constituents from FLEETEX activities (37.6 µg/L) would exceed chronic criteria resulting in localized, short-term impacts. Less than significant impact.*
PREFERRED ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	No change to noise contours at the NAS Point Mugu or San Nicolas Island airfields. Less than significant impact. A <1 L_{dnmr} increase from current Sea Range airborne noise levels. Less than significant impact.	*A <1 L_{dnmr} increase from current Sea Range airborne noise levels. Less than significant impact.*	Mugu Lagoon: short-term concentrations for metals (0.06-2.7 µg/L), fuel (0.65-2.2 µg/L), and perchlorate (3.9-13.4 µg/L) below standards. Sea Range: PAHs (4.02-193 µg/L) below standards. Battery constituents from nearshore intercept and FLEETEX activities (7.1-37.6 µg/L) would exceed chronic criteria resulting in localized, short-term impacts. Less than significant impact.	*PAHs (4.02-141,000 µg/L); aircraft target activities would temporarily exceed standards but would quickly dissipate to levels at or below standards. Other activities below standards. Battery constituents from FLEETEX activities (37.6 µg/L) would exceed chronic criteria resulting in localized, short-term impacts. Less than significant impact.*
MITIGATION MEASURES	None.	*None.*	None.	*None.*

* Water quality concentrations of each activity are addressed independently, not collectively. NAWQC criteria are applicable only for short-term concentrations but not for loading or long-term effects. In addition, it is extremely unlikely that any two activities would affect the same volume of water, even if they occurred very close together in time.

Table ES-4. Impact Summary Chart (continued)

Alternative	MARINE BIOLOGY — NEPA (On Land→ Territorial Waters)	MARINE BIOLOGY — EO 12114 (Non-Territorial Waters)	FISH AND SEA TURTLES — NEPA (On Land→ Territorial Waters)	FISH AND SEA TURTLES — EO 12114 (Non-Territorial Waters)
NO ACTION ALTERNATIVE	Concentration of sediment and water quality contaminants below criteria established for protection of aquatic life with the exception of current FLEETEX activities. Hazardous constituents from FLEETEX activities slightly exceed criteria for sediment quality and may produce localized, short-term impacts. No impacts on threatened and endangered species. No long-term changes to species abundance or diversity. Less than significant impact.	*Concentration of sediment and water quality contaminants below criteria established for protection of aquatic life (excluding QF-4 and FLEETEX activities). QF-4 activities may produce localized, short-term impacts in the open ocean away from sensitive resources. Hazardous constituents from FLEETEX activities slightly exceed criteria for sediment quality and may produce localized, short-term impacts. No impacts on threatened and endangered species. No long-term changes to species abundance or diversity. No loss or degradation of sensitive species habitat from missile or target debris. Less than significant impact.*	Ship noise and noise caused by intact missiles may result in short-term behavioral changes in fish (e.g., fish may temporarily avoid the area); less than significant impact. No significant impacts on small number of sea turtles within the ROI.	*Ship noise and noise caused by intact missiles may result in short-term behavioral changes in fish (e.g., fish may temporarily avoid the area); less than significant impact. No significant impacts on small number of sea turtles within the ROI.*
MINIMUM COMPONENTS ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Concentration of sediment and water quality contaminants below criteria established for protection of aquatic life, with exception of the additional FLEETEX. Hazardous constituents from the current and additional FLEETEX activities slightly exceed criteria for sediment quality and may produce localized, short-term impacts. No impacts on threatened and endangered species. No long-term changes to species abundance or diversity. Potential loss of small amount of kelp within range of natural variability. Less than significant impact.	*Concentration of sediment and water quality contaminants below criteria established for protection of aquatic life, with exception of the additional FLEETEX. Hazardous constituents from the current and additional FLEETEX activities slightly exceed criteria for sediment quality, and may produce localized, short-term impacts. No impacts on threatened and endangered species. No long-term changes to species abundance or diversity. No loss or degradation of sensitive species habitat from missile or target debris. Less than significant impact.*	Ship noise and noise caused by intact missiles may result in short-term behavioral changes in fish (e.g., fish may temporarily avoid the area); less than significant impact. No significant impacts on small number of sea turtles within the ROI. Potential loss of small numbers of fish due to immediate exposure of nearshore intercept debris. No significant impacts on fish populations or fisheries.	*Ship noise and noise caused by intact missiles may result in short-term behavioral changes in fish (e.g., fish may temporarily avoid the area); less than significant impact. No significant impacts on small number of sea turtles within the ROI.*

Table ES-4. Impact Summary Chart (continued)

Alternative	*MARINE BIOLOGY (CONTINUED)* **NEPA** (On Land→ Territorial Waters)	*MARINE BIOLOGY (CONTINUED)* ***EO 12114*** *(Non-Territorial Waters)*	*FISH AND SEA TURTLES (CONTINUED)* **NEPA** (On Land→ Territorial Waters)	*FISH AND SEA TURTLES (CONTINUED)* ***EO 12114*** *(Non-Territorial Waters)*
PREFERRED ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Concentration of sediment and water quality contaminants below criteria established for protection of aquatic life, with exception of the additional FLEETEX. Hazardous constituents from the current and additional FLEETEX activities slightly exceed criteria for sediment quality, and may produce localized, short-term impacts. No impacts on threatened and endangered species. No long-term changes to species abundance or diversity. Potential loss of small amount of kelp within range of natural variability. Less than significant impact.	*Concentration of sediment and water quality contaminants below criteria established for protection of aquatic life, with exception of the additional FLEETEX. Hazardous constituents from the current and additional FLEETEX activities slightly exceed criteria for sediment quality, and may produce localized, short-term impacts. No impacts on threatened and endangered species. No long-term changes to species abundance or diversity. No loss or degradation of sensitive species habitat from missile or target debris. Less than significant impact.*	Ship noise and noise caused by intact missiles may result in short-term behavioral changes in fish (e.g., fish may temporarily avoid the area); less than significant impact. No significant impacts on small number of sea turtles within the ROI. Potential loss of small numbers of fish due to immediate exposure of nearshore intercept debris. No significant impacts on fish populations or fisheries.	*Ship noise and noise caused by intact missiles may result in short-term behavioral changes in fish (e.g., fish may temporarily avoid the area); less than significant impact. No significant impacts on small number of sea turtles within the ROI.*
MITIGATION MEASURES	None.	*None.*	None.	*None.*

Table ES-4. Impact Summary Chart (continued)

MARINE MAMMALS

Alternative	**NEPA** (On Land→ Territorial Waters)	***EO 12114*** *(Non-Territorial Waters)*
NO ACTION ALTERNATIVE	There is a low probability in any one year that any marine mammal is injured or killed by intact missile impacts or shock waves (0.0004), inert mine drops (0.0005), or falling debris from intercepts (0.0007) in Territorial Waters (Table 4.7-3). The probability that a threatened or endangered species is hit approaches zero. Impacts are less than significant. Small numbers of marine mammals (2.0 per year) experience TTS with no biological consequences in Territorial Waters (Table 4.7-3). The likelihood of any individual animal experiencing TTS more than once per year approaches zero. Impacts are less than significant. Pinnipeds on San Nicolas Island show little reaction to most transient sounds. However, recent Navy monitoring efforts revealed that pinnipeds stampeded during two separate Vandal launch events. Pinniped populations near the launch sites and around the entire island are expanding. Pinnipeds at Point Mugu are not exposed to sound levels that could cause disturbance. Population level impacts are less than significant.	*There is a low probability in any one year that any marine mammal is injured or killed by intact missile impacts or shock waves (0.0009), or falling debris from intercepts (0.001) in non-Territorial Waters (Table 4.7-3). The probability that a threatened or endangered species is hit approaches zero. Impacts are less than significant.* *Small numbers of marine mammals (2.1 per year) experience TTS (Table 4.7-3) with no biological consequences in non-Territorial Waters. The likelihood of any individual animal experiencing TTS more than once per year approaches zero. Impacts are less than significant.*
MINIMUM COMPONENTS ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Increased debris would have a negligible effect on the overall probability of a marine mammal being injured or killed by intact missiles and falling debris hitting the water (Table 4.7-5). Small numbers of marine mammals (5.2 per year) may experience short-term TTS with no biological consequences (Table 4.7-5). Impacts would be less than significant. Pinnipeds on San Nicolas Island would show little reaction to nearshore intercepts. San Nicolas Island construction would not affect pinniped haul-out sites. Otherwise same as for No Action Alternative. Population-level impacts would be less than significant.	*Increased debris would have a negligible effect on the overall probability of a marine mammal being injured or killed by intact missiles and falling debris hitting the water (Table 4.7-5).* *Small numbers of marine mammals (2.3 per year) may experience short-term TTS with no biological consequences (Table 4.7-5). Impacts would be less than significant.*
PREFERRED ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Increased debris would have a negligible effect on the overall probability of a marine mammal being injured or killed by intact missiles and falling debris hitting the water (Table 4.7-6). Small numbers of marine mammals (5.2) per year may experience short-term TTS with no biological consequences (Table 4.7-6). Impacts would be less than significant. Some of the pinnipeds on western San Nicolas Island may react to some additional launches. Population-level impacts would be less than significant. Use of the beach launch pads at NAS Point Mugu and construction at San Nicolas Island would not affect pinniped haul-out sites. Additional launches from San Nicolas Island would have no long-term impacts. Received sound levels at the Mugu Lagoon haul-out site would remain below the disturbance threshold. Impacts would be less than significant.	*Increased debris would have a negligible effect on the overall probability of a marine mammal being injured or killed by intact missiles and falling debris hitting the water (Table 4.7-6).* *Small numbers of marine mammals (2.9) per year may experience short-term TTS with no biological consequences (Table 4.7-6). Impacts would be less than significant.*

Table ES-4. Impact Summary Chart (continued)

	MARINE MAMMALS (CONTINUED)	
Alternative	**NEPA** (On Land→ Territorial Waters)	***EO 12114*** *(Non-Territorial Waters)*
MITIGATION MEASURES	Recent monitoring efforts at San Nicolas Island revealed that pinnipeds stampeded during two separate Vandal launch events. In response to these recent observations, the Navy applied for and received Incidental Harassment Authorization (IHA) from NMFS. In accordance with the IHA, where practicable, the Navy will adopt the following mitigation measures when doing so will not compromise operational safety requirements or mission goals: • the Navy will prohibit personnel from entering pinniped haul-out sites below the missile's predicted flight path within two hours prior to launch; • the Navy will avoid launch activities during harbor seal pupping seasons; • the Navy will limit launch activities during other pinniped pupping seasons; • the Navy will not launch target missiles at low elevation on launch azimuths that pass close to beach haul-out site(s); • the Navy will avoid multiple target launches in quick succession over haul-out sites, especially when young pups are present; • the Navy will limit launch activities during the night; • the Navy will maintain a minimum altitude of 1,000 feet from pinniped haul-out sites during aircraft and helicopter operations; and • the Navy will contact NMFS within 48 hours if injurious or lethal takes are discovered during marine mammal monitoring. A description of the activities covered under the IHA and a summary of the associated monitoring program are included in Appendix E of this EIS/OEIS.	*None.*

Table ES-4. Impact Summary Chart (continued)

TERRESTRIAL BIOLOGY

Alternative	NEPA (On Land→ Territorial Waters)	EO 12114 (Non-Territorial Waters)
No Action Alternative	The potential for bird strikes by aircraft, missiles, targets, and debris is low and precludes biologically significant impacts on bird populations. Increases in ambient noise levels from routine aircraft takeoffs and landings and missile and target launches from NAS Point Mugu sometimes result in temporary interruption of foraging, resting, or flying behaviors with no biologically significant impacts on bird populations. Potential for adverse impacts to breeding cormorant colonies on San Nicolas Island due to human disturbance and gull predation resulting from launch activities (i.e., cormorants may leave their nests). Monitoring program ensures impacts remain less than significant. Potential impacts on sensitive species from direct hits from JATO bottles at both NAS Point Mugu and San Nicolas Island are less than significant given the very low probability of a strike, when considered on either an individual or yearly basis (Table 4.8-2). Potential impacts on sensitive species habitat from JATO bottles accumulating in Mugu Lagoon or on San Nicolas Island are less than significant given implementation of the JATO bottle removal program, now in effect at NAS Point Mugu and in development at San Nicolas Island. Potential for adverse impact to snowy plovers nesting near the Building 807 Launch Complex on San Nicolas Island from human and vehicle traffic associated with launch operations. Mitigation measures have been developed in coordination with the USFWS and are described in the Biological Opinion issued by the USFWS and summarized in Section 4.8.5 of this EIS/OEIS..	*Potential impacts limited to debris effects on seabirds. Seabird density is low in affected areas and the potential for direct impacts is remote. Less than significant impact.*
Minimum Components Alternative (This alternative includes impacts identified for the No Action Alternative.)	Short-term increase in noise similar to current operations. Construction sites on San Nicolas Island would avoid sensitive habitat. Less than significant impact. An increase in operations would increase the potential for bird strikes from aircraft, missiles, targets, and debris but potential for strikes still low enough to preclude biologically significant impacts on bird populations. Small increase in JATO bottle use from the additional FLEETEX would have a negligible effect on the overall probability of a sensitive species being hit by a JATO bottle (Table 4.8-2); impacts would be less than significant.	*Potential impacts limited to debris effects on seabirds. Seabird density is low in affected areas and the potential for direct impacts is remote. Less than significant impact.*

Table ES-4. Impact Summary Chart (continued)

Alternative	NEPA (On Land→ Territorial Waters) — *TERRESTRIAL BIOLOGY (CONTINUED)*	*EO 12114 (Non-Territorial Waters)*
PREFERRED ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Short-term increase in noise similar to current operations. Construction sites on San Nicolas Island would avoid sensitive habitat. Less than significant impact. An increase in operations would increase the potential for bird strikes from aircraft, missiles, targets, and debris but potential for strikes still low enough to preclude biologically significant impacts on bird populations. Small increase in JATO bottle use from the additional FLEETEX would have a negligible effect on the overall probability of a sensitive species being hit by a JATO bottle (Table 4.8-2); impacts would be less than significant. Potential for adverse impacts to nesting snowy plovers from disturbance due to missile launches from Pad B and Pad C at NAS Point Mugu resulting in increased noise and human activity. Mitigation measures have been developed in coordination with the USFWS and are described in the Biological Opinion issued by the USFWS and summarized in Section 4.8.5 of this EIS/OEIS.	*Potential impacts limited to debris effects on seabirds. Seabird density is low in affected areas and the potential for direct impacts is remote. Less than significant impact.*
MITIGATION MEASURES	Monitor existing cormorant colonies on San Nicolas Island to determine reaction to launches. Develop mitigation measures if an adverse reaction is observed. Monitor Building 807 Launch Complex area during snowy plover breeding season to determine usage and nest locations. Place physical barriers around active nests. Further methods to offset disturbance have been developed in consultation with the USFWS and are described in the Biological Opinion issued by the USFWS and summarized in Section 4.8.5 of this EIS/OEIS. Conduct regular surveys and monitor snowy plover nesting sites within the Pad B and Pad C launch areas at NAS Point Mugu. Protect active nests by placement of barricades and signs. Further methods have been identified in coordination with the USFWS and are described in the Biological Opinion issued by the USFWS and summarized in Section 4.8.5 of this EIS/OEIS.	*None.*

Table ES-4. Impact Summary Chart (continued)

Alternative	CULTURAL RESOURCES: **NEPA** (On Land→ Territorial Waters)	CULTURAL RESOURCES: ***EO 12114*** *(Non-Territorial Waters)*	LAND USE: **NEPA** (On Land→ Territorial Waters)	LAND USE: ***EO 12114*** *(Non-Territorial Waters)*
NO ACTION ALTERNATIVE	Potentially significant but mitigable impact on submerged cultural resources in Becher's Bay.	*Few cultural resources offshore. No significant impacts on submerged resources.*	No change to existing land use. Less than significant impact.	*No change to existing land use. Less than significant impact.*
MINIMUM COMPONENTS ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Potential for significant but mitigable impacts on subsurface archaeological deposits during construction on San Nicolas Island.	*Few cultural resources offshore. No significant impacts on submerged resources.*	Closure of San Nicolas Island to peak commercial fishing 2-4 days per year. Less than significant impact.	*No substantial changes to current or planned land use. Less than significant impact.*
PREFERRED ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Potential for significant but mitigable impacts on subsurface archaeological deposits during construction on San Nicolas Island.	*Few cultural resources offshore. No significant impacts on submerged resources.*	Closure of San Nicolas Island to peak commercial fishing 2-4 days per year. Less than significant impact.	*No substantial changes to current or planned land use. Less than significant impact.*
MITIGATION MEASURES	If inert mine drops or cleanup activities occur nearshore of the hazard area and expose cultural resources, initiate data recovery measures in accordance with Section 106. Resulting impacts would be less than significant. Implement construction requirement to halt work upon discovery of resource and initiate Section 106 consultation. Resulting impacts would be less than significant.	*None.*	None.	*None.*

Table ES-4. Impact Summary Chart (continued)

Alternative	*TRAFFIC*		*SOCIOECONOMICS*	
	NEPA (On Land→ Territorial Waters)	***EO 12114*** *(Non-Territorial Waters)*	**NEPA** (On Land→ Territorial Waters)	***EO 12114*** *(Non-Territorial Waters)*
NO ACTION ALTERNATIVE	No increase in vehicular traffic. Established flight procedures and no change to airspace use. Advance notice system and low levels of marine traffic in affected areas. Less than significant impact.	*Established flight procedures and no change to airspace use. Advance notice system and low levels of marine traffic in affected areas. Less than significant impact.*	Current range operations do not adversely affect commercial shipping and fishing, sport fishing, or tourist-related economic activities. Less than significant impact.	*Current range operations do not adversely affect commercial shipping and fishing, sport fishing, or tourist-related economic activities. Less than significant impact.*
MINIMUM COMPONENTS ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	No increase in vehicular traffic. Aircraft sorties increase by less than 1%. Less than 4% increase in total vessel activity for TMD testing and training. Short duration (2-3 days) of additional training. Less than significant impact.	*Aircraft sorties increase by less than 1%. Less than 4% increase in total vessel activity for TMD testing and training. Short duration (2-3 days) of additional training. Less than significant impact.*	Short-term, adverse effects on individual commercial fishermen during peak periods (about $150,000 maximum total potential revenue loss on a peak day); since some lost revenue could be recaptured for the 2-4 closures/year during peak periods, regional earnings would not be significantly affected and impact would be less than significant. Minority or low income populations would not be disproportionately affected. Children would not be exposed to increased noise levels or disproportionately exposed to safety risks.	*Temporary range clearance procedures would not affect economic activities in offshore waters. Less than significant impact.*
PREFERRED ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Short-term construction traffic on San Nicolas Island. Less than 2% increase in aircraft activity for TMD testing and training. Short duration of additional training (7 days maximum). Established air and marine traffic procedures. Less than significant impact.	*Less than 2% increase in aircraft activity for TMD testing and training. Short duration of additional training (2-3 days). Established air and marine traffic procedures. Less than significant impact.*	Short-term, adverse effects on individual commercial fishermen during peak periods (about $150,000 maximum total potential revenue loss on a peak day); since some lost revenue could be recaptured for the 2-4 closures/year during peak periods, regional earnings would not be significantly affected and impact would be less than significant. Minority or low income populations would not be disproportionately affected. Children would not be exposed to increased noise levels or disproportionately exposed to safety risks.	*Temporary range clearance procedures would not affect economic activities in offshore waters. Less than significant impact.*
MITIGATION MEASURES	None.	*None.*	None.	*None.*

Table ES-4. Impact Summary Chart (continued)

Alternative	HAZARDOUS MATERIALS: NEPA (On Land→ Territorial Waters)	HAZARDOUS MATERIALS: *EO 12114 (Non-Territorial Waters)*	PUBLIC SAFETY: NEPA (On Land→ Territorial Waters)	PUBLIC SAFETY: *EO 12114 (Non-Territorial Waters)*
NO ACTION ALTERNATIVE	Military munitions are not considered hazardous wastes when they are used for their intended purpose, including training of military personnel and research and development activities. This includes virtually all of the use of guided missiles, ballistic missiles, rockets, and missile targets at the Point Mugu Sea Range. A review of the use of munitions and targets on the Sea Range was conducted and their hazardous constituents disposition was analyzed; these results are used in the analyses of other resource areas to determine the potential for significant impacts. The components that contain hazardous constituents include propellants, batteries, flares, telemetry, igniters, jet fuel, diesel fuel, hydraulic fluid, and explosive warheads. A total of 964.82 pounds (437.64 kg) per year of hazardous constituents were deposited within Territorial Waters of the Sea Range in the baseline year. There would be no increase in the generation, transport, or storage of hazardous waste and therefore no impacts on hazardous waste management at NAS Point Mugu or San Nicolas Island. Less than significant impact.	*Military munitions are not considered hazardous wastes when they are used for their intended purpose, including training of military personnel and research and development activities. This includes virtually all of the use of guided missiles, ballistic missiles, rockets, and missile targets at the Point Mugu Sea Range. A review of the use of munitions and targets on the Sea Range was conducted and their hazardous constituents disposition was analyzed; these results are used in the analyses of other resource areas to determine the potential for significant impacts. The components that contain hazardous constituents include propellants, batteries, flares, telemetry, igniters, jet fuel, diesel fuel, hydraulic fluid, and explosive warheads. A total of 12,105.04 pounds (5,490.81 kg) per year of hazardous constituents were deposited within non-Territorial Waters of the Sea Range in the baseline year.*	Range clearance procedures implemented before each event; EMR below safety thresholds for personnel. Less than significant impacts.	*Range clearance procedures implemented before each event. Less than significant impacts.*
MINIMUM COMPONENTS ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	A total of 2,869.99 pounds (1,301.82 kg) per year of hazardous constituents would be deposited within Territorial Waters of the Sea Range (an increase of 1,905.17 pounds [864.18 kg] over current operations). The small increase in range operations would not significantly affect hazardous waste management at NAS Point Mugu or San Nicolas Island. Less than significant impact.	*A total of 12,804.82 pounds (5,808.23 kg) per year of hazardous constituents would be deposited within non-Territorial Waters of the Sea Range (an increase of 699.78 pounds [317.42 kg] over current operations).*	Range clearance procedures implemented before each event. Less than significant impacts.	*Range clearance procedures implemented before each event. Less than significant impacts.*

Table ES-4. Impact Summary Chart (continued)

	HAZARDOUS MATERIALS (CONTINUED)		***PUBLIC SAFETY (CONTINUED)***	
Alternative	**NEPA** (On Land→ Territorial Waters)	***EO 12114*** *(Non-Territorial Waters)*	**NEPA** (On Land→ Territorial Waters)	***EO 12114*** *(Non-Territorial Waters)*
PREFERRED ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	A total of 2,988.95 pounds (1,355.78 kg) per year of hazardous constituents would be deposited within Territorial Waters of the Sea Range (an increase of 2,024.13 pounds [918.14 kg] over current operations). The small increase in range operations would not significantly affect hazardous waste management at NAS Point Mugu or San Nicolas Island. Less than significant impact.	*A total of 13,269.75 pounds (6,019.12 kg) per year of hazardous constituents would be deposited within non-Territorial Waters of the Sea Range (an increase of 1,164,71 pounds [528.31 kg] over current operations).*	For upper tier events, the Navy would increase range safety and clearance resources and increase coordination efforts with the FAA and Coast Guard. Less than significant impacts.	*For upper tier events, the Navy would increase range safety and clearance resources and increase coordination efforts with the FAA and Coast Guard. Less than significant impacts.*
MITIGATION MEASURES	None.	*None.*	None.	*None.*

Table ES-5. Projects and Actions on the Point Mugu Sea Range or in the Immediate Vicinity of NAS Point Mugu that were Evaluated for Cumulative Impacts

Action	Description
VR-55 and MMF Relocation	Relocation of five C-130 aircraft, 66 maintenance vans, and associated personnel from Moffet Field, California, to NAS Point Mugu
Surface Warfare Engineering Facility	Radio frequency emitters located at the Construction Battalion Center in Port Hueneme; operated by a separate Navy Command
West Coast Basing of the F/A-18E/F Aircraft	Once considered a potential receiving installation for F/A-18 aircraft and associated personnel, NAS Point Mugu was eliminated as a candidate
San Clemente Island Range Complex	Ongoing operations at Navy-owned San Clemente Island and associated range and operational areas
Tomahawk Testing and Training	A proposal to use an existing underwater launch site near San Clemente Island and establish and use a new missile recovery area on San Nicolas Island
Inert Ordnance Delivery Location at San Nicolas Island	A proposal to establish an inert ordnance delivery area on San Nicolas Island
Pier Construction at San Nicolas Island	A proposal to establish a new supply pier on San Nicolas Island
E-2C Aircraft Parking Apron Extension	A proposal to extend an existing aircraft parking apron at NAS Point Mugu.
Range Operations Center Addition	A proposal to construct a two-story addition to the existing Range Operations Center at NAS Point Mugu.
Vandenberg Air Force Base Ongoing Operations	Operations include launching and tracking satellites in space and testing and evaluating strategic intercontinental ballistic missile systems
Evolved Expendable Launch Vehicle Program	Development and deployment of Evolved Expendable Launch Vehicle systems at Vandenberg Air Force Base
F-22 Low-Level Supersonic Over-Water Testing	Operations include conducting 24 low-level supersonic sorties per year over open ocean areas within the Point Mugu Sea Range
California State University Channel Islands Campus	Reuse of the former California State Development Hospital facilities in Camarillo as a new university campus in Ventura County
Construction Projects within the Region of Influence	Various construction projects proposed in Ventura County and at NAS Point Mugu
Hyper-X Research Vehicle Program	Preflight preparation and test flight activities that include use of the Point Mugu Sea Range
Shipping Channel Relocation	A proposal to relocate the Southern California Shipping Channel 25 miles south of its current location
Channel Islands National Marine Sanctuary	The management plan for the sanctuary is currently being revised
Minerals Management Service Exploratory Drilling	A proposal to conduct exploratory drilling activities in Federal waters offshore Santa Barbara County, California
Marine Vessel Noise	Marine vessel noise from Navy, commercial, and private vessel traffic in the Sea Range

available and are in adequate supply. Proposed new construction would comply with local and state codes which are designed to promote energy efficiency, water conservation, and the use of renewable energy sources. No additional conservation measures related to direct energy consumption by the proposed action are identified.

Irreversible or Irretrievable Commitment of Resources. The proposed action would constitute an irreversible or irretrievable commitment of nonrenewable or depletable resources for the materials and energy expended during implementation of the TMD, training, and facility modernization elements. Implementation of the proposed action would not result in the destruction of environmental resources such that the range of potential uses of the environment would be limited.

Relationship Between Short-Term Environmental Impacts and Long-Term Productivity. Implementation of the proposed action would result in increased air emissions, increased noise, increased air and vessel traffic, and increased deposition of weapons testing debris into the Sea Range. These impacts would be positively offset by the long-term productivity of NAWCWPNS Point Mugu and the long-term goal of allowing the Navy to successfully meet future defense requirements.

Unavoidable Adverse Effects. CEQ regulations (40 C.F.R. § 1502.16) require a discussion of any adverse environmental effects that cannot be avoided. All potentially adverse impacts of the proposed action would be mitigable to a less than significant level by the implementation of mitigation measures recommended in this document (refer to Table ES-4).

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LIST OF ACRONYMS

A/C	Aircraft
AAMRL	Armstrong Aerospace Medical Research Laboratory
AAW	anti-air warfare
ABL	Airborne Laser
ADORE	Autonomous Data Optical Relay Experiment
ADT	average daily traffic
AEL	acceptable exposure level
AESO	Aircraft Environmental Support Office
AFB	Air Force Base
AGL	above ground level
AGM	air-to-ground missile
AICUZ	Air Installation Compatible Use Zone
AIM	air intercept missile
AIRFA	American Indian Religious Freedom Act
AM	Amplitude Modulation
AMRAAM	Advanced Medium Range Air-to-Air Missile
ANGB	Air National Guard Base
APZ	accident potential zone
ARPA	Archaeological Resources Protection Act
ARTCC	Air Route Traffic Control Center
ASBS	Area of Special Biological Significance
ASDV	advanced SEAL delivery vehicles
A-SEL	A-weighted sound exposure level
ASM	anti-surface missile
AST	above ground storage tank
ASW	anti-submarine warfare
ATC	air traffic control
ATCAA	air traffic control assigned airspace
BASH	bird-aircraft strike hazard
BATS	Ballistic Aerial Target System
BBS	Beacon Breach Line
BDU	bomb dummy unit
BG	Battle Group
BHWG	Bird Hazard Working Group
BITE	Battle Management Interoperability Test and Evaluation/Training Exercise
BLM	Bureau of Land Management
BLT	Battalion Landing Team
BMDO	Ballistic Missile Defense Organization
BRAC	Base Realignment and Closure
C	Celsius
CA	California (cultural resource naming convention)
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CAAQS	California Ambient Air Quality Standards

CAE	Control Area Extension
CALCOFI	California Cooperative Fisheries Investigation
Cal/EPA	California Environmental Protection Agency
CAP	Combat Air Patrol
CARB	California Air Resources Board
CBC	Construction Battalion Center
CBU	cluster bomb unit
CCA	California Coastal Act
CCC	California Coastal Commission
CCD	Coastal Consistency Determination
CCMP	California Coastal Management Program
CDFG	California Department of Fish and Game
CDMG	California Division of Mines and Geology
CDP	Census Designated Place
CEQ	Council on Environmental Quality
cfd	cubic feet per day
cfh	cubic feet per hour
C.F.R.	Code of Federal Regulations
CH&SC	California Health and Safety Code
CHMRIMP	Consolidated Hazardous Material Reutilization and Inventory Management Program
CINMS	Channel Islands National Marine Sanctuary
CINP	Channel Islands National Park
CIWS	Close-In Weapon System
cm	centimeter
CMSA	Consolidated Metropolitan Statistical Area
CNEL	community noise equivalent level
CNO	Chief of Naval Operations
CNPS	California Native Plant Society
CO	carbon monoxide
COC	contaminants of concern
COIL	chemical-oxygen-iodine laser
CQB	close quarter battle
CR	Cross Range
CRRC	Combat Rubber Raiding Craft
CRWQCB	California Regional Water Quality Control Board
CSAR	combat search and rescue
CSU	California State University
CSULA	California State University, Los Angeles
CTS	Command Transmitter Systems
CWA	Clean Water Act
CWC	Clean Water Code
CZ	clear zone
CZMA	Coastal Zone Management Act
dB	decibel

LIST OF ACRONYMS (continued)

DASN (E&S)	Deputy Assistant Secretary of the Navy for Environment and Safety
DBCRA	Defense Base Closure and Realignment Act
dd	double distance
DDESB	Department of Defense Explosive Safety Board
DDT	dichlorodiphenyltrichloroethane
DET	Distributed Explosive Technology
DNA	deoxyribonucleic acid
DoD	U.S. Department of Defense
DOI	U.S. Department of Interior
DR	Down Range
DRMO	Defense Reutilization and Marketing Office
DWR	Department of Water Resources
EATS	Extended Area Test System
EELV	Evolved Expendable Launch Vehicle
EFAWEST	Engineering Field Activity West
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EMMD	Environmental Material Management Division
EMR	electromagnetic radiation
EO	Executive Order
EOD	Explosive Ordnance Disposal
EPCRA	Emergency Planning and Community Right-to-Know Act
ERB	Environmental Review Board
ESA	Endangered Species Act
ESQD	explosive safety quantity-distance
ESU	Evolutionary Significant Unit
F	Fahrenheit
FAA	Federal Aviation Administration
FACSFAC	Fleet Area Control and Surveillance Facility
FAST	Floating at Sea Target
FCMP	Fisheries Conservation Management Plan
FFCA	Federal Facility Compliance Act
FICON	Federal Interagency Committee on Noise
FICUN	Federal Interagency Committee on Urban Noise
FLEETEX	Fleet Exercise
FLETA	Fleet Training Area
FMS	foreign military sales
FOCUS	Fiber Optics Communications Underwater Systems
FONSI	Finding of No Significant Impact
fps	feet per second
F-SEL	flat sound exposure level
FTS	flight termination system
FY	Fiscal Year
g	gram
GBU	glider bomb unit
gpd	gallons per day
GIS	Geographic Information System
GPS	Global Positioning System
gsf	gross square feet
ha	hectare
HARM	High-Speed Antiradiation Missile
HAZMINCEN	Hazardous Material Minimization Center
HC	hydrocarbon
HERF	hazards of electromagnetic radiation to fuel
HERO	hazards of electromagnetic radiation to ordnance
HERP	hazards of electromagnetic radiation to personnel
HF	High Frequency
HICS	Hazardous Inventory Control System
HITS	Historical Temporal Shipping
hr	hour
HSD	Hueneme School District
HUD	U.S. Department of Housing and Urban Development
HWMP	Hazardous Waste Management Plan
Hz	Hertz
ICBM	Intercontinental Ballistic Missile
IFR	Instrument Flight Rules
IMO	International Maritime Organization
IR	instrument flight rules route
IRP	Installation Restoration Program
ISTT	Improved Surface Tow Target
IU	Indexing Unit
IWTP	Industrial Waste Treatment Plant
JATO	jet assisted take off
JP	jet petroleum
JSOW	Joint Stand Off Weapon
kg	kilogram
KHz	kilohertz
km	kilometer
kV	kilovolt
kW	kilowatt
L	liter
LARWQCB	Los Angeles Regional Water Quality Control Board
LAV	Light Armored Vehicle
LCAC	Landing Craft Air Cushion
LCMP	Local Coastal Management Program
LCP	Local Coastal Program

LIST OF ACRONYMS (continued)

L_{dn}	day-night average sound level
L_{dnmr}	onset-rate adjusted monthly day-night average sound level
L_{eq}	equivalent sound level
LIDAR	Light Detection and Ranging
LOS	Level of Service
Lpd	liters per day
LSAEMO	Land, Sea, Airspace, and Environmental Management Office
LTMR	Long-Term Mine Reconnaissance
LZ	landing zone
m	meter
MALS	Marine Aviation Logistics Squadron
MARPOL	International Convention for the Prevention of Pollution from Ships
MCAS	Marine Corps Air Station
MEU	Marine Expediatory Units
MFH	military family housing
MFSO	Missile Flight Safety Officer
MHz	megahertz
ml	milliliter
mm	millimeter
MMF	Mobile Maintenance Facility
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MMR	Military Munitions Rule
MOA	military operations area
MOCS	Multilateral Operations Control System
MOTR	Multiple Object Tracking Radar
MPE	maximum permissible exposure
MPRSA	Marine Protection, Research, and Sanctuaries Act
MSL	mean sea level
MST	Mobile Ship Target
MTR	military training route
mW	milliwatt
µg	microgram
µPa	micro Pascal
NAAQS	National Ambient Air Quality Standards
NAF	Naval Air Facility
NAGPRA	Native American Graves Protection and Repatriation Act
NAIC	National Air Intelligence Center
NAS	Naval Air Station
NAVAIR	Naval Air Systems Command
NAVSEA	Naval Sea Systems Command
NAVSPECWAR	Naval Special Warfare Command
NAWC	Naval Air Warfare Center
NAWCAD	Naval Air Warfare Center Aircraft Division
NAWCWPNS	Naval Air Warfare Center Weapons Division
NAWCWPNSINST	NAWCWPNS Instruction
NAWQC	National Ambient Water Quality Criteria
NAWS	Naval Air Weapons Station
NCP	National Oil and Hazardous Pollution Contingency Plan
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NM	nautical mile
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOHD	nominal ocular hazard distance
NOI	Notice of Intent
NOLO	No Live Operator
NOTAM	Notice to Airmen
NOTMAR	Notice to Mariners
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRC	National Research Council
NRHP	National Register of Historic Places
NRSR	Natural Resources Summary Report
NSR	New Source Review
NSWC	Naval Surface Warfare Center
NTMR	Near-Term Mine Reconnaissance
NWTS	Naval Weapons Test Squadron
O_3	ozone
OCM	oil content monitor
ODD	Oxnard Drainage Ditch
OEIS	Overseas Environmental Impact Statement
OLF	Outlying Landing Field
OPNAVINST	Chief of Naval Operations Instruction
OPTEVFOR	Operational Test and Evaluation Force
OSD	Oceanview School District
OSHA	Occupational Safety and Health Administration
OT&E	Operational Test & Evaluation
OUHSD	Oxnard Union High School District
OUSD	Oxnard Unified School District
OWS	oil water separator
Pa	Pascal
PAH	polycyclic aromatic hydrocarbon
PAO	Public Affairs Office
Pb	lead
PBC	Patrol Boat Coastal
PBL	Patrol Boat Light
PBR	Patrol Boat River

LIST OF ACRONYMS (continued)

PCB	polychlorinated biphenyl
PEL	personnel exposure level
PHD	Port Hueneme Division
P.L.	Public Law
PM_{10}	particular matter less than 10 microns in diameter
PMRF	Pacific Missile Range Facility
PMSA	Primary Metropolitan Statistical Area
POL	petroleum, oils, and lubricants
ppm	parts per million
ppt	parts per thousand
PSD	Prevention of Significant Deterioration
psf	pounds per square foot
PRG	Preliminary Remediation Goals
PTS	Permanent Threshold Shift
RAJPO	Range Joint Program Office
RAM	Rolling Airframe Missile
RCRA	Resource Conservation and Recovery Act
RDT&E	Research, Development, Test, and Evaluation
RF	radio frequency
RIB	Reinforced Inflatable Boat
RO	reverse osmosis
ROD	Record of Decision
ROG	reactive organic gas
ROI	region of influence
RSA	Range Safety Approval
RSOP	Range Safety Operational Plan
SABRE	Shallow Water Assault Breaching
SCAQMD	South Coast Air Quality Management District
SCB	Southern California Bight
SCORE	Southern California Offshore Range
SCrI	Santa Cruz Island (cultural resource naming convention)
SD	standard deviation
SDTS	Self Defense Test Ship
SDV	swimmer delivery vehicles
SEAL	Sea, Air, and Land
SEL	sound exposure level
SHOBA	Shore Bombardment Area
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SLAM	Standoff Land Attack Missile
SNI	San Nicolas Island (cultural resource naming convention)
SO_2	sulfur dioxide
SOAR	Southern California Acoustic Range
SOI	sphere of influence
SPCC	Spill Prevention, Control, and Countermeasure Plan
SPL	sound pressure level
SRAM	Short Range Attack Missile
SSM	Surface-to-Surface Missile
SUA	Special Use Airspace
SWEF	Surface Warfare Engineering Facility
SWRCB	State Water Resources Control Board
T&E	test and evaluation
TBM	theater ballistic missile
TDS	total dissolved solids
THAAD	Theater High Altitude Air Defense
TIM	time in mode
TL	transmission loss
TM	Telemetry Modernization
TMD	Theater Missile Defense
TSD	Treatment, Storage, and Disposal
TSDF	Treatment, Storage, and Disposal Facility
TSPI	time, space, and position information
TSS	Traffic Separation Scheme
TTS	Temporary Threshold Shift
UCLA	University of California, Los Angeles
UCSB	University of California, Santa Barbara
UHF	Ultra High Frequency
UNDS	Uniform National Discharge Standards
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
U.S.C.	U.S. Code
USCG	U.S. Coast Guard
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USS	United States Ship
USSOCOM	U.S. Special Operations Command
UST	underground storage tank
UUV	unmanned underwater vehicle
UWCD	United Water Conservation District
V/C	volume to capacity
VAFB	Vandenberg Air Force Base
VCAPCD	Ventura County Air Pollution Control District
VCFCD	Ventura County Flood Control District
VCPWA	Ventura County Public Works Agency
VEN	Ventura (cultural resource naming convention)
VFR	Visual Flight Rules
VHF	Very High Frequency
VMT	vehicle miles traveled
VR	visual flight rules route
WW II	World War II

CHAPTER 1
PURPOSE AND NEED

1.1 INTRODUCTION

This Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) has been prepared by the Department of the Navy in compliance with the National Environmental Policy Act (NEPA) of 1969 (42 U.S. Code [U.S.C.] § 4321 et seq.); the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (Title 40 Code of Federal Regulations [C.F.R.] §§ 1500-1508); Department of the Navy Procedures for Implementing NEPA (32 C.F.R. 775); and Executive Order 12114 (EO 12114), Environmental Effects Abroad of Major Federal Actions. The NEPA process ensures that environmental impacts of proposed major federal actions are considered in the decision making process. EO 12114 requires environmental consideration (i.e., preparation of an OEIS) for actions that may significantly affect the environment outside U.S. Territorial Waters. This EIS/OEIS satisfies the requirements of both NEPA and EO 12114. It will be filed with the U.S. Environmental Protection Agency (USEPA) and distributed to appropriate federal, state, local and private agencies, organizations and individuals for review and comment.

Naval Air Warfare Center Weapons Division (NAWCWPNS) Point Mugu is located in Ventura County along the Pacific Coast of southern California and includes a 36,000 square mile (93,200 km^2) Sea Range (Figure 1-1). This EIS/OEIS addresses NAWCWPNS Point Mugu's proposal to accommodate theater missile defense (TMD) testing and training, accommodate an increase in current levels of training exercises, and modernize facilities to increase the Sea Range's capability to support existing and future operations. Elements associated with the proposed action and alternatives evaluated in this EIS/OEIS are described in Chapter 2.

The Assistant Secretary of the Navy for Installations and Environment (ASN [I&E]) will be the decision-maker regarding possible implementation of the proposed action and alternatives addressed in this EIS/OEIS. As part of the decision-making process, the Deputy Assistant Secretary of the Navy (Environment) will review the EIS/OEIS, consider the environmental impacts, and then decide whether to implement the Preferred Alternative or the Minimum Components Alternative (described in Chapter 2) and initiate any necessary permitting actions, or select the No Action Alternative in which case operations would continue at current levels.

1.2 PURPOSE AND NEED

PURPOSE: 1) TO ACCOMMODATE THEATER MISSILE DEFENSE TESTING AND TRAINING AT NAWCWPNS POINT MUGU; 2) TO ACCOMMODATE AN INCREASE IN CURRENT LEVELS OF TRAINING EXERCISES AT NAWCWPNS POINT MUGU; AND 3) TO MODERNIZE FACILITIES TO ENHANCE THE EXISTING TESTING AND TRAINING CAPABILITIES AT NAWCWPNS POINT MUGU.

NEED: TO MEET THE ESTABLISHED NAWCWPNS POINT MUGU MISSION TO CONDUCT STATE-OF-THE-ART WEAPONS SYSTEMS TESTING AND EVALUATION BY PROVIDING A SAFE, OPERATIONALLY REALISTIC, AND THOROUGHLY INSTRUMENTED SEA RANGE TESTING ENVIRONMENT AND TO MAINTAIN THE OPERATIONAL READINESS OF OUR MILITARY SERVICES BY PROVIDING A REALISTIC TRAINING ENVIRONMENT.

Figure 1-1
Regional Location

1.2.1 Objectives

NAWCWPNS, part of the Naval Air Systems Command (NAVAIR), is a multi-site organization that includes a land range and associated facilities at China Lake, California; a detachment at White Sands, New Mexico; as well as Point Mugu. The strategic vision for NAWCWPNS Point Mugu is to be the Navy's premier test, training, and experimentation center for weapons systems associated with air warfare, missiles and missile subsystems, aircraft weapons integration, and airborne electronic warfare systems. The NAWCWPNS Point Mugu role is to provide a safe, operationally realistic, and thoroughly instrumented Sea Range testing and training environment.

The NAWCWPNS Point Mugu Sea Range has been operated by the Department of the Navy for more than 50 years. NAWCWPNS Point Mugu controls 36,000 square miles (93,200 km^2) of Special Use Airspace (SUA) over the Pacific Ocean associated with the Sea Range. The Sea Range provides a safe, highly instrumented volume of air and sea space in which to conduct controlled tests and operational training. The combination of location, widespread instrumentation sites, unique test capabilities, and a highly skilled technical workforce provides the most advanced and efficient method of conducting the critical test and evaluation (T&E) and training necessary to maintain technical standards in the U.S. Navy. The Point Mugu Sea Range is used by U.S. and allied military services to test and evaluate sea, land, and air weapon systems; to provide realistic training opportunities; and to maintain operational readiness of these forces. This T&E and training process is critical to the successful assessment, safe operation, and improvement of the capabilities of current and future weapon systems.

1.2.2 Purpose and Need for the Proposed Action

NAWCWPNS Point Mugu has a need to meet the established mission to conduct state-of-the-art weapons systems testing and evaluation by providing a safe, operationally realistic, and thoroughly instrumented Sea Range testing environment and to maintain the level of operational readiness of our military services by providing a realistic training environment. The evolution of international threats and operational technologies has increased the number and type of military operations that require large water ranges for testing and training activities. Consequently, the role of NAWCWPNS Point Mugu as an air warfare test and training center has become even more critical.

Ballistic missile defense testing and training require large geographical areas, sophisticated instrumentation and supporting facilities, and technically qualified personnel to provide realistic engagement scenarios (Office of the Director of Defense Research and Engineering 1999). Engagement scenarios will be multi-participant, multi-weapon, and multi-target scenarios over wide areas. Instrumentation must provide precise metric data and must satisfactorily support post-mission analyses in a timely manner. Multiple test ranges and supporting facilities will be required to conduct TMD testing and training (Office of the Director of Defense Research and Engineering 1999). This need has been demonstrated by interest in the Point Mugu Sea Range as a TMD testing and training site. For example, the Army Program Executive Officer (PEO) for Air Missile Defense has identified the Point Mugu Sea Range as a potential location for testing and training their TMD systems. In addition, the Ballistic Missile Defense Organization (BMDO) has identified the Point Mugu Sea Range as an alternative range for specific TMD programs.

The training function is critical to ensuring that our military services maintain their state of readiness. Readiness equates to military forces that are proficient at their jobs—ready to deploy quickly, capable of conducting joint operations (multi-service and/or multi-nation), and able to fight effectively. Mastering complicated equipment, particularly current high technology operating and weapons systems, requires intensive and realistic training with that equipment (ships, aircraft, weapons, and logistic support) on a simulated battlefield. In view of the need for military training, the Navy has recognized that the well-equipped assets of the Point Mugu Sea Range have the potential for meeting the training needs of U.S. and allied military services. This view was validated by the Commander, Third Fleet, who has stated "our goal in the planning of a Joint Force Training Exercise is to provide the most realistic training possible in preparing a Battle Group for forward deployment. You (NAWCWPNS Point Mugu) have played a vital role in preparing the sailors, airmen, and marines…for the challenging tasks they will encounter during their forward deployed operations" (Third Fleet 1999). In addition, the Commander, Carrier Group One, when discussing efforts to improve Fleet readiness, emphasized the importance of recent cooperation with NAWCWPNS Point Mugu in maximizing the quality of training: "…the operational experience, physical infrastructure, and geolocation of NAWCWPNS Point Mugu make it uniquely valuable and we are only beginning to explore this. I look forward to their valuable contributions in the future" (Carrier Group One 1999).

To meet the testing and training need described above, the purpose of the proposed action is: 1) to accommodate TMD testing and training at NAWCWPNS Point Mugu; 2) to accommodate an increase in current levels of training exercises at NAWCWPNS Point Mugu; and 3) to modernize facilities to enhance the existing testing and training capabilities at NAWCWPNS Point Mugu. Specific components of the proposed action include four distinct types of TMD testing and training, an increase in the current level of littoral (coastal) warfare training and fleet exercise training, and specific modernization of facilities on San Nicolas Island and at Naval Air Station (NAS) Point Mugu[1] to better accommodate future test and training requirements. Although uncertainties exist in the international arena and downsizing of the Department of Defense (DoD) continues, the specific testing, training, and facility modernization proposals evaluated in this EIS/OEIS are based on NAWCWPNS Point Mugu's current knowledge of priorities for future testing and training, and the needs and desires of NAWCWPNS Point Mugu to conduct more testing and training on the Sea Range.

1.3 Scope and Content of the EIS/OEIS

As defined in the CEQ regulations, an EIS/OEIS is a concise public document specifying environmental impacts from a proposed action for which a federal agency is responsible. The EIS/OEIS provides full and objective discussion of significant environmental impacts. An EIS/OEIS ensures that the programs and actions of the federal government meet the policies and goals set forth in NEPA and EO 12114. The Navy considers potential environmental impacts in conjunction with other relevant materials to plan actions and make decisions. In accordance with NEPA, the Navy initiated a public and agency scoping process to assist with the identification of relevant environmental issues to be analyzed in this EIS/OEIS. A summary of the scoping process and relevant scoping materials are provided in Appendix A.

The EIS/OEIS addresses the environmental impacts resulting from implementation of the proposed action and alternatives. The proposed action consists of three distinct elements: TMD, training, and facility modernization. The geographic scope of this EIS/OEIS includes the 36,000 square mile (93,200 km^2) Point Mugu Sea Range, NAS Point Mugu, Laguna Peak, San Nicolas Island, San Miguel Island, and a small portion (about 10 acres [4.1 hectares]) of leased land on Santa Cruz Island (Figure 1-2). (A more detailed description of NAWCWPNS Point Mugu is provided in Chapter 3.) The Sea Range subareas (e.g., 4B, 5A, etc.) depicted on Figure 1-2 are not published on navigational charts but are designated for range scheduling purposes only. While operations are conducted throughout the Sea Range, range areas are used throughout this EIS/OEIS to provide the reader with a geographic reference.

Rather than focusing on specific operations that may occur within a limited part of the Point Mugu Sea Range, this EIS/OEIS provides a range-wide, comprehensive evaluation of proposed, as well as current, activities conducted on the Sea Range. Five major types of test scenarios generally describe and encompass the operations currently conducted on the range in support of research, development, test, and evaluation (RDT&E) activities: 1) air-to-air operations, 2) air-to-surface operations, 3) surface-to-air operations, 4) surface-to-surface operations, and 5) subsurface-to-surface operations (refers to subsurface missile launches). In addition, three typical types of ongoing training activities currently occur on the Sea Range: 1) Fleet training exercises, 2) small-scale amphibious warfare training, and 3) special warfare training. These ongoing RDT&E and training activities comprise the No Action Alternative, as they would continue regardless of which alternative is selected. Thus, the No Action Alternative establishes a baseline to compare with future test and training evolutions.

[1] Naval Air Station (NAS) Point Mugu was previously called Naval Air Weapons Station (NAWS) Point Mugu. This December 1998 change reflects the transfer of the base property to the U.S. Pacific Fleet.

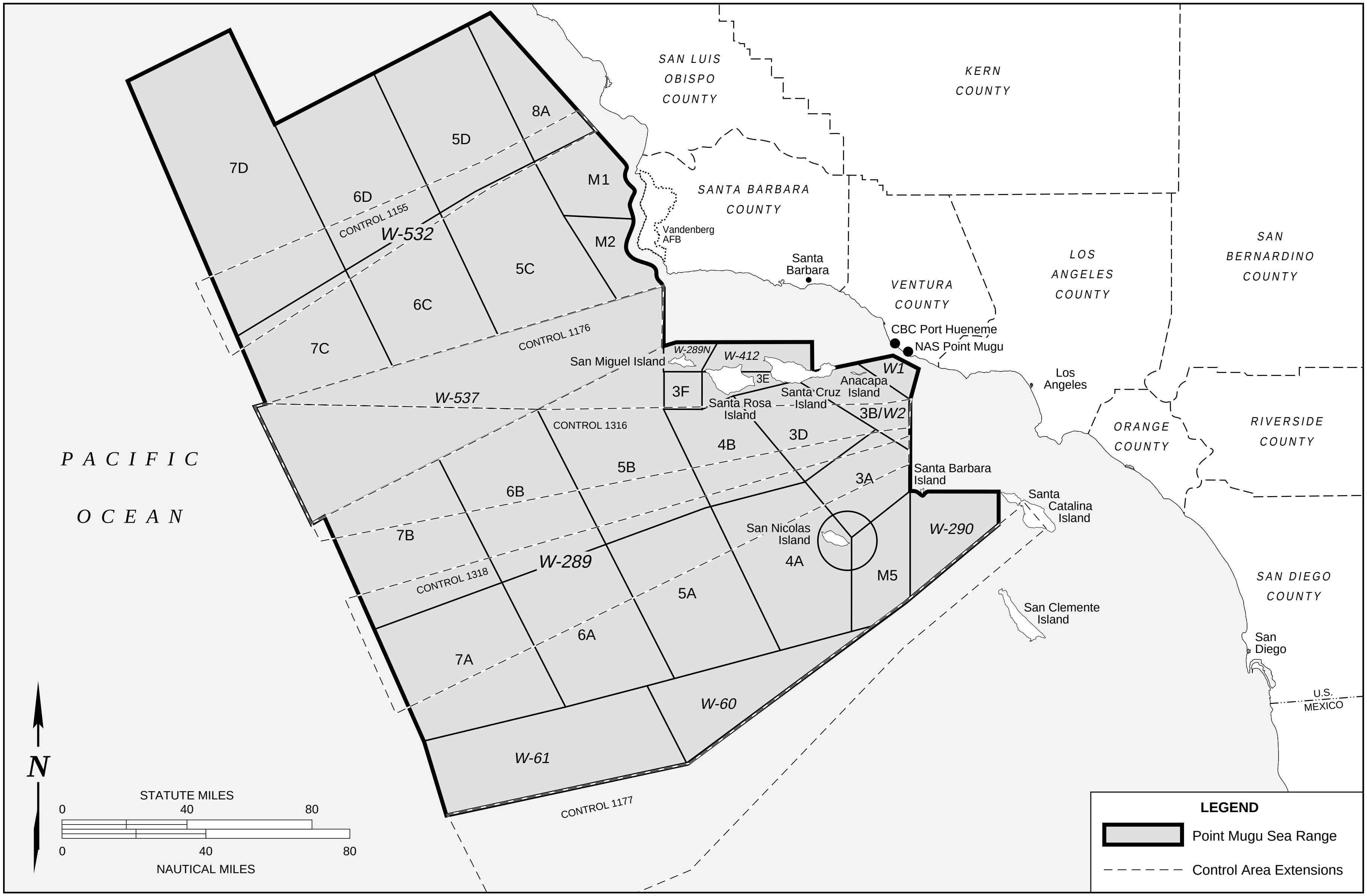


Figure 1-2
Point Mugu Sea Range

The scope of this EIS/OEIS encompasses all typical operations that are scheduled and managed by NAWCWPNS Point Mugu. Operations that are not scheduled by NAWCWPNS Point Mugu, or those activities whose T&E protocols are not controlled or managed by NAWCWPNS Point Mugu, are not included within the scope of this EIS/OEIS. Since NAWCWPNS Point Mugu controls the DoD RDT&E and training operations on the range, activities not scheduled by NAWCWPNS Point Mugu only account for about 3 percent of all Sea Range military activities, and typically include minor military events (e.g., transits through the range). Therefore, all typical Sea Range operations are addressed in this EIS/OEIS. As test and training proposals are identified in the future, such proposals will be the subject of separate NEPA documentation as appropriate.

1.4 REGULATORY SETTING

1.4.1 Federal Jurisdictional Boundaries

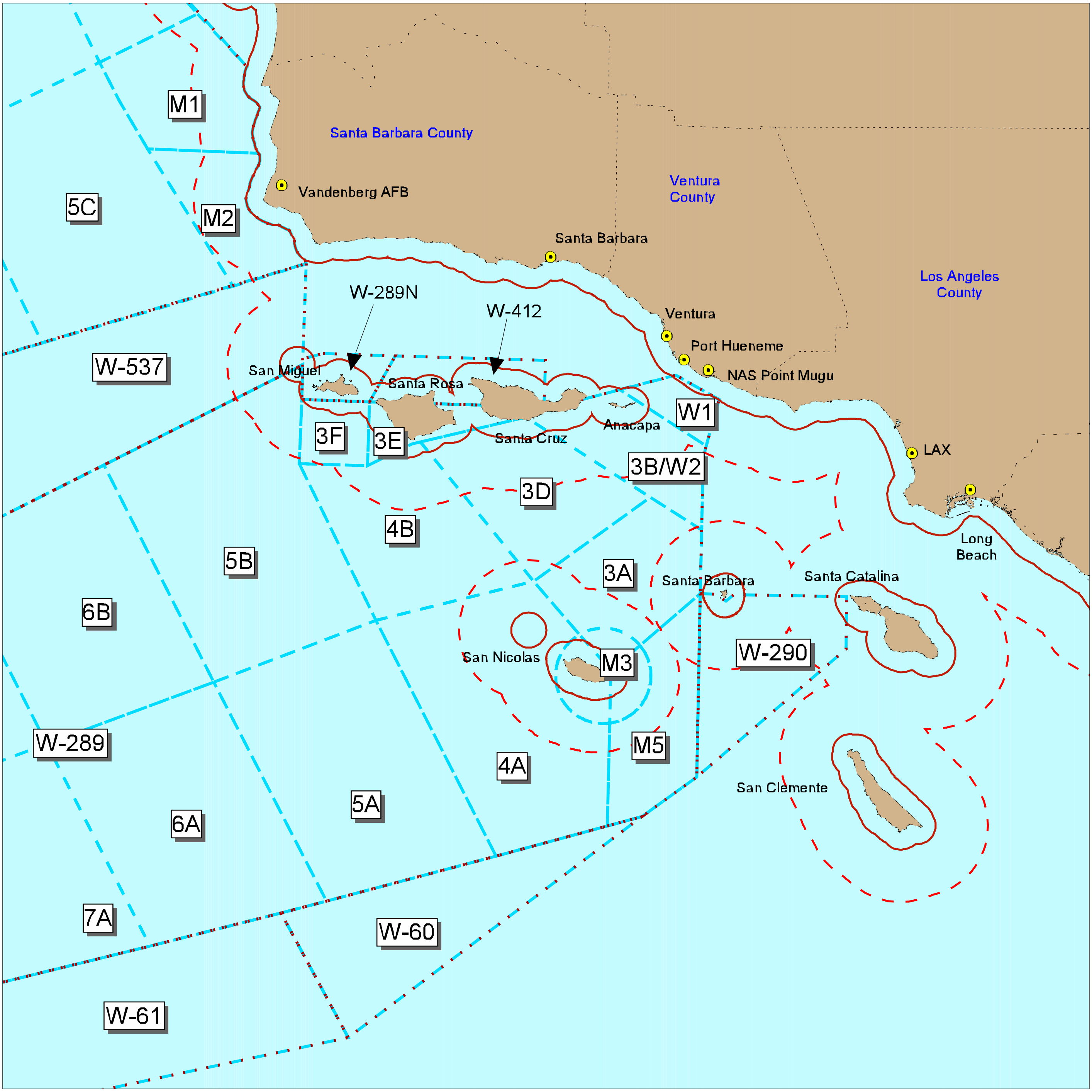
This EIS/OEIS was prepared in accordance with NEPA and EO 12114. Impacts within U.S. Territory are analyzed using the procedures set out in NEPA and associated implementing regulations. Under customary international law, U.S. Territory generally extends out into the ocean for a distance of 3 NM (5.6 km) from the coastline. By Presidential Proclamation 5928, issued December 27, 1988, the United States extended its exercise of sovereignty and jurisdiction under international law to 12 NM (22 km), but the Proclamation expressly provides that it does not extend or otherwise alter existing Federal law or any associated jurisdiction, rights, legal interests, or obligations. The Proclamation thus did not alter existing legal obligations under NEPA. As a matter of policy, however, the Department of the Navy has elected to apply NEPA to the 12 NM (22 km) limit established by the Proclamation. Figure 1-3 depicts the 12 NM (22 km) territorial sea established by Presidential Proclamation 5928 as it relates to NAWCWPNS. Impacts at NAS Point Mugu, the Channel Islands, and those portions of the inner sea range within these boundaries are subjected to analysis under NEPA.

Impacts in the areas that are outside U.S. Territorial Waters, often referred to as the global commons, are analyzed using the procedures set out in EO 12114 and associated implementing regulations. A majority of the impacts associated with use of the Sea Range fall outside U.S. Territory. To assist the reader in distinguishing between impacts occurring inside and outside U.S. Territory, those impacts occurring outside U.S. Territory are italicized in the text.

1.4.2 State Jurisdictional Boundaries

The State of California's jurisdictional purview extends 3 nautical miles (NM) (5.6 km) offshore of the coast and coastal islands. The 3-NM (5.6-km) coastal zone is shown in relation to the Point Mugu Sea Range in Figure 1-3. While these areas fall within U.S. Territorial Waters and operations within these areas are evaluated under NEPA, they are also subject to additional state regulations when federal sovereign immunity has been waived by Congress. State regulations are described as applicable in this EIS/OEIS.

U.S. Territorial Waters Limit
State Waters Limit



Legend

- Warning Area Boundaries
- Sea Range
- U.S. Territorial Waters Limit
- State Waters Limit (3 NM)

Projection: Universal Transverse Mercator
North American Datum 1927
Zone 11

Figure 1-3

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CHAPTER 2
DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

This chapter provides detailed information on the proposed action and alternatives that are analyzed in this EIS/OEIS. In addition to conducting current test and training operations at the Naval Air Warfare Center Weapons Division (NAWCWPNS) Point Mugu Sea Range (Sea Range), NAWCWPNS Point Mugu proposes: 1) to accommodate theater missile defense (TMD) testing and training at NAWCWPNS Point Mugu; 2) to accommodate an increase in current levels of training exercises at NAWCWPNS Point Mugu; and 3) to modernize facilities to enhance the existing testing and training capabilities at NAWCWPNS Point Mugu.

This chapter is divided into two major subsections: Section 2.1 (page 2-1) describes the major elements of the proposed action and Section 2.2 (page 2-18) describes alternatives to the proposed action, including the No Action Alternative. The major elements of the proposed action described in Section 2.1 include the Theater Missile Defense Element (2.1.1), the Training Element (2.1.2), and the Facility Modernization Element (2.1.3). A glossary of operational terms and their definitions is presented in Chapter 10.

2.1 PROPOSED ACTION

The NAWCWPNS Point Mugu Sea Range currently supports five general categories of tests to evaluate sea, land, and air weapons systems: 1) air-to-air tests, 2) air-to-surface tests, 3) surface-to-air tests, 4) surface-to-surface tests, and 5) subsurface-to-surface tests. The Sea Range also supports three general categories of training including: 1) Fleet training exercises, 2) small-scale amphibious warfare training, and 3) special warfare training. (Current test and training activities are described in more detail in Chapter 3.) In addition to the current test and training operations conducted on the Sea Range, NAWCWPNS Point Mugu proposes to accommodate TMD test and training activities and an increase in the current level of both Fleet training exercises and special warfare training. Facilities at Naval Air Station (NAS) Point Mugu and San Nicolas Island would be modernized to increase the Sea Range's capability to support existing and future operations.

The specific testing, training, and facility modernization proposals evaluated in this EIS/OEIS are based on NAWCWPNS Point Mugu's current knowledge of priorities for future testing and training, and the needs and desires of NAWCWPNS Point Mugu to attract more testing and training activity to the Sea Range. Therefore, while at the current time there is no specific commitment to conduct TMD testing and training on the Sea Range, this EIS/OEIS evaluates the environmental impacts associated with TMD activities in order to provide the ability to conduct TMD work in the future. The three separate elements of the proposed action — TMD, training, and facility modernization — are discussed in the following sections.

2.1.1 Theater Missile Defense Element

"TMD" is defined as the ability of the United States to defend its armed forces deployed abroad and its friends and allies against the threat of missile attack from both short- and long-range missiles in any theater of operations. The "theater" is defined as a geographic region encompassing the military operational area. The term TMD is used to describe a whole family of atmospheric and exo-atmospheric defensive missile programs and thus encompasses a wide variety of programs. Consequently, all services within the Department of Defense (DoD) and several allied countries are involved with development of various TMD testing and training programs. As such, TMD is envisioned to be part of a comprehensive, integrated defense system. The TMD system will not be based at fixed sites but will be capable of rapid deployment by aircraft, sea, or ground transportation anywhere in the world to support U.S. troops and allies.

Different types of TMD are being developed to counter specific threat capabilities. Since the distances between threats to U.S. assets can vary considerably, TMD intercept altitudes correspondingly vary greatly, requiring large areas tailored to specific testing and training purposes. The Navy, other DoD services, and several allied countries are developing different types of TMD that require appropriate facilities for safely testing and training these systems. For example, the Pacific Missile Range Facility (PMRF) in Hawaii was recently approved for certain types of TMD tests (TMD testing at PMRF has been evaluated in a previous EIS; U.S. Navy 1998).

Both weapons system testing and training are critical to the successful establishment and operation of new TMD systems. The DoD conducts research, test, and evaluation on its defense programs when acquiring new systems. Testing and evaluation are designed to provide necessary information regarding risk and risk mitigation; to furnish empirical data to validate models and simulations; to assess technical performance specifications and system maturity; and to determine whether systems are effective, suitable, and survivable for their intended use. Much of the design, development, and testing of defense systems is conducted in the laboratory and with computer simulations. However, these data must be verified and validated against real-world conditions, resulting in the need for system testing in a realistic environment. Once a system's operational effectiveness is confirmed, the system is ready for training by DoD operating services. Weapons system training ensures that operating forces are skilled and ready to successfully implement a defense system; allows for integration within existing operating procedures; and facilitates the development of safe and effective operating protocols.

NAWCWPNS Point Mugu proposes that the Sea Range accommodate four distinct types of TMD testing and training activities: 1) boost phase intercept, 2) upper tier, 3) lower tier, and 4) nearshore intercept events at San Nicolas Island. The differences in these types of TMD can be characterized by the phase of flight of target missiles and proximity to defended assets. Figure 2-1 shows a schematic representation of proposed TMD scenarios. In general, these four types of TMD can be distinguished based on the altitude of intercept of the missile and target. Boost phase refers to intercepts during the boost (i.e., "takeoff") period of flight and are typically below 50,000 feet (15,240 meters [m]). Upper tier includes intercepts generally above 100,000 feet (30,480 m) while lower tier includes intercepts typically between 50,000 and 100,000 feet (15,240 and 30,480 m). Finally, nearshore intercepts occur at very low altitudes (i.e., below 1,000 feet [300 m]) close to the shore.

The proposal addressed in this EIS/OEIS includes the accommodation of testing and training activities in each of the four TMD categories. The proposal to increase levels of other training activities (non-TMD) is described in Section 2.1.2, Training Element. NAWCWPNS Point Mugu proposes that the Sea Range could accommodate the following number of TMD test and training events annually: three boost phase intercept, three upper tier, three lower tier, and eight nearshore intercept. The proposed tempo of TMD activities is based on anticipated future use of the Sea Range. For the upper and lower tier categories, NAWCWPNS Point Mugu proposes to provide capabilities for both target launch and test missile firings on the Sea Range. Operations projections for proposed TMD activities are presented in Section B.6 of Appendix B. The four types of TMD activities are described in more detail in the following sections. Since TMD activities include various missile and target launch platforms, figures depicting each of the four TMD types should be considered representative of a typical scenario; specific details regarding potential launch platforms are included within the text.

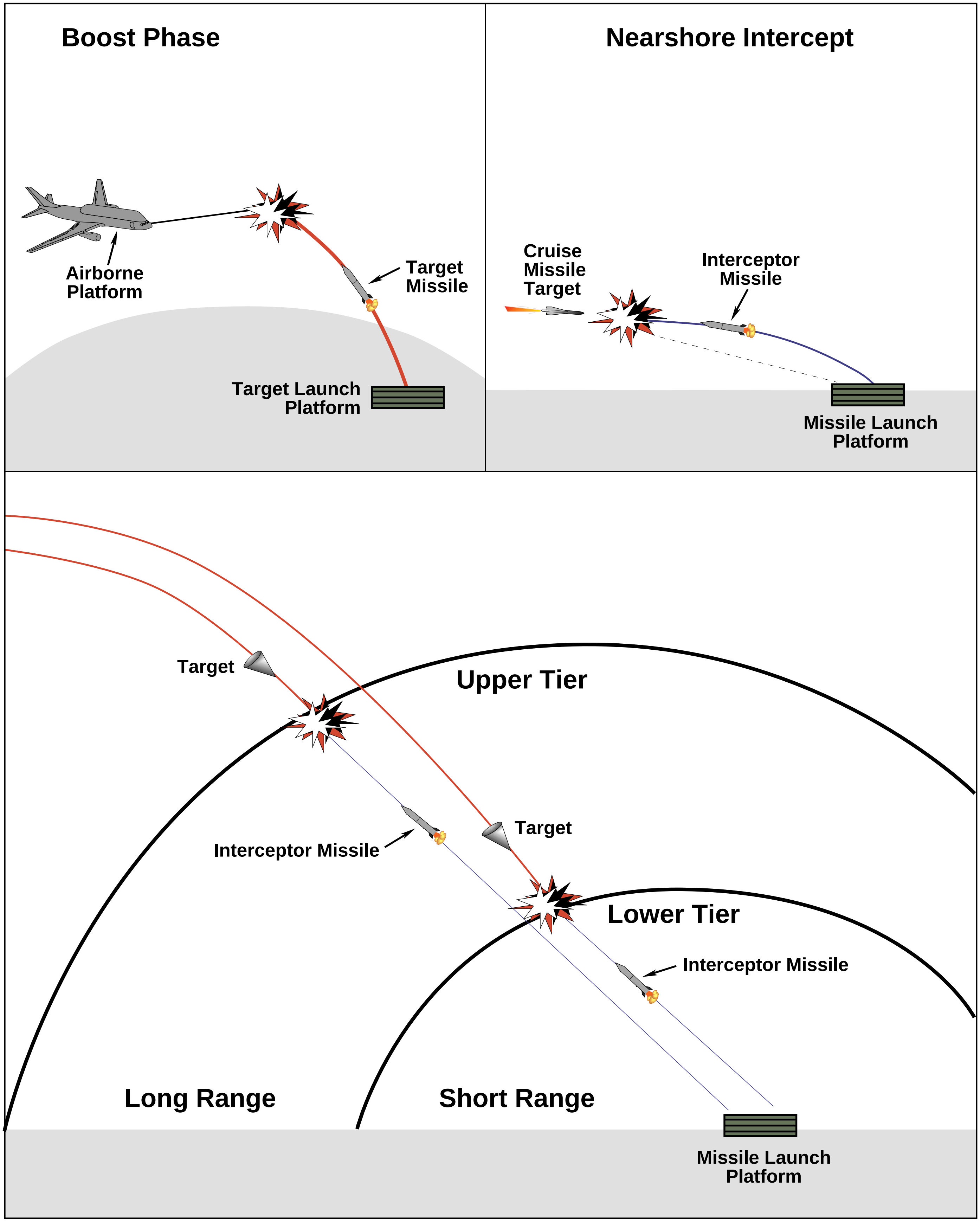


Figure 2-1
Proposed Representative Testing Scenarios

2.1.1.1 Boost Phase Intercept

A - General Overview

Boost phase intercept systems are designed to intercept tactical or theater ballistic missiles (TBMs)[1] in flight, during the boost (powered ascent) period of flight (see Figure 2-1). In order for the weapon to reach the TBM shortly after launch, current boost phase intercept concepts generally require approaching enemy borders with an aircraft carrying the system. The aircraft carrying the system must be able to remain aloft a long time to ensure full-time coverage of a threat area. Boost phase intercept systems often use lasers (e.g., a chemical-oxygen-iodine laser) to intercept the target. NAWCWPNS Point Mugu proposes to accommodate up to three laser boost phase intercept test or training events per year. Airborne laser (ABL) boost phase intercept testing has been evaluated in a previous EIS (U.S. Air Force 1997a); this EIS/OEIS tiers off and where necessary provides summarized information from the Air Force EIS. Figure 2-2a shows the approximate range areas to be used to accommodate representative boost phase intercept activities.

B - Boost Phase Intercept Participants

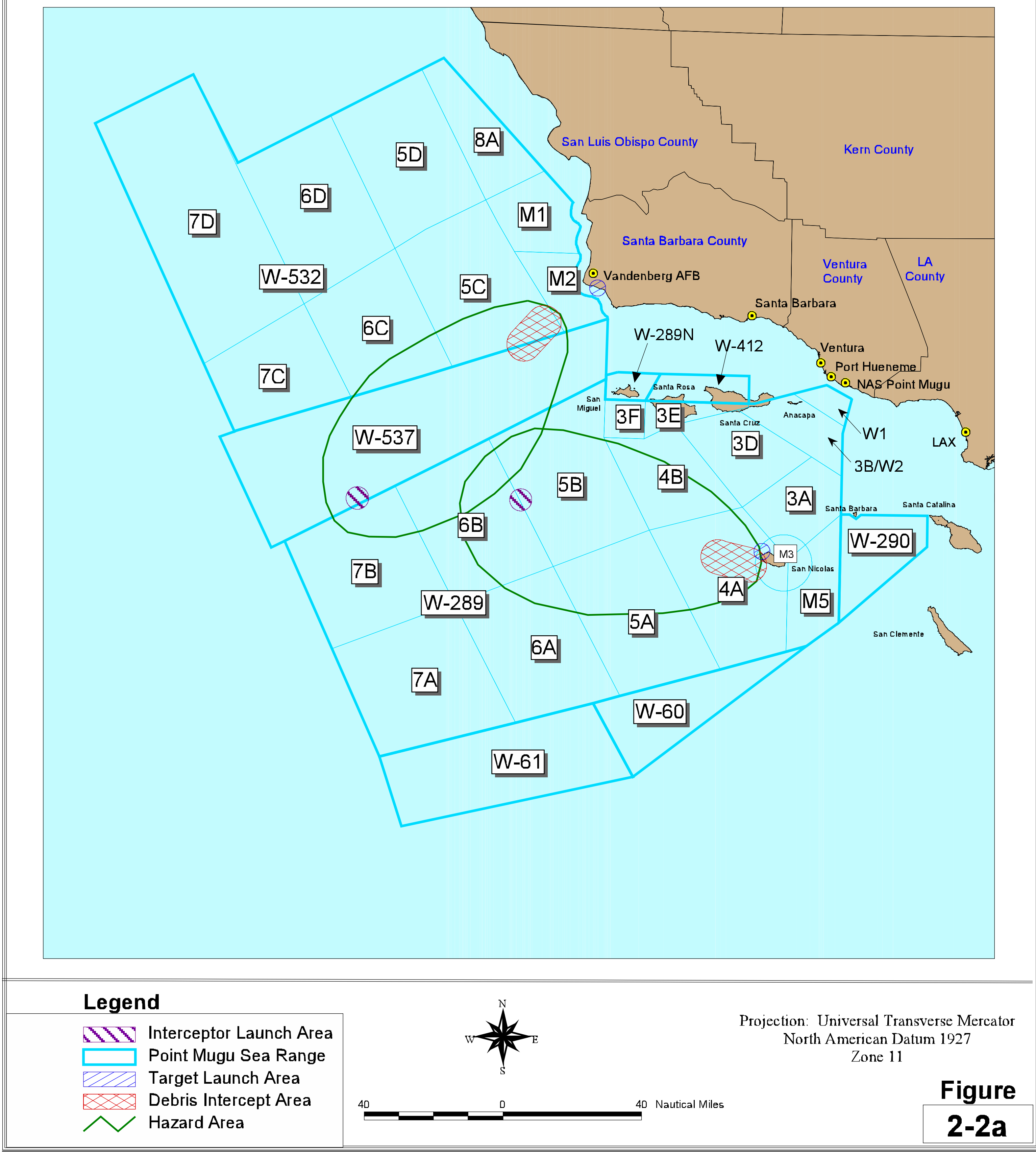
During boost phase intercept test or training events, a highly modified Boeing 747 would operate at altitudes of 35,000 feet (10,668 m) or above and be operating on the Sea Range for up to 8 hours, depending on test and training needs. It would be accompanied by fighter aircraft that would be operating on the Sea Range for up to 2 hours or longer if air refueling is provided. Other support aircraft such as range safety and radar surveillance aircraft could be operating on the Sea Range for up to 10 hours depending on the needs of the test or training event. Targets could either be air-launched, sea-launched, or surface-launched from San Nicolas Island or Vandenberg Air Force Base (VAFB). Aviation rescue and support boats would be on the Sea Range only during the test or training event because their endurance is constrained by fuel.

C - Hazard and Debris Patterns

A safety hazard pattern is the maximum surface area that could be affected by a weapon if it does not follow its prescribed flight path. Established flight termination procedures ensure that the weapon remains within the safety hazard pattern. The debris intercept area, a smaller subset of the safety hazard pattern, is the area that is exposed to the potential impact of falling pieces of a missile or target as the result of an intercept (refer to Section 3.0.2.1 for a more detailed description). Safety hazard patterns and debris intercept areas increase in size as the altitude of intercept increases. However, the density of the debris pattern decreases with increasing altitude intercept. For boost phase intercept events with intercepts of target missiles at altitudes of about 50,000 feet (15,240 m), the footprint of the safety hazard pattern would be located over several range areas (see Figure 2-2a).

[1] Theater or "tactical" ballistic missiles are relatively short-range ballistic missiles as opposed to intercontinental ballistic missiles. An example of a theater or tactical missile is the "Scud" missile used by Iraq during the Persian Gulf war in 1990. The term "ballistic" means that a missile has both powered and unpowered phases of flight and the flight path that it follows is typically a ballistic arc (i.e., normally no flight corrections are made to the flight path after engine cut-off).

TMD Element
A) Representative Boost Phase Intercept Scenarios



Projection: Universal Transverse Mercator
North American Datum 1927
Zone 11

Figure 2-2a

2.1.1.2 Upper Tier

A - General Overview

Upper tier TMD attempts to intercept ballistic targets at long ranges and outside of the atmosphere. Upper tier is designed to engage threat ballistic targets at high altitudes and long range, enabling the defense of large ground areas and the ability to take multiple shots if necessary. Upper tier systems require test and training ranges that offer full instrumentation, ability to accommodate long-range test and training scenarios, proximity to service assets, and target launch capabilities. The upper tier programs require large areas for testing and training. NAWCWPNS Point Mugu proposes to accommodate up to three upper tier test or training events per year. However, the Sea Range could serve as the launching area for either the interceptor missile or the ballistic target. In either circumstance, the hazard and intercept areas depicted in Figure 2-2b are representative of upper tier scenarios.

B - Upper Tier Participants

Interceptor missiles could be sea-launched (e.g., using a vessel or launch barge) from the Sea Range or launched from San Nicolas Island. Targets could be air-launched (e.g., from C-130 aircraft), sea-launched, or surface-launched from San Nicolas Island. If vessels are used to fire the missile or target, they would likely be operating on the Sea Range for two to three days during preparation for the test or training event, as would the necessary support ships. Range safety and radar surveillance aircraft could be operating on the Sea Range for up to 10 hours or more depending on the needs of the test or training event. Aviation rescue and support boats would be on the Sea Range only during the test or training event because their endurance is constrained by fuel.

C - Hazard and Debris Patterns

The safety hazard patterns and debris intercept areas increase in size as the altitude of intercept increases. For upper tier events with intercepts of target missiles out of the atmosphere (above 100,000 feet [30,480 m]), the footprint of a debris pattern could cover virtually all of the Sea Range west of San Nicolas Island and south of W-537. However, when the debris pattern is this large, the density of the debris is extremely low. Non-participants would be cleared of an area much larger than the area where there is a potential hazard from debris.

2.1.1.3 Lower Tier

A - General Overview

Lower tier TMD is a closer-in intercept of the ballistic target after reentry into the atmosphere. Lower tier systems engage threat ballistic targets at lower altitudes, closer to friendly forces, defending high value point and area targets such as airfields, carrier battle groups, armored columns, and supply depots. Depending on the firing and intercept geometry, in addition to the required instrumentation, the Point Mugu Sea Range could accommodate lower tier events of both the ballistic target missile and the lower tier interceptor missile. NAWCWPNS Point Mugu proposes to accommodate up to three lower tier test or training events per year. Figure 2-2c shows the approximate range areas to be used to accommodate representative lower tier activities.

TMD Element
B) Representative Upper Tier Scenario

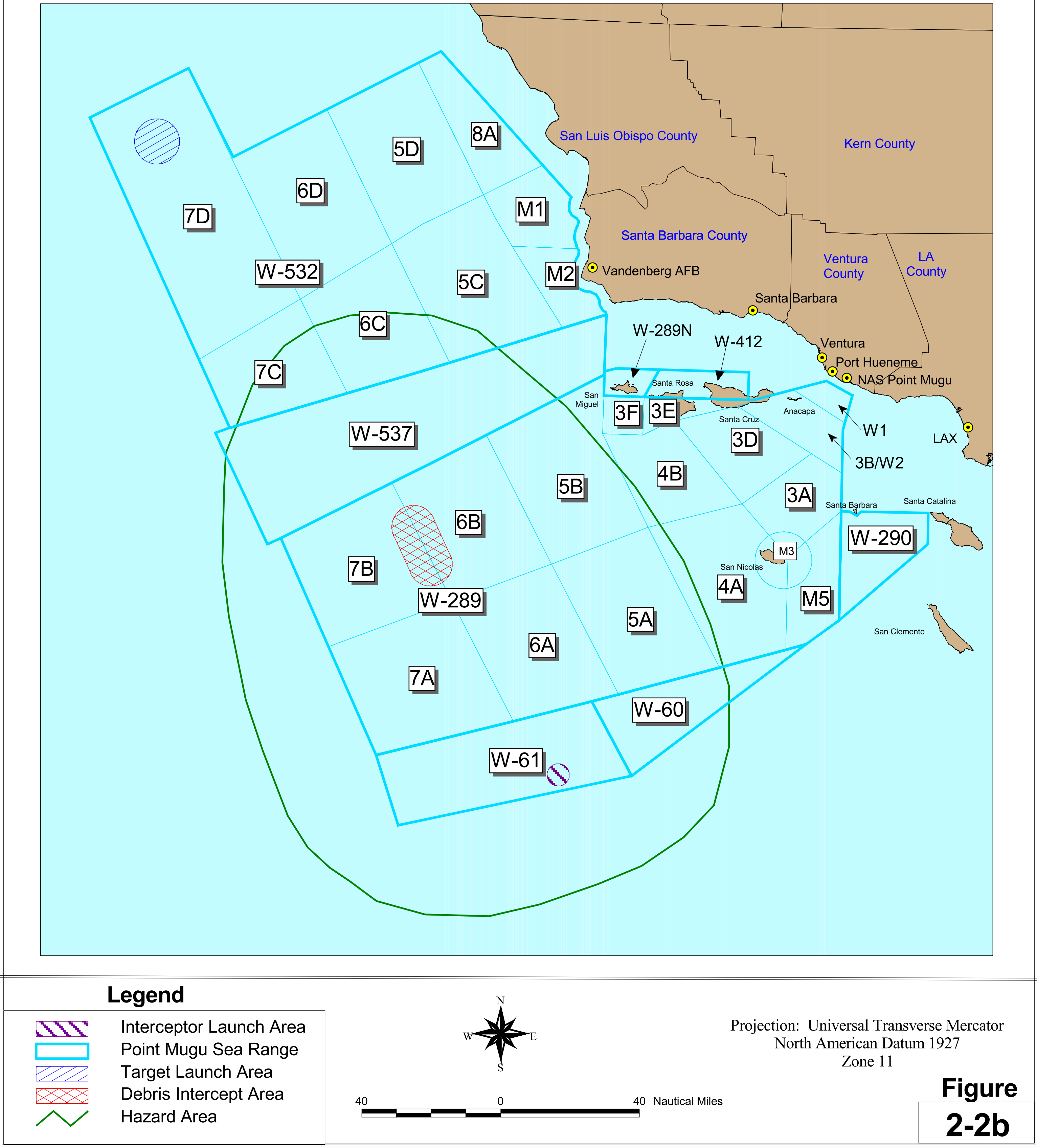
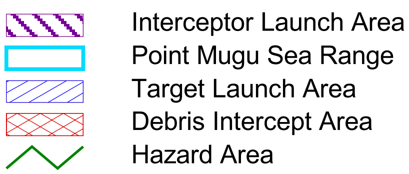
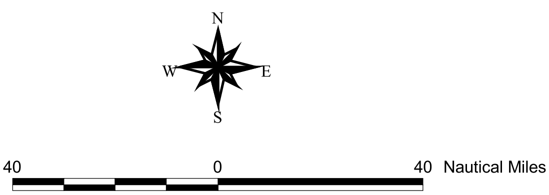


Figure 2-2b

TMD Element
C) Representative Lower Tier Scenario

Legend





Projection: Universal Transverse Mercator
North American Datum 1927
Zone 11

Figure
2-2c

B - Lower Tier Participants

Interceptor missiles could be sea-launched (e.g., using a vessel or launch barge) from the Sea Range or launched from San Nicolas Island. Targets could be air-launched (e.g., from C-130 aircraft), sea-launched, or surface-launched from San Nicolas Island. If vessels are used to fire the missile or target, they would likely be operating on the Sea Range for two to three days during preparation for the test or training event, as would the necessary support ships. Range safety and radar surveillance aircraft could be operating on the Sea Range for up to 10 hours or more depending on the needs of the test or training event. Aviation rescue and support boats would be on the Sea Range only during the test or training event because their endurance is constrained by fuel.

C - Hazard and Debris Patterns

For lower tier events on the Sea Range, the intercepts would occur at much lower altitudes than upper tier and well within the atmosphere (about 50,000 to 100,000 feet [15,240 to 30,480 m]). Thus, both the debris pattern footprint and safety hazard patterns would become correspondingly smaller and density of debris somewhat higher (see Figure 2-2c).

2.1.1.4 Nearshore Intercept

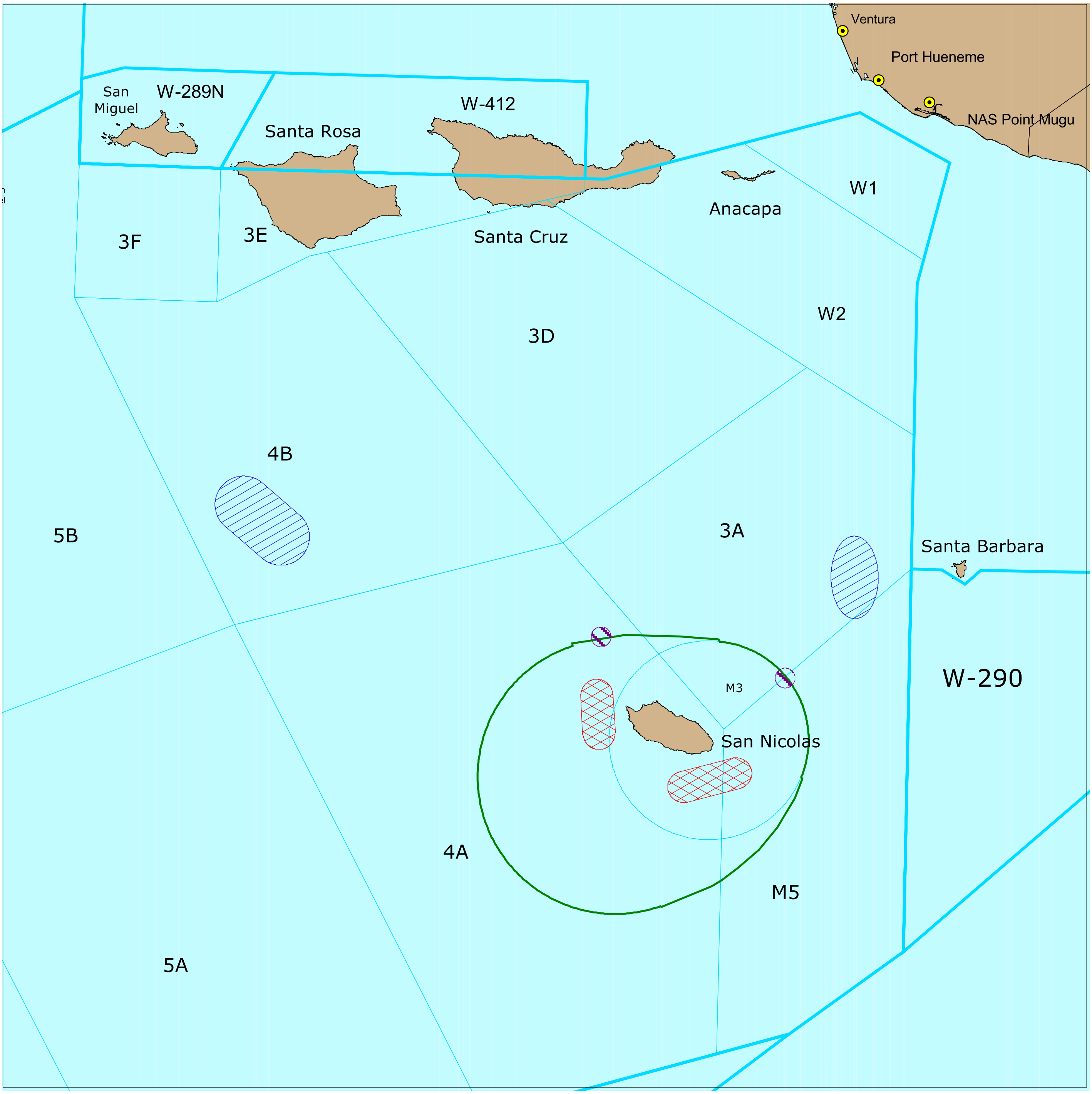
A - General Overview

These test and training events are designed for firing surface-to-air missiles and air-to-air missiles against a low-altitude subsonic target flown in a nearshore environment. The nearshore intercept provides a challenge for the weapon system because the interceptor missile must acquire and intercept the target at a low altitude in the presence of a land background (which adds clutter to the missile radar environment). The test scenario would involve the flight of a subsonic target a minimum of 0.5 nautical mile (NM) (0.9 kilometers [km]) offshore San Nicolas Island to present an intercept opportunity for a missile engagement from a ship or aircraft. All intercepts would be more than 1 NM (1.9 km) offshore of San Nicolas Island and at low altitudes (about 1,000 feet [300 m]). The debris pattern from the interceptor missile would be small and would be located entirely over the water at least 1 NM (1.9 km) offshore. Although the other TMD events may involve the use of both live and inert warheads, the missiles associated with nearshore intercept events would not use live warheads and the targets would be recovered, if possible. Because of the low altitude of the target, the ships would be relatively close to San Nicolas Island, within 20 NM (37 km). NAWCWPNS Point Mugu proposes to accommodate up to eight nearshore intercept test or training events per year. Figure 2-2d shows the approximate range areas to be used to accommodate representative nearshore intercept activities. Figure 2-2e shows the approximate geometry of the nearshore intercept in relation to San Nicolas Island.

B - Nearshore Intercept Participants

Interceptor missiles could be sea-launched (e.g., using a vessel or launch barge) from the Sea Range or air-launched. Targets could be air-launched (e.g., from C-130 aircraft) or surface-launched from NAS Point Mugu. If a vessel is used to fire the missile, it would likely be on the Sea Range for two or three days during preparation for the test or training event, as would the necessary support ships. The range safety aircraft, target launch aircraft, and the target recovery helicopter would be on the range only on the day of the test or training event. The range safety aircraft would fly the longest sortie, lasting over 5 hours. The target launch aircraft sortie would likely last 4 hours or less, depending on the needs of the test or training event. The altitude of the target launch aircraft would be under 10,000 feet (3,050 m)

TMD Element
D) Representative Nearshore Intercept Scenarios



Legend

- Interceptor Launch Area
- Point Mugu Sea Range
- Target Launch Area
- Debris Intercept Area
- Hazard Area

Note : Debris pattern will always be at least 1 NM offshore.

10 0 10 Nautical Miles

Projection: Universal Transverse Mercator
North American Datum 1927
Zone 11

Figure 2-2d

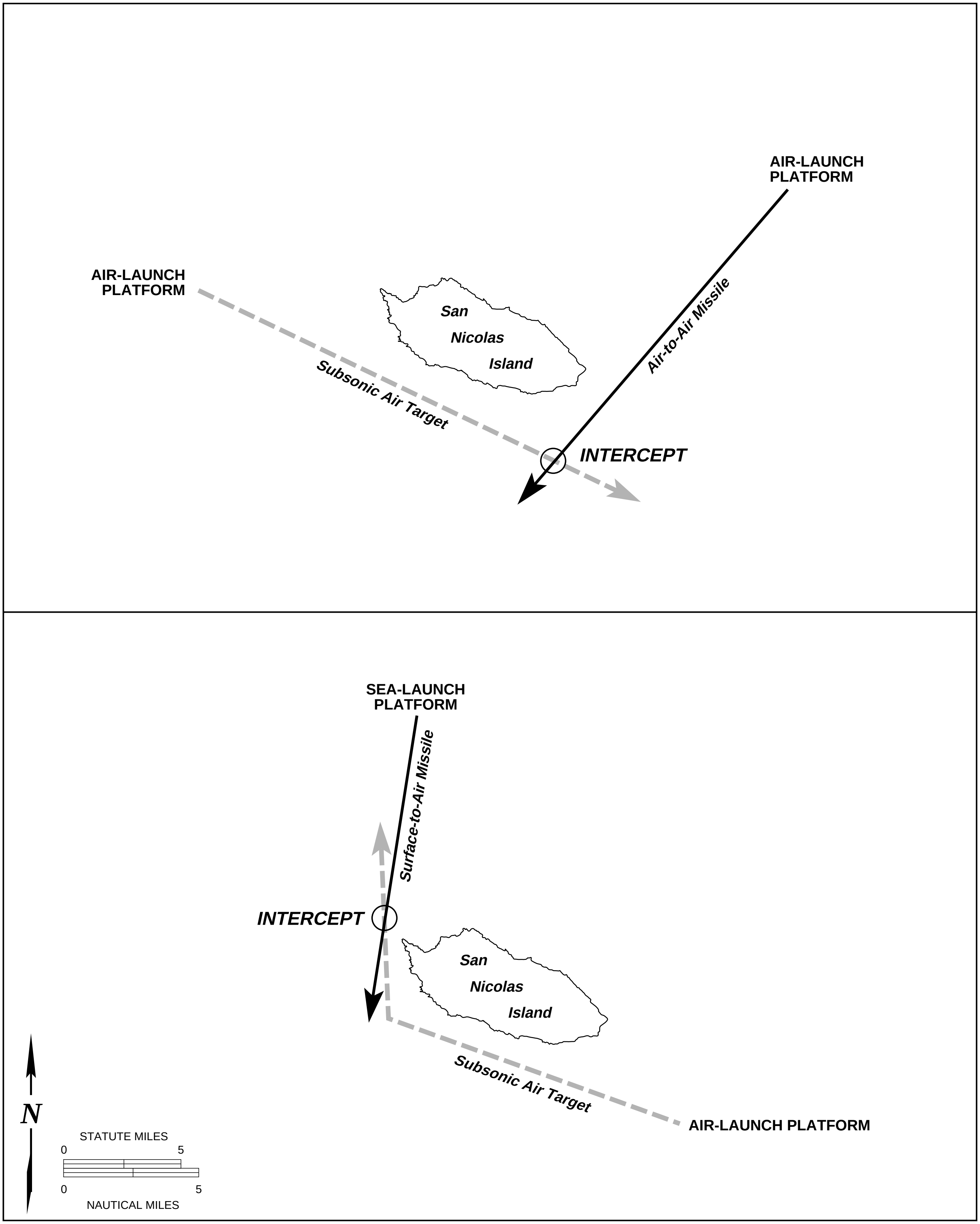


Figure 2-2e
Proposed Representative Nearshore Intercept Geometry at San Nicolas Island

since the intercept is a low-altitude event. The helicopter's recovery sortie from Point Mugu to the range would be about 2 hours or less at a low altitude, under 1,000 feet (300 m).

C - Hazard and Debris Patterns

The nearshore intercept would produce a relatively small debris pattern footprint since the intercept occurs at altitudes less than 1,000 feet (300 m). However, the density of the debris within the footprint would be higher since there is little time for dispersion. Although the intercept is designed to occur near San Nicolas Island, the firing geometry would require that the entire debris pattern impact the water at least 1 NM (1.9 km) offshore in order not to endanger lives or property on the island.

Table 2-1 shows the maximum increase in the number of operations that could be accommodated on the Sea Range under the proposed action for each component of TMD. Supporting data for these event numbers are included in Appendix B.

Table 2-1. Estimated Annual TMD Testing and Training Activities

	Aircraft Sorties	Ships and Boats	Missiles Fired	Targets Launched
Theater Missile Defense				
Boost Phase Intercept	30	15	3	3
Upper Tier	12	23	6	3
Lower Tier	15	23	3	3
Nearshore Intercept	32	50	8	8
Total Proposed for TMD	**89**	**111**[1]	**20**	**17**

[1] Includes 91 range support boats.

2.1.2 Training Element

The Sea Range currently supports two Fleet training exercises per year, four small-scale amphibious training exercises per year, and two special warfare training exercises per year. In addition to this current level of training, NAWCWPNS Point Mugu proposes to accommodate one additional Fleet training exercise per year, and two additional special warfare exercises per year (small-scale amphibious training would remain at current levels).

2.1.2.1 Fleet Exercise Training

A Fleet Exercise, or FLEETEX, is a generic term which broadly encompasses a variety of Fleet training activities including but not limited to missile exercises, aircraft operations, joint training activities (e.g., Air Force and Navy), tactical training, and Fleet battle experiments. A FLEETEX is a coordinated, multi-ship exercise designed around particular training events and scenarios. The objective of a FLEETEX is to conduct realistic fleet operations with minimal operational constraints, consistent with the safety of participants and non-participants. A FLEETEX is typically conducted during a consecutive period of two to three days. The exercises employ units which the Navy would use in combat (i.e., a Battle Group or some of its components). Some FLEETEXs may have a fleet air-defense focus; others may emphasize surface or littoral warfare activities. Each is tailored to meet the Navy's training needs at the time of the exercise. A typical FLEETEX scenario at the Sea Range involves launching 33 targets intercepted by a similar number of missiles. Because of the large portions of the Sea Range covered, Point Mugu would perform continuous air and sea surveillance with aircraft augmented with land-based radars during this scenario. The Battle Group also provides aerial coverage for operational safety. FLEETEXs are currently the largest and most complex scenarios performed on the Sea Range. FLEETEXs are currently performed on the Point Mugu Sea Range twice per year (refer to Chapter 3 for a description of current activities). Under the proposed action, that tempo could increase to three per year. NAWCWPNS Point Mugu does not conduct test or training activities involving systems related to anti-submarine warfare (e.g., sonar, underwater explosives). In some FLEETEXs, however, submarines are used to launch missiles.

2.1.2.2 Special Warfare Training

Special warfare training is a type of littoral training that currently takes place on the Sea Range. Special warfare operations generally involve activities of individuals (less than ten personnel) conducting simulated clandestine operations at San Nicolas Island. Typical operations include parachute insertion, swimmer penetration, hydrographic reconnaissance, inflatable boat operations, beach patrolling, and ingress and egress by aircraft.

In addition to the ongoing special warfare operations at their current level of activity (two per year), NAWCWPNS Point Mugu proposes to increase special warfare training activity by Sea, Air, and Land teams (or SEALs) of the Navy Special Forces Command from two to four times per year.

Table 2-2 shows the projected increase in the number of training operations that could be accommodated on the Sea Range under the proposed action. Supporting data for these event numbers are included in Appendix B.

Table 2-2. Proposed Additional Training Activity Per Year

Activity	Aircraft Sorties	Ships and Boats	Missiles Fired/Ordnance Deployed[2]	Targets Launched[2]
FLEETEX Expansion	57	18[1]	34	33
Special Warfare Training	4	32	0	0

[1] Includes 12 range support boats.
[2] The number of *Missiles Fired/Ordnance Deployed* and *Targets Launched* are not equal because their ratio of use varies by event.

2.1.3 Facility Modernization Element

2.1.3.1 Point Mugu Modernizations

As part of the Facility Modernization Element, NAWCWPNS Point Mugu proposes to use two previously used launch sites (each containing two pads) to serve as new missile launch locations at NAS Point Mugu. Currently, approximately six missiles per year are launched from a truck directly in front of the Building 55 Launch Complex (Figure 2-3a). In addition, targets are launched from this complex. These targets require the use of a jet assisted takeoff (JATO) bottle. The bottle falls off soon after launch and typically lands 700 to 1,400 feet (210 to 420 m) in front of Building 55 (see Figure 2-3a). Four previously used launch pads are located along Beach Road between the beach and Mugu Lagoon (see Figure 2-3a). Under the proposed action, the Bravo pad (also known as *B pad*) or the Charlie pad (*C pad*) may be used for missile launches at this location. Missiles could either be truck-launched (the truck has a self-contained launch system and would be driven to the B or C pad) or launched directly from a mobile launch system located on the B or C pad. No construction would be required since missiles could

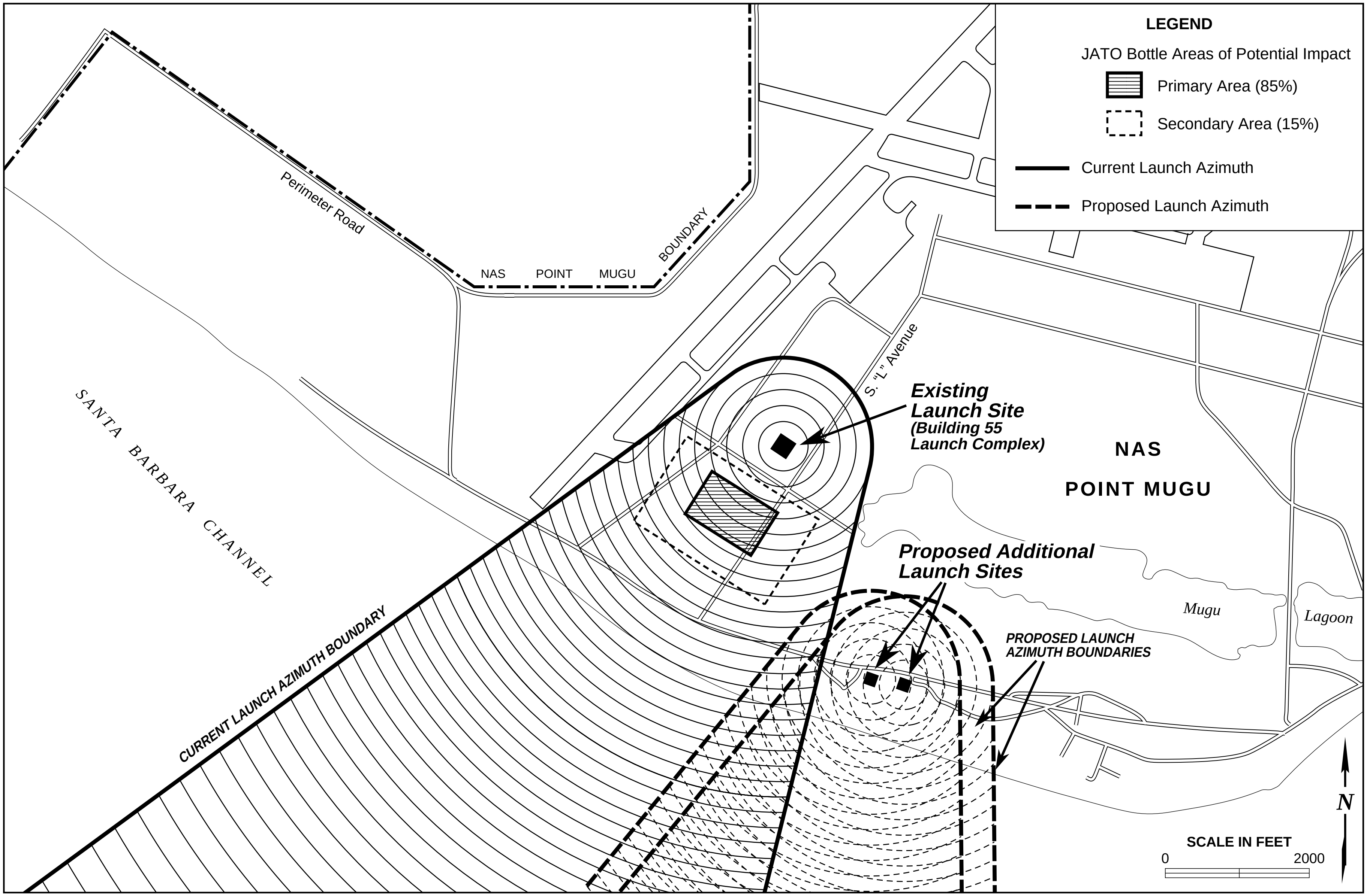


Figure 2-3a
Enhanced Capabilities: Proposed Launch Sites at NAS Point Mugu

be launched off the existing pads; nevertheless, since the pads are currently not used for launching, some minor pad preparation (e.g., cleaning, maintenance, and security) would be required. Use of these locations would not affect the number of missiles launched from NAS Point Mugu. Safety and clearance procedures performed prior to missile launches would be identical to current methods.

Some of the proposed beach launches may include the use of solid propellant boosters. These solid propellant boosters provide the initial thrust necessary until the launched vehicle can propel itself independently. These boosters fall off soon after launch. Unlike JATO bottles, these boosters would typically land in the ocean 0.25 to 0.50 mile (0.40 to 0.80 km) offshore. The solid propellant contained in the boosters burns out during the launch operation and would be completely expended prior to the booster entering the ocean.

2.1.3.2 San Nicolas Island Modernizations

To maintain top-quality support of existing and future test and training operations, San Nicolas Island modernization is included as a component of the proposed action. The proposed San Nicolas Island modernizations include construction of additional facilities and the addition of two new target launch systems. The proposed modernizations would not require additional staff on the island. Figure 2-3b depicts the proposed San Nicolas Island modernizations. Table 2-3 summarizes the modernization proposals. Where applicable, estimated footprint areas of new construction are also shown in the table.

Table 2-3. Proposed New Construction for San Nicolas Island Modernization Proposals

#[1]	Modernization	Total Area of Disturbance
1	Add vertical missile launcher to existing launch pad	None (build on existing pad)
2	Construct new 50K launcher for target missiles	1,200 SF (111 m^2) concrete pad
3	Add new Range Support Building	12,000 SF (1,115 m^2) construction area
4	Develop five new multiple-purpose instrumentation sites	15,000 SF (1,394 m^2) construction area (each)

SF = square feet; m^2 = square meters
[1] Numbers correspond to those shown on Figure 2-3b.
Source: NAWCWPNS Point Mugu 1996l.

1) Vertical Launch System. As part of the San Nicolas Island modernizations, a vertical launch system would be constructed at one of the pads at the Building 807 Launch Complex on the west end of the island (see Figure 2-3b). A land-based vertical launch capability is useful for missile testing and training events because it effectively simulates a realistic shipboard launch scenario without the logistics of launching from a ship on the Sea Range. The launcher would be placed on a previously graded area which is devoid of vegetation. The siting criteria for this facility include an onshore location near sea level which is logistically feasible (i.e., missiles can be transported safely to and from the site, and there is an adequate safety buffer zone around the site). San Nicolas Island is suitable for the proposed vertical launch system since it is currently used for missile launches and since safety procedures have already been established for missile launches at the west end of the island. Consequently, since it is located within the Sea Range, San Nicolas Island would be able to effectively simulate a shipboard launch during weapons testing and training events.

A vertical launcher approximately 30 feet (9.1 m) tall and stabilized by four cables would be placed on an existing pad. A specific design has not yet been selected; however, instead of cables, the launcher could potentially be stabilized by placing mounded fill material on all four sides. This fill material would be fully contained within the boundaries of the existing launch pad. Missiles launched from the new system would be used in support of Fleet and test and evaluation (T&E) activities conducted on the Sea

San Nicolas Island Modernization Locations of Proposed New Facilities

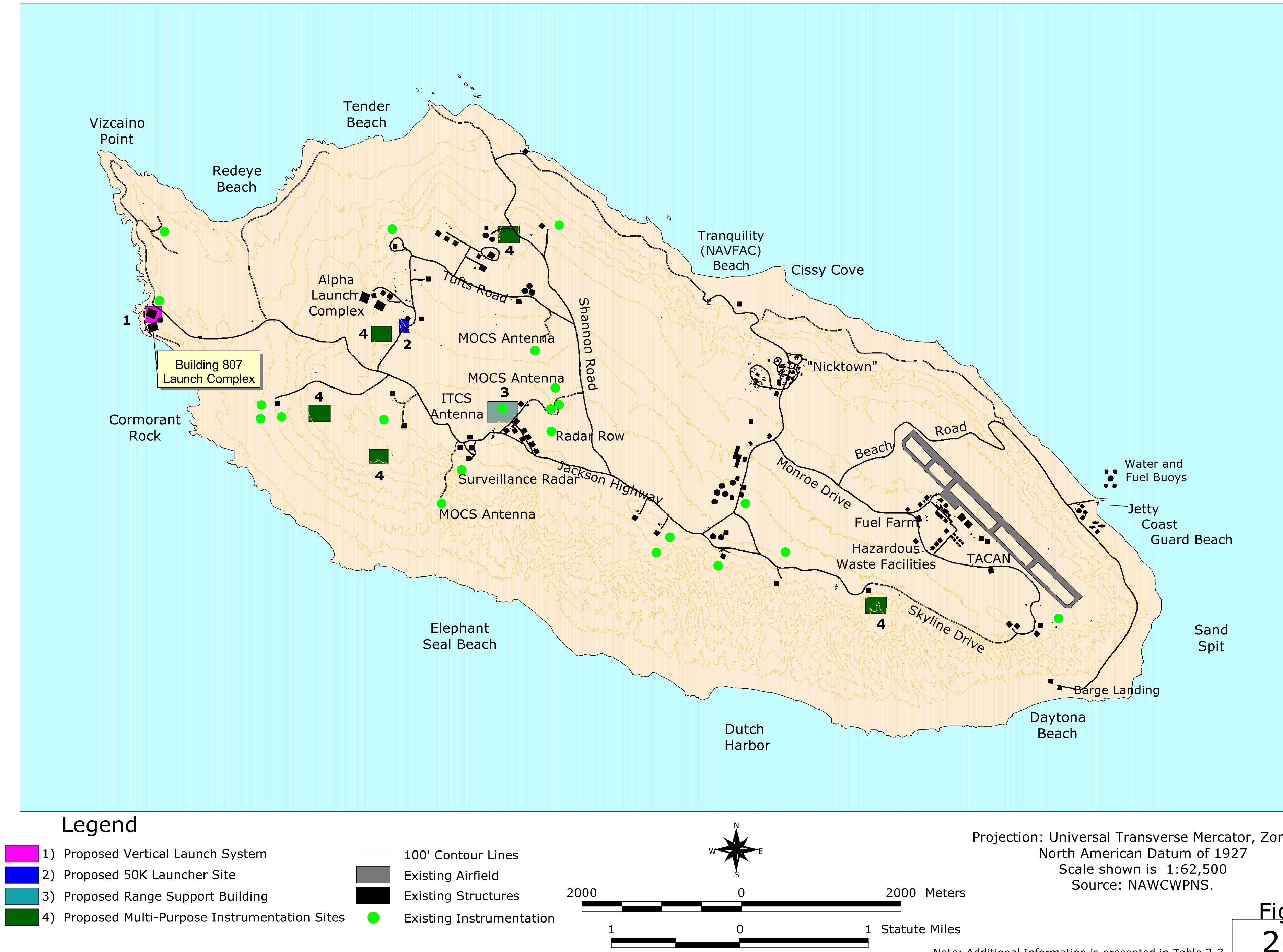


Figure 2-3b

Range and would be similar to missiles currently launched from San Nicolas Island. Missiles would use the same azimuth established for target launches initiated from the west end of the island. Therefore, the same safety procedures used for all launches at this location would apply to the proposed vertical launch system. Under the proposed action, the vertical launch system would be used approximately three times per year.

2) 50K Launcher. NAWCWPNS Point Mugu proposes to add a launch site near the existing inland launch area (see Figure 2-3b), which is currently used for many of the target launches from San Nicolas Island. This launcher would facilitate a wider variety of target support for training and testing operations on the Sea Range as it would be capable of launching targets and missiles weighing up to 50,000 pounds (22,680 kg). The largest vehicle currently launched at San Nicolas Island is the Vandal missile target (approximately 38,000 pounds [17,237 kg]). The 50K launch site would consist of a large, heavy-duty rail launcher on a launch pad similar in size to the existing Vandal launch pad (approximately 1,200 square feet [111 square meters]). It would be located about one half mile (0.8 km) southeast of the Vandal pad at a location currently used for occasional mobile launch activities (see Figure 2-3b). Under the proposed action, the 50K launcher would be used approximately three times per year.

3) Range Support Building. A new range support building would provide secure work spaces for project personnel, onsite operational display capability, and debriefing/teleconferencing support. The proposed site is on the central plateau of the island north of Jackson Highway (see Figure 2-3b).

4) Multi-Purpose Instrumentation Sites. Five strategically located multi-purpose instrumentation sites would be constructed. These facilities would increase NAWCWPNS capabilities through the use of mobile instrumentation and would also increase opportunities for resource sharing. Examples of mobile instrumentation, which could be used at the proposed sites, include portable communication vans, portable optics stations, and portable tracking systems. All of this equipment would be portable and used only during the operations they would support. Each site would require approximately 15,000 square feet (1,394 square meters). The five proposed locations are shown on Figure 2-3b.

2.1.4 Operations Baseline

Since the establishment of the Point Mugu Sea Range in 1946, the tempo and types of operations have fluctuated. These fluctuations have been due to changing world situations, the introduction of advances in warfighting doctrine (most recently focusing on longer-range and highly-accurate standoff weapons, including guided missiles), phased development of weapons acquisition programs, and the DoD test and evaluation budget. For example, Sea Range operations reached a high during the early 1980s when the DoD budget was robust, but since the close of the Cold War, lower levels of activity have been experienced. Most of the factors influencing tempo and types of operations are fluid in nature and will continue to cause fluctuations in Sea Range activity levels. Thus, simply using the most recent recorded data is not representative of long-term operations.

Accordingly, it became important to choose a baseline that accurately reflects the typical Sea Range level of operations and against which relative impacts of the proposed action could be measured. As a result, fiscal year 1995 (FY95) was chosen as the period being the most representative of baseline operations on the Point Mugu Sea Range. The operational activity conducted during FY95 reflects the broad range of test and training activity currently occurring on the Sea Range with respect to aircraft and ship operations. In addition, the FY95 operations data reflect the historical operational tempo for the range. Lastly, Sea Range infrastructure and work force have been configured to support the FY95 operational type and tempo. Accordingly, data from FY95 are used throughout this document as the baseline for evaluating environmental impacts that may result from the proposed TMD, training, and facility modernization elements.

In general, activity levels can be subdivided into categories which include aircraft sorties; ships and boats afloat within or near the Sea Range; missile firings; and target launches. Table 2-4 presents the baseline operations tempo plus the proposed new activities.

Table 2-4. Baseline Plus Proposed Sea Range Activities

Category	Aircraft Sorties	Ships and Boats[1]	Missiles Fired/ Ordnance Deployed[2]	Targets Launched[2]
Operations Baseline[3]	3,934	799	351	300
Proposed Action				
Theater Missile Defense	89	111	20	17
Additional FLEETEX	57	18	34	33
Additional Special Warfare	4	32	0	0
Total Proposed Action	**150**	**161**	**54**	**50**
Total	**4,084**	**960**	**405**	**350**

1 Includes range support boats.
2 The number of *Missiles Fired/Ordnance Deployed* and *Targets Launched* are not equal because their ratio of use varies by event.
3 See Section 2.1.4, Operations Baseline.

2.2 ALTERNATIVES

Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations [C.F.R.] 1502.14) and Navy Procedures (32 C.F.R. 775) provide guidance on the consideration of alternatives in an EIS and promote the rigorous exploration and objective evaluation of all reasonable alternatives. Reasonable alternatives must meet the stated objectives of the proposed action. Since the purpose and need for the proposed action are to enhance NAWCWPNS Point Mugu capabilities, alternative sites do not provide reasonable alternatives and are thus beyond the scope of this EIS/OEIS.

To help identify reasonable alternatives, the Navy eliminated testing, training, and facility modernization proposals that would be inconsistent with the Sea Range mission and associated facilities, instrumentation, and infrastructure that support this mission. Test and training alternatives that could be better supported at another location were also considered unreasonable; rather than duplicate capabilities of another range, alternatives need to better accommodate the existing test and training capabilities at NAWCWPNS Point Mugu. Selection criteria were developed to help identify potential alternatives and eliminate unreasonable alternatives from further consideration. Selection criteria include: 1) reasonable alternatives must fulfill the need for, and purpose of, the proposed action; 2) reasonable alternatives must be consistent with the strategic vision for NAWCWPNS Point Mugu; and 3) supporting facilities, instrumentation, and/or infrastructure must be complementary to existing Sea Range capabilities. Alternatives that do not meet one or more of these criteria were not carried forward for analysis within this EIS/OEIS.

2.2.1 Alternatives Eliminated From Further Consideration

Several alternative test, training, and facility modernization components were initially screened and evaluated to determine their ability to meet the selection criteria but were eliminated from consideration due to their inconsistency with both the mission and strategic vision for the Point Mugu Sea Range.

Alternative test, training, and facility modernization components eliminated from consideration and their comparison to the selection criteria are presented in Table 2-5. For comparison purposes, Table 2-5 also includes the proposed action components. A brief description of the alternative components not carried forward for analysis and the reasons for their rejection are provided below.

Table 2-5. Potential Alternative Components and Selection Criteria

	Selection Criteria		
	Meets Purpose and Need for the Proposed Action	**Consistent with Mission and Strategic Vision for Sea Range**	**Supporting Facilities, Instrumentation and/or Infrastructure are Complementary to Existing Sea Range Capabilities**
Alternative Tests			
ASW	✕	✕	●
HE underwater	✕	✕	●
Line detonation	✕	✕	●
TMD[1,2]	●	●	●
Alternative Training Exercises			
LCACs	●	✕	●
Live munitions on San Nicolas Island	●	✕	●
Underwater explosives	●	✕	●
Additional FLEETEX[1]	●	●	●
Additional Special Warfare[1]	●	●	●
Alternative Facility Modernizations			
Instrumented Underwater Acoustic Range	✕	✕	✕
Space Launch Capability	✕	✕	✕
Vertical Missile Launcher[1]	●	●	●
50K Launcher for Target Missiles[1]	●	●	●
New Range Support Building[1]	●	●	●
New Multiple-Purpose Instrumentation Sites[1]	●	●	●

[1] This component is part of the proposed action.
[2] Includes testing and training activities.
● = meets criterion ASW = anti-submarine warfare TMD = theater missile defense
✕ = does not meet criterion HE = high explosive LCAC = landing craft air cushion

A - Alternative Tests

Adding new capabilities for anti-submarine warfare (ASW), tests that use high explosives (HE) underwater, and tests that require line detonation were initially considered in addition to TMD as testing alternatives but were rejected due to their inability to meet the selection criteria. Although such tests may allow for the evaluation of new technologies and threat scenarios, a purpose of the proposed action, they are all inconsistent with the mission and strategic vision for NAWCWPNS Point Mugu. The Sea Range is used primarily for testing and evaluation of weapons systems associated with air warfare, not submarine warfare; therefore, all three alternative tests are inconsistent with both the mission and strategic vision for NAWCWPNS Point Mugu. For these reasons, these alternative tests were eliminated from further consideration.

B - Alternative Training Exercises

Adding new capabilities for training exercises, including the use of landing craft air cushions (LCACs), training with live munitions on San Nicolas Island, and training involving underwater explosives were initially considered in addition to increasing the number of FLEETEXs but were rejected because they were not consistent with the strategic vision for the Point Mugu Sea Range. As discussed above for testing, the Sea Range supports aeronautical and related technology systems, not systems related to submarine warfare. For more than 50 years, the Sea Range has been an airborne missile testing and training range; training events requiring LCACs or underwater explosives would be inconsistent with the future vision for NAWCWPNS Point Mugu. Therefore, none of the alternative training exercises were carried forward for analysis.

C - Alternative Facility Modernizations

Development of an instrumented underwater acoustic range and development of a space launch capability were initially considered as alternative facility modernization proposals but were eliminated due to their inability to meet the selection criteria. Although these alternatives could provide the range with expanded test and training opportunities, both are incompatible with the mission and strategic vision for the Sea Range. Instrumented underwater acoustic ranges exist at other locations and typically support submarine warfare test and training activities that are inconsistent with the Sea Range role as an air warfare testing center. Space launch capabilities also exist at other locations and launching vehicles over 50,000 pounds would be incompatible with existing launch operations at NAS Point Mugu and San Nicolas Island. In comparison, the facility modernization components included in the proposed action have been identified as specific requirements to maintain top-quality support of existing and future test and training operations. These proposals would enhance the capabilities that support testing and training activities presently being carried out at Point Mugu.

2.2.2 Alternatives Considered

Three alternatives are analyzed in this EIS/OEIS. These include the No Action Alternative, the Minimum Components Alternative, and the Preferred Alternative as described below.

2.2.2.1 No Action Alternative - Current Operations

The NAWCWPNS Point Mugu Sea Range has been operated by the Department of the Navy for more than 50 years. During the baseline year, 3,359 operations were scheduled on the Sea Range. Under the No Action Alternative, current test and training operations would continue and the Sea Range would not accommodate TMD testing and training. The ongoing five categories of tests would continue to be conducted on the Sea Range (current operations are described in more detail in Chapter 3). In addition, the three types of training activities would continue at current levels, and proposed facility modernizations would not be implemented.

Although selection of the No Action Alternative would not allow the Sea Range to accommodate TMD events or increase the levels of current training activities, ongoing test and training operations at the Point Mugu Sea Range would not be affected. Table 2-6 shows the components of current activities that comprise the No Action Alternative. Evaluation of the No Action Alternative in this EIS/OEIS provides a credible baseline for assessing environmental impacts of the Minimum Components Alternative and the Preferred Alternative, described below.

Table 2-6. Current Activities

Current Types of Tests	Current Types of Training
Air-to-Air	Fleet Training Exercises (2/year)
Air-to-Surface	Small-Scale Amphibious Warfare Training (4/year)
Surface-to-Air	Special Warfare Training (2/year)
Surface-to-Surface	
Subsurface-to-Surface	

2.2.2.2 Minimum Components Alternative

Although both the Preferred Alternative and the Minimum Components Alternative meet all selection criteria, the Minimum Components Alternative meets the purpose and need of the proposed action while minimizing the number of components that would be implemented. If the Minimum Components Alternative is selected, only one component of each proposed action element (i.e., TMD, training, and facility modernization) would be implemented. Under this alternative, in addition to current testing and training activities, the Sea Range would be able to accommodate up to eight nearshore intercept events and one additional FLEETEX per year. The only facility modernization component which would be implemented is the construction of five multiple-purpose instrumentation sites on San Nicolas Island. The three components that compose the Minimum Components Alternative were selected based on the goal of meeting the purpose and need for the proposed action to the maximum extent possible while minimizing the number of activities to be implemented. For example, accommodation of nearshore intercept would provide up to eight opportunities a year to evaluate new technologies and threat scenarios, as compared with the lower operational tempo of the other three TMD activities. Since special warfare training typically involves fewer than 30 personnel while a FLEETEX involves an entire Battle Group, this component was selected on the basis of maximizing the effectiveness of training. Finally, in comparison with the other facility modernization proposals, constructing five multi-purpose instrumentation sites on San Nicolas Island would help to maximize the Sea Range's capability to accommodate evolving technologies. Although this alternative meets the purpose and need for the proposed action, the capability of the Sea Range to support existing and future operations would not be fulfilled to the extent it would under the Preferred Alternative.

2.2.2.3 Preferred Alternative

The Preferred Alternative was described in detail earlier in this Chapter (Section 2.1). In addition to the five categories of tests currently conducted on the Sea Range, under the Preferred Alternative the Sea Range would be able to accommodate TMD testing and training activities. In addition, the Sea Range would be able to accommodate an increase in the level of current training activities. Facility modernization components at both NAS Point Mugu and San Nicolas Island would be implemented to enhance the capability of the Sea Range to support existing and future operations. A comparison of the three alternatives analyzed in this EIS/OEIS is provided in Table 2-7.

Table 2-7. Alternatives Analyzed in this EIS/OEIS

Operational Element	Alternatives		
	No Action Alternative	Minimum Components Alternative	Preferred Alternative
Current Operations			
Air-to-Air	Current RDT&E Levels	Current RDT&E Levels	Current RDT&E Levels
Air-to-Surface			
Surface-to-Air			
Surface-to-Surface			
Subsurface-to-Surface			
TMD Element (Per Year)			
Boost Phase	0	0	3
Upper Tier	0	0	3
Lower Tier	0	0	3
Nearshore Intercept	0	8	8
Training Element (Per Year)			
FLEETEX	2	3	3
Special Warfare	2	2	4
Facility Modernization Element			
NAS Point Mugu	None	None	New Launch Locations
San Nicolas Island	None	- 5 multi-purpose instrumentation sites	- Missile Launcher - Vertical Launcher - Range Support Building - 5 multi-purpose instrumentation sites

RDT&E = Research, Development, Test and Evaluation

CHAPTER 3
AFFECTED ENVIRONMENT

This chapter provides detailed information on current test and training operations at the Naval Air Warfare Center Weapons Division (NAWCWPNS) Point Mugu Sea Range as well as describes existing conditions of environmental resources that may be affected by the proposed action or alternatives. This chapter is divided into two major subsections: Section 3.0 (page 3.0-1) provides an overview of the Point Mugu Sea Range and describes Point Mugu Sea Range baseline operations, and Sections 3.1 through 3.14 (starting on page 3.1-1) describe the affected environment in terms of 14 resource areas: geology and soils; air quality; noise; water quality; marine biology; fish and sea turtles; marine mammals; terrestrial biology; cultural resources; land use; traffic; socioeconomics (including Environmental Justice); hazardous materials, hazardous wastes, and non-hazardous wastes; and public safety. The information in these resource sections provides baseline data from which to identify and evaluate potential impacts that could result from implementation of the proposed action or alternatives. The data presented are commensurate with the importance of potential impacts in order to provide the proper context for the analysis.

A region of influence (ROI) has been identified and analyzed for each resource. An ROI is a geographic area in which environmental effects for that resource would be most likely to occur. For most resources, the ROI includes the Point Mugu Sea Range and range support facilities at Naval Air Station (NAS) Point Mugu and San Nicolas Island (described in the following section). Because Sea Range activities on San Miguel, Santa Rosa, and Santa Cruz islands are minimal, these islands are included in the ROI only for selected resources as appropriate. Although they are located within the ROI, there are no current or proposed Sea Range activities on Anacapa or Santa Barbara islands.

A glossary of operational terms (including a table of English to metric unit conversion factors) is presented in Chapter 10, Glossary and Index.

3.0 CURRENT ACTIVITIES

3.0.1 NAWCWPNS Point Mugu Overview

3.0.1.1 Description

NAS Point Mugu

NAS Point Mugu operates and maintains station facilities and provides support services for NAWCWPNS and other tenants. These services include the Point Mugu air terminal, air traffic control, firefighting and crash crews, and airfield services. NAS Point Mugu does not provide port or docking facilities for any ships or boats.

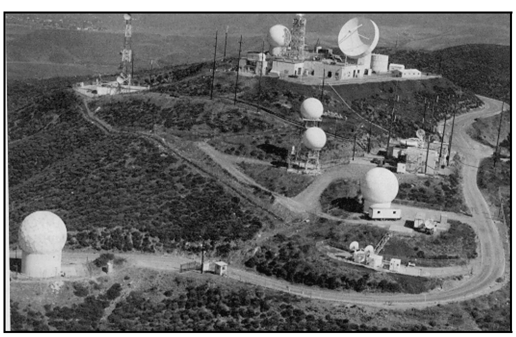
NAWCWPNS Point Mugu controls 36,000 square miles (93,200 km^2) of Special Use Airspace (SUA) over the Pacific Ocean associated with the Sea Range (refer to Figure 1-2). SUA is airspace within which specific activities must be confined, or wherein limitations are imposed on aircraft not participating in those activities. This area provides the Navy with a realistic operational environment for the safe conduct of controlled air, surface, and subsurface launched missile tests, aircraft tests, and fleet exercises involving aircraft, surface ships, and various targets. The combination of location, widespread instrumentation sites, unique test capabilities, and a highly skilled technical workforce provides the most advanced and efficient method for conducting the critical test and evaluation (T&E) and training necessary to maintain technical standards in the U.S. Navy.

Sufficient usable airspace for T&E, training, and other range activities is vital to the success of meeting NAWCWPNS Point Mugu mission requirements. Airspace overlying the Sea Range includes both Restricted Areas and Warning Areas. Restricted Areas are airspace over U.S. land or Territorial Waters that are used by the military to exclude non-authorized aircraft and to contain hazardous military activities. The term "hazardous" implies, but is not limited to, firing of weapons, aircraft training and testing, and other specialized events from which it is prudent to exclude civil air traffic. Warning Areas are designated airspace for military activities that are in international airspace but are open to all aircraft. Flights in Warning Areas by non-participating aircraft are not prohibited since these areas are over international waters.

The airspace of the Restricted and Warning Areas extend from the surface to an "unlimited" altitude. However, Sea Range operations are typically conducted well below 100,000 feet (30,500 m). The restricted areas on the Sea Range are over San Nicolas Island, over the NAS Point Mugu airfield, and over nearshore waters adjacent to the airfield. NAWCWPNS Point Mugu takes every reasonable measure to ensure that Sea Range airspace is clear of non-participating air and sea traffic prior to any hazardous activities.

3.0.1.2 Regional Location

The deep ocean area and controlled airspace associated with the Point Mugu Sea Range parallels the California coastline for about 200 miles (320 km) and extends seaward for more than 180 miles (290 km). The NAS main base at Point Mugu consists of 4,490 acres (1,817 hectares [ha]) on the Pacific coast, approximately 50 miles (80 km) northwest of Los Angeles, in southern Ventura County (Figure 3.0-1). The base is bounded by U.S. Highway 1 on the northeast, the Pacific Ocean along the south and west, and an agricultural buffer zone established by the County of Ventura to the north and northwest.



Instrumentation Facilities on Laguna Peak

In addition to the main base area, instrumentation facilities are located on Laguna Peak, a 1,457-feet (444-m) above mean sea level (MSL) summit at the western end of the Santa Monica Mountains. This peak is just east of the base, providing an elevated line of sight for surface surveillance radar, telemetry reception, and optical tracking, as well as an over-the-horizon transmitter capability for the flight control of pilotless aircraft. The Navy owns and uses 44 acres (18 ha) at the summit of Laguna Peak to house instrumentation and communication facilities.

NAS Point Mugu

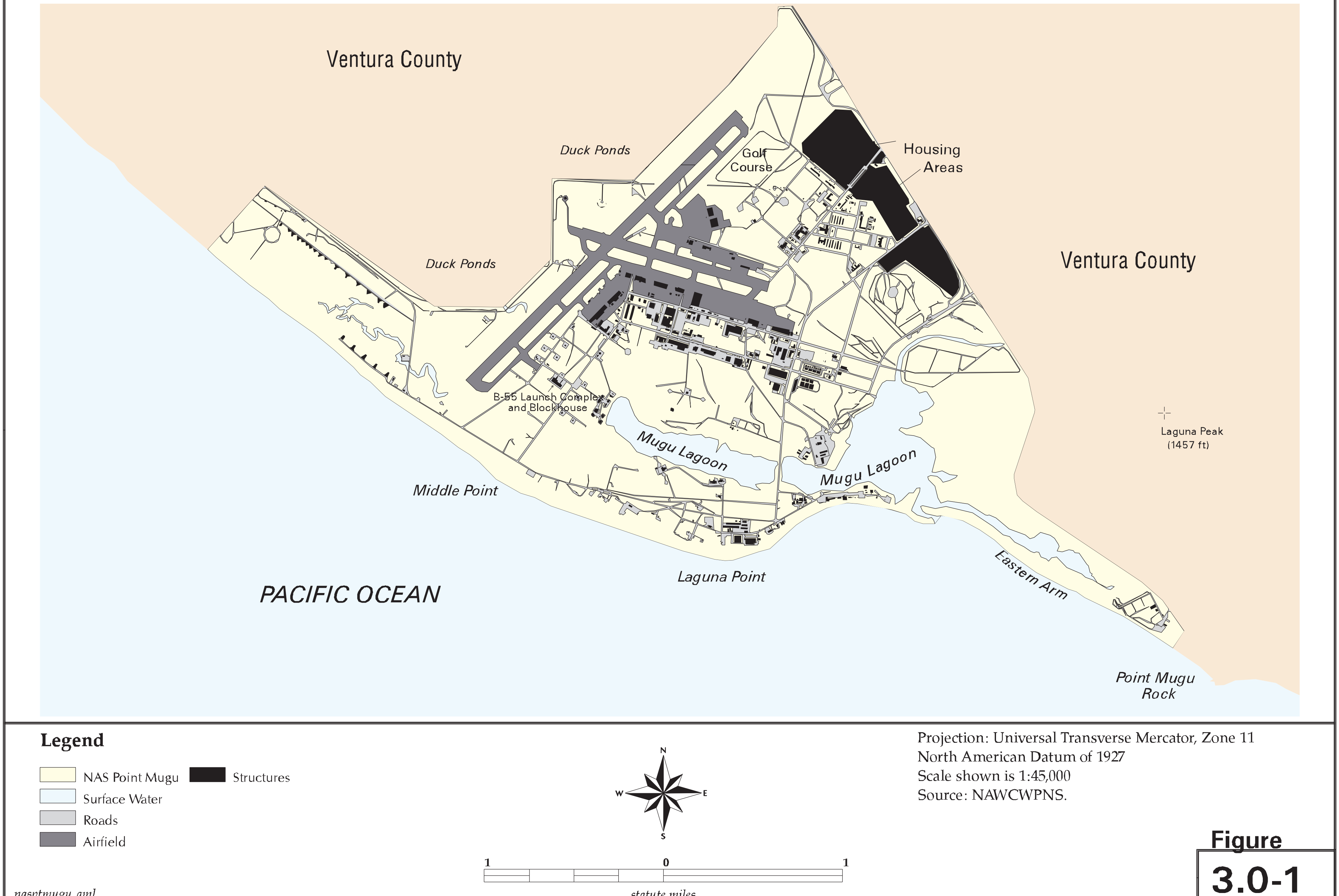


Figure 3.0-1

3.0.1.3 NAS Support Operations

A - Support Activities

NAS Point Mugu operates the base and the support services for NAWCWPNS at Point Mugu and on San Nicolas Island. These activities are in direct support of NAWCWPNS and other base tenants for the T&E and training at NAS Point Mugu, San Nicolas Island, and the Point Mugu Sea Range. A civilian and military workforce provides the essential base public works support including facilities engineering and maintenance, utilities, and transportation services to San Nicolas Island. NAS Point Mugu employees also provide supply, administrative, military community service programs, and physical security services for the base. The Point Mugu Environmental Division is a part of the Public Works Department. This office manages the environmental programs for cleanup, conservation, pollution prevention, and compliance with federal, state, and local environmental laws and regulations.

B - Airfield Operations

NAS Point Mugu has two main runways: the primary runway (designation 03/21) is 11,000 feet (3,350 km) long, and the secondary runway (designation 09/27) is 5,500 feet (1,680 km) long. Both runways have loading capacities of 700,000 pounds (320,000 kg) and can accommodate aircraft as large as C-5s. There are ten hangars for aircraft maintenance and support. The airfield area also contains munitions storage bunkers and revetment areas for the storage, handling, and loading of missiles, targets, and other munitions. The runway and air traffic control facilities are operated and maintained by NAS Point Mugu. Table 3.0-1 presents a breakdown of airfield operations by the major type of aircraft (military and civilian) at NAS Point Mugu for FY95. Civilian traffic is for local civilian airports or civilian traffic operating in the greater Oxnard Plain area.

Table 3.0-1. Point Mugu Airfield Total Aircraft Operations, FY95[1]

	FY95
Military	19,866
Civilian	5,300
Total	**25,166**

[1] During the preparation of this EIS/OEIS, the Navy announced its decision to realign four E-2 squadrons from Marine Corps Air Station Miramar to NAS Point Mugu (the Record of Decision was signed in June of 1998). The realignment included 16 aircraft and associated support personnel and their families (Southwest Division 1998). The addition of the E-2 aircraft to Point Mugu results in an increase of 20,767 aircraft operations per year at the airfield.
Source: NAWS Point Mugu 1998j.

The airspace in the Point Mugu local area is heavily traveled. Navy Air Traffic Control provides services to military and civilian aircraft operating near NAS Point Mugu. The majority of airspace associated with the Point Mugu Sea Range is over international waters. Control of this airspace is governed by international agreements that apply to transoceanic flight by aircraft. The control of civil aircraft operating under Instrument Flight Rule (IFR) clearances and transiting the Sea Range is accomplished by the Federal Aviation Administration (FAA) Los Angeles Air Route Traffic Control Center. Aircraft operating under Visual Flight Rule (VFR) conditions are not precluded from operating in the Warning Area airspace over the Sea Range; however, during hazardous activities, every effort is made by both the FAA and NAWCWPNS Point Mugu to ensure that non-participating aircraft are clear of potentially hazardous areas on the Sea Range.

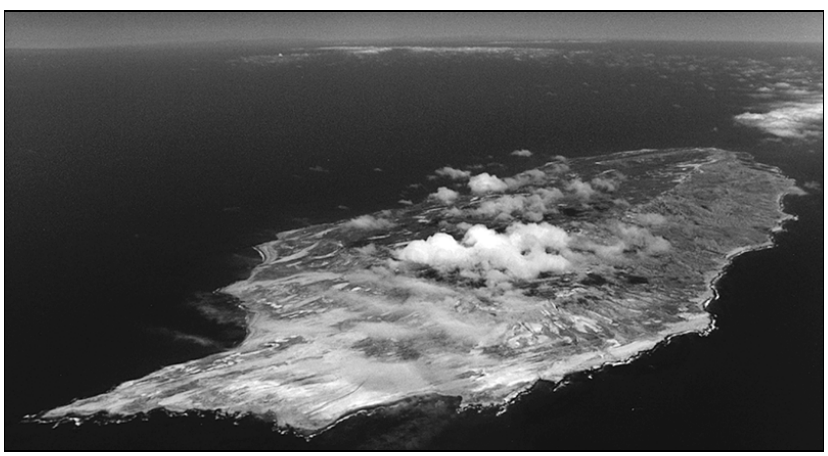
C - Aircraft Maintenance Facilities

NAS Point Mugu operates aircraft maintenance facilities, including hangars, aircraft spares storage buildings, and engine maintenance shops. Most of the aircraft maintenance facilities are located in the vicinity of the runways. However, the Aircraft Maintenance Department operates two aircraft maintenance complexes near the beach. The first complex includes engine maintenance shops and an aircraft spares storage facility, while the second complex is comprised of an engine maintenance shop and jet engine test cells. The test cells, used to test jet engines used on the Sea Range, are located at the south end of Laguna Road near the beach. This complex includes both inside and outside test cells. The inside cells are permitted (under a stationary source air quality permit) to operate for 200 hours per year while the outside test cells are permitted to operate for 250 hours per year. Typically, the test cells will be operated for a few hours per day for about one week, at a frequency of approximately once per month.

D - Range Facilities at the Channel Islands

In addition to the facilities at NAS Point Mugu and Laguna Peak, the Point Mugu Sea Range encompasses San Nicolas Island and portions of the northern Channel Islands (refer to Figure 1-2). Four of the Channel Islands are either owned by the Navy or provide Navy instrumentation sites that are critical to Sea Range operations. These islands are San Nicolas Island and San Miguel Island, which are owned by the Navy; Santa Cruz Island, the majority of which is owned by the Nature Conservancy (the National Park Service [NPS] owns 14,733 acres of the eastern potion) with approximately 10 acres leased by the Navy; and Santa Rosa Island, which is owned by the NPS. Although owned by the Navy, San Miguel Island is jointly managed by the Navy and the NPS which administers the management program. San Miguel, Santa Cruz, Santa Rosa, Santa Barbara, and Anacapa islands form the Channel Islands National Park (CINP).

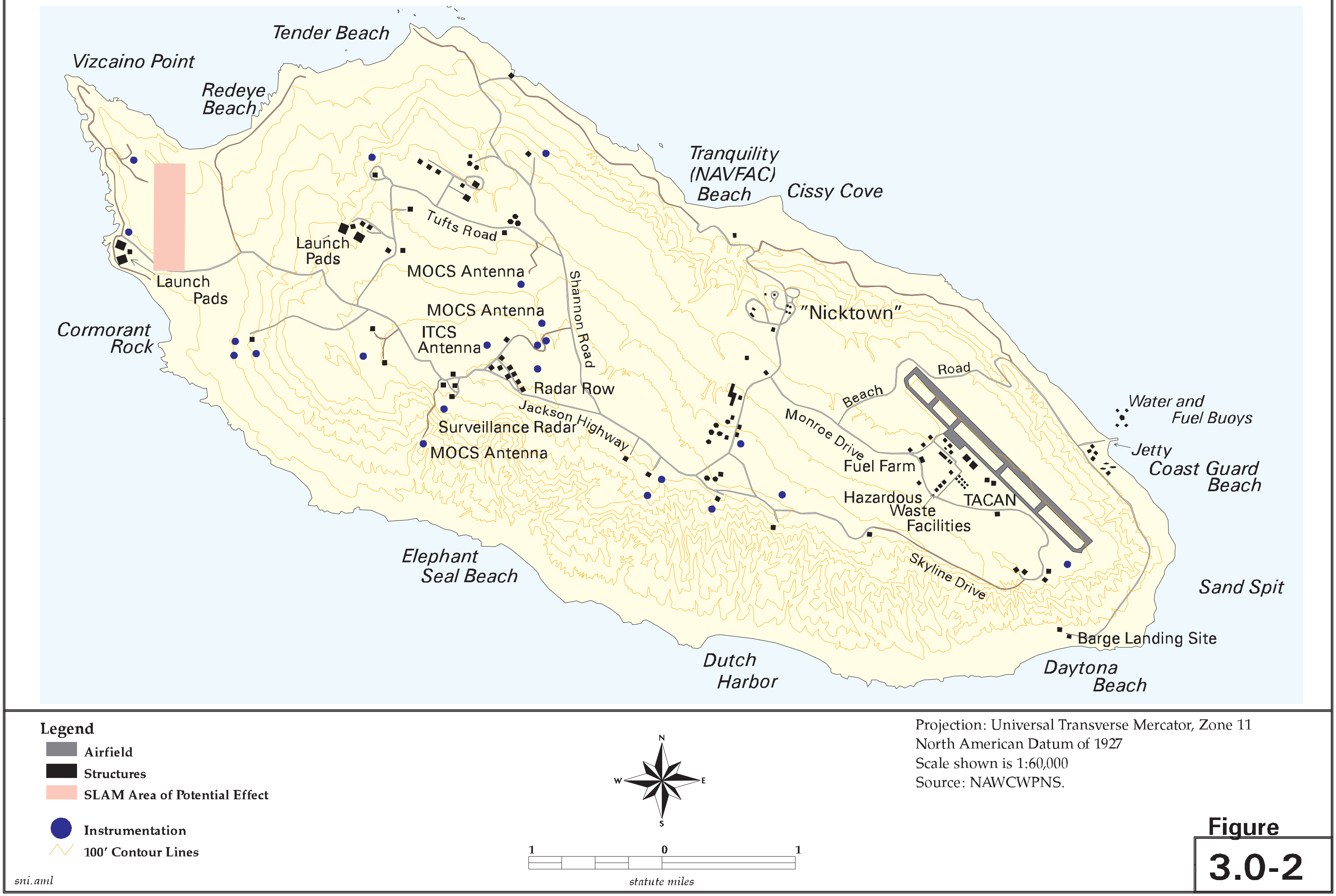
San Nicolas Island



San Nicolas Island

Located approximately 65 miles (105 km) southwest of Point Mugu, San Nicolas Island is owned and operated by the Navy as a major element of the Point Mugu Sea Range. Because of its strategic location offshore, San Nicolas Island is important to the Sea Range because it can be used to simulate shipboard launches of missiles and targets. The island is 9 miles (14 km) long by 3.6 miles (5.8 km) wide, encompasses 13,370 acres (5,411 ha) (Figure 3.0-2), and is on the line that separates the inner and outer Sea Range. An airfield (designation 12/30) is located on San Nicolas Island near the southeastern edge of the island's central mesa. The landing area consists of one 10,000-foot (3,050-m) concrete and asphalt runway. The airfield can accommodate aircraft up to the size and weight of C-5 aircraft. The island is extensively instrumented with metric tracking radar, electro-optical devices, telemetry, and communications equipment necessary to support long-range and over-the-horizon weapons testing and fleet training. It houses facilities that support all aspects of range operations, such as missile and target launches and missile impacts and scoring.

San Nicolas Island



Projection: Universal Transverse Mercator, Zone 11
North American Datum of 1927
Scale shown is 1:60,000
Source: NAWCWPNS.

Figure 3.0-2

Santa Cruz Island

Instrumentation Facilities at Santa Cruz Island

Located approximately 25 miles (40 km) west of Point Mugu, Santa Cruz is the largest of the eight Channel Islands, measuring 24 miles (39 km) long and varying in width from 2 to 7 miles (3 to 11 km). NAWCWPNS Point Mugu leases approximately 10 acres (4.1 ha) from the Nature Conservancy on the southeast part of the island as an instrumentation site for the Sea Range.

San Miguel Island

Located approximately 70 miles (110 km) west of Point Mugu, San Miguel Island is owned by the Navy but is jointly managed by the Navy and the NPS, who administers the program as part of the CINP. There are no Navy facilities on the island except for an unmanned, remotely interrogated solar powered automatic weather station.

Santa Rosa Island

Located approximately 49 miles (77 km) west of Point Mugu, Santa Rosa Island is owned by the NPS. There are no Navy facilities on the island except for a tracking antenna.

3.0.2 Baseline Point Mugu Sea Range Operations

This section describes baseline operations at the Point Mugu Sea Range. Baseline operations include aircraft types and typical routes used, the range planning process, range safety procedures, and detailed descriptions of the five major types of test operations performed at the range, as well as the large fleet training exercises (FLEETEXs) conducted at the range twice each year. This section concludes with quantitative data on range use and tempo (including locations) for FY95. This quantification of operations tempo establishes a NAWCWPNS Point Mugu baseline (refer to Section 2.1.4) to which proposed operational changes can be compared.

3.0.2.1 Operations Background

A - Operations Overview

NAWCWPNS activities at Point Mugu provide T&E of weapon systems by providing U.S. and allied forces modeling and simulation capabilities and an area to perform actual operations and missile firings. The Point Mugu Sea Range provides operationally realistic climatological and physical features which closely simulate conditions in many of the primary threat regions of the world. Although range activities have historically had a Navy focus, all services within the DoD use the range facilities. NAWCWPNS Point Mugu's customers include Naval Air Systems Command (NAVAIR); Naval Sea Systems Command (NAVSEA); U.S. Pacific Fleet; the U.S. Marine Corps (USMC); the U.S. Air Force (USAF); other Department of Defense (DoD) agencies; and foreign military sales (FMS). The composition of Point Mugu Sea Range customers is shown in Figure 3.0-3.

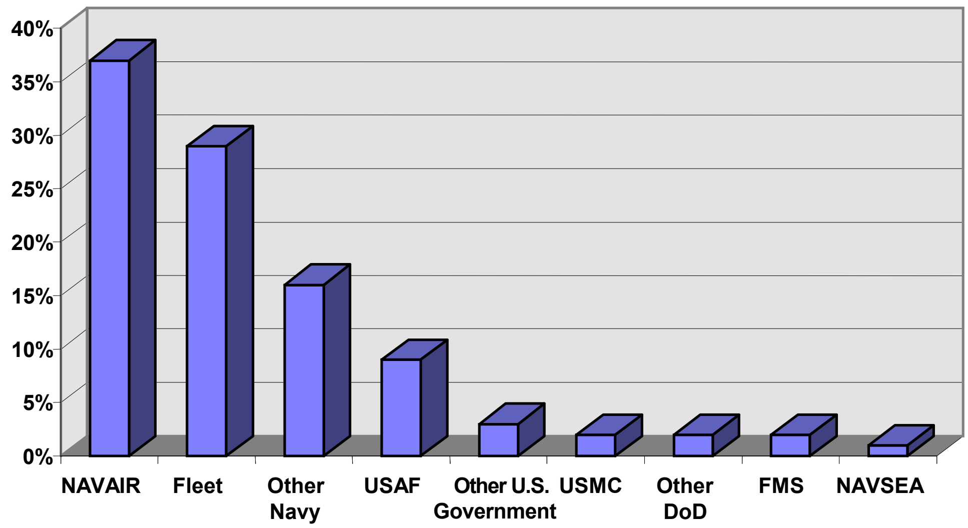


Figure 3.0-3
Point Mugu Sea Range Customers, FY90-95

The Point Mugu Sea Range is used primarily by the Navy to test guided missiles and other weapons systems, as well as the ships and aircraft that serve as platforms to launch them. The missiles tested at the Sea Range include air-to-air, air-to-surface, surface-to-air, surface-to-surface, and subsurface-to-surface systems. Point Mugu maintains a large array of realistic airborne and surface targets to test these missile systems. Aircraft which fly on the Sea Range usually take off and land at NAS Point Mugu, although some aircraft may fly to the Sea Range from other military bases in California. Aircraft also originate from aircraft carriers during FLEETEXs. Navy ships are often present on the Sea Range for testing of missiles or other systems and for major naval training exercises. Some of these ships and boats belong to NAWCWPNS, while others are stationed at other naval bases and come to the Sea Range for only a few days for testing or training.

B - Range Aircraft Activities

Aircraft Types

Typical aircraft operating at the Point Mugu Sea Range are shown in Figure 3.0-4. Table 3.0-2 provides performance data and specifications for typical aircraft.

Typical Flight Routes

An aircraft sortie consists of a takeoff, the assigned mission, and a subsequent landing. Aircraft sorties typically last only a few hours. The Point Mugu Sea Range is divided into defined areas to allow for multiple events to occur simultaneously and to afford a safety margin for test and training activities. The Control Area Extensions (CAEs) are areas through the Sea Range that are used by commercial and civil aircraft flying on assigned air traffic control routes. The CAEs can be requested and closed by NAWCWPNS when necessary. Standard entry and exit points into the airspace over the Sea Range are not used; however, it is possible to generalize the most commonly used routes and flight patterns.

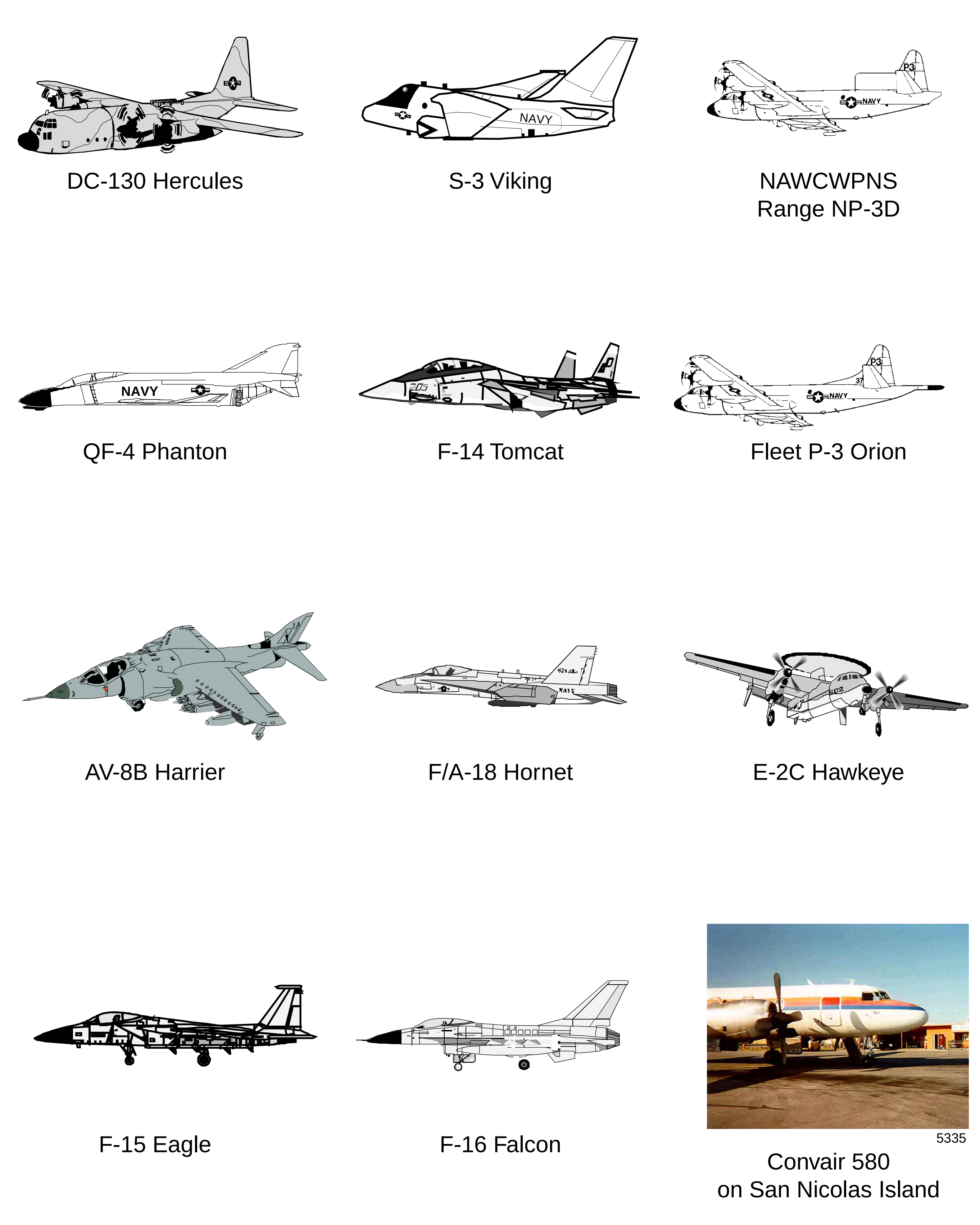


Figure 3.0-4
Typical Aircraft Types Operating at the Point Mugu Sea Range

Table 3.0-2. Common Aircraft Types Used on the Sea Range

	Jet-Engine Aircraft					Turboprop Aircraft[1]		
Type	**F-14**	**F/A-18**	**S-3**	**AV-8B**	**QF-4**	**NP-3D**	**DC-130**	**E-2C**
Nickname	**Tomcat**	**Hornet**	**Viking**	**Harrier**	**Phantom II**	**Orion**	**Hercules**	**Hawkeye**
Mission	Fighter	Fighter/Attack	Anti-Submarine Warfare	Fighter/Attack	Target/Target Launch A/C	Sea Surveillance Data Relay	Target Launch Aircraft	Surveillance and Control
Maximum Speed High Altitude	Mach 2.34 1,342 knots	Mach 1.8 1,030 knots	480 knots	700 knots	Mach 2.1 1,200 knots	411 knots	325 knots	323 knots
Maximum Speed Low Altitude	800 knots		440 knots	590 Knots	600 knots	200 knots Search	300 knots	311 knots
Approach Speed	134 knots	134 knots	110 knots	130 knots 0 knots	136 knots	135 knots	105 knots	103 knots
Number of Engines	2	2	2	1	2	4	4	2

[1] The Convair 440 (see Figure 3.0-4) is a 2-engine turboprop aircraft used to shuttle passengers between NAWS Point Mugu and San Nicolas Island.

Source: Polmar 1997.

Figure 3.0-5 depicts typical entry routes into the range, flight routes within the range, the two standard airborne target recovery areas, and the typical missile launch point west of San Nicolas Island.

C - Range Ship Activities

Ship Types

The main vessel types include range project boats (e.g., tugs, QST-35 [target boats]), range support boats (e.g., aviation rescue boats), and project ships (e.g., self defense test ships, destroyers, cruisers, aircraft carriers, frigates, submarines, etc.). Typical Navy ships operating at the Point Mugu Sea Range are shown in Figure 3.0-6.

Typical Ship Routes

A sortie by a ship or boat is similar to an aircraft sortie, although not generally referred to as a sortie. It can be considered an event, a vessel leaving port, accomplishing its assigned mission, and returning to port. While aircraft sorties last only a few hours, ship events can last from a few hours to several days. The smaller support ships or boats are fuel limited and generally do not have crew accommodations to allow for an extended stay afloat on the Sea Range. The larger vessels (e.g., major Naval combatants) can remain on the range for extended periods either for testing activities or training exercises. Typical routes used by surface ships, support boats, and surface targets are shown in Figure 3.0-7.

D - Targets

Airborne and Surface Targets

Testing missiles on the Sea Range requires a large array of realistic targets. Point Mugu provides a group of targets for this purpose. Typical airborne targets used on the Sea Range are shown in Figure 3.0-8. The airborne target systems include small jet powered aircraft (15 to 20 feet [5 to 6 m] long), supersonic missiles, and Navy fighter aircraft, the QF-4, which can be flown via remote control from the ground (a rotary wing aircraft target, the QUH-1, is also used on the range). Most target systems are not destroyed during missile testing and are recovered for reuse. Because airborne targets are expensive, the concept of "near-miss" is used to facilitate target recovery and reuse. A planned and programmed "near-miss" allows for the evaluation of an airborne weapon system (i.e., a near-miss is scored as a successful intercept) while preserving the airborne target for subsequent tests. The airborne targets can be launched from aircraft or from surface launch sites at NAS Point Mugu or San Nicolas Island as described below. Surface targets are also used extensively on the Sea Range. These targets range in size from small, towed floating boats that simulate radar signatures of large vessels to ex-Navy destroyers which are remotely controlled while on the Sea Range. These large ship targets, like most airborne targets, are not destroyed during testing and are designed for continued use.

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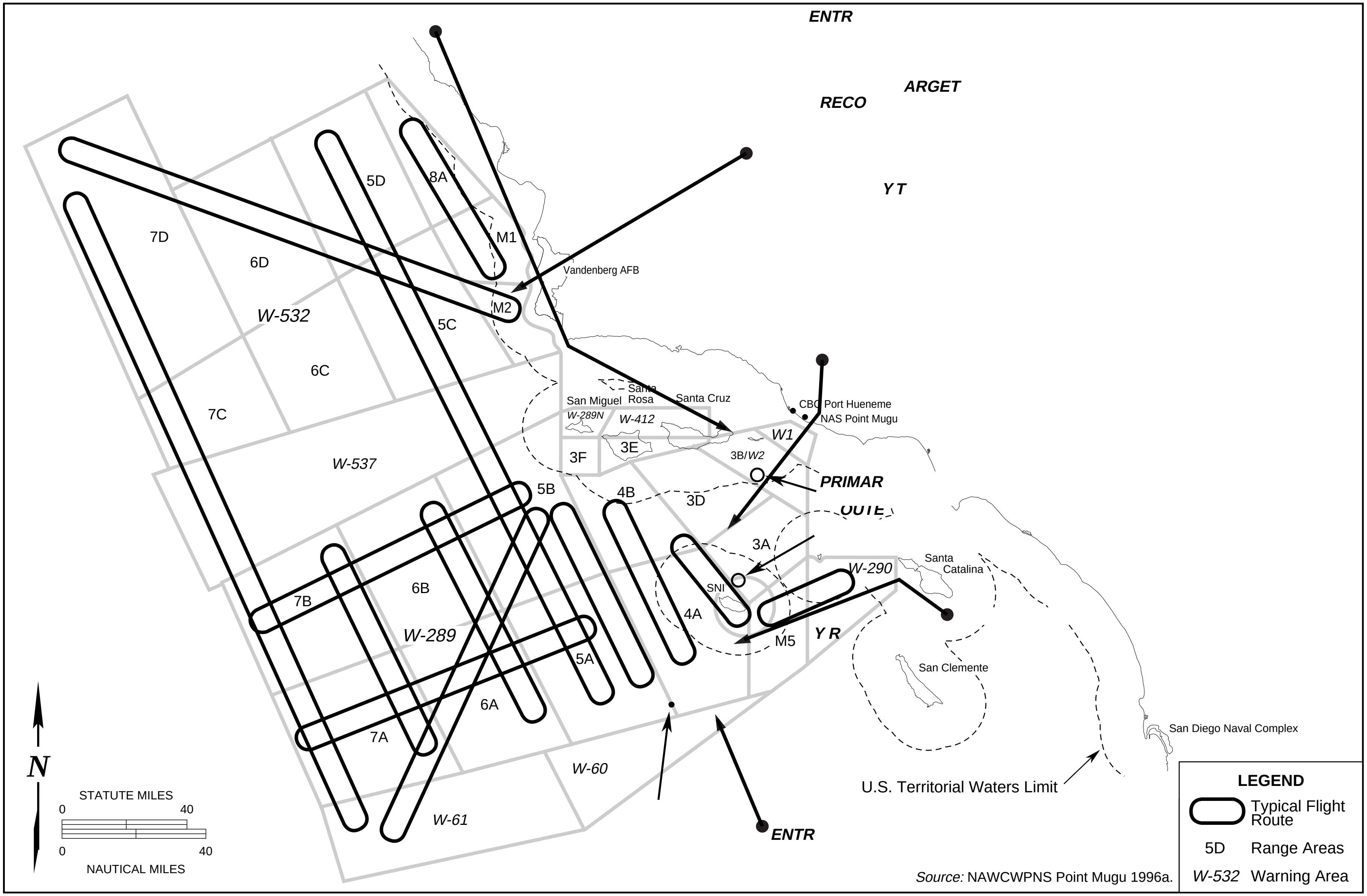


Figure 3.0-5
Typical Flight Routes

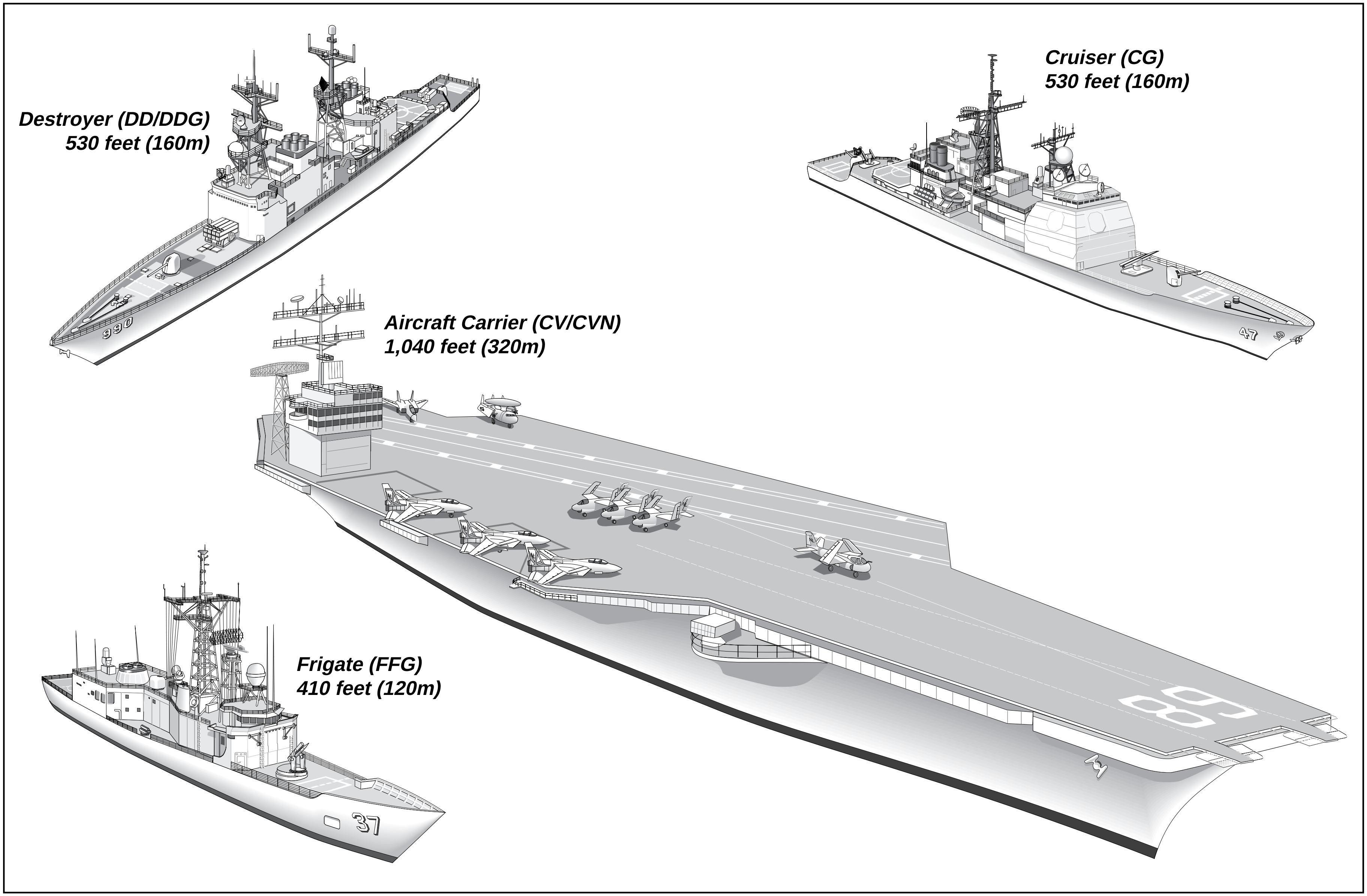


Figure 3.0-6
Typical Navy Ships Operating on the Point Mugu Sea Range

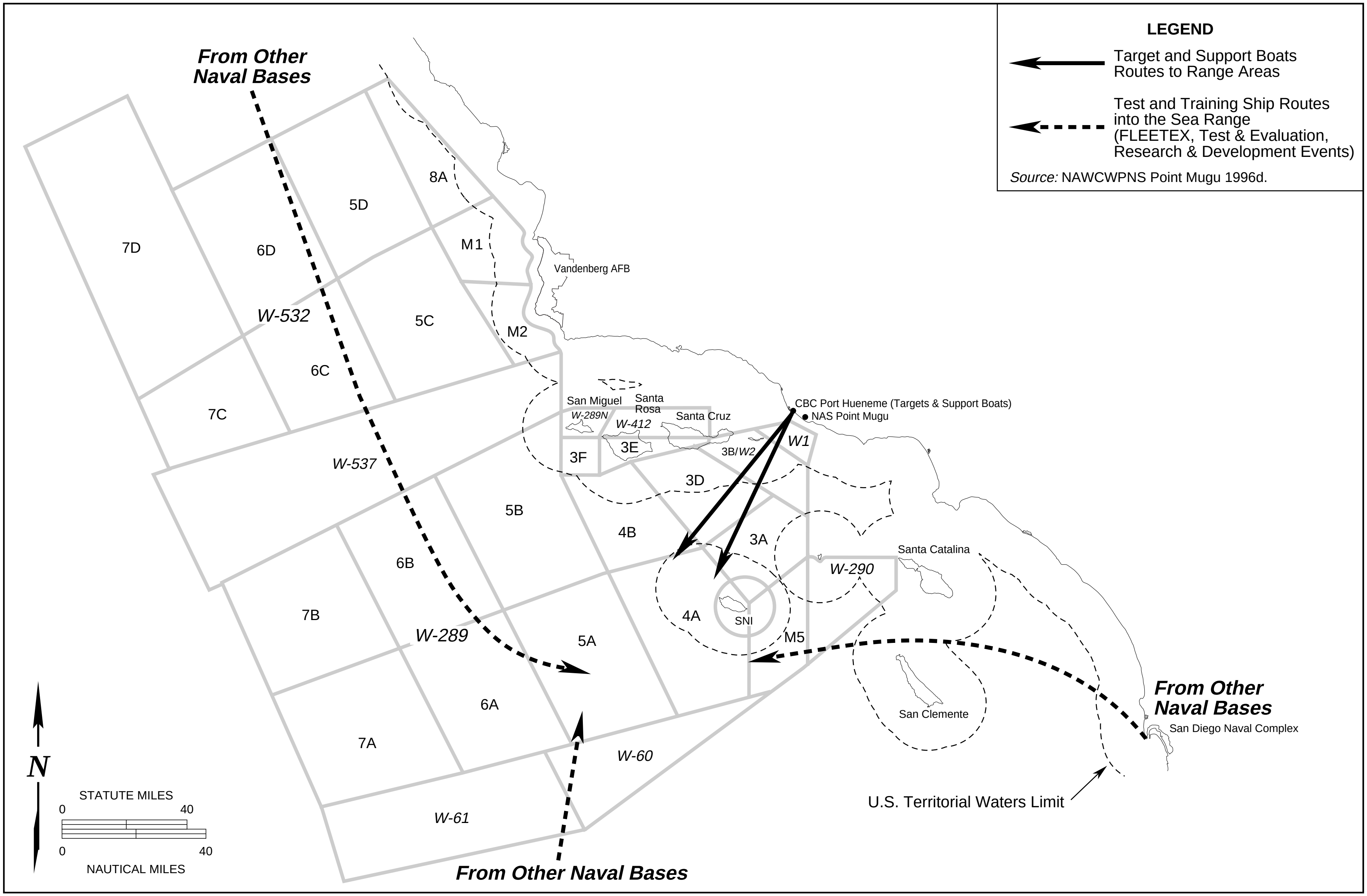


Figure 3.0-7
Typical Routes — Surface Ships, Support Boats, and Surface Targets

Sources: NAWCWPNS Point Mugu 1996m; BMDO 1994.

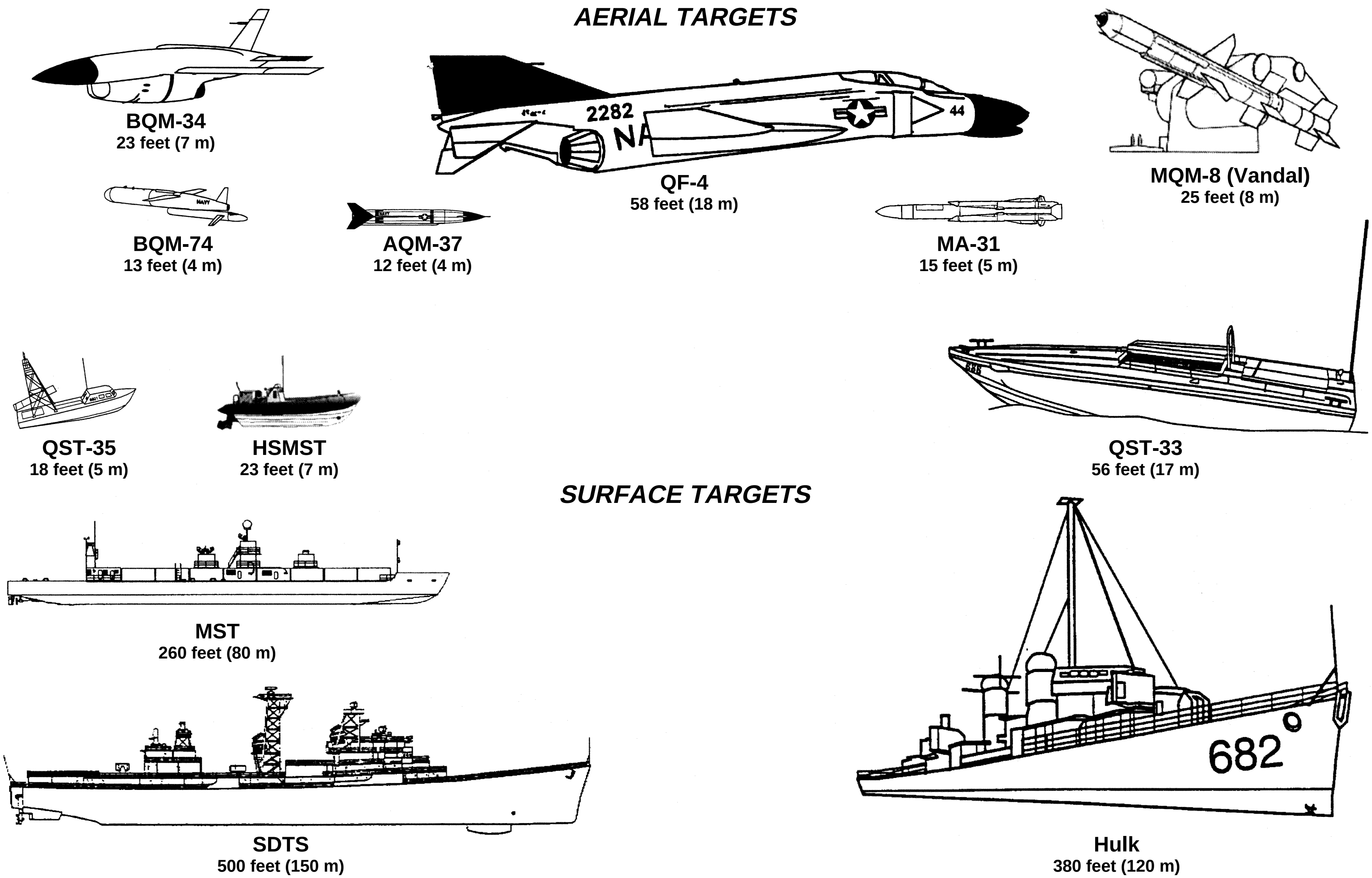


Figure 3.0-8
Targets Used at Point Mugu Sea Range

Surface Target Launches

Target Launch at NAS Point Mugu

NAS Point Mugu. Targets are launched from the NAS Point Mugu Building 55 Launch Complex (refer to Figure 2-3a). Targets launched from this location include BQM-34s and BQM-74s. These targets require use of a jet assisted takeoff (JATO) bottle. This metal alloy bottle contains solid rocket propellant which, when ignited, provides initial thrust necessary until its turbojet engine can propel the target independently. The bottle falls off soon after the launch and typically lands 700 to 1,400 feet (210 to 420 m) in front of Building 55. A BQM-74C target uses two smaller JATO bottles per launch; other targets typically use only one bottle per launch. NAWCWPNS Point Mugu has established a program to recover JATO bottles.

Missiles are also launched from a truck placed directly in front of the Building 55 Launch Complex. The truck launcher is self-contained and is onsite only for the launch duration. Approximately six missiles per year are launched from this location. JATO bottles are not used for these launches.

San Nicolas Island. San Nicolas Island has two launch areas which can accommodate the launch of targets on the Sea Range (see Figure 3.0-2). The Alpha Launch Complex is normally used for launching the MQM-8 Vandal and the BQM-74 targets. These targets are fired to the northwest into a 45-degree azimuth launch cone; the heading is normally about 270 degrees (to the west) and the JATO bottles typically land 700 to 1,400 feet (210 to 420 m) past the launch pad (Figure 3.0-9). The Vandal is the largest target launched from this location. The Vandal crosses the beach about 4.75 seconds after launch at high subsonic speeds.

The other launch area at San Nicolas Island is the Building 807 Launch Complex on the southwest coast of the island and is used to launch both targets and other missiles: Tomahawk, Rolling Airframe Missile (RAM), and Special Engineering Test Targets. Its launch azimuth is approximately 30 degrees wide and is oriented toward the southwest. Targets launched from each of these areas cross the coast at high subsonic airspeeds and normally under 1,500 feet (460 m) above sea level.

E - Environmental Planning

Safety and environmental management are integral parts of the range operations planning process. NAWCWPNS has established a single point of contact for environmental planning: the Land, Sea, Airspace and Environmental Management Office (LSAEMO). The Program Manager, range customer, and LSAEMO form a team that develops a complete project description of each new test or training proposal and requests initiation of an environmental review of the proposal with the Environmental Review Board (ERB). The ERB is composed of personnel from the legal staff and the NAWS, China Lake Environmental Project Office. An analysis of the project is conducted to evaluate the potential environmental impacts associated with the proposed activity, and the ERB recommends the appropriate level of National Environmental Policy Act (NEPA) documentation required for each project. The ERB evaluation is conducted in accordance with Department of the Navy Procedures for Implementing NEPA (32 C.F.R. 775). This is done as early as possible in the planning stage of project development.

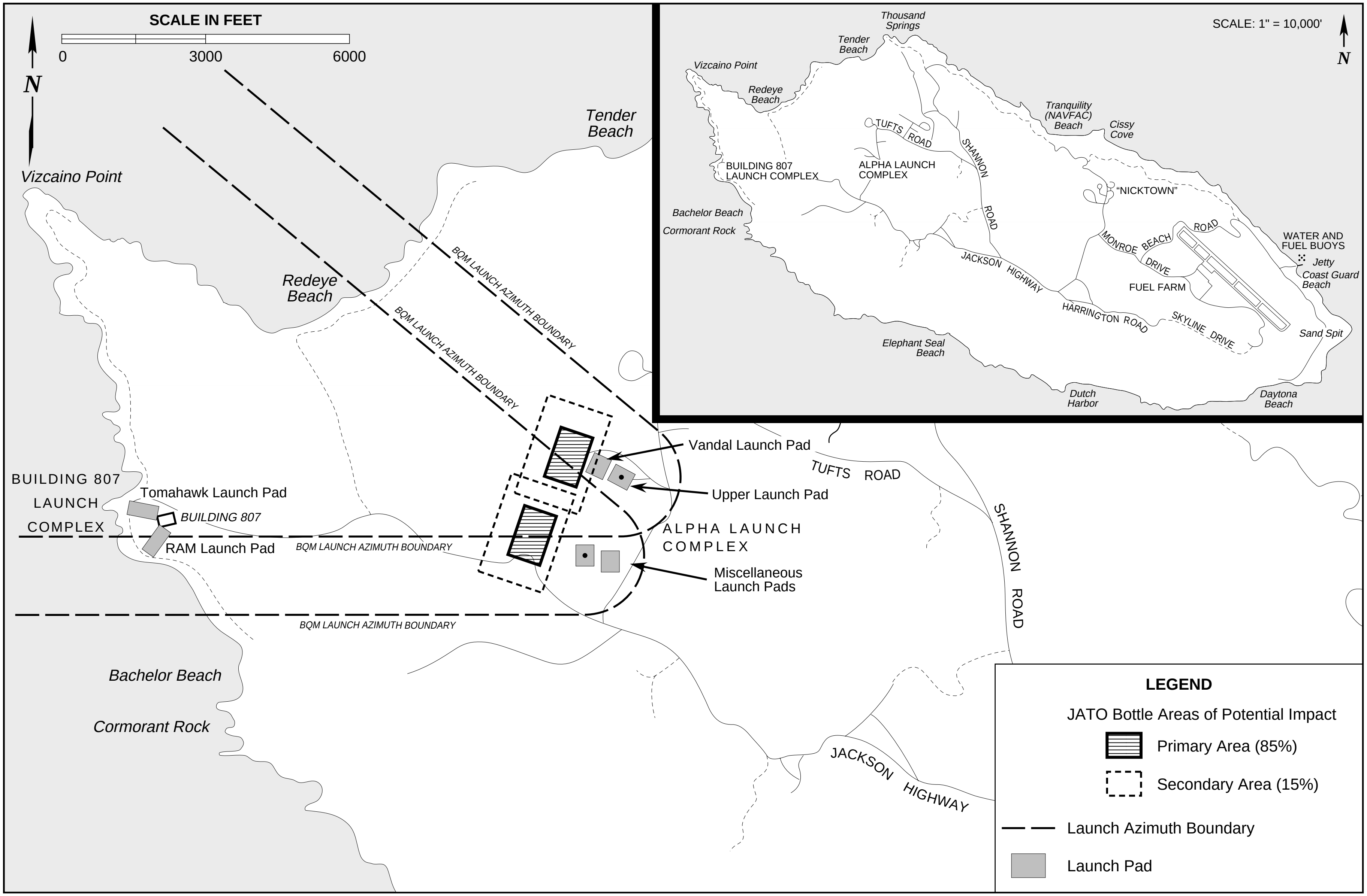


Figure 3.0-9
BQM Target Launch Site at San Nicolas Island

F - Safety

Missile Safety Areas

Table 3.0-3 lists the general types of missiles fired on the Point Mugu Sea Range. Scale representations of these missiles are shown in Figure 3.0-10. Missiles fired on the Sea Range are designed to intercept an airborne or surface target. The three general types of safety areas for missiles include: 1) the clearance area, 2) the safety hazard pattern, and 3) the missile debris pattern. These three safety areas are described below.

Table 3.0-3. Typical Missile Types Used on the Point Mugu Sea Range

Missile Designation	Missile Name
AIM/RIM-7	Sparrow
AIM-9	Sidewinder
AIM-54	Phoenix
AIM-120	Advanced Medium-Range Air-to-Air Missile (AMRAAM)
AGM-84	Harpoon; Standoff Land Attack Missile (SLAM)
AGM-65	Maverick
AGM-88	High Speed Anti-Radiation Missile (HARM)
AGM-154	Joint Standoff Weapon (JSOW)
RIM-116A	Rolling Airframe Missile (RAM)
SM-1 and 2	Standard Missile
MIM-23B	I-Hawk
FIM-92	Stinger
RGM-84 and UGM-84	Harpoon
RGM-109 or UGM-109	Tomahawk

Clearance Areas

The clearance area is the largest of the three general missile safety areas. The clearance area includes the entire range areas that contain the safety hazard pattern (described below). The clearance areas provide an additional safety buffer since the entire safety hazard and missile debris patterns are contained within their boundaries, as well as the areas outside the patterns but within the range areas.

Safety Hazard Patterns

A safety hazard pattern is the maximum surface area that could be endangered by a missile if it does not follow its prescribed flight path. Each pattern shows the maximum down-range and cross-range distance that the missile could reach during flight. The patterns are specific to each missile and vary by altitude at launch (i.e., a missile will have both a greater down-range and cross-range distance when launched from a higher altitude). The safety hazard pattern is based on the assumption that the missile is unguided at launch. The safety hazard pattern is a smaller subset of the clearance area.

Missile Debris Patterns

Debris patterns are different than safety hazard patterns. A debris pattern is the area that is exposed to the potential impact of falling pieces of a missile or a target as the result of an intercept. Therefore, the debris pattern for a given test is a smaller subset of the safety hazard pattern and is located within these boundaries. When a missile strikes a target, or achieves a near miss, the size of the debris pattern is

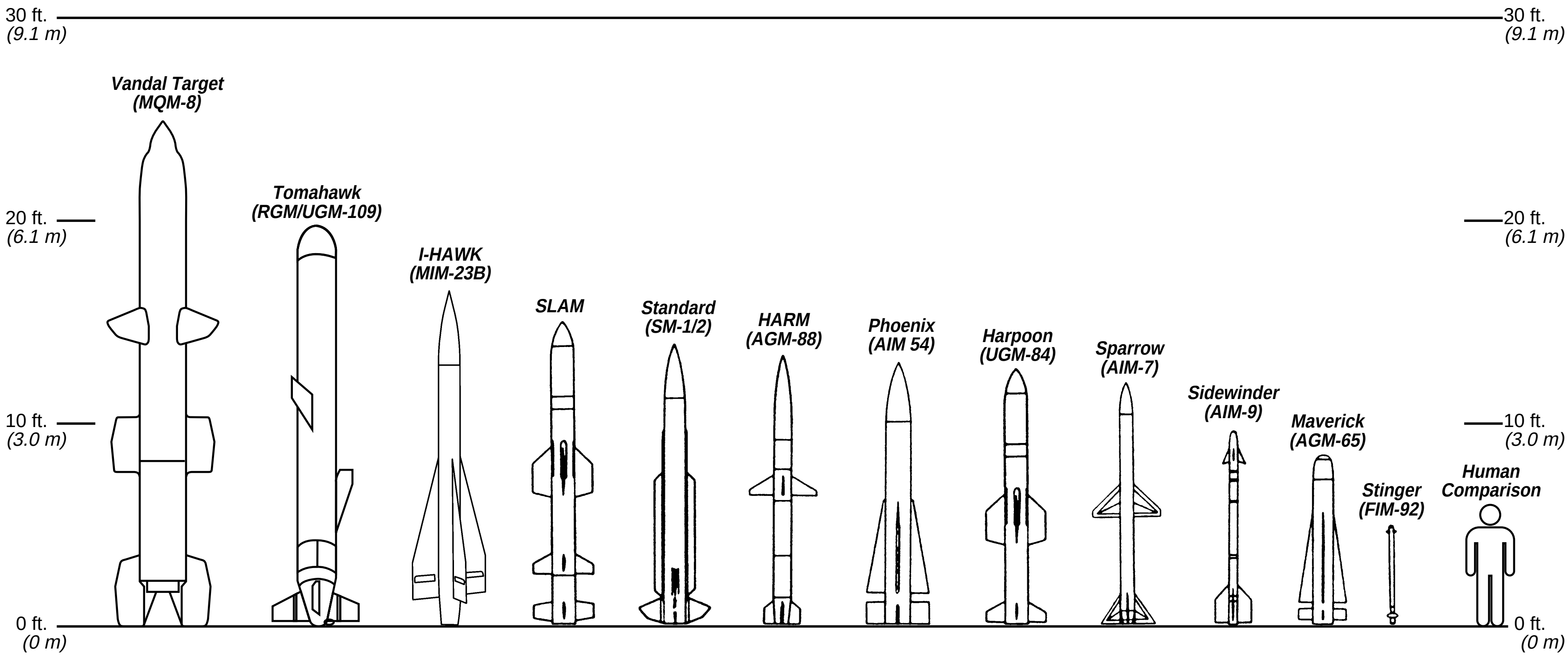


Figure 3.0-10
Typical Missiles Used at Point Mugu Sea Range

dependent on the altitude, angle, and speed of the intercept. Typically, the higher the altitude, the larger the debris pattern.

Another factor influencing the size of the debris pattern is the size of the pieces resulting from the intercept; smaller pieces of debris will disperse farther than larger pieces. In the case of a warhead shot, for example, the debris is generally extremely small in size and may be dispersed over a very large area. On the other hand, in the case of a planned near-miss, the missile may be programmed to fall to the water intact, resulting in a very small debris pattern (in this case the target would be programmed to fly back to a recovery area for reuse). Debris patterns are always contained within the safety hazard pattern of the test missile.

In addition to a direct hit, many of the missiles used on the Sea Range are equipped with a Flight Termination System (FTS), a system used to destroy a missile in flight. Most missiles used on the range are not equipped with warheads but have an FTS (see FTS description in the following section). Some of these systems use an explosive charge to destroy the missile at any time during the operation. If the FTS is exercised at a high altitude, the extent of the debris dispersion can be very wide, depending on the prevailing winds and the size of the missile fragments. Should the FTS be used at low altitude, the debris pattern is much more limited in size due to the shorter time that variables (e.g., altitude, wind, fragment size, etc.) have to influence the debris footprint. Even if an FTS is used to destroy a missile in flight, the debris pattern is always contained within the larger safety hazard pattern.

Range Safety Policy and Procedures

The Range Safety Office is the principal advisor and coordinator on all aspects of T&E range safety procedures concerning flight and concerning explosive, toxic, and radiation hazards related to weapons, targets, and other unmanned vehicles launched for programs conducted on the Point Mugu Sea Range. The Sea Range safety policy, procedures, and guidance are provided in NAWCWPNS Instruction 5100.2 dated July 9, 1993. This document defines range safety requirements, criteria and the safety planning process, and operational procedures. Although the commander of NAWCWPNS has the ultimate responsibility for range safety, the authority for execution of these safety programs is delegated to the Sea Range Safety Officer in the Range Safety Office. Every precaution is implemented in the planning and execution of all operations resulting in the launching of missiles on the Sea Range to prevent injury to human beings or damage to property.

<u>Range Surveillance and Clearance</u>. The Sea Range safety program establishes procedures and approval authorities to ensure that safety hazard patterns and impact areas are kept clear of non-participating aircraft and ships. Inherent in this responsibility is the close coordination with controlling agencies for both air and surface traffic over and on the Sea Range. NAWCWPNS issues notices to airmen (NOTAMs) and mariners (NOTMARs) to notify non-participants 24 hours in advance of planned testing and training activities on the Sea Range. Furthermore, a system has been established whereby commercial vessels entering the Sea Range establish contact with NAWCWPNS safety personnel. If the vessel's route will intersect any portion of the established clearance area, the vessel is advised either to increase or reduce their speed accordingly in order to ensure safe separation.

<u>Flight Termination</u>. Safety policy establishes clear guidelines and procedures for flight termination, when required, for missiles fired on the Sea Range. Generally, an FTS is required when a missile or any portion or stage of a missile possesses the capability to exceed its designated impact limits. An FTS is capable of terminating thrust or aerodynamic lift; it can also destroy the missile at any point during the powered portion of its flight. Three methods of flight termination are used about equally on the Sea Range: 1) dive the vehicle into the water, 2) command recovery, and 3) explode the fuel tank. The FTS

method is dependent on the type of missile involved. For liquid propelled missiles, flight termination action causes engine shutdown and zero thrust by fuel dispersion or intermixing. For solid propellant missiles, a condition of zero thrust is imposed, and any residual thrust causes the vehicle to tumble. For aerodynamic missiles, flight termination creates a condition of zero lift by separating the wings, the control surfaces, or complete disintegration of the missile. While most of the FTS methods used on the Sea Range do not use an explosive charge, if used for FTS, the weight of the charge is dependent on the size of the missile. In all cases, the vehicle is destabilized or severed into the minimum number of pieces required to produce tumbling.

The altitude at which the FTS is used varies considerably, from sea level to the missile's maximum operational altitude. Flight termination is normally initiated by the Missile Flight Safety Officer (MFSO) under the following conditions: 1) if there is an indication of an impact limit violation; 2) if the position of the missile is unknown due to loss of tracking data and the missile has the capability of violating the impact limit; or 3) due to unsatisfactory performance which creates a safety hazard and loss of range safety control. Flight termination thus provides an additional margin of safety for Sea Range operations.

Safety Planning and Documentation. The basic documents for range safety execution are Range Safety Approvals (RSAs) and Range Safety Operational Plans (RSOPs). These documents are prepared by the Range Safety Officer with extensive interaction with the range users. The RSA contains the operational procedures and safety criteria governing the launch of missiles not requiring an FTS. An RSA/RSOP must be prepared for each distinctly different program involving missile flight. The RSA/RSOP may be valid for more than one launch if the launch or missile parameters have not changed. RSAs/RSOPs are suspended or canceled whenever there is a violation of safety criteria. The applicable RSA/RSOP is reinstated only after a thorough review/investigation of the incident leading to the suspension or cancellation. The Range Safety Officer is required to review RSAs/RSOPs on a periodic basis and publish a listing of those that are current and valid.

NP-3D Performing Sea Surveillance

Implementing Sea Surveillance and Safety Clearance. NP-3D aircraft assigned to the Weapons Test Squadron at Point Mugu provide sea surveillance and range safety clearance of test areas on the Sea Range and also act as airborne platforms for data telemetry, collection, and/or relay. These missions provide range safety clearance on the Outer Sea Range beyond the range of the sea surveillance radars on the Channel Islands and at Laguna Peak near Point Mugu. For missile firing missions or other hazardous operations in the Outer Sea Range, the NP-3Ds are used to implement the following safety procedures:

1. takeoff from NAS Point Mugu and proceed to the selected area of the Sea Range;
2. conduct a radar and visual search of the planned test area from 4,000 feet (1,220 m) MSL (this altitude provides about 100 nautical miles [NM] [190 km] of radar coverage);
3. upon contact with a surface vessel, attempt to communicate with the captain or crew via FM radio;
4. warn the crew of the impending test and advise them to move out of the affected test area;
5. if unable to establish radio contact, the aircraft descends to low altitude over the boat (approximately 500 feet [150 m]);

6. attempt to get the attention of the crew by visual means while still trying to establish radio contact;
7. advise the crew of the hazards of their position on the Sea Range and monitor the vessel as it leaves the area;
8. communicate range clearance to Range Operations.

If the area cannot be cleared, the operation is delayed or moved to an area that is clear. After the test area is cleared of all non-participating surface vessels, the NP-3D climbs to a higher altitude (5,000 to 8,000 feet [1,520 to 2,440 m] MSL) to perform its secondary mission of telemetry data collection and relay. Telemetry may consist of both electronic and photo-optical data collection. The return flight to NAS Point Mugu is typically at 5,000 feet [1,520 m] MSL. Figure 3.0-11 shows typical sea surveillance routes flown on the Point Mugu Sea Range.

G - Recovery Areas

Typical Target Recovery

Some airborne targets are not recoverable (e.g., MQM-8 Vandals and AQM-37s); however, many other types of airborne targets are recoverable. Target retrieval is required depending on the type of target used. Helicopters are typically used for recovery operations. However, boats can be used when a drone cannot be safely transported to NAS Point Mugu by helicopter. Most of the missiles fired on the Sea Range do not carry live warheads, and unless a target sustains a direct hit from a missile, it is flown to a designated recovery area. A recovery parachute is remotely deployed, and the target is recovered from the water by a Navy team aboard a boat or helicopter. The Sea Range has two standard recovery areas; the primary recovery area is located approximately 10 NM (19 km) south of Anacapa Island and the secondary recovery area is located 6 NM (11 km) north of San Nicolas Island (see Figure 3.0-5).

3.0.2.2 Test Scenarios on the Point Mugu Sea Range

The Point Mugu Sea Range is the Navy's primary ocean testing area for guided missiles and related ordnance. Most testing of missiles and activities on the Sea Range fall into five general categories, or scenarios. These scenarios, which depend on the missile and target characteristics of the test articles, consist of the following: air-to-air, air-to-surface, surface-to-air, surface-to-surface, and subsurface-to-surface. Table 3.0-4 provides a summary of current test scenario activities at the Point Mugu Sea Range. This matrix shows typical test participants, locations, and conditions for each of the scenarios. However, since some tests may require flexibility that is not shown in the data, Table 3.0-4 does apply inclusively to all operations in the Sea Range.

Each of the scenarios is described below in four subcategories: General (provides overview of the scenario), Examples (provides specific example), Safety, and Recovery.

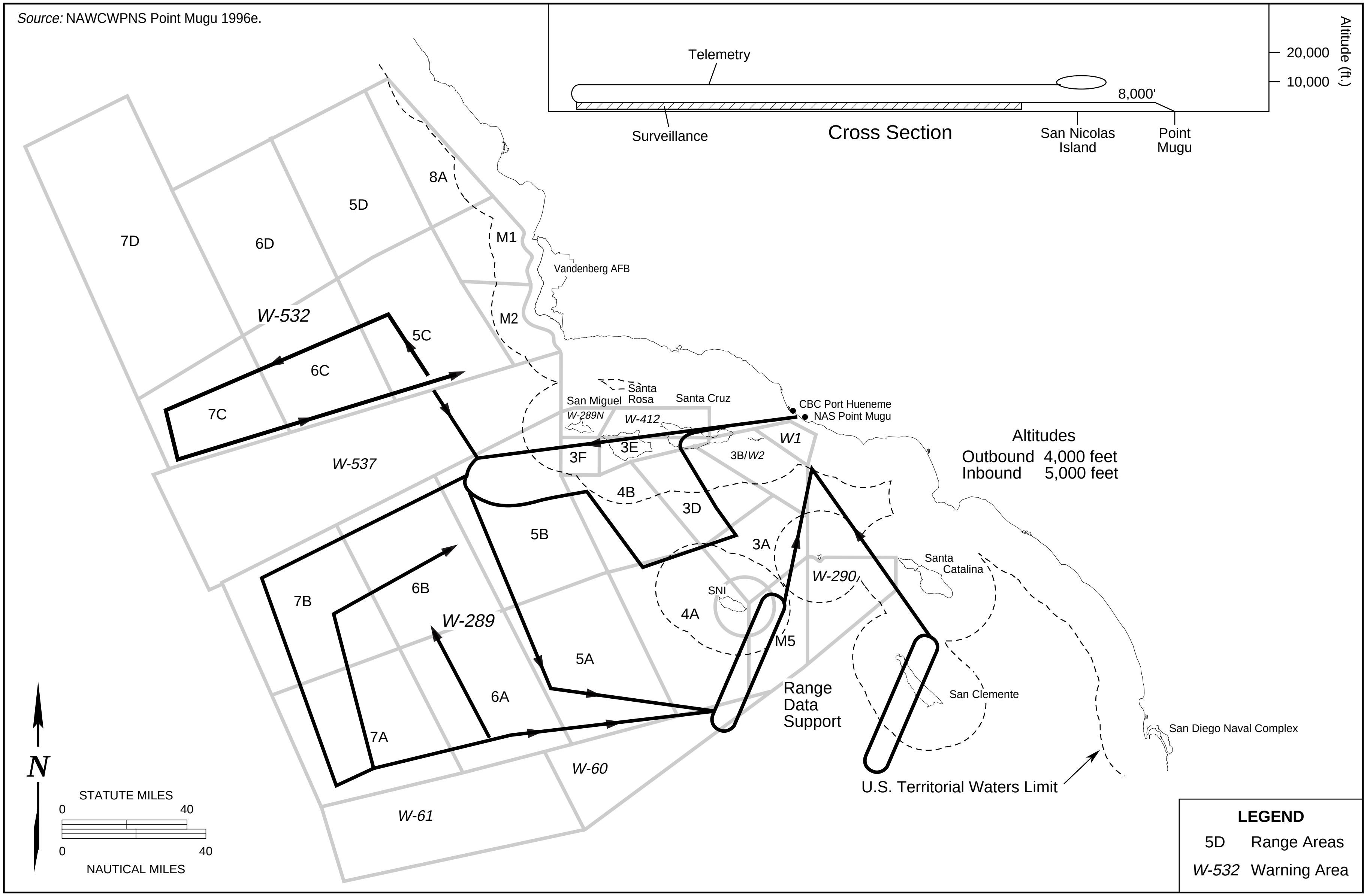


Figure 3.0-11
Typical Sea Surveillance Flight Profile

Table 3.0-4. Test Scenario Matrix[1]

	Air-Air	Air-Surface	Surface-Air	Surface-Surface	Subsurface-Surface
Launch Operations per Year (FY91-95)*	58 (35%)	55 (33%)	33 (20%)	16 (10%)	3 (2%)
Estimated Aircraft Sorties in Launch Ops per Year	1,379	74	394	69	6
Missiles Fired-Baseline Year**	170***	20	85	39	0
Typical Participants	F/A-18, F-14, F-16, F-15 Helicopters	F/A-18, EA-6B AV-8B P-3, S-3 Helicopters	Cruiser, FFG Ground-Base Destroyer, CV Landing Ship	Cruiser Destroyer Ground-Base	Submarine
Missiles	Phoenix Sparrow Sidewinder AMRAAM	Harpoon HARM Maverick JSOW SLAM	Sea Sparrow Standard Stinger I-Hawk RAM	Harpoon Tomahawk SSM-1	Harpoon Tomahawk
Targets	BQM-74E MQM-8 AQM-37 BQM-34 MA-31	QST-35 & 33 Barge MST Hulk San Nicolas Island (west end)	BQM-74 MQM-8 AQM-37 BQM-34 Banner Vandal MA-31	QST-35 QST-33 Hulk MST	Hulk Barge MST
Target Launch Platforms/Areas	DC-130 QF-4 NAS Point Mugu San Nicolas Island	None	DC-130 QF-4 NAS Point Mugu San Nicolas Island Ships	None	N/A
Targets Launched	182	132	103	40	2****
Targets Recovered	104	85	59	26	2****
Typical Engagement Areas	4A, 4B, 5A, 5B, 6A, 6B, 6C	3D, 4A, 4B	3A, 3D, 4A, 4B	W1, W2, 3B, 3D, 4B	3D, 4B, M3
Typical Duration	1.5 hours	1.5 hours	2 hours	2 hours	3 days
Support Aircraft	KC-135 NP-3D E-2C Contract Helo	NP-3D S-3	Contract Helo	NP-3D	P-3 S-3 H-60 Helo
Support Boats	Range Support Boats	Range Support Boats	Range Support Boats	Range Support Boats	Range Support Boats Contractor

[1] The data in this table provide information on the major types of testing activities that occur on the Point Mugu Sea Range.

* Based on NAWCWPNS Range Scheduling Statistical Report. FY = Fiscal Year (i.e., October 1 through September 30).

** 351 missiles were fired on the Sea Range in the baseline year. The differences in the total in this table are due to some missiles being categorized as “other” and the remaining number are from classified projects.

*** 30 of these air-to-air missile firings occurred during FLEETEXs.

**** No subsurface-to-surface missiles were fired in the baseline year; these numbers represent an annual average between FY91-95.

A - Air-to-Air Tests

General

F/A-18 Firing Sidewinder Missile – Air-to-Air

The air-to-air scenario involves testing weapons that support the Navy's mission of air warfare. A typical air-to-air scenario involves the test and evaluation of an airborne weapon system (e.g., a test missile fired from a fighter aircraft against an airborne target). The test missiles are highly instrumented to record the intercept parameters and usually do not carry live warheads. The airborne targets are not normally destroyed (unless there is a direct hit) and are recovered by boat or helicopter from the water for subsequent reuse. Test missiles are destroyed prior to impact with the water and are not normally recovered.

Most testing under this scenario involves captive-carry flight testing using an inert missile that is not fired. A "captive-carry" sortie involves an aircraft carrying inert missiles equipped with telemetry devices to simulate carrying and firing live ordnance. However, some scenarios involve configuring a missile with telemetry and a booster for launch and data gathering. Others require the actual firing of a live air-to-air missile at an airborne target. The missiles do not always physically strike the target. However, when missile impacts do occur they are at about 20,000 to 30,000 feet (6,100 to 9,100 m). (See Table 3.0-4 for a summary of the frequency and components of air-to-air testing, as well as other test scenarios.)

Examples

Figure 3.0-12 displays a representative air-to-air scenario for an F/A-18 launch of a Sparrow missile using a BQM-74 target that is air-launched from a DC-130 range aircraft. Target retrieval following the test or operation is conducted by a range or contractor helicopter, and a range boat is used for backup target recovery. All participants take off and land from NAS Point Mugu.

Targets for captive-carry tests usually are manned aircraft since the missiles are not launched. For air-to-air tests that require missile launching at an actual target, these targets can be unmanned, full-scale aircraft (QF-4); subscale, subsonic, surface- or air-launched targets (subsonic BQM-34, BQM-74, Ballistic Aerial Target System [BATS]); an air-launched supersonic target (AQM-37); or the supersonic land-launched MQM-8G (Vandal).

Command and control of all range participants, data gathering, and range safety are performed for each air-to-air scenario.

Safety

Safety of personnel, aircraft, and ships is the primary priority for all Sea Range activities. Prior to any live firing of missiles or ordnance, range safety officials ensure that the range areas are clear of non-participating aircraft or ships. Every practical effort is made to keep non-participating boats and aircraft out of the safety hazard pattern. This is done by establishing Restricted and Warning Areas, publishing NOTMARs and NOTAMs, and maintaining close coordination with agencies controlling

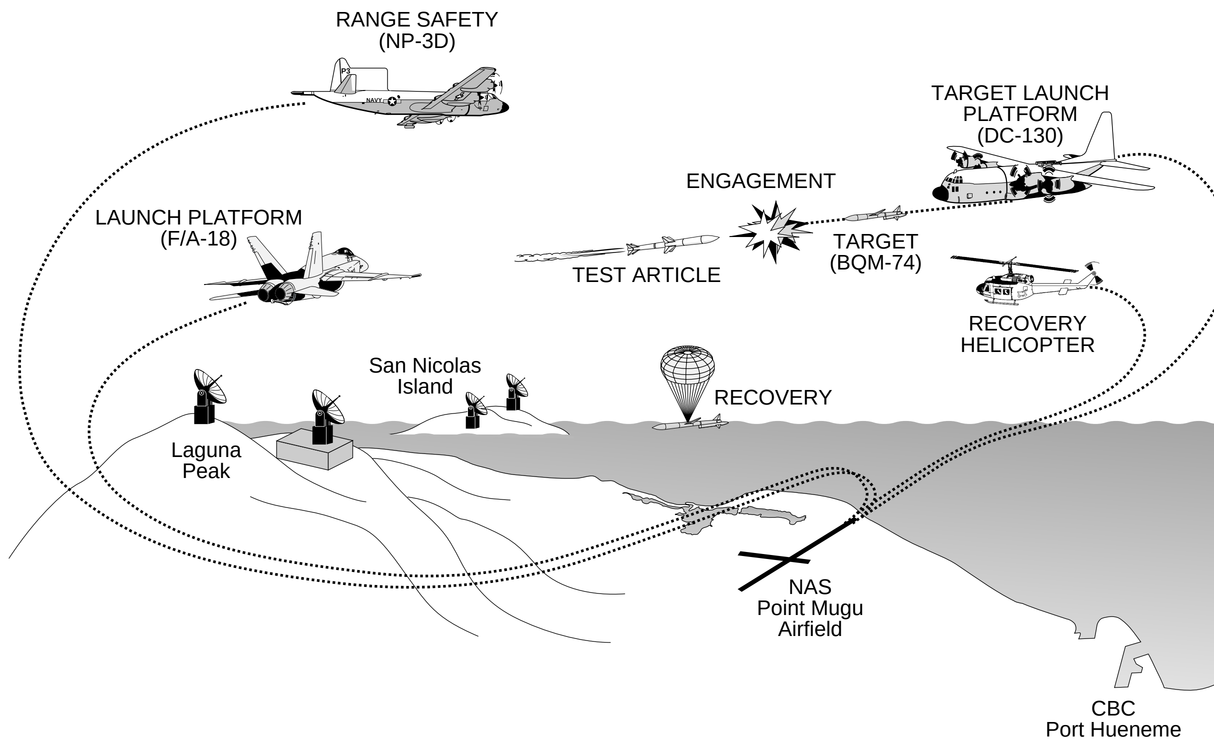


Figure 3.0-12
Representative Air-to-Air Scenario

aircraft and surface traffic. Prior to any hazardous activity, the projected impact areas are surveyed by Range Safety aircraft. Each missile has a safety hazard pattern, which is the surface area that could be endangered by the missile if it does not follow its prescribed flight path. Safety hazard patterns for selected Navy missiles are shown in Appendix B. The debris pattern for a given test is a smaller subset of the safety hazard pattern and is located within these boundaries. If non-participating ships or aircraft are in the impact area, these individuals are warned of the impending hazard and asked to leave. If the area cannot be cleared, the tests or training events are delayed until the area is clear or the event is moved to a clear area. Prior to any live firing of missiles or ordnance, range safety officials ensure that the range areas are clear of non-participating aircraft or ships (see “Safety” in Section 3.0.2.1-F).

Recovery

Many of the airborne targets used in the air-to-air scenarios are recoverable. As described in Section 3.0.2.1, helicopters and boats are used for recovery operations. Typically, the primary recovery area 10 miles (16 km) south of Anacapa Island (see Figure 3.0-5) would be used to recover airborne targets used in the air-to-air scenarios.

B - Air-to-Surface Tests

General

F/A-18 Releasing SLAM – Air-to-Surface

The air-to-surface scenario involves testing weapons that support the Navy's strike/surface warfare mission. These tests often include an aircraft weapon system using a missile, bomb, inert mine shape, or any other object released from an aircraft for attack of an enemy surface target. Free-fall bombs and mine shapes are usually inert, without fusing or explosives, and are used to test the accuracy of a weapon system. Targets for the air-to-surface scenario are floating surface targets or the SLAM target area on the western tip of San Nicolas Island (refer to Figure 3.0-2). Floating surface targets are usually not sunk and, if struck, are repaired for later use. The missiles being tested are instrumented for the test, do not normally carry live warheads, and are destroyed on impact with the water. (See Table 3.0-4 for a summary of the frequency and components of air-to-surface testing, as well as other test scenarios.)

Examples

Figure 3.0-13 displays a representative air-to-surface test scenario for a DC-130 launch of an air-to-surface weapon (e.g., Harpoon) against a target hulk. (A hulk is a stripped-down, environmentally clean destroyer or other ex-Navy vessel used as a surface target. A hulk is usually not sunk and, if struck, is repaired for later use). Additional range support involves chase aircraft (e.g., F/A-18), a range support boat, and a tugboat required to place and recover the destroyer hulk on site. The targets in these cases can only be recovered by a towing boat (the seaworthiness of the target following the test determines if it will be recovered).

Targets for this scenario can be seaborne such as remotely controlled powered boats (SEPTARs) like the 56-foot (17-m) QST-35 or the 18-foot (6-m) QST-33, full-scale hulks, the Mobile Ship Target (MST), the Self Defense Test Ship (SDTS), or barges. Targets are typically towed to a desired location on the range and augmentation systems energized (i.e., turned on) by range personnel. These targets can be towed by other boats or operated by remote control by range personnel. The NAWCWPNS Surface Craft and Surface Targets Divisions at Construction Battalion Center (CBC) Port Hueneme provide range support for most of the boat targets and transportation of targets personnel. San Nicolas Island contains a small target area that is used for air-to-surface weapons testing, primarily for the SLAM missile. The target is located on the northwest portion of San Nicolas Island and consists of several stacks of empty shipping containers.

Range support for the air-to-surface scenario is similar to ground and air support used during the air-to-air scenario. However, additional support is required to place and operate towed or self-propelled surface targets.

Another example of an air-to-surface scenario is the inert mine shape drop. During this operation, inert mines shapes (typically pieces of concrete in various shapes or steel casings filled with concrete) are released from aircraft to test the accuracy of a weapon system. The mine shapes are typically dropped in nearshore waters of Becher's Bay off Santa Rosa Island (Figure 3.0-14) (no Navy activities take place on the island). After the mine shapes are dropped, an EOD team locates them for scoring purposes and recovery. Some of the inert mine shapes are equipped with pingers to facilitate recovery. When

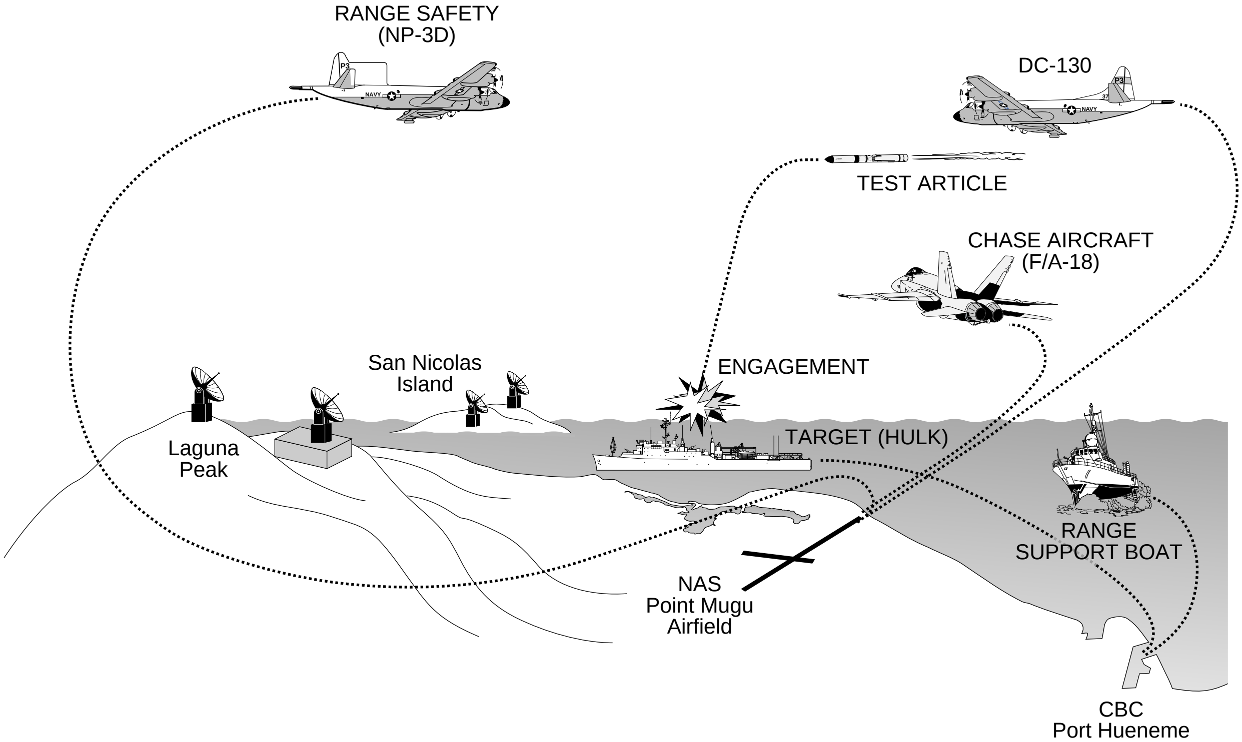


Figure 3.0-13
Representative Air-to-Surface Scenario

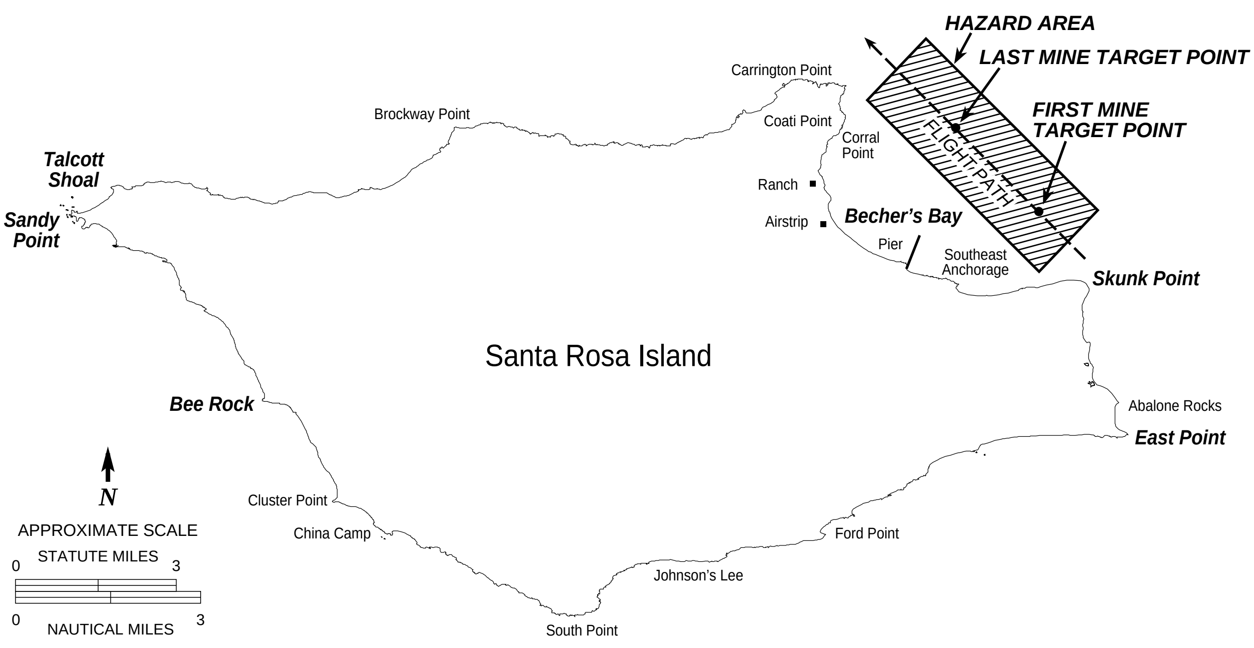


Figure 3.0-14
Inert Mine Shape Drop Zone Near Santa Rosa Island

operating, the pingers produce sound at source levels of approximately 175 dB and at frequencies (approximately 28 to 45 kHz) outside the range of human hearing (i.e., approximately 20 Hz to 15 kHz). The EOD recovery team uses passive acoustic equipment that helps locate the mine shapes based on the strength of the received sounds from the pingers. Once the locations of the mine shapes are determined, they are recovered for future use. Approximately 99 percent of the mine shapes equipped with pingers are recovered; the locations of those without pingers are often not determined and they are therefore not recovered. In the baseline year, 49 inert mine shapes were dropped in Becher's Bay, and approximately 40 percent (about 20) were recovered.

Safety

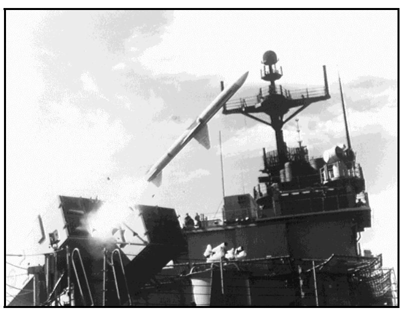
Sea Range safety procedures for this scenario are similar to those described in the air-to-air scenario. In addition, standard clearance procedures are implemented for the west end of San Nicolas Island when SLAM testing occurs there.

Recovery

Floating surface targets are not normally sunk during air-to-surface testing. Most of the surface targets are retrieved by recovery boats.

<u>C - Surface-to-Air Tests</u>

General



Sea Sparrow Missile – Surface-to-Air

The surface-to-air scenario involves testing weapons that support the air warfare mission. This includes testing a ship's defensive weapons systems for defense against an enemy airborne target or threat. Other surface-to-air scenarios include surface-launched weapons systems and airborne targets. The targets are similar to the air-to-air scenario and are air-launched or surface-launched.

Testing surface-to-air missiles involves Navy ships firing their self defense missiles against airborne targets. Targets used by the Navy in this scenario can be launched from aircraft such as the DC-130 or QF-4 and are recovered when possible. The AQM-37 and MQM-8 Vandal supersonic targets are not recovered and are destroyed either on impact by the test missile or upon water entry. Missile impact altitudes for surface-to-air tests are dependent on the type of missile or target being tested. Altitudes can range from less than 100 feet (30 m) for MQM-8 Vandal targets to 80,000 feet (24,238 m) for AQM-37s. Range support assets are similar to air-to-air and air-to-surface scenarios. (See Table 3.0-4 for a summary of the frequency and components of surface-to-air testing, as well as other test scenarios.)

Examples

Figure 3.0-15 displays a representative surface-to-air test scenario for a ship launching a surface-to-air missile against a subscale BQM-74 launched from San Nicolas Island. Range clearance is performed by a NP-3D Orion, and target retrieval is performed by a contract helicopter. All participants (except the unmanned target) take off from and land at NAS Point Mugu.

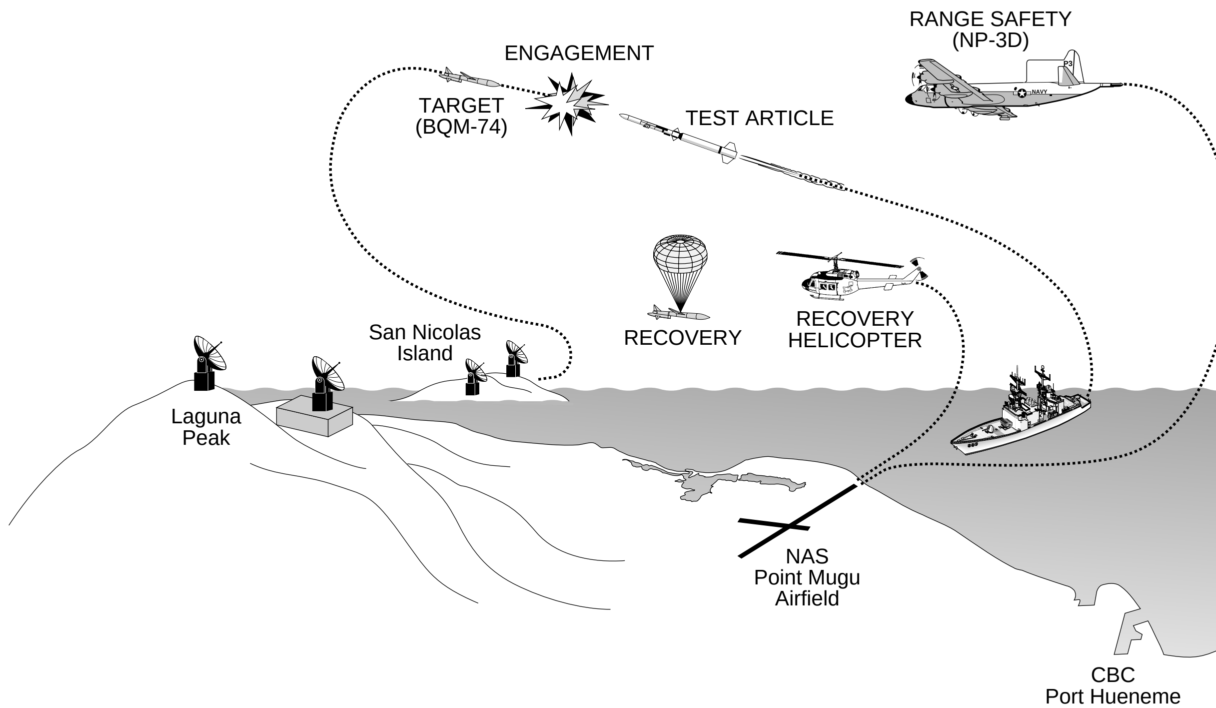


Figure 3.0-15
Representative Surface-to-Air Scenario

Phalanx Close-In Weapon System

Another example of a surface-to-air scenario involves testing a ship's close-in defense systems against high-speed anti-ship missiles. Close-in ship defense systems are considered the last line of defense designed to protect ships from missile attacks. Close-in ship defense systems include a search and track radar, gun, magazine, weapon control unit, and associated electronics, all integrated into a single unit. The gun is hydraulically powered and fires a projectile with a tungsten penetrator. Each firing burst consists of about 200 rounds. The typical missile intercept range is between 2 miles (3 km) and 4 miles (6 km) from the ship. Missile intercept altitudes typically range from about 20 feet (6 m) to 50 feet (15 m) above the water.

The Navy has equipped most ships with close-in defense systems including frigates, destroyers, cruisers, amphibious ships, and aircraft carriers. Testing close-in ship defense systems on the Sea Range involves Navy ships firing the gun against an airborne target. In addition, calibration tests are conducted which do not require the use of targets.

Safety

Sea Range safety procedures for this scenario are identical to those described in the air-to-air scenario.

Recovery

Sea Range target recovery procedures are identical to those described in the air-to-air scenario.

D - Surface-to-Surface Tests

General

Tomahawk Missile – Surface-to-Surface

The surface-to-surface scenario involves testing weapons that support the surface warfare mission. In this scenario, a surface vessel fires a missile against a surface target, which is either another ship or a land target. This includes testing of a ship's weapon system using a cruise missile weapon to attack a surface target. The test article can be captive-carry using an inert missile, missile with telemetry and a live rocket, or the actual firing of a live missile (typically during a FLEETEX; see Section 3.0.2.3). Air support is required from the range to provide chase aircraft and safety procedures are implemented to clear the target operational area. Other aspects of the test are identical to the air-to-surface scenario. (See Table 3.0-4 for a summary of the frequency and components of surface-to-surface testing, as well as other test scenarios.)

Examples

Figure 3.0-16 displays a representative surface-to-surface test scenario for a ship launching a surface-to-surface missile against a target hulk. Additional range support involves the chase aircraft, range support boat, and tug required to position an unpowered target. Recovery of the range targets is similar to that performed for air-to-surface tests.

Safety

Sea Range safety procedures for this scenario are identical to those described in the air-to-air scenario. In addition, extensive safety precautions are taken when surface-to-surface missiles are fired against land targets on San Nicolas Island, including a safety chase aircraft and a termination system which turns off the engine and provides parachute recovery of the missile.

Recovery

Sea Range target recovery procedures are identical to those described in the air-to-surface scenario.

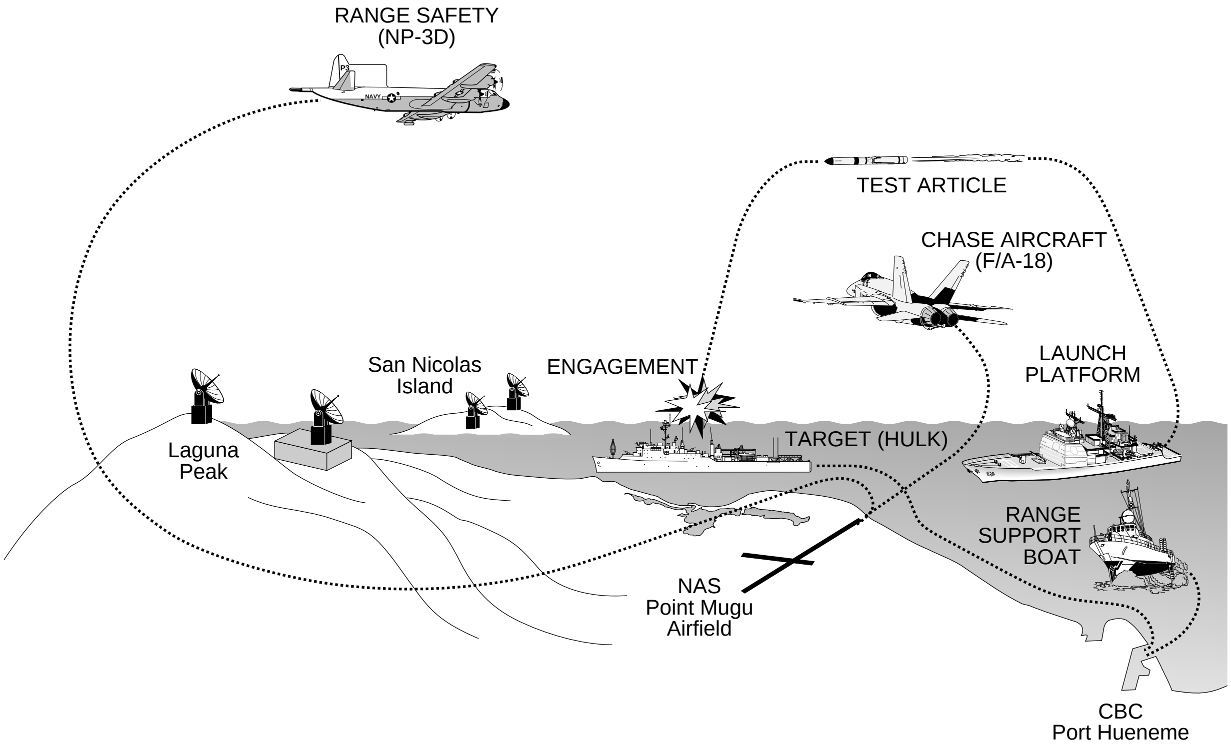


Figure 3.0-16
Representative Surface-to-Surface Scenario

E - Subsurface-to-Surface Tests

Tomahawk Missile – Subsurface-to-Surface

General

The subsurface-to-surface scenario involves testing weapons that support the strike/surface warfare mission. This includes testing a submarine's weapon system to attack a surface or land target. Missiles are fired from a submarine in the Sea Range at a surface target (hulk) on the Sea Range similar to those discussed in the air-to-surface scenario. The air support required from the range to clear the target operational area and provide chase aircraft is identical to the air-to-surface scenario. (See Table 3.0-4 for a summary of the frequency and components of subsurface-to-surface testing, as well as other test scenarios.)

Examples

Figure 3.0-17 displays a representative subsurface-to-surface test scenario for a submarine launching a subsurface-to-surface missile against a surface target. Additional range support involves the chase aircraft, range support boat, and tug required to tow the target into place. Recovery of the surface targets is similar to that performed for air-to-surface tests.

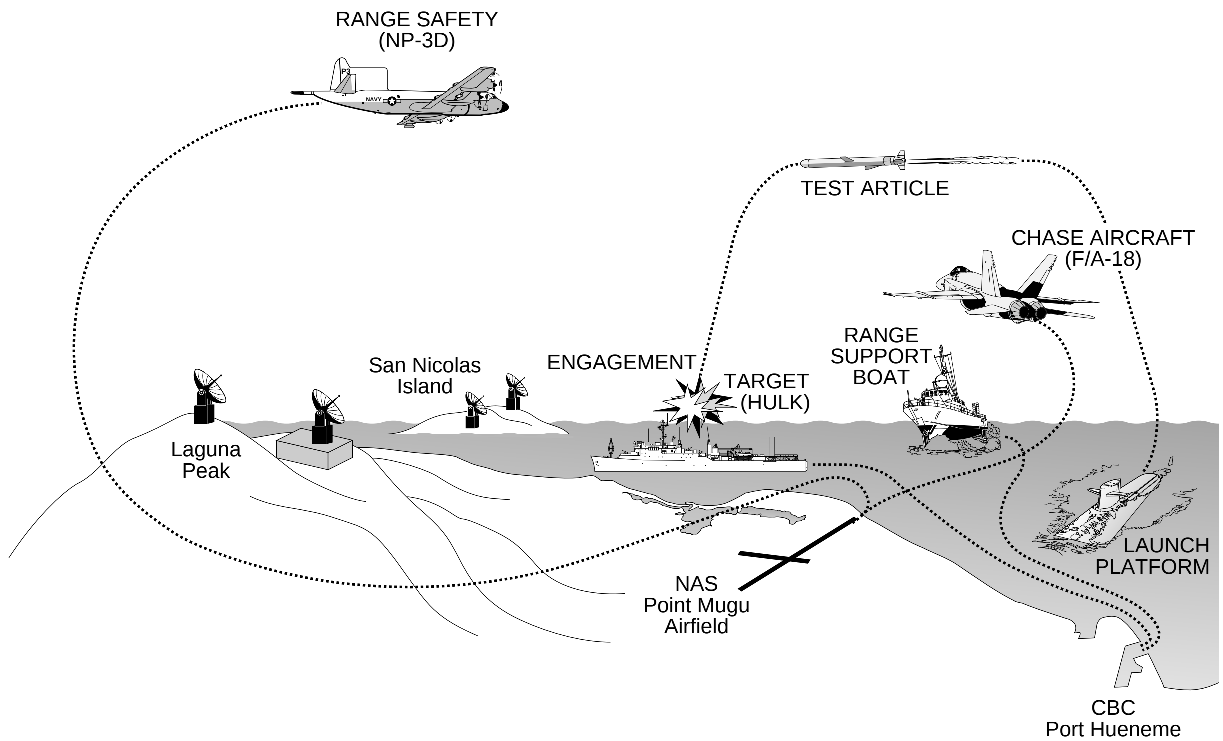


Figure 3.0-17
Representative Subsurface-to-Surface Scenario

Safety

Sea Range safety procedures for this scenario are identical to those described in the air-to-air scenario. In addition, extensive safety precautions are taken when subsurface-to-surface missiles are fired against land targets, including a safety chase aircraft and an FTS.

Recovery

Sea Range target recovery procedures are identical to those described in the air-to-surface scenario.

F - Ancillary Operations Systems

Ancillary Operations Systems are those systems which support routine Sea Range operations. These include systems such as radars, communications, lasers, chaff, and flares that are used in conjunction with the five typical test scenarios described in the previous section.

Radar Systems

Surveillance Radars. NAWCWPNS uses a variety of surveillance radars and display systems to detect and track aircraft and surface vessels on or near the Sea Range. Surveillance radars can provide a complete picture of all of the activity within line-of-sight on the range, including both participants and non-participants. Continuous monitoring of range traffic allows NAWCWPNS to conduct hazardous operational test and training events involving aircraft flights, missile firings, other weapons employment, and target drone launches without undue danger to the public or non-participating boats or aircraft present on the range. There are several types of surveillance radars used by NAWCWPNS Point Mugu. They are distinguished by their location, surveillance area, and targets. These radars are located at NAS Point Mugu, Laguna Peak, San Nicolas Island, Santa Cruz Island, or aboard an airborne platform such as a NP-3D. Their surveillance areas can extend as far as 200 NM (370 km) from the site. NAWCWPNS surveillance radars typically operate at powers ranging from 250 kW to 1,000 kW (or 1 MW) (NAWCWPNS Point Mugu 1997b). Frequencies range from 1,300 MHz to 2,800 MHz.

Metric Radar and Other Systems. Metric radar systems are distinctly different from the surveillance systems. The metric tracking systems produce electronic data to generate time, space, and position information (TSPI). TSPI data are sent to the Range Data System for real-time tracking and operational control. The TSPI system uses both onboard transponder equipment (which is interrogated by the radar) or radar skin track only. The Sea Range tracking systems include metric tracking radars, Multilateration Operations Control System (MOCS), Range Joint Program Office (RAJPO) Global Positioning System (GPS), and photo-optical instrumentation. The Sea Range metric radars provide precise tracking of range operations participants using four radars at NAS Point Mugu and four at San Nicolas Island. MOCS is capable of tracking over 60 participants from sea level to 100,000 feet (30,500 m). It also has an over-the-horizon capability through to line-of-sight airborne relay. Accuracy of the system is enhanced by the use of GPS satellites. The RAJPO GPS is capable of tracking 25 participants. MOCS operates at 141 MHz with 40 watts average power, and RAJPO GPS operates at 1,380 MHz with 27 watts average power. The Sea Range also employs an extensive array of high-speed photo-optical equipment from both ground based and airborne platforms to record test and training activity. NAWCWPNS metric radars typically operate at powers of about 1,000 kW and frequencies of about 5,700 MHz (NAWCWPNS Point Mugu 1997b).

Communication Systems

Sea Range communication systems include voice communication systems (telephone), radio communication systems (including satellite interfaces), a Sea Range connectivity structure, video systems, and range timing systems. These communications systems provide the means for effective conduct of testing and training activities on the Sea Range. The communication services also provide for sea, land, and area clearance, range instrumentation connectivity, missile flight safety, target control, and target recovery operations. The majority of NAWCWPNS communication systems typically operate at frequencies higher than 30 MHz (NAWCWPNS Point Mugu 1997b).

Communication Nodes. The major communication nodes for the Sea Range are located at NAS Point Mugu, Laguna Peak, San Nicolas Island, and the Navy's leased area on Santa Cruz Island. The Sea Range Communication Center at NAS Point Mugu is linked to these communication nodes by wire, microwave links, or fiber-optic cable.

Communication Capabilities. The communication system provides immediate contact and access by command and control agencies for ships, aircraft, missiles, and targets on the Sea Range. There are also data links to Vandenberg Air Force Base (AFB), Edwards AFB, and NAWCWPNS China Lake. Activities by testing or training participants on the Sea Range can be monitored through the integrated displays located in the Operations Control Rooms at NAS Point Mugu and San Nicolas Island.

Radio Communications. Radio communications provide the link from ships and aircraft on the Sea Range to the command and control system both for operational training or testing activities. The Sea

Range provides radio communication systems in the High Frequency (HF), Very High Frequency (VHF), and Ultra High Frequency (UHF) bands. The Sea Range also has two UHF satellite communication systems: a multiple access system which can allow two or more channels to be transmitted over the same satellite link and a standard UHF FM system which has an encryption capability.

Microwave Systems. The Sea Range uses microwave transmission of voice and data signals over long over-water paths. These links include digital microwave paths from NAS Point Mugu to Vandenberg AFB via Santa Cruz Island. There are also two analog microwave paths between NAS Point Mugu and Vandenberg AFB. A microwave link between the Sea Range Communications Center and Laguna Peak serves as a backup to land lines connecting the two.

Fiber Optics Communications Underwater System (FOCUS). FOCUS connects Point Mugu with San Nicolas Island via a redundant system of fiber-optic cables. This system handles both voice and data transmission needs.

Command Transmitter System (CTS). The CTS provides the Sea Range with a system for the controlled testing of unmanned targets, aircraft, missiles, and other long range vehicles used on the range. CTS is a UHF transmitter designed for ground use for controlling pilotless aircraft or boats and other controllable unmanned systems. CTS allows the operator to control aircraft or target drones throughout the Sea Range or surface vessels within 40 miles (64 km) of the active transmitter site. The CTS is used to control airborne targets such as the Q-F4, Vandal, and AQM-37. The CTS also provides the capability for flight termination for systems which are considered too hazardous for test flights without an independent destruct capability. Flight termination control through CTS is used on systems such as the Tomahawk, Harpoon, and Vandal missiles.

Chaff and Flare Use


C-130 Dispensing Flares

Chaff and flare dispensing are conducted on the Point Mugu Sea Range during various weapons testing events. Chaff consists of thin polymer with a metallic (aluminum) coating which are dropped from aircraft or launched from ships to confuse or passively jam enemy radar, enabling friendly aircraft to avoid detection. The Range Control Officer (RCO) is responsible for ensuring that chaff operations are planned so that chaff drops typically do not impact within 10 NM (19 km) of the shoreline. Prior to scheduled chaff drops, the Geophysics Division conducts special upper wind soundings and provides chaff impact prediction to the Operations Conductor and the RCO. Chaff drops are prohibited until impact prediction places chaff impacts outside the 10 NM (19 km) limit from shore.

Flares used on the Sea Range are of two types: defensive flares or flares used for illumination. Defensive flares are ejected from aircraft or launched from ships in order to confuse heat-seeking missiles. Illumination flares are dropped from aircraft or launched from ships by shells and descend to the surface by parachute, providing surface illumination during darkness. Illumination and defense flares burn out prior to ground or water impact. Baseline information on flare and chaff operations in the Sea Range (including the type of launch platform, areas involved, and altitudes) is summarized in Table 3.0-5. Chaff and flares are used infrequently on the Point Mugu Sea Range (typically totaling less than 20 times per year). However, each chaff and flare operation often includes multiple launches (e.g., ten bundles of chaff may be released during one operation). In the baseline year, a total of 262 flares

Table 3.0-5. Baseline Flare and Chaff Activity

Operation	Platform	Number of Operations	Areas	Altitude
Defensive Flare Launch	F-14	3	3A, 3B, 4A, 4B, 5A, and 5B	Above 3,000 feet
Defensive Flare Launch	QF-4	3	Unknown	Above 3,000 feet
Paraflare Launch	Launched from ships	9	M-5, W-290, 4A, 4B, 5A, 5B, 3D, 3E, 3F, and W2	Above 3,000 feet
Chaff Launches	Helicopters and mobile ship targets	11	W1, W2, 3A, 3D, and 4A	Below 3,000 feet

Source: NAWCWPNS Point Mugu 1996f.

were launched during approximately 15 operations and 114 bundles of chaff were dispensed during 11 operations.

Laser Systems (used for measurement purposes)

A laser is an intense beam of visible electromagnetic radiation. Two types of laser systems are used occasionally on the Sea Range: designators and range finders. In addition, lasers are occasionally tested for their use in making meteorological measurements. Designators are mounted on missiles and use lasers to "acquire" (detect and track) targets. Range finders are mounted on aircraft and use lasers to measure the precise distance between the aircraft and a selected object. Use of these systems is primarily associated with missile testing activities but does not occur as part of routine operations on the Sea Range. Eye-hazard distances for humans have been established for various types of laser systems. This indicates the maximum distance at which injury could occur from direct exposure to the human eye. The eye-hazard distance for designators and range finders used on the Sea Range is approximately 12-NM (22-km) (NAWCWPNS Point Mugu 1997c). Consequently, any activity involving use of a designator or range finder requires implementation of standard range surveillance and clearance procedures.

3.0.2.3 Training Activities on the Point Mugu Sea Range

A - Fleet Training Exercises

Fleet Training Exercise

As noted previously in Section 2.1.2.1, a FLEETEX is a generic term which broadly encompasses a variety of Fleet training activities. FLEETEXs are major Naval training events designed to exercise a Battle Group's warfighting capabilities as they are intended to function in actual combat. A Battle Group refers to a group of ships that are tailored by size and type for specific warfare missions. FLEETEXs include development of an intelligence situation with the exercised units engaged against hostile forces simulated by other Naval units. These types of complex training exercises usually involve an entire Battle Group working together and are vital to maintaining operational readiness of U.S. Naval forces. FLEETEXs on the Sea Range typically last two to three days and generally involve multiple missile firings, 50 or more aircraft sorties, and varied types of surface combatants. A FLEETEX incorporates all or part of the scenarios previously discussed. The Point Mugu Sea Range provides the opportunity to involve weapons systems and personnel in realistic warfare environments, including complex live-fire scenarios. FLEETEXs on the Sea Range do not involve the use of active sonar. Although each FLEETEX varies, all typically involve large numbers of ships and aircraft, usually with emphasis on air warfare and surface warfare training. Table 3.0-6 provides the number of aircraft sorties, targets, and missiles fired during a typical FLEETEX held on the Sea Range. Figure 3.0-18 displays a typical FLEETEX scenario.

Table 3.0-6. Typical Fleet Training Exercise Participants[1]

	Aircraft Sorties	Targets Launched	Missiles Fired	Project Ships[2]
Total	57	33	34	18

[1]A FLEETEX typically occurs during a two to three day period.
[2]Includes 12 range support boats.
Source: U.S. Navy Third Fleet 1995.

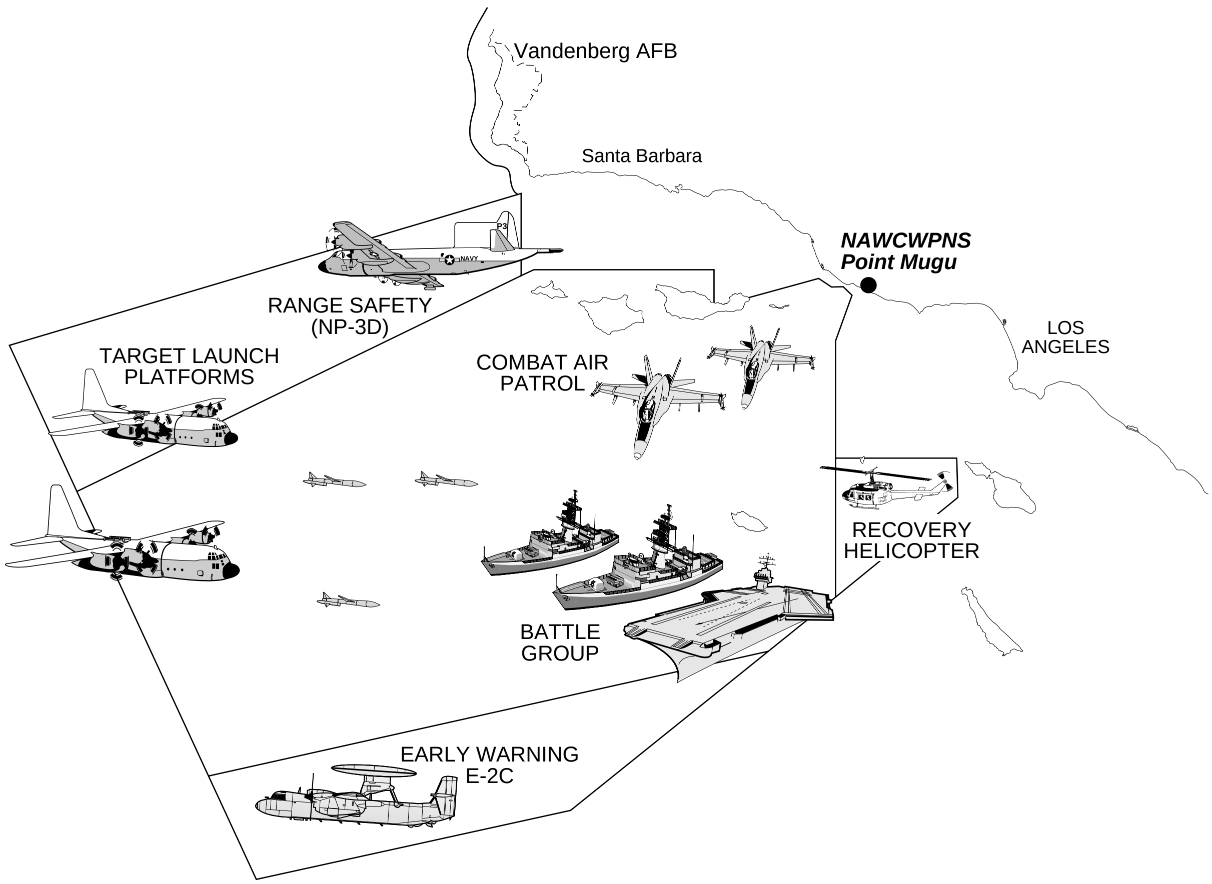


Figure 3.0-18
Representative Fleet Training Exercise Scenario

During a FLEETEX most events occur according to a schedule known in advance to the participants, although there is some degree of flexibility allowed to increase the sense of reality. Naval forces which participate in a FLEETEX come from Naval bases outside of the Sea Range. Under most circumstances, support provided by the Sea Range is in the form of airborne or surface targets that are fired on by units participating in the FLEETEX. NAWCWPNS also provides range surveillance aircraft for range safety purposes. The usual objectives of any FLEETEX are to validate Naval Battle Group tactics, provide highly realistic training to the participants, exercise command and control procedures, and engage targets representing hostile threats, all with due regard for the safety of ships and aircraft on the Sea Range. Most other operations on the Sea Range do not involve the use of ordnance with live warheads. However, FLEETEXs routinely expend missiles with live warheads against both airborne and surface targets. Weapons are not expended during these exercises unless the intended point of impact is within the assigned range area and a valid weapons release order is given.

B - Littoral Warfare Training

Littoral warfare training is conducted by the Marine Corps and by Navy Special Warfare forces. Marine Corps amphibious warfare training involves operations on land and on sea. Amphibious operations include shore assault, boat raids, airfield seizure, humanitarian assistance, and light-armor reconnaissance. Amphibious landings are carried out principally by Amphibious Task Groups which consist of Naval surface forces and Marine Expeditionary Units (MEU). Navy Special Warfare forces conduct maritime operations under the command of Naval Special Warfare Command and can be deployed to participate in operations directed by the U.S. Special Operations Command (USSOCOM).

Navy special warfare capability is built around small units known as SEAL Teams (SEAL is an acronym for Sea, Air, Land). SEAL Teams can be deployed together with Amphibious Task Groups or separately to support the needs of Unified Commands worldwide. SEAL Teams are highly trained units with airborne, unconventional warfare, clandestine operations, underwater, and amphibious capabilities. They are supported by Special Boat Units with high performance surface and subsurface craft. Table 3.0-7 shows environmental siting criteria associated with littoral warfare training at several San Nicolas Island beach locations at various times of the year. These siting criteria are used to determine when special warfare operations or small-scale amphibious training can be conducted at the island. Constraints are associated with seasonal marine mammal shore activity and bird nesting behavior.

Table 3.0-7. Environmental Siting Criteria for Special Warfare and Small-Scale Amphibious Training at San Nicolas Island

Beach[1]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Daytona Beach East	X	X	X									X
Coast Guard	*	*	X	X	X	X	X	X	X			*
Cissy Cove	*	*	X	X	X	X	X	X	X			*
Tender	*	*	X	X	X	X	X	X	X			*
Redeye	X	X	X	X	X	X	X	X	X			X

[1] See Figure 3.0-2 for locations.
X - Beach Closed.
* - Expect Closure in next few years.
Source: NAWS Point Mugu 1997a.

Marine Corps amphibious warfare training and SEAL special warfare training are described separately in the following sections.

Small-Scale Amphibious Warfare Training

Small-Scale Amphibious Warfare Training

Amphibious landing training exercises in the Point Mugu Sea Range are currently conducted about four times per year and traditionally consist of small-scale manned raids at pre-approved sites. These activities typically have occurred at San Nicolas Island when the schedule of operations and existing environmental restrictions allow (see the previous subsection). Since the Fleet routinely uses other ranges for this type of training, the units become too familiar with the training grounds. To evaluate their training skills prior to deployment, unfamiliar ground is required. Deployment of personnel is performed by small inflatable boats, helicopters, or aircraft. Helicopters have been limited to the insertion and extraction of troops to and from the San Nicolas Island airstrip or other approved areas. The following provides a general description of Marine Corps amphibious operations on and around San Nicolas Island.

Locations. Amphibious warfare training exercises have been conducted at various locations on and surrounding San Nicolas Island (see Figure 3.0-2). Beach areas are carefully selected to avoid or minimize damage to vegetation, wildlife, or cultural sites. There are several alternative sites that have accommodated shore landings, boat raids, and combat rubber boat landings. They include Daytona Beach (where resupply barges routinely land) and Redeye Beach (see Figure 3.0-2). Helicopter assaults, airfield seizure, and humanitarian assistance training can be conducted on the active airfield with proper coordination. Light armor operations including reconnaissance are restricted to the vicinity of the airfield and existing roads. Search and rescue missions can be accomplished on beach areas in the vicinity of the old jetty on Coast Guard Beach, Daytona Beach, the SLAM targets, and the Vandal launch pad. Hydrographic and nearshore reconnaissance can be conducted in the waters at Redeye Beach or off Daytona Beach.

Beach Landings. The MEU includes a Battalion Landing Team (BLT), but Marine landings on San Nicolas Island beaches have involved only company- and platoon-sized units. A company has three infantry platoons and a weapons platoon (a total of approximately 100-150 personnel). Each platoon has approximately 20-25 personnel. Company-sized operations on San Nicolas Island typically come ashore by aircraft or helicopter due to the sensitivity of the beach area on San Nicolas Island. A company-sized raid typically lasts about two days from start to finish.

Smaller platoon-sized raids arrive on the island by helicopter or by a small boat landing on selected beach areas. Trucks or tanks are not used. Operations performed by platoons include shore assault training, small boat landing (with rubber boats), land reconnaissance, and patrolling. For either sized operation, blank ammunition and smoke can be used, but live ordnance cannot. Flares are used only with permission of the Environmental Project Office due to the danger of fire.

Aircraft Support Operations. For San Nicolas Island operations, aircraft typically include two to four F/A-18s to provide air cover for a platoon, with four to eight aircraft for a company. These aircraft perform air cover and close air support missions flying or operating about 20 minutes below 3,000 feet (910 m) and 20 minutes above 3,000 feet (910 m) per mission. Two AV-8B aircraft and two AH-1 helicopters provide close air support. Two sections (two aircraft each) of AV-8Bs usually alternate operations, for a total of four sorties per exercise. The AS-1W Cobras similarly fly four sorties. No ordnance is dropped or fired during these operations. Marine units also come ashore San Nicolas Island by helicopter at inland sites in suitable areas, including the airfield. In this case, CH-46 and CH-53 helicopters are used in approved locations. Helicopters also are used for extraction of Marine forces from the island.

Special Warfare Training

Special Warfare Training

Special warfare training exercises are currently conducted about two times per year. Special warfare onshore operations generally involve human activities of individuals on foot (less than ten personnel), group movement on foot (less than 30 personnel), group climbing, clandestine patrolling, laying-in (for observation), and communication by radio. No land vehicles are used except for safety purposes. Helicopters perform hovering and landing operations and are also used to conduct personnel and cargo parachute drops. Surface craft activities on beaches include the use of Combat Rubber Raiding Craft (CRRC), Reinforced Inflatable Boats (RIBs), and Patrol Boat Light (PBL). CRRCs are 15 feet (5 m) long with a 6-foot (2-m) beam, weighing 265 pounds (120 kg) and powered by a 55-horsepower (hp) outboard engine. RIBs range in size from 24 feet (8 m) long to 30 feet (10 m) long. PBLs are 25-foot (8-m) Boston Whalers.

Sites for onshore SEAL training on San Nicolas Island (see Figure 3.0-2) can include several beach areas (e.g., Redeye Beach and other areas northeast of the airfield). Selection of beach areas for training is based not only on training requirements but also the environmental sensitivity of the beach and inshore areas (see the previous subsection). Since SEAL training involves only a small number of individuals who are highly trained and leave little evidence of their presence or actual damage to their training environment, they have a greater choice of areas in which to train.

Locations for SEAL offshore operations include virtually the whole Sea Range, but especially the range areas around San Nicolas Island: M-3, M-5, 3A, and 4A. Special warfare training exercises extend in duration from eight hours to two days. Virtually all nearshore operations occur in Range Area M-3, the area encircling San Nicolas Island. Within this area, there are multiple alternative locations and routes that can be used.

3.0.2.4 Range Use and Tempo

A general list of terminology associated with range use and tempo is presented in Table 3.0-8.

A - Point Mugu Sea Range Activity Levels, FY95

The Scheduling Office keeps detailed records by fiscal quarter on Sea Range operations. Operations are categorized by sponsoring agency, type of program, phase of program, and test scenario. Each operation is given a descriptive and distinct code which provides information on the above data elements. The data in Table 3.0-9 provide operations category information for FY95 scheduled, completed, scrubbed, and canceled operations. To estimate the number of operations that actually involved aircraft flights and ship operations, it is necessary to add completed operations and scrubbed operations (since supporting aircraft or ships may have launched prior to operation cancellation). The Scheduling Office also keeps records of use by hours scheduled versus hours used; the actual number of hours that the range was in use is also shown in Table 3.0-9.

Table 3.0-8. Definition of Range Use Operations Terminology

Term	Definition
Operation	A test or training activity (e.g., test and evaluation of a Phoenix missile versus an AQM-37 target) that is scheduled on the Sea Range. An operation can involve as few as one aircraft or ship. An operation can also involve numerous aircraft or ships in a coordinated testing and training event and still be considered a single operation.
Canceled Operation	An operation in which the scheduled activity is terminated at least 2 hours prior to the launching of the test article.
Scrubbed Operation	An operation removed from the daily schedule within 2 hours of the scheduled launching of a target, missile, or other test article. Supporting aircraft or ships may have launched in advance of the launch of the test article. In this event, those assets would be recalled since the test or event could not be completed successfully.
Launch Operation	An operation involving a vehicle or device (target or missile) which departs from a launch site (e.g., BQM-34 launched from land on San Nicolas Island) or another vehicle (QF-4, F/A-18, F-14, or DC-130).
Support Operation	Any effort not specified as a Launch Operation is categorized as a Support Operation.
Completed Operation	An operation that is scheduled and executed on the Sea Range.
Sortie	The term generally refers to the complete flight of a single aircraft (i.e., one takeoff, one or more flight operations, and a final landing).

Table 3.0-9. Point Mugu Sea Range Baseline Operations Summary, FY95

	FY95
Completed Operations[1]	2,061
Scrubbed Operations[1]	416
Canceled Operations[1]	882
Actual Operations[2]	**2,477**
Hours Used	**8,412**

[1] Scheduled Operations can be calculated by summing the Completed, Scrubbed, and Canceled Operations.
[2] Actual Operations were derived by adding Completed Operations and Scrubbed Operations.
Source: NAWCWPNS Point Mugu 1996g,h.

The number of aircraft sorties on the Point Mugu Sea Range in FY95 is shown in Table 3.0-10.

Table 3.0-10. Aircraft Sorties on the Point Mugu Sea Range and Missiles Launched by Activity Category, FY95

	FY95
Aircraft Sorties	3,934
Missiles Launched	
-Navy Test Missiles	55
-Fleet Training Missiles	275
-Air Force Missiles	10
-Foreign Military Sales Missiles	11
Total Missiles Launched	**351**

Source: NAWCWPNS Point Mugu 1996g,h.

The distribution of missile launches on the Point Mugu Sea Range in FY95 is differentiated by missile activity type in Table 3.0-10. About 78 percent of the missile launches were performed for training.

B - Baseline Sea Range Activity

Current levels of activity on the Sea Range are described in order to assess the environmental effects of the proposed action. Baseline Sea Range activity is presented by aircraft sorties, missile launches, ship and boat activity, and target activity.

During the baseline year, a total of 2,477 completed and scrubbed operations occurred on the Sea Range. Since the Sea Range reporting system tracks operations rather than sorties, in order to assess the actual number of aircraft sorties, a manual review of the Sea Range database of operations was performed. These sorties, by aircraft type, were counted in the Range Resources Reports. These data on aircraft sorties by type are shown in Table 3.0-11. The completed and scrubbed operations resulted in 3,934 aircraft sorties. The data in the table show only 1,951 operations versus 2,477: the difference is that not all operations on the Sea Range necessarily generate aircraft sorties.

Flying operations took place over the entire Sea Range but were concentrated in the six areas south and southwest of the Channel Islands (4A, 4B, 5A, 5B, 6A, and 6B). Areas of aircraft activity (extracted from the FY95 NAWCWPNS Schedule of Operations) and corresponding densities are depicted in Figure 3.0-19. (Note: the aggregate numbers on the density chart exceed the total number of sorties [3,934] since an individual sortie may have activity in more than one range area.) Sortie density data are presented in Appendix B. Typical flight routes to and within the Sea Range were shown previously in Figure 3.0-5.

C - Baseline Missile Impacts

During exercise scenarios, aircraft, ships, and land-based systems launch a variety of missiles that terminate in the Sea Range. Missiles travel at high speeds and break up upon impact with the ocean. Missile debris is not recovered. Some missile targets (e.g., the BQM-74 and BQM-34) are recovered by parachute and then refurbished for another test. However, some test articles and some targets cannot be recovered. Safety hazard patterns for selected missiles are shown in Appendix B. Table 3.0-12 provides the number of missiles by type that were launched on the Sea Range in the baseline year. Included in the numbers of missiles launched on the Sea Range are missiles from Vandenberg AFB. These missiles are included in the NAWCWPNS Point Mugu database since they affect scheduling of operations on the Sea Range when they are launched. These missiles are normally long-range ballistic missiles such as the Minuteman or Peacekeeper. Their flight paths pass above the Sea Range operational areas exclusively at high altitudes (about 100,000 feet [30,500 m]) and the missiles do not impact on the Sea Range.

Figure 3.0-20 shows the density of missile impacts on the Sea Range based on NAWCWPNS Point Mugu missile launch data from the FY95 Schedule of Operations. Densities represent the cumulative number of missiles that impacted each area of the range. The data used to develop the Missile Impact Density Chart are included in Appendix B.

D - Baseline Target Activity

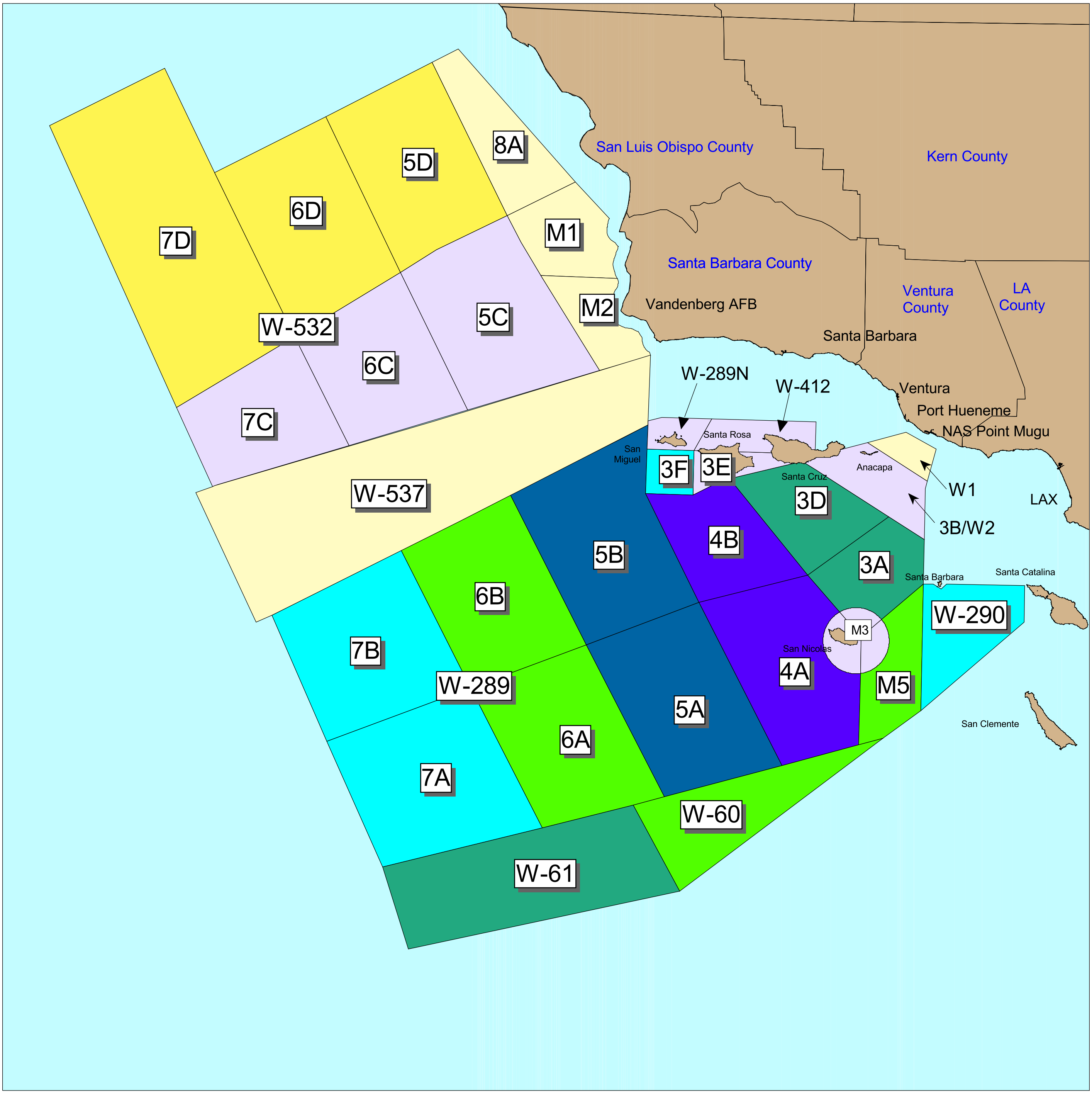
Table 3.0-13 provides the number of targets by type launched on the Sea Range in the baseline year. These were then separated into three categories: aerial, surface, and aircraft. Aircraft flights, such as a QF-4 (i.e., a QF-4 is remotely flown for use as a target), are considered aircraft sorties and are counted in

Table 3.0-11 Point Mugu Sea Range Sorties by Aircraft[1]

Baseline Aircraft Activity			
Aircraft Type	Number of Operations	Number of Sorties	Percent by Sorties
Multi-Aircraft[2]	249	996	25.3
F/A-18	308	869	22.1
F-16	140	432	11.0
F-14	222	411	10.4
Helicopters	205	244	6.2
QF-4/F-4	149	187	4.8
KC-135	122	123	3.1
A-6/EA-6	83	116	2.9
B-2	90	90	2.3
C-130	69	69	1.8
S-3	32	62	1.6
Lear	45	51	1.3
P-3	34	49	1.2
Cessna	36	37	0.9
A-7	13	23	0.6
Gulfstream	18	18	0.5
A-3	16	17	0.4
B-720	14	14	0.4
AV-8B	5	13	0.3
B-1	7	12	0.3
E-2[3]	10	11	0.3
F-15	7	10	0.3
E-3	8	8	0.2
Tanker	8	8	0.2
EC-18B	7	7	0.2
F-111	6	7	0.2
AEROCOM	6	6	0.2
Partenavia	6	6	0.2
C-141	5	5	0.1
L-1011	5	5	0.1
Pioneer	4	4	0.1
T-37	3	3	0.1
T-39	2	3	0.1
ACRO	2	2	0.1
C-12	2	2	0.1
T-38	2	2	0.1
Other	11	12	0.3
Total	**1,951**	**3,934**	**100.0**

1 The values in the table group similar aircraft together (e.g., F-14A and F-14D).
2 NAWCWPNS does not track individual aircraft types for multiple aircraft formations. Numbers of these aircraft are documented in the "Multi-Aircraft" category. A value of 4 was estimated for the formation number of aircraft for the Multi-Aircraft category.
3 The E-2 sorties originated from aircraft carriers during FLEETEX operations.
Source: NAWCWPNS Point Mugu 1996j.

Baseline Sea Range
Area Usage



Aircraft Sorties per Area

- 0-499
- 500-529
- 530-1299
- 1300-1459
- 1460-1599
- 1600-1999
- 2000-2199
- 2200-2450

50 0 50 Nautical Miles

Projection: Universal Transverse Mercator
North American Datum 1927
Zone 11

Figure 3.0-19

Table 3.0-12. Missiles by Type Launched on the Point Mugu Sea Range (Baseline Operations)

Missile	Launched
AIM-7 Sparrow	82
SM-I/SM-II Standard	56
AIM-9 Sidewinder	46
AIM-54 Phoenix	30
FIM-92 Stinger	19
BATS	18
RGM/UGM-84 Harpoon	12
AIM-120 AMRAAM	10
SLAM	9
SSM	7
AGM-88 HARM	6
RIM-7 Sea Sparrow	6
I-Hawk	4
AGM-154 JSOW	4
AGM-65 Maverick	1
RGM/UGM-109 Tomahawk	1
NATACMS	1
Other	29
Air Force ICBM (From Vandenberg AFB)	10
Total	**351**

Source: NAWCWPNS Point Mugu 1996g.

range aircraft sortie totals. NAWCWPNS operations personnel refer to a QF-4 remote control sortie as a No Live Operator (NOLO) flight. Aerial targets are launched either from aircraft or surface launch sites. Surface targets include surface vessels (e.g., hulks, SEPTARs, QST-33, QST-35). A matrix of target descriptions and capabilities is presented in Appendix B.

E - Baseline Ship Activity on the Point Mugu Sea Range

Ship activity includes Naval vessels used during T&E scenarios, range support for FLEETEXs, and vessels involved with surface-to-surface and surface-to-air scenarios. Submarines also come into the range (typically twice per year) to launch missiles in support of subsurface-to-surface tests. Ship activity can be further grouped by project or support craft. Table 3.0-14 shows the baseline number of activities for project ships, project boats, and support boats used on the Point Mugu Sea Range. The multiple ships category data in this table were compiled from NAWCWPNS records where the type of vessel was not specified but was identified as operating with the MOCS. The MOCS terminology has replaced the term Extended Area Test System (EATS). Table 3.0-14 also shows the baseline number and activity level of project boats and support boats used on the Sea Range. Typical routes used by Navy ships and boats on the Point Mugu Sea Range were shown previously in Figure 3.0-7.

F - Baseline Composite Activity Level for the Point Mugu Sea Range

The numbers of sorties by aircraft, ships and boats, aerial targets, and surface targets for the baseline year are summarized in Table 3.0-15.

Baseline Sea Range Missile Impact Density

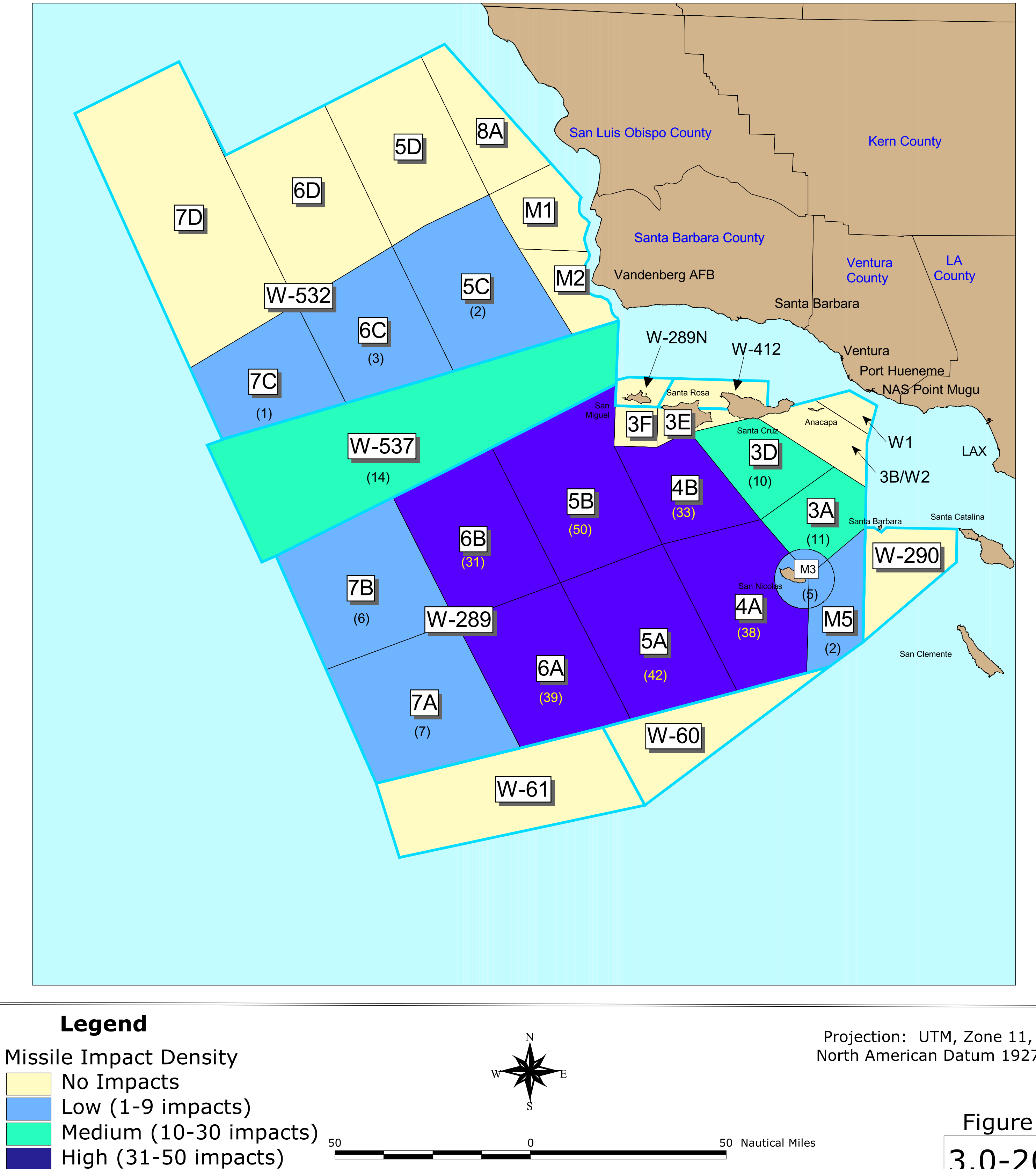


Figure 3.0-20

Table 3.0-13. Targets by Type Used on the Point Mugu Sea Range (Baseline Operations)

Type of Air Target	Number Launched	Type of Surface Target	Number Launched
BQM-74	141	QST-35	34
AQM-37	29	Mobile Ship Target (MST)	21
QF-4 NOLO	24	QST-33	20
BQM-34	22	Tow Bar	8
MQM-8	9	Pontoon boat	5
QUH-1	7	Floating at Sea Target (FAST)	2
BQM-37	5	Improved Surface Tow Target (ISTT)	2
TDU-34	1	Hulk (Old Destroyer)	1
Air Target Total	**238**	**Surface Target Total**	**93**
Total, Less Target Aircraft	**207**		

Source: NAWCWPNS Point Mugu 1996k.

Table 3.0-14. Baseline Number of Activities for Project Ships, Project Boats, and Support Boats Used on the Point Mugu Sea Range

Project Ships		
Nomenclature	**Ship Type**	**Number of Activities[1]**
None	Multiple Ships with MOCS	220
SDTS	Self Defense Test Ship	49
FFG	Guided Missile Frigate	45
DDG	Guided Missile Destroyer	31
CG	Guided Missile Cruiser	23
DD	Destroyer	22
LPD	Landing Platform Dock	20
None	M/V Research	14
CV	Aircraft Carrier	14
SSN	Submarine	11
CVN	Aircraft Carrier	10
AO	Fleet Oiler	7
LHA	Landing Helicopter Assault Ship	7
LSD	Landing Ship Dock	6
AOE	Multi-Purpose Stores Ship	5
DD	Canadian Ship	4
None	Contract Ship	4
LHD	Landing Helicopter Dock	3
	Project Ships Subtotal	**495**
Project Boats		
SL	Project Boats	79
Support Boats		
AVR	Aviation Rescue Boats	225
	Total	**799**

[1] Ship activities are not double-counted.
Source: NAWCWPNS Point Mugu 1996k.

Table 3.0-15. Baseline Range Activity

	Range Aircraft Sorties	Ships and Boats	Aerial Targets (Less Aircraft)	Surface Targets	Missiles Fired
Baseline	3,934	799	207	93	351

Source: NAWCWPNS Point Mugu 1996g.

3.1 GEOLOGY AND SOILS

3.1.1 Introduction

3.1.1.1 Definition of Resource

The geologic resources of an area consist of all soil and bedrock materials. This includes sediments and rock outcroppings in the nearshore and open ocean underwater environment. For the purpose of this EIS/OEIS, the terms soil and rock refer to unconsolidated and consolidated material, respectively. Geologic resources can also include mineral deposits, significant landforms, tectonic features, and paleontological remains (i.e., fossils). These resources can have scientific, economic, and recreational value.

3.1.1.2 Regional Setting

A - Point Mugu Sea Range

The Point Mugu Sea Range, which encompasses both terrestrial and marine environments, is located in southern California, a region noted for its intense seismic activity. This activity is due primarily to the right lateral motion of the Pacific and North American Plate boundary. Although the study area lies entirely within the Pacific Plate, the tectonic mechanisms controlling this phenomenon have created a complex system of faults that have fragmented the landscape, combining rocks of vastly different source areas.

B - Point Mugu

NAS Point Mugu is located in the Ventura Basin, a large syncline or trough that extends over 120 miles (190 km) and includes the Santa Barbara Channel. Like other structural features of the Transverse Ranges, the basin trends east-west. The sediments of this basin are primarily marine. However, the combination of orogenic activity and rising sea level have produced a great diversity of sediments, particularly in the current coastal region.

C - San Nicolas Island

San Nicolas Island is the outermost island of the southern Channel Islands in the Peninsular Range geomorphic province. It lies on the Santa Rosa-Cortez Ridge, one of several northwest-trending ridges which characterize the region. The entire region is thought to be underlain by the Franciscan formation which consists of a broad variety of rocks including deep-marine sedimentary rocks as well as metamorphosed igneous rock derived from oceanic crust.

3.1.1.3 Region of Influence

The region of influence for the alternatives addressed in this EIS/OEIS includes ocean bottom sediments in the Point Mugu Sea Range as well as geology and soils at Point Mugu and at San Nicolas Island. Ocean sediments immediately offshore from these areas are addressed where appropriate. The Navy operates instrumentation sites at Santa Cruz, Santa Rosa, and San Miguel islands. However, current activities do not affect geology and soils and the proposed action does not involve construction at these locations, so soils on these islands are not addressed.

3.1.2 Point Mugu Sea Range

3.1.2.1 Ocean Bottom Topography

Figure 3.1-1 shows the major bathymetric (i.e., underwater topography) features of the Southern California Bight within the Sea Range. The entirety of the offshore region encompassed by the Sea Range is often referred to as the Continental Borderland. The landforms of this region are characterized by the distinct topographic features of the geomorphic provinces described above. The dominant series of northwest-trending, alternating basins and ranges are cut by the northern Channel Islands and the Santa Barbara Channel. The continental shelf (a shallow, level shelf parallel to the California coast) is particularly narrow, and is often less than 5 miles (8 km) wide. The high relief and numerous basins and ranges of the Continental Borderland distinguish this continental slope from those found in other parts of the world. Rather than having the flat, gently sloping platforms characteristic of most continental slopes, the relief of the Continental Borderland varies by as much as 8,500 feet (2,600 m). The slope area extends west to the Patton Escarpment, a steep ridge that drops approximately 4,900 feet (1,500 m) to the deep ocean floor of the Pacific. Located between the mainland and the Patton Escarpment are a series of submarine canyons, ridges, basins, banks, and seamounts that provide unique marine habitat (see Section 3.5).

3.1.2.2 Ocean Bottom Sediments

The majority of continental shelf sediments in the study area have an average thickness of approximately 100 feet (30 m). During normal years, the predominant sand-sized particles are carried by longshore currents south along the inner shelf into the Hueneme and Mugu canyons. However, years of unusually high flooding have produced a northwest trending submarine delta at the mouth of the Santa Clara River.

Much of the Sea Range ocean floor is composed of soft bottom sediments in the lower slopes and basins. Rocky substrates tend to occur close to the islands or on some of the offshore shelves, ridges, and banks that lead to other basins (see Figure 3.1-1).

3.1.3 Point Mugu

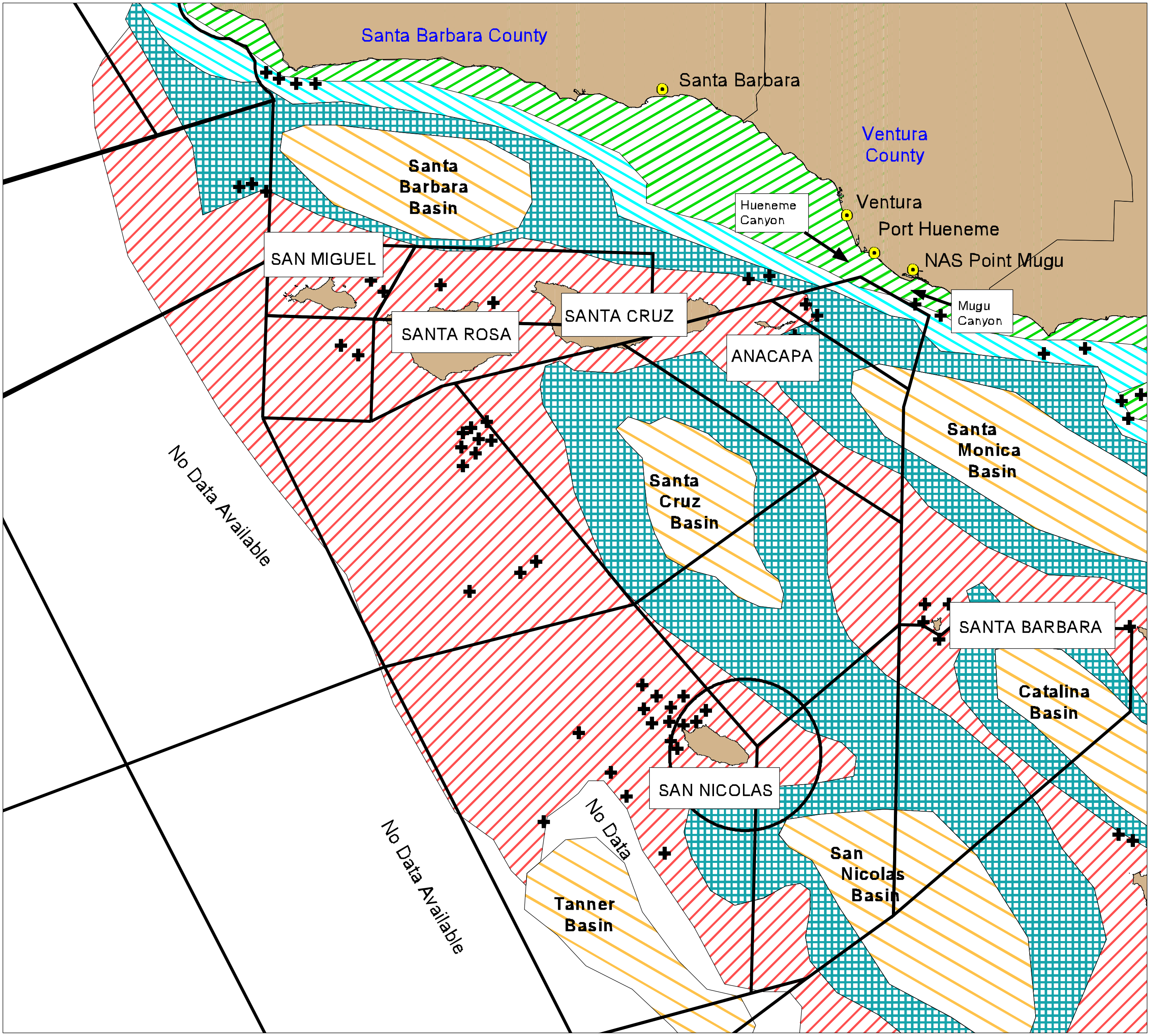
3.1.3.1 Onshore

A - Geology

NAS Point Mugu is located on the edge of the Oxnard Plain, which is traversed by the Santa Clara River and by Calleguas Creek. The Oxnard Plain is composed largely of floodplain and marine sedimentary deposits. Unconsolidated sediments underlie the base to an estimated depth of 1,500 feet (460 m). Sedimentary deposition in the form of fluvial (river), tidal, and beach processes continues to dominate the geologic setting of the base. Topographically, NAS Point Mugu is characterized by extremely low relief, with an average slope of approximately 1 foot per 500 feet (1 m per 500 m).

The California Division of Mines and Geology (CDMG) classifies faults as either active or potentially active depending on the age of most recent known activity. A fault is considered active if displacement has occurred within the Holocene Epoch (last 11,000 years) and potentially active if the last displacement was within the Quaternary (last 1.6 million years). The majority of the unnamed faults in the offshore area are considered active.

Major Bathymetric Features of the Southern California Bight

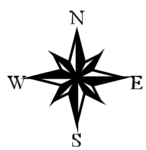


Legend

Point Mugu Sea Range

Major Bathymetric Features

- Mainland Shelf (30 - 150 m)
- Offshore Shelves, Ridges, and Banks (30 - 500 m)
- Upper Slope (150 - 750 m)
- Lower Slope (500 - 1500 m)
- Basins
- Deep Rocky Substrate



20 0 20 Nautical Miles

Projection: Universal Transverse Mercator, Zone 11
North American Datum of 1927
Scale shown is 1:1,200,000
Source: Dailey et al. 1993.

Figure 3.1-1

There are four named faults in the vicinity of NAS Point Mugu: the Bailey, Sycamore Canyon, Boney Mountain, and Malibu Coast faults (the Bailey and Sycamore Canyon faults are shown in Figure 3.1-2). Additionally, there are several scattered unnamed, smaller faults in the offshore area. According to the CDMG convention, the Bailey, Boney Mountain, and Sycamore Canyon faults are classified as potentially active. The segment of the Malibu Coast Fault nearest the base is also considered potentially active. The Bailey and Sycamore Canyon faults possibly cut through the base, although their precise locations can only be inferred due to the prevalence of recent sediments. The Boney Mountain Fault lies approximately 2.5 miles (4 km) to the east and trends roughly north-south. Of the four faults, the Malibu Coast Fault is probably the most significant in terms of size and activity. It lies just offshore to the south of Point Mugu and is estimated to be at least 17 miles (27 km) long. This fault trends east-west with a fault zone as wide as one third of a mile (0.5 km). It is believed to have caused the 1973 Point Mugu earthquake.

B - Geologic Hazards

Although the faults listed in the previous section represent those nearest to NAS Point Mugu, they are not the only faults that could potentially affect the base. However, for the purposes of this report, individual faults beyond those described above will not be discussed.

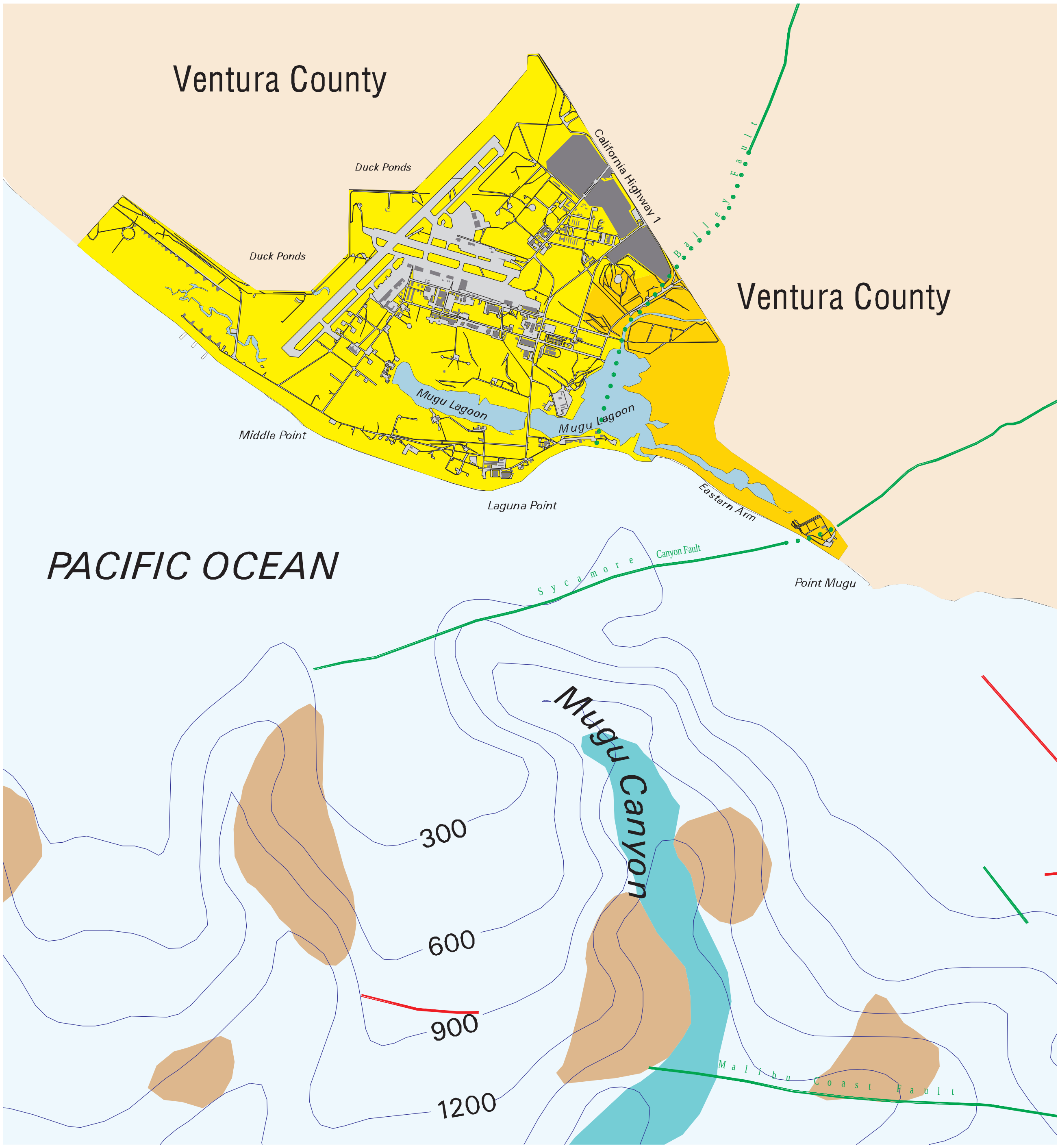
Fault activity causes damage in a variety of ways. Hazards can include landsliding, ground shaking, surface displacement and rupture, and the triggering of tsunamis. In general, the type of damage caused at a particular location depends on: a) the location's proximity to active faults, b) the frequency and severity of the disturbance, c) the potential for surface rupture, d) the composition of the location's surface and subsurface materials, and e) topography. Thus far, NAS Point Mugu has not experienced damage due to landsliding, surface displacement or rupture, or tsunamis.

The primary seismic threat to the base is ground shaking. This is particularly true east of Calleguas Creek and Mugu Lagoon where the shaking would be manifested as liquefaction. Liquefaction is defined as "the transformation of a granular material from a solid state into a liquefied state as a consequence of increased pore-water pressures." Following the Point Mugu earthquake of 1973, several sand boils and lurch cracks were observed at the Calleguas Creek stream channel and along the banks of Mugu Lagoon. The areas most at risk are those with fine to medium-grained sedimentary deposits of the very recent age (less than 1,000 years) and a shallow water table. The unconsolidated sediments onbase are thick and are of the age and texture described as most susceptible to liquefaction. In addition, the depth to the water table is exceptionally shallow, often less than 15 feet (5 m).

C - Soils

The soils at NAS Point Mugu generally fall into four categories: fill material, coastal beach sands, tidal flats, and the loamy sands and silty clay loams typical of the Oxnard Plain. Fill material constitutes a large portion of the base soils, but its properties are not well documented. Most of the fill was dredged from the lagoon and is presumed to have similar properties to the other soils onbase. Generally, base soils exhibit poor drainage and slow runoff characteristics, which contributes to ponding and occasional flooding. The erosion hazard of most soils is slight, except for the coastal beaches.

NAS Point Mugu and Offshore Geologic Hazards



Legend

- Areas of Sediment Slump*
- Paleo Sediment Channel
- Areas of High Relative Liquefaction Susceptibility
- Areas of High to Moderate Relative Liquefaction Susceptibility
- Holocene Fault
- Quaternary Fault** (dashed where inferred)

N W E S

Scale shown is 1:70,000
Universal Transverse Mercator Coordinate System, Zone 11
North American Datum of 1927
Contour interval is 300 feet (91 m)
Source: NAWCWPNS.

*Movement of slope sediments offshore from the mouth of Mugu Lagoon causes measureable changes to the bathymetry of Mugu Canyon each year.

**Inferred location of Bailey Fault was adapted from the Pacific Missile Test Center Master Plan, 1986.

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Figure 3.1-2

D - Paleontological Resources

There are no known paleontological resources at NAS Point Mugu. In addition, no paleontological resources are anticipated at NAS Point Mugu due to its geologic history.

3.1.3.2 Offshore

The shelf off the coast of Point Mugu is extremely narrow, approximately 0.9 mile (1.5 km) wide. Beyond the shelf, the terrain drops off rapidly into Mugu Canyon (see Figure 3.1-2). Slope failures (i.e., rapid movement of slope sediments) in Mugu Canyon are common. They typically occur at depths of 160 to 2,000 feet (50 to 600 m) and are less than 0.4 square miles (1 km^2) in area. In addition, there are several known areas of sediment creep (areas where the sediment has "sagged" but not broken free). It is believed that instances of slope failure as well as documented shoreline retreat are related to the erosion of the rock rip-rap wall constructed along the shoreline of Point Mugu.

Little documentation is available regarding offshore erosion. The following discussion has been derived from a variety of documents describing general sedimentary processes in submarine canyons in southern California. A combination of factors creates a high erosion potential in the area offshore from Point Mugu. Longshore currents transport sediments from the Santa Clara and Ventura rivers south along the coast. When these currents reach the Hueneme and Mugu canyons, much of this material washes down the sides of the canyon into deeper ocean. These currents, deprived of their normal sediment load, scour the coast to replenish the sediment supply. This has the dual effect of both eroding the shoreline and increasing slope instability in Mugu Canyon by increasing the sediment load. Slope stability is further decreased by: a) the proximity of faults with known recent activity, and b) suspected gas accumulation in the nearshore sediments (this causes increased pore pressure and decreased shear strength). Thus, seismic activity along the faults is likely to cause landsliding or slumping in the nearshore sediments. Finally, although Mugu Lagoon is subject to seasonal tidal flushing, sediment input in Mugu Lagoon has increased dramatically in recent years.

3.1.4 San Nicolas Island

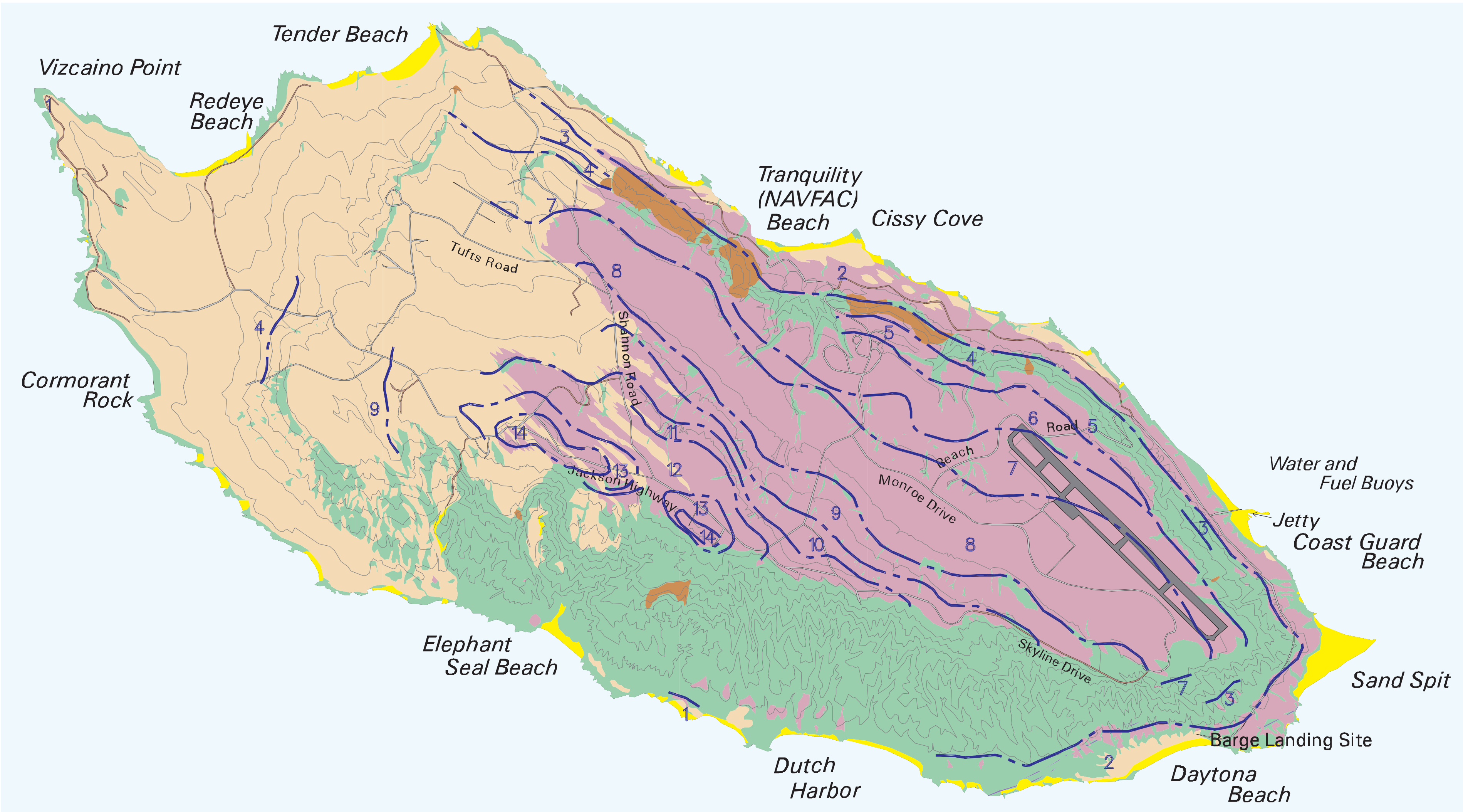
3.1.4.1 Geology

The most notable geologic feature of San Nicolas Island is the series of Eocene marine terraces that formed as a result of sea level changes and tectonic uplift. A map of the geologic features and inner margins of marine terraces is shown in Figure 3.1-3. The numerous terrace levels range from underwater depths of approximately 400 feet (120 m) to an elevation of over 900 feet (270 m). The terraces are covered by windblown sand (dune) deposits that decrease in depth from northwest to southeast. Underlying both dune sands and marine terrace deposits are alternating layers of Tertiary marine sandstone and siltstone. All units have been folded into a broad anticline (downward facing fold). The axis of this fold runs parallel to the length of the island, plunges slightly southeast, and is offset by several Pre-Quaternary faults.

3.1.4.2 Soils

San Nicolas Island soils are extremely diverse, due largely to the varied terrain. Soils generally form a thin layer over bedrock material. Along the steep southern edge of the island, the soil layer is virtually nonexistent. Longitudinal sand dune deposits cover the west end of the island and are composed of wind-transported quartzitic sand. The majority of the rest of the island is covered by sandy loams with

Generalized Geologic Map of San Nicolas Island



Legend

- Unconsolidated Beach Sand
- Dune Sand Deposits
- Marine Terrace Deposits
- Consolidated Tertiary Sediments
- Known Landslide Areas
- 100′ Contour Intervals
- Inferred Inner Margins of Marine Terrace Platforms

Projection: Universal Transverse Mercator, Zone 11
North American Datum of 1927
Scale shown is 1:60,000
Source: Burnham et al. 1963.

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Figure 3.1-3

scattered sandy beaches along the coast. Most of the island soils are rated as severely limited for construction, are highly susceptible to erosion by wind, and are moderately erodable by water.

3.1.4.3 Paleontological Resources

Fossils occur throughout the Eocene sedimentary units and marine terrace deposits on San Nicolas Island, and thus occur extensively throughout surface and subsurface units. The fossils of the Eocene rocks are predominantly foraminifera, and can be correlated with those of other geologic formations throughout southern California. Fossils of the marine terrace deposits consist of over 250 species of mollusks and other invertebrates. These assemblages are presumed to occur throughout all the marine terraces on San Nicolas Island and are unique in their completeness. The fossils "... represent one of the most complete sequence of fossil assemblages from successive terrace levels in southern California and contain the largest faunas reported from terrace levels higher than 500 feet (150 m)" (Vedder and Norris 1963).

3.2 AIR QUALITY

3.2.1 Introduction

3.2.1.1 Definition of Resource

Air quality is defined by ambient air concentrations of specific pollutants determined by the U.S. Environmental Protection Agency (USEPA) to be of concern with respect to the health and welfare of the general public. Six major pollutants of concern are carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3), suspended particulate matter (PM_{10}), and lead (Pb). The USEPA has established National Ambient Air Quality Standards (NAAQS) for these pollutants, called "criteria pollutants." The NAAQS establish ambient concentrations of criteria pollutants that are considered protective of public health and welfare.

Pollutant emissions typically refer to the amount of pollutants or pollutant precursors introduced into the atmosphere by a source or group of sources. Pollutant emissions contribute to the ambient air concentrations of criteria pollutants, either by directly affecting the pollutant concentrations measured in the ambient air or by interacting in the atmosphere to form criteria pollutants. Primary pollutants, such as CO, SO_2, lead, and some particulates, are emitted directly into the atmosphere from emission sources. Secondary pollutants, such as O_3, NO_2, and some particulates, are formed through atmospheric photochemical reactions that are influenced by meteorology, ultraviolet light, and other atmospheric processes.

In general, emissions that are considered "precursors" to secondary pollutants in the atmosphere (such as reactive organic gases [ROG] and oxides of nitrogen [NO_x], which are considered precursors for O_3) are the pollutants for which emissions are evaluated to control the level of O_3 in the ambient air.

The California Air Resources Board (CARB) subsequently established the more stringent California Ambient Air Quality Standards (CAAQS). Areas within California in which ambient air concentrations of a pollutant are higher than the state and/or federal standard are considered to be in *nonattainment* for that pollutant. Figure 3.2-1 shows both the federal and state ambient air quality standards. Ventura County is classified as a *severe nonattainment area* for the federal standard for O_3, and a *nonattainment area* for the state standards for PM_{10} and O_3. San Nicolas Island and Santa Cruz Island are both considered by the USEPA to be attainment/unclassifiable areas for the NAAQS.

A - Federal Requirements

The USEPA is the agency responsible for enforcing the federal Clean Air Act (CAA) of 1970 and its 1977 and 1990 amendments (42 U.S.C. § 7401 et seq.). The purpose of the CAA is to establish NAAQS, to classify areas as to their attainment status relative to the NAAQS, to develop schedules and strategies to meet the NAAQS, and to regulate emissions of criteria pollutants and air toxics to protect public health and welfare. Under the CAA, individual states are allowed to adopt ambient air quality standards and other regulations, provided they are at least as stringent as federal standards. The Clean Air Act Amendments (CAAA) (1990) established new deadlines for achievement of the NAAQS, dependent upon the severity of nonattainment.

The USEPA requires each state to prepare a State Implementation Plan (SIP), that describes how that state will achieve compliance with the NAAQS. A SIP is a compilation of goals, strategies, schedules, and enforcement actions that will lead the state into compliance with all federal air quality standards.

POLLUTANT	AVERAGING TIME	CALIFORNIA STANDARDS (1)	NATIONAL STANDARDS (2)	
			Primary	Secondary
Ozone (O_3) (3)	8 Hour	•	0.08 ppm (157 $\mu g/m^3$)	Same as Primary Standards
	1 Hour	0.09 ppm (180 $\mu g/m^3$)	0.12 ppm (235 $\mu g/m^3$)	
Carbon Monoxide (CO)	8 Hour	9.0 ppm (10 mg/m^3)	9.0 ppm (10 mg/m^3)	•
	1 Hour	20 ppm (23 mg/m^3)	35 ppm (40 mg/m^3)	
Nitrogen Dioxide (NO_2)	Annual Average	•	0.053 ppm (100 $\mu g/m^3$)	Same as Primary Standard
	1 Hour	0.25 ppm (470 $\mu g/m^3$)	•	
Sulfur Dioxide (SO_2)	Annual Average	•	0.030 ppm (80 $\mu g/m^3$)	•
	24 Hour	0.04 ppm (105 $\mu g/m^3$)	0.14 ppm (365 $\mu g/m^3$)	•
	3 Hour	•	•	0.50 ppm (1300 $\mu g/m^3$)
	1 Hour	0.25 ppm (655 $\mu g/m^3$)	•	•
Respirable Particulate Matter (PM_{10})	Annual Arithmetic Mean	30 $\mu g/m^3$	50 $\mu g/m^3$	Same as Primary Standards
	24 Hour	50 $\mu g/m^3$	150 $\mu g/m^3$	
Respirable Particulate Matter ($PM_{2.5}$)	Annual Arithmetic Mean	no separate standard	15 $\mu g/m^3$	Same as Primary Standards
	24 Hour		65 $\mu g/m^3$	
Sulfates	24 Hour	25 $\mu g/m^3$	•	•
Lead (Pb)	30 Day Average	1.5 $\mu g/m^3$	•	•
	Calendar Quarter	•	1.5 $\mu g/m^3$	Same as Primary Standard
Hydrogen Sulfide (HS)	1 Hour	0.03 ppm (42 $\mu g/m^3$)	•	•
Vinyl Chloride (chloroethene)	24 Hour	0.010 ppm (26 $\mu g/m^3$)	•	•
Visibility Reducing Particles	8 Hour (10:00 a.m. to 6:00 p.m. PST)	In sufficient amount to produce an extinction coefficient of 0.23 per kilometer due to particles when the relative humidity is less than 70 percent. Measurement in accordance with CARB Method V.	•	•

ppm – parts per million
$\mu g/m^3$ – micrograms per cubic meter
mg/m^3 – milligrams per cubic meter
• – no standard established

Sources: CARB 1999; USEPA 1999.

(1) CO, SO_2 (1- and 24-hour), NO_2, O_3, PM_{10}, and visibility reducing particles standards are not to be exceeded. All other California Standards are not to be equaled or exceeded.

(2) Not to be exceeded more than once a year except for annual standards.

(3) USEPA promulgated new federal 8-hour O_3 and fine particulate matter standards in 1997. The federal 1-hour O_3 standard continues to apply in areas that violated the standard. Attainment status for the 8-hour standard will be determined in 2000.

Figure 3.2-1
California and National
Ambient Air Quality Standards

Each change to a compliance schedule or plan must be incorporated into the SIP. In California, the SIP consists of separate elements for each air basin, depending on the attainment status of that air basin.

The CAAA also requires that states develop an operating permit program that requires all major sources of pollutants to obtain an air permit, and contains programs designed to reduce mobile source emissions and control emissions of hazardous air pollutants by establishing control technology guidelines for various classes of sources.

Clean Air Act Conformity

On November 30, 1993, the USEPA instituted final rules for determining general conformity of federal actions with state and federal air quality implementation plans. Section 176(c) of the CAA, the General Conformity Rule, requires federal agencies to ensure that actions undertaken in nonattainment or maintenance areas are consistent with the applicable implementation plan. In order to demonstrate conformity with the CAA, a project must clearly demonstrate that it does not: 1) cause or contribute to any new violation of any standard in any area; 2) increase the frequency or severity of any existing violation of any standard in any area; or 3) delay timely attainment of any standard, any required interim emission reductions, or other milestones in any area. A conformity applicability analysis is required for each of the nonattainment pollutants or its precursor emissions.

Compliance with the General Conformity Rule is presumed if the emissions associated with the federal action are below the relevant *de minimis* emissions levels for the region in which the action is proposed. Because Ventura County is classified as a severe nonattainment area for the federal O_3 standard, the *de minimis* level for O_3 precursors (NO_x and ROG) is 25 tons (28 metric tons) per year. In the event that the conformity applicability analysis demonstrates that the federal action is subject to the General Conformity Rule, a conformity determination must be conducted to demonstrate that the action is in conformity with the applicable implementation plan.

New Source Review

A New Source Review (NSR) is required when a source has the potential to emit any pollutant regulated under the CAA in amounts equal to or exceeding specified major source thresholds (100 or 250 tons [110 or 280 metric tons, respectively] per year) which are predicated on the source's industrial category. A major modification to the source also triggers an NSR. A major modification is a physical change or change in the method of operation at an existing major source that causes a significant "net emission increase" at that source of any pollutant regulated under the CAA. Any new or modified stationary emission sources within the county require permits from the Ventura County Air Pollution Control District (VCAPCD) to construct and operate. Through the VCAPCD's permitting process, stationary sources are reviewed and are subject to an NSR process. The NSR process ensures that factors such as the availability of emission offsets and their ability to reduce emissions are addressed and conform with the SIP.

<u>B - California Requirements</u>

The California Clean Air Act of 1988 (26 California Health and Safety Code [CH&SC] § 10000 et seq.) established CAAQS for criteria pollutants as well as additional standards for sulfates, hydrogen sulfide, vinyl chloride, and visibility reducing particles. The CARB is the agency responsible for enforcing regulations designed to achieve and maintain the CAAQS. Some air quality management districts have been given authority by the state to manage their own stationary source emissions. The CARB requires that each of these air districts develop its own strategy for achieving compliance with the NAAQS and

CAAQS, but maintains regulatory authority over these strategies, as well as all mobile source emissions throughout the state. The VCAPCD is the local agency responsible for the administration and enforcement of air quality regulations affecting Point Mugu.

3.2.1.2 Regional Setting

Coastal southern California and the adjacent valleys, mountains, and basins experience a *Mediterranean Climate* characterized by generally warm, dry summers and cool winters interspersed with wet storms from the Pacific Ocean and dry winds from the interior. During the summer months, a semi-permanent region of high pressure over the Pacific is responsible for creating cooling sea breezes, which tend to keep the coastal strip generally comfortable, while inland areas become very warm. Temperature inversions that occur in the stable air may trap pollutants that become photochemically modified in the abundant sunshine. During the winter months, the moderating influences of the ocean together with a protective ring of mountains inland insulate much of southern California from very cold air except far inland, and over higher terrain. Most of the precipitation that occurs during the year falls from winter-season storms that traverse the Pacific when the region of high pressure is displaced.

Many of the air basins in the coastal region of southern California are nonattainment areas for federal O_3 standards. This is due to several factors, including increases in population that generate increased industrial and automotive activity; episodes of air stagnation; warm periods with low, strong inversions; and transport of pollutants from neighboring areas.

On average, the Sea Range generally experiences frequent northwesterly surface winds. However, such conditions are interrupted by: 1) cool season storms (with southerly winds) and periods of dry offshore northeast winds (Santa Ana winds); 2) mainly warm season coastal eddies with southeast winds over the inner waters; and 3) alternating land/sea breeze circulations as one approaches the mainland coast. Due to the influence of the continent on the overall wind flow, in addition to the eddies and other complicating factors nearshore, there is a strong tendency for the relatively persistent northwesterly winds in the outer Sea Range to become more westerly as the air approaches the mainland.

3.2.1.3 Region of Influence

Identifying the region of influence (ROI) for air quality requires knowledge of the type of pollutant, emission rates of the pollutant source, proximity to other emission sources, and local and regional meteorology. For inert pollutants (all pollutants other than O_3 and its precursors), the ROI is generally limited to a few miles downwind from the source. However, for photochemical pollutants such as O_3, the impact area may extend much farther downwind. O_3 is a secondary pollutant that is formed in the atmosphere by photochemical reactions of previously emitted pollutants, or *precursors* (ROG, NO_x, and PM_{10}). The maximum effect of precursors on O_3 levels tends to occur several hours after the time of emission during periods of high solar load (i.e., sunlight) and may occur many miles from the source. O_3 and O_3 precursors transported from other regions can also combine with local emissions to produce high local O_3 concentrations. Extensive modeling efforts demonstrate that a majority of the emissions occurring inland of San Nicolas Island and the northern Channel Islands will, under certain wind conditions, be transported to onshore areas east and southeast of the Sea Range (NAWCWPNS Point Mugu 1997e) (refer to discussion in Section 4.2.1 and Appendix C). Therefore, the ROI for air quality impacts includes Santa Barbara County, Ventura County, the South Coast Air Quality Management District (SCAQMD), and San Diego County. Air Districts within the ROI are depicted on Figure 3.2-2.

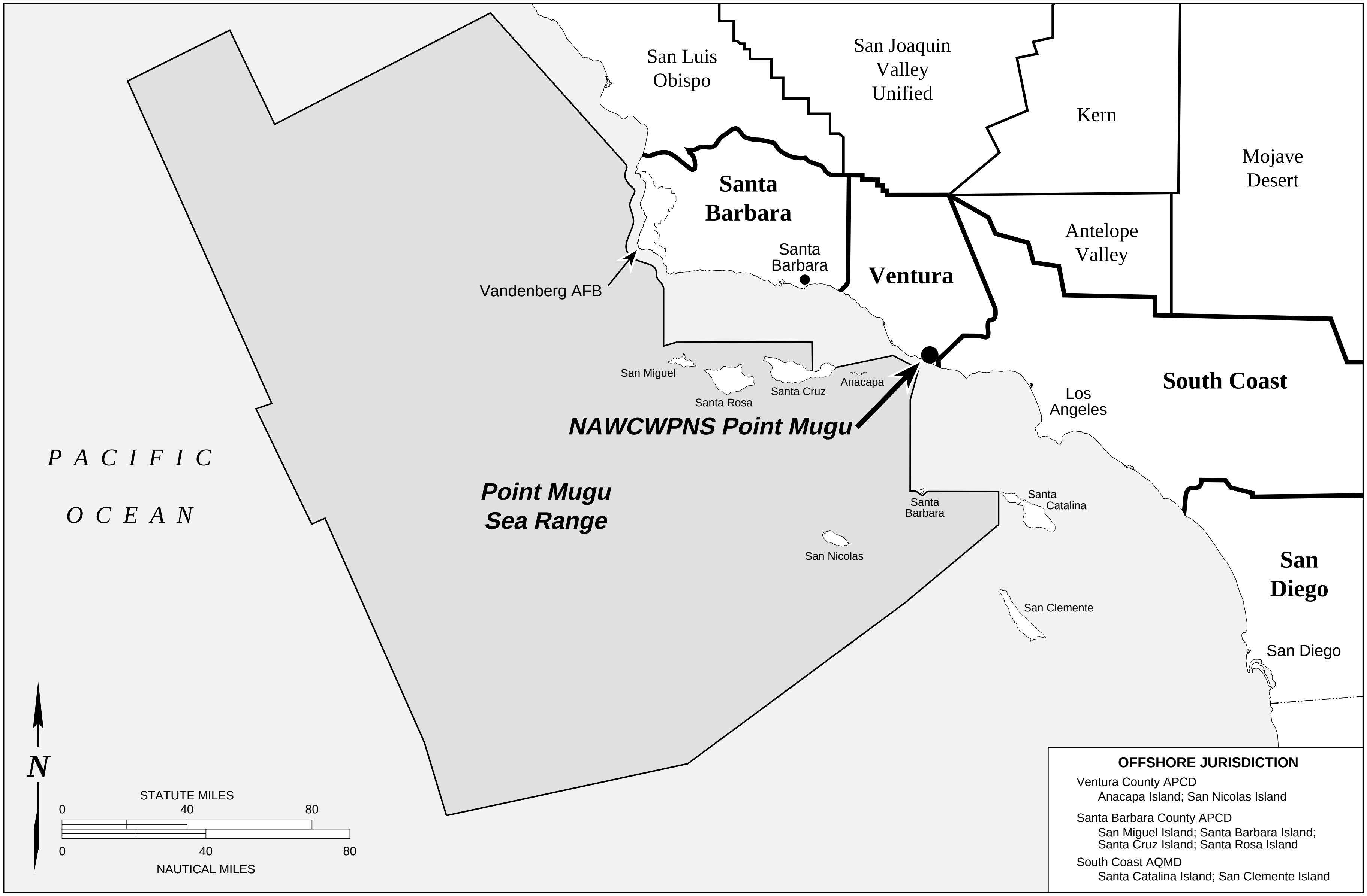


Figure 3.2-2
Air Districts in the Region of Influence

For purposes of this EIS/OEIS, baseline emissions are presented for the Sea Range, NAS Point Mugu, San Nicolas Island, and Santa Cruz Island. Although the proposed action would not affect the Navy's support facilities located on Santa Cruz Island (the Navy currently leases approximately 10 acres [4.1 hectares] from the Nature Conservancy as an instrumentation site), stationary emission sources owned by the Navy contribute to the overall baseline air emission estimates discussed in this section. San Miguel Island is not addressed within this section because there are no Navy facilities on the island except for an unmanned, remotely interrogated solar-powered automatic weather station.

3.2.2 Point Mugu Sea Range

3.2.2.1 Ambient Air Quality

A - Climate

Climate data presented in this section are also applicable to San Nicolas Island, Santa Cruz Island, and the other Channel Islands. Meteorological data for the Sea Range are based on data collected at a weather station located on San Nicolas Island. The station is situated at 504 feet (154 m) above mean sea level and records means, minimums, and maximums of precipitation, temperature, cloud cover, winds, and other parameters including frequency and heights of the subtropical inversion that is a characteristic of southern California weather patterns.

Total precipitation at San Nicolas Island averages 8.40 inches (21.3 cm) per year. The dry season occurs between May and September. The rainy season occurs between November and March when the island receives 87 percent of its total annual rainfall. The month of highest average precipitation is January. The average mean monthly temperature on land is 59°F (15°C), with a seasonal variation (January to July) of approximately 9°F (5°C). Temperatures during the coolest month average 54.7°F (13°C), and during the warmest month average 65.4°F (19°C). Prevailing winds are northwesterly, with an average speed from that direction of 13 knots (24.1 km/hour).

B - Air Quality

Portions of the Sea Range are located in Santa Barbara and Ventura counties. Ventura County is classified as a *nonattainment area* for the state standards for O_3 and PM_{10}, and a *severe nonattainment area* for the federal O_3 standard. Lack of available data for visibility-reducing particles, hydrogen sulfide, and vinyl chloride has resulted in an "unclassified" attainment status for these three air contaminants for the state ambient air quality standards. The county is designated as an *attainment area* for other federal and state ambient air quality standards.

Santa Barbara County is classified as a *nonattainment area* for the federal standard of O_3, and a *nonattainment area* for the state standards for both O_3 and PM_{10}. The county is designated as an *attainment area* for other federal and state ambient air quality standards.

San Nicolas Island and Santa Cruz Island are both considered to be attainment/unclassifiable as to air quality by the USEPA (USEPA 1996).

C - Existing Emissions

The following categories of emitting sources are present in the Sea Range (a description of the methodology used to calculate emissions and detailed emission estimates are included in Appendix C):

- Aircraft operations;
- Missile and target operations; and
- Marine vessel operations.

3.2.2.2 Emissions from Airborne Sources

Airborne sources of emissions in the Sea Range include military aircraft conducting exercises, contract aircraft making deliveries and transporting personnel, and missile and target launches. Offshore emission estimates were calculated for the baseline year to establish an air quality baseline for the Sea Range.

A - Aircraft Operations

Table 3.2-1 shows the annual baseline emissions for aircraft operating in the Sea Range.

Table 3.2-1. Baseline Aircraft Operations on the Sea Range

Aircraft Type	Engine Model	No. of Engines	No. of Sorties	Emissions, tons/year				
				CO	NO_x	ROG/HC	SO_x	PM_{10}
F-4	J79-GE-10B	2	149	5.29	0.40	1.92	0.04	0.80
F-14	TF30-P-414	2	222	0.00	0.00	0.00	0.00	0.00
F-18	F404-GE-400	2	308	0.00	0.00	0.00	0.00	0.00
C-130	T56-A-16	4	69	0.00	0.00	0.00	0.00	0.00
P-3	T56-A-16	4	31	0.04	0.82	0.01	0.04	0.18
E-2C	T56-A-426	2	10	0.02	0.12	0.01	0.00	0.02
S-3	T34-GE-400	2	32	1.54	0.31	0.22	0.02	0.04
AV-8B	F-402-RR-404	1	5	0.20	0.06	0.03	0.00	0.00
Total				**7.09**	**1.71**	**2.19**	**0.10**	**1.04**

Aircraft operations associated with aircraft flights originating from NAS Point Mugu (e.g., taxi, takeoff, etc.) have already been included in the emission estimates for NAS Point Mugu (refer to Section 3.2.3) and are not included in the emissions estimates for the Sea Range. Therefore, with the exception of the F-4, which also takes off and lands on San Nicolas Island, aircraft would be operating in the cruise mode while conducting exercises in the Sea Range. Emissions above 3,000 feet (914 m) were considered to be above the atmospheric inversion layer and would not have an impact on local air quality. The average time the aircraft operates between 0 and 3,000 feet (0 and 914 m) was calculated based on aircraft operating profiles and estimated time of operation for each sortie.

B - Missiles and Targets

Current Sea Range activities include test and training operations, including air-to-air, air-to-surface, surface-to-air, surface-to-surface, and subsurface-to-surface tests, as well as Fleet training exercises. These operations involve launching missiles and/or targets which are involved in the test and training scenarios. Emissions are associated with combustion of propellants and/or fuels used to propel the missiles and targets. (Missiles and targets are not used during littoral warfare training exercises.)

In order to estimate emissions associated with missile and target operations, the types of missiles and targets were determined from baseline year information. In certain cases, the specific type of propellant used was unavailable. For operations involving unknown propellants, the propellant emissions were estimated based on combustion of a known type of solid propellant, and emissions factors for the first stage of the boost operation and first stage of sustained combustion operation were used to represent emissions (Range Surveillance Center 1996). For the purpose of this analysis, it was assumed that most of the emissions associated with missile and target operations would take place below 3,000 feet (914 m), and therefore could impact air quality. Table 3.2-2 presents a summary of the emission estimates for current missile and target operations in the Sea Range.

3.2.2.3 Emissions from Marine Vessels

The majority of marine vessel traffic consists of commercial vessels transiting the inner waters enroute to and from the Ports of Los Angeles and Long Beach. Additional commercial vessel traffic is associated with transit to and from Port Hueneme. Other marine vessel traffic in the Sea Range comprises military boat and ship traffic, as well as a limited number of commercial vessels providing various support services to the military craft. A number of non-military recreational vessels are also regularly present in the Sea Range. Because they are present regardless of military operations, they are not considered to be part of the baseline emissions attributable to the Navy. For the purpose of determining Sea Range baseline emissions, only military vessels and those vessels responsible for providing support have been characterized. In addition, emissions from yellow gear (support/maintenance equipment) aboard aircraft carrier vessels have been included. Emissions estimates from marine vessel activities in the Sea Range are presented in Table 3.2-3.

3.2.2.4 Summary of Sea Range Emissions

Table 3.2-4 presents a summary of the baseline emissions for current Sea Range activities.

3.2.3 Point Mugu

3.2.3.1 Ambient Air Quality

A - Climate

Principal topographic features in Ventura County include coastal mountain ranges, the coastal shore, the coastal plain, and several inland valleys. The northern half of the county, which includes Los Padres National Forest, is extremely mountainous, with elevations reaching 8,800 feet (2,682 m). Consequently, the climate in the northern half of the county varies a great deal depending on altitude. This description of climate focuses on the southern half of the county where Point Mugu is located.

The average annual temperature in the coastal and inland valleys of the south half of Ventura County ranges from the upper 50°s (°F) (about 14°C) at the coast (Point Mugu) to the mid-60°s (°F) (about 18°C) in Simi Valley. The difference between the maximum and minimum temperature becomes greater as distance increases from the coast. The average minimum and maximum temperatures at Point Mugu are 51° and 69°F (10° and 21°C), respectively. The smaller range of temperatures at Point Mugu reflects the moderating influence of the ocean on air temperature. The ocean's ability to warm and cool the overlying air while its temperature remains relatively unchanged produces the moderating effect.

Table 3.2-2. Missile/Target Activities in Sea Range

Missile/Target	No. Fired/ Launched	Emissions, tons/year				
		CO	NO_x	ROG/HC	SO_x	PM_{10}
Missiles						
AIM-7 Sparrow [a]	82	0.00	0.00	0.00	0.00	0.00
AIM-9 Sidewinder	46	0.09	0.00	0.00	0.00	0.07
AIM-54 Phoenix [a]	30	0.00	0.00	0.00	0.00	0.00
AIM-120 Advanced Medium-Range Air-to-Air Missile (AMRAAM) [a]	10	0.00	0.00	0.00	0.00	0.00
AGM-84 Harpoon	12	0.00	0.01	0.00	0.00	0.00
Standoff Land Attack Missile (SLAM)	9	0.00	0.00	0.00	0.00	0.00
AGM-88 High Speed Anti-Radiation Missile (HARM)	6	0.25	0.00	0.00	0.00	0.20
AGM-65 Maverick	1	0.01	0.00	0.00	0.00	0.01
AGM-154 Joint Standoff Weapon (JSOW) [a]	4	0.00	0.00	0.00	0.00	0.00
SM-1&2 Standard Missile - (RIM-66-B) (RIM-66-C)	56	14.79	0.00	0.00	0.00	11.49
FIM-92 Stinger	19	0.04	0.00	0.00	0.00	0.03
HAWK	4	0.54	0.00	0.00	0.00	0.42
RGM-109/UGM-109 Tomahawk	1	0.00	0.00	0.00	0.00	0.00
SSM	7	0.34	0.00	0.00	0.00	0.26
Other Missiles	29	0.58	0.00	0.00	0.00	0.44
RIM-7 Sea Sparrow	6	0.12	0.00	0.00	0.00	0.09
Naval-configuration Army Tactical Missile System (NATACMS)	1	0.00	0.00	0.00	0.00	0.00
BATS	18	0.00	0.00	0.00	0.00	0.00
Naval Gunfire						
Aircraft and Vessel Gunfire Activities	9,998	0.27	0.00	0.00	0.00	0.00
Targets						
Airborne Targets						
AQM-37 [a]	29	0.00	0.00	0.00	0.00	0.00
MQM-8	9	0.44	0.00	0.00	0.00	0.34
TDU-34	1	0.00	0.00	0.00	0.0	0.00
QF-4 NOLO	24	0.36	0.12	0.07	0.01	0.12
BQM-74	141	0.02	0.06	0.01	0.00	0.05
BQM-34	22	0.20	0.04	0.00	0.00	0.06
Surface Targets						
QST-35	34	159.85	4.15	5.36	0.21	0.26
Mobile Ship Target (MST)	21	1.01	1.91	0.04	0.01	0.06
QST-33	20	18.81	0.49	0.64	0.03	0.03
Tow Bar [b]	8	0.00	0.00	0.00	0.00	0.00
Pontoon Boat (IVANDUCK)[b]	5	0.00	0.00	0.00	0.00	0.00
Floating at Sea Target (FAST)[b]	2	0.00	0.00	0.00	0.00	0.00
Improved Surface Tow Target (ISTT)[b]	2	0.00	0.00	0.00	0.00	0.00
Total		**197.72**	**6.78**	**6.12**	**0.26**	**13.93**

[a] Missile/target launched or fired above 3,000 feet.
[b] Surface target is not engine powered.
Source: NAWCWPNS Point Mugu FY95 Operations.

Table 3.2-3. Point Mugu Sea Range Marine Vessel Emissions

Ship Type	No. of Events	Emissions, tons/year				
		CO	NO_x	ROG/HC	SO_x	PM_{10}
Project Ships						
Self-Defense Test Ship	49	6.19	19.36	0.56	2.39	0.49
Guided Missile Frigate	45	12.11	31.02	1.42	11.77	1.56
Guided Missile Destroyer	31	8.97	41.50	0.59	20.19	1.71
Guided Missile Cruiser	23	7.83	19.57	0.56	10.96	0.99
Destroyer	22	9.66	22.82	0.73.	12.88	1.19
Landing Platform Dock	20	0.46	2.81	0.35	8.11	1.71
Aircraft Carrier	24	4.12	22.14	2.62	60.96	12.85
Fleet Oiler	7	0.36	2.24	0.27	6.31	1.33
Landing Helicopter Assault Ship	7	0.36	2.12	0.26	6.01	1.27
Landing Ship Dock	6	1.03	13.59	0.63	1.92	0.65
Canadian Ship	4	3.18	8.16	0.39	3.09	0.41
Contract Ship	4	0.17	0.28	0.01	0.91	0.05
Landing Helicopter Deck	3	0.13	0.77	0.10	2.19	0.47
Multi-Purpose Stores Ship	5	1.65	14.87	0.25	5.99	0.48
Range Project Boats	79	42.98	24.60	3.27	5.94	0.90
Range Support Boats	225	9.09	33.32	4.21	8.49	2.00
Yellow Gear (four squadrons)						
TA-75	2	0.00	0.04	0.00	0.01	0.00
A/S 32K-1A	2	0.00	0.00	0.01	0.00	0.00
JG-40	2	0.00	0.04	0.00	0.01	0.00
Total		**108.29**	**259.25**	**16.23**	**168.13**	**28.06**

Table 3.2-4. Summary of Sea Range Emissions

Activity	Emissions, tons/year				
	CO	NO_x	ROG/HC	SO_x	PM_{10}
Aircraft Operations	7.09	1.71	2.19	0.10	1.04
Missiles and Targets	197.72	6.78	6.12	0.26	13.93
Marine Vessel Operations	108.29	259.25	16.23	168.13	28.06
Total	**313.10**	**267.74**	**24.54**	**168.49**	**43.03**

Almost all rainfall in Ventura County occurs during the winter and early spring (November through April). Summer rainfall is normally restricted to scattered thundershowers in lower elevations, and somewhat heavier activity in the mountains associated with influx of tropical air. Occasionally, these showers may reach the coastal zone.

Since the sea breeze is typically stronger than the land breeze, the net wind flow during the day is from west to east. Under light land-sea breeze patterns, recirculation of pollutants can occur as emissions move westward during morning hours, and eastward during the afternoon. This can cause a build-up of pollutants over several days, as well as interbasin transport.

In Ventura County, weather is typically mild with fog and low clouds common in the summer. At Point Mugu, where official cloud cover records are available, the cloudiest month of the year is June, while the clearest month is November. Point Mugu averages 45 percent clear skies, 18 percent partly cloudy skies, and 36 percent cloudy skies during the year. Inland locations typically have a lower percentage of cloud cover than coastal areas.

B - Attainment Status

Ventura County is considered a *nonattainment area* for the state ambient O_3 and PM_{10} standards, and a *severe nonattainment area* for the federal O_3 standard. Lack of available data for visibility reducing particles, hydrogen sulfide, and vinyl chloride has resulted in an "unclassified" attainment status for these three air contaminants for the state ambient air quality standards. The county is designated as an *attainment area* for other federal and state ambient air quality standards.

C - Existing Emissions

Emission sources at NAS Point Mugu include aircraft operations, motor vehicle use, and various stationary sources. Stationary sources include aircraft engine tests cells, stationary engines used for generators and compressors, fuel storage and handling facilities, boilers, and gasoline stations. Missile and target launches were accounted for in estimates of Sea Range emissions (Section 3.2.2) and are not included in this section.

Summaries of aircraft emissions are shown in Table 3.2-5. The aircraft emissions estimates were based on 1996 emissions estimates in addition to emissions associated with the realignment of four E-2 squadrons to NAS Point Mugu (Southwest Division 1998). Emission estimates were based on emission factors obtained from the Navy's Aircraft Environmental Support Office (AESO).

Table 3.2-5. Aircraft Operations Emissions at NAS Point Mugu

	Emissions, tons/year				
Aircraft	**CO**	**NO_x**	**ROG/HC**	**SO_x**	**PM_{10}**
P-3	4.95	17.06	2.23	1.19	4.97
C-130	8.50	27.11	3.60	1.91	8.03
C-12	0.00	0.00	0.00	0.00	0.00
A-7	0.00	0.00	0.00	0.0	0.00
F-86	0.00	0.00	0.00	0.00	0.00
A-3	0.00	0.00	0.00	0.00	0.00
A-6	0.00	0.00	0.00	0.00	0.00
F-4	21.47	2.15	6.73	0.29	3.65
F-14	32.25	10.68	14.09	0.93	3.46
F/A-18	9.83	4.08	3.38	0.19	1.21
T-38	9.47	0.18	1.33	0.16	0.83
H-46	0.00	0.00	0.00	0.00	0.00
UH-1	0.00	0.00	0.00	0.00	0.00
206B	0.46	0.12	0.15	0.05	0.02
CV-440	0.00	0.00	0.00	0.00	0.00
H-60	0.82	0.87	0.20	0.09	0.38
CV-340	5.24	0.03	0.75	0.02	0.01
CV-580	1.26	2.97	0.42	0.22	0.95
Metroliner	0.35	0.78	0.10	0.06	0.25
General Aviation	1.83	0.01	0.05	0.00	0.00
Other Carriers	0.61	1.15	0.09	0.00	0.07
E-2	6.73	22.1	4.53	0.93	5.55
Total	**103.77**	**89.29**	**37.65**	**6.04**	**29.38**

Source: Tables D-15 and D-66 from the Final Environmental Impact Statement for the Realignment of E-2 Squadrons from MCAS Miramar (Southwest Division 1998).

Table 3.2-6 presents a summary of the baseline emissions for NAS Point Mugu, inclusive of stationary and mobile emission sources.

Table 3.2-6. Summary of Emissions at NAS Point Mugu

Emission Source Category	Emissions, tons/year				
	CO	NO_x	ROG/HC	SO_x	PM_{10}
NAS Point Mugu[1]					
Aircraft Operations	103.77	89.29	37.65	6.04	29.38
Personal Vehicle Work Trips	408.30	29.26	40.99	0.75	78.32
Government Vehicle Use	24.39	5.67	5.05	0.07	8.03
Fuel Farm, JP-8B Jet Fuel	0.00	0.00	0.00	0.00	0.00
Natural Gas Use-housing/office/industrial	0.70	1.61	0.12	0.01	0.01
Engine Test Cells	1.33	4.19	0.18	0.53	1.57
Aircraft Engine Maintenance Runups	5.69	6.30	5.48	0.34	3.93
Coating and Cleaning	0.00	0.00	3.66	0.00	0.00
Ground Support Equipment - Diesel Engines	2.41	25.42	1.86	5.20	1.76
Ground Support Equipment - Gasoline Engines	125.30	3.03	4.92	0.16	0.16
Incinerator	0.00	0.00	0.00	0.00	0.00
Fuel Farm, Aviation Gasoline	0.00	0.00	2.71	0.00	0.00
Fuel Farm, Vehicle Gasoline	0.00	0.00	1.95	0.00	0.00
Fuel Oil Boilers	0.01	0.06	0.00	0.13	0.01
Natural Gas Low NO_x Boilers	0.35	0.71	0.09	0.01	0.05
Propane Combustion	0.00	0.00	0.00	0.00	0.00
Other Natural Gas Use	0.64	3.22	0.17	0.02	0.10
Navy Exchange Gas Station	0.00	0.00	0.89	0.00	0.00
Public Works Gas Station	0.00	0.00	0.21	0.00	0.00
Lawn Mowers	nd	1.69	11.80	nd	nd
Aircraft Refueling	0.00	0.00	0.15	0.00	0.00
Aircraft Painting	0.00	0.00	0.10	0.00	0.00
Solvent Use	0.00	0.00	0.11	0.00	0.00
Abrasive Blasting	0.00	0.00	0.00	0.00	0.01
Total	**672.89**	**170.45**	**118.09**	**13.26**	**123.33**

[1] Emissions for NAS Point Mugu are based on 1996 emissions estimates in addition to emissions associated with the realignment of E-2 squadrons as calculated for the Final Environmental Statement for the Realignment of E-2 Squadrons from MCAS Miramar (Southwest Division 1998).

Note: nd = no data

Source: Tables D-16 (E-2 Engine Runups), D-18 (E-2 Ground Support Equipment - presented as either diesel or gas engine), D-20 (E-2 Miscellaneous Stationary Sources - offbase housing emissions not included), D-40 (Personnel Vehicle Emissions for E-2 Personnel - offbase vehicle use not included), D-54 (Government Vehicle Use by E-2 Squadrons), and D-63 (NAWS Point Mugu Emissions) from the Final Environmental Impact Statement for the Realignment of E-2 Squadrons from MCAS Miramar (Southwest Division 1998). Estimates of 1996 aircraft maintenance runups are based on 1990 emissions numbers reduced to reflect 1996 estimates consistent with the reduction assumptions as reflected in the E-2 FEIS as calculated by the NAS Environmental Division (S. George 1998).

3.2.4 San Nicolas Island

3.2.4.1 Ambient Air Quality

A - Climate

Meteorological and climatological information for San Nicolas Island is included in Section 3.2.2.

B - Attainment Status

San Nicolas Island has been categorized as an unclassified/attainment area by the USEPA. Due to the lack of major emitting sources on the island, in conjunction with predominantly strong winds from the northwest, the likelihood of pollutants remaining in the ambient air of the island is very low.

3.2.4.2 Emissions from Stationary Sources

Stationary sources on San Nicolas Island consist of a power plant, a gasoline refueling station and underground storage tank (UST), small boilers, several internal combustion engines, a waste incinerator, and various adhesive and sealant operations. All non-exempt emitting sources on San Nicolas Island are permitted under Ventura County Permits to Operate Numbers 5207 and 1207. The permits limit the total hourly and monthly emissions of criteria pollutants by these sources, as well as total fuel use, pounds of waste incinerated, total power produced, and amount of sealant and adhesive product used.

3.2.4.3 Emissions from Mobile Sources

Mobile sources of emissions on San Nicolas Island consist of aircraft and target operations, as well as combustion emissions from a limited number of military vehicles on the island. Table 3.2-7 shows vehicle counts from San Nicolas Island and Santa Cruz Island. The majority of vehicles are located on San Nicolas Island. Emissions from aircraft and target operations at San Nicolas Island are included with those presented for the Sea Range (Section 3.2.2).

Table 3.2-7. Vehicle Counts, San Nicolas Island and Santa Cruz Island

Vehicle Type	Vehicles at SNI/SCI (1996)	Gas Vehicles SNI/SCI (1996)	Diesel Vehicles SNI/SCI (1996)
Bus, 20 passenger, 36 passenger	2	2	0
Pick-up Truck (½T, ¾T)	30	30	0
Panel Truck	3	3	0
Van	8	8	0
Truck (1T to 1.5T)	13	13	0
Truck (2T to 2.5T)	7	4	3
Truck (5T)	1	1	0
Truck (7.5T to 10T)	2	0	2
Truck (15T)	2	0	2

Note: T = tons

3.2.5 Other Channel Islands

The Navy operates instrumentation sites at San Miguel, Santa Rosa, and Santa Cruz islands. However, the only site that generates emissions is on Santa Cruz Island.

3.2.5.1 Regional Setting, Santa Cruz Island

A - Climate

Meteorological and climatological information for Santa Cruz Island is included in Section 3.2.2, which presents an overview of climate and weather patterns for the Sea Range.

B - Attainment Status

Santa Cruz Island has been categorized as an unclassified/attainment area by the USEPA. Due to the lack of major emitting sources on the island, in conjunction with frequent strong winds, the likelihood of pollutants remaining in the ambient air of the island is very low.

3.2.5.2 Emissions from Stationary Sources

Stationary emission sources at Santa Cruz Island which are owned by the Navy include a power plant, a boiler, and a 15,000 gallon (57,000 liters) fuel storage tank (above ground). The equipment is permitted under Santa Barbara County APCD Permits to Operate Numbers 9195 and 8362. The permits limit the total hourly and yearly emissions of criteria pollutants by these sources, as well as pounds of waste incinerated and type of fuel used.

3.2.6 Summary of Baseline Air Emissions

Table 3.2-8 presents a summary of the overall baseline air emissions estimated for the Sea Range, NAS Point Mugu, San Nicolas Island, and Santa Cruz Island.

Table 3.2-8. Summary of Baseline Air Emissions

	Emissions, tons/year				
Location	**CO**	**NO_x**	**ROG/HC**	**SO_x**	**PM_{10}**
Sea Range	313.10	267.74	24.54	168.49	43.03
NAS Point Mugu	672.89	170.45	118.09	13.26	123.33
San Nicolas Island	33.92	151.75	11.45	5.17	11.65
Santa Cruz Island	0.30	0.45	0.07	0.19	0.16
Total	**1,020.21**	**590.39**	**154.15**	**187.11**	**178.17**

3.3 NOISE

3.3.1 Introduction

3.3.1.1 Definition of Resource

Noise is defined as any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, diminishes the quality of the environment, or is otherwise annoying. Response to noise varies by the type and characteristics of the noise source, distance between source and receptor, receptor sensitivity, and time of day. Noise may be intermittent or continuous, steady or impulsive, and may be generated by stationary sources such as industrial plants or by transient sources such as automobiles and aircraft. Noise receptors can include humans as well as terrestrial and marine animals. Of specific concern to this EIS/OEIS are potential noise effects on humans, marine mammals, birds, and fish (to the extent that noise introduced to the sea can affect catchability). Each receptor has higher or lower sensitivities to sounds of varying characteristics. Information specific to the noise receptors of concern (e.g., fish, marine mammals, etc.) is provided in other sections of this EIS/OEIS as appropriate. This section focuses primarily on noise from airborne sources.

Due to the complex characteristics of sound, a variety of metrics (or units) are necessary to describe the noise environment in specific conditions. A description of the characteristics of airborne and underwater noise, as well as the noise metrics used in this EIS/OEIS, is provided in Appendix D, Overview of Airborne and Underwater Acoustics. Noise metrics used in the impact analyses are referenced as appropriate within the resource sections of Chapter 4.

3.3.1.2 Regional Setting

A - Point Mugu Sea Range

Noise sources in the Point Mugu Sea Range are transitory and widely dispersed. The Sea Range covers very little land area (refer to Figure 1-2). Few structures occur within areas encompassed by the range (primarily located on San Nicolas Island), and no public communities are established beneath Sea Range airspace that are subject to routine aircraft overflight. Airborne noise sources include civilian and military aircraft, both of which fly at altitudes ranging from hundreds of feet to tens of thousands of feet above the surface.

B - Point Mugu

NAS Point Mugu is surrounded by lands designated generally as residential, commercial, industrial, community services, open space, agriculture, and undeveloped. These surrounding areas are subject to noise from civilian and military aircraft operations, automobile traffic, and construction activities. Aircraft noise tends to be the dominant noise source in areas immediately adjacent to airfields and beneath primary flight corridors. Noise levels and land use compatibility in these areas are addressed in the Air Installation Compatible Use Zone (AICUZ) program. NAS Point Mugu released the installation's original study in 1977. Since that time, land development in surrounding communities has continued, and NAS Point Mugu has reevaluated its contribution to the noise environment by conducting aircraft noise surveys and land use studies. An update to the AICUZ study was conducted in 1992 (U.S. Navy 1992). Subsequently, an EIS prepared for the realignment of E-2 squadrons to NAS Point Mugu characterized noise levels associated with airfield operations. The resulting noise contours are based on 1996 operational data plus the additional E-2 operations (about 20,767 aircraft operations per year).

3.3.1.3 Region of Influence

The ROI for airborne noise includes all areas of the Sea Range where aircraft or aero-vehicle noise is emitted, especially areas where concentrated or routine aircraft activity occurs. This includes areas at and surrounding NAS Point Mugu that are exposed to noise from aircraft activity associated with the NAS Point Mugu airfield. Portions of the City of Oxnard, Ventura County, and the City of Camarillo lie within the ROI. Noise levels have been estimated for all range areas to provide a basis for comparison to standards typically used in characterizing a land-based noise environment that is typified by infrequent, but potentially loud, overflights.

3.3.2 Point Mugu Sea Range

Airborne noise in the Sea Range is created by subsonic and supersonic flight activity of aircraft, aerial targets, and missiles. Airborne noise introduced by surface vessels is negligible compared to noise introduced by low-flying aircraft and targets. Consequently, airborne noise levels calculated for the Sea Range are addressed with respect to aircraft, aerial targets, and missiles only.

Aircraft assigned to NAWCWPNS are the most prevalent noise sources operating in the Sea Range. Although the Sea Range hosts nearly every type of aircraft in the DoD aircraft inventory, more than 90 percent of annual aircraft activity is accounted for by aircraft affiliated with the test squadrons. Table 3.3-1 lists aircraft using the Sea Range most often.

Table 3.3-1. Typical Sea Range Aircraft

Aircraft	No. at NAS Point Mugu	Type	Flight Speeds
QF-4	12	Fixed-wing jet + A/B	Subsonic and supersonic
F-14	7	Variable sweep-wing jet + A/B	Subsonic and supersonic
F/A-18	0	Fixed-wing jet + A/B	Subsonic and supersonic
EA-6B	0	Fixed-wing jet	Subsonic
AV-8B	0	Fixed-wing jet	Subsonic
S-3	0	Fixed-wing jet	Subsonic
NP-3D	5	Fixed-wing turboprop	Subsonic
Helicopters	5	Rotary-wing turboshaft	Subsonic

Source: NAWCWPNS Point Mugu 1996m, 1998d.

Aerial targets available to Sea Range users include full-scale (fixed-wing and rotary-wing aircraft) and sub-scale subsonic and supersonic targets. Targets are powered by rocket motors, jet engines, or a combination of both. Noise characteristics of the targets or target launch platforms are discussed below for subsonic and supersonic flight conditions.

3.3.2.1 Subsonic Noise

The L_{dn} noise metric is best suited for predicting noise levels in areas where noise-generating activities occur routinely and are part of the daily community noise environment (refer to Appendix D). Aircraft activities in special use airspace generally tend to be random and sporadic. To account for the unique nature of military aircraft operations in these areas (e.g., high speed, low-altitude), the USAF developed the L_{dnmr} sound measurement. Like the L_{dn} noise metric, L_{dnmr} incorporates a 10 dB penalty for those noise events occurring between 10:00 p.m. and 7:00 a.m., and represents average noise levels dominated by the loudest noise events occurring throughout the averaging period.

The Point Mugu Sea Range has been divided into range areas to facilitate tracking, planning, and coordination of range activities. Noise levels were calculated separately for each airspace element, or range area. The range activities vary from one range area to another, even for adjacent airspaces. Therefore, calculations of noise levels may yield differing results for adjacent airspace elements, depending on the type, level, and frequency of test and training events in each airspace unit.

Noise levels resulting from aircraft operating in the Sea Range were calculated with the DoD noise modeling program MR_NMAP using the L_{dnmr} metric. Resulting noise levels were calculated based on the number of sorties, time of day the sorties occurred, altitudes of the aircraft during the sorties, and power settings of the aircraft. Nearly 4,000 baseline aircraft sorties were modeled, based on aircraft activity documented in Sea Range scheduling reports (refer to Section 3.0, Current Activities). Scheduling reports detail the range areas that an aircraft may enter during an exercise. Since one sortie can involve an aircraft flying through many range areas, assumptions were made regarding the amounts of time an aircraft would spend in each airspace area during any given sortie.

Throughout a given year, aircraft and targets are involved in air-to-air and air-to-surface tests and exercises. During air-to-air exercises, aircraft and targets tend to operate at higher altitudes; lower altitudes are used most often for air-to-surface events. For noise modeling purposes, aircraft are assigned to specified altitudes for varying time periods reflecting the changes in altitude an aircraft may require to complete an exercise.

Table 3.3-2 presents the average operational parameters reflected in the noise modeling effort for those aircraft whose contributions to the existing noise environment on the Sea Range are clearly dominant. The altitude bands are given with the assumption that the upper and lower boundaries of an airspace encompass the range of altitudes expected to be flown by each aircraft. Based on these assumptions, Table 3.3-3 presents the existing noise levels under each range area. These noise levels are shown graphically in Figure 3.3-1.

Table 3.3-2. Typical Aircraft Operating Parameters

		% of Time at Altitudes in Sea Range				
Aircraft	Time/Sortie (minutes)	0 - 1,000 feet AGL	1,000 - 5,000 feet AGL	5,000 - 10,000 feet AGL	10,000 - 20,000 feet AGL	20,000+ feet AGL
F-4	120	10	35	15	25	15
F-14	120	10	35	15	25	15
F/A-18	120	10	35	15	25	15
EA-6B	120	10	35	15	25	15
AV-8B	120	10	35	15	25	15
S-3	120	10	35	15	25	15
P-3	120	10	60	30	0	0
Helicopters	120	10	60	30	0	0

AGL = Above Ground Level

Subsonic targets operating within the Sea Range are powered by small non-afterburning jet engines producing about 240 pounds (1,100 newtons) of thrust for a BQM-74E, and about 2,000 pounds (8,900 newtons) of thrust for a BQM-34S. In comparison, an F-14 has two afterburner-equipped jet engines, each producing about 21,000 to 27,000 pounds (93,000 to 120,000 newtons) of thrust. The smaller BQM-74E is generally used at altitudes lower than 1,000 feet (300 m). The larger, more powerful BQM-34S is used most often above 10,000 feet (3,000 m), and used about one third of the time at altitudes

Table 3.3-3. Existing Average Subsonic Sound Levels by Range Area[1]

Range Area	Distributed Sound Level (L_{dnmr})
3A (W-289)	52.8
3B (W-289)	54.5
3D (W-289)	52.2
3E (W-289)	58.5
3F (W-289)	58.6
4A (W-289)	60.6
4B (W-289)	63.3
5A (W-289)	60.3
5B (W-289)	60.1
5C (W-532)	57.4
5D (W-532)	55.5
6A (W-289)	56.6
6B (W-289)	56.6
6C (W-532)	58.4
6D (W-532)	55.3
7A (W-289)	48.2
7B (W-289)	48.5
7C (W-532)	59.1
7D (W-532)	52.6
8A (W-532)	56.1
M1 (W-532)	57.1
M2 (W-532)	58.0
M5 (W-289)	60.9
W-289 W-412	57.0
W-289N	61.5
W-290	52.6
W-537	49.1
W-60	58.8
W-61	48.0

[1]Based on assumptions presented in Table 3.3-2 and data in Table 3.0-11.

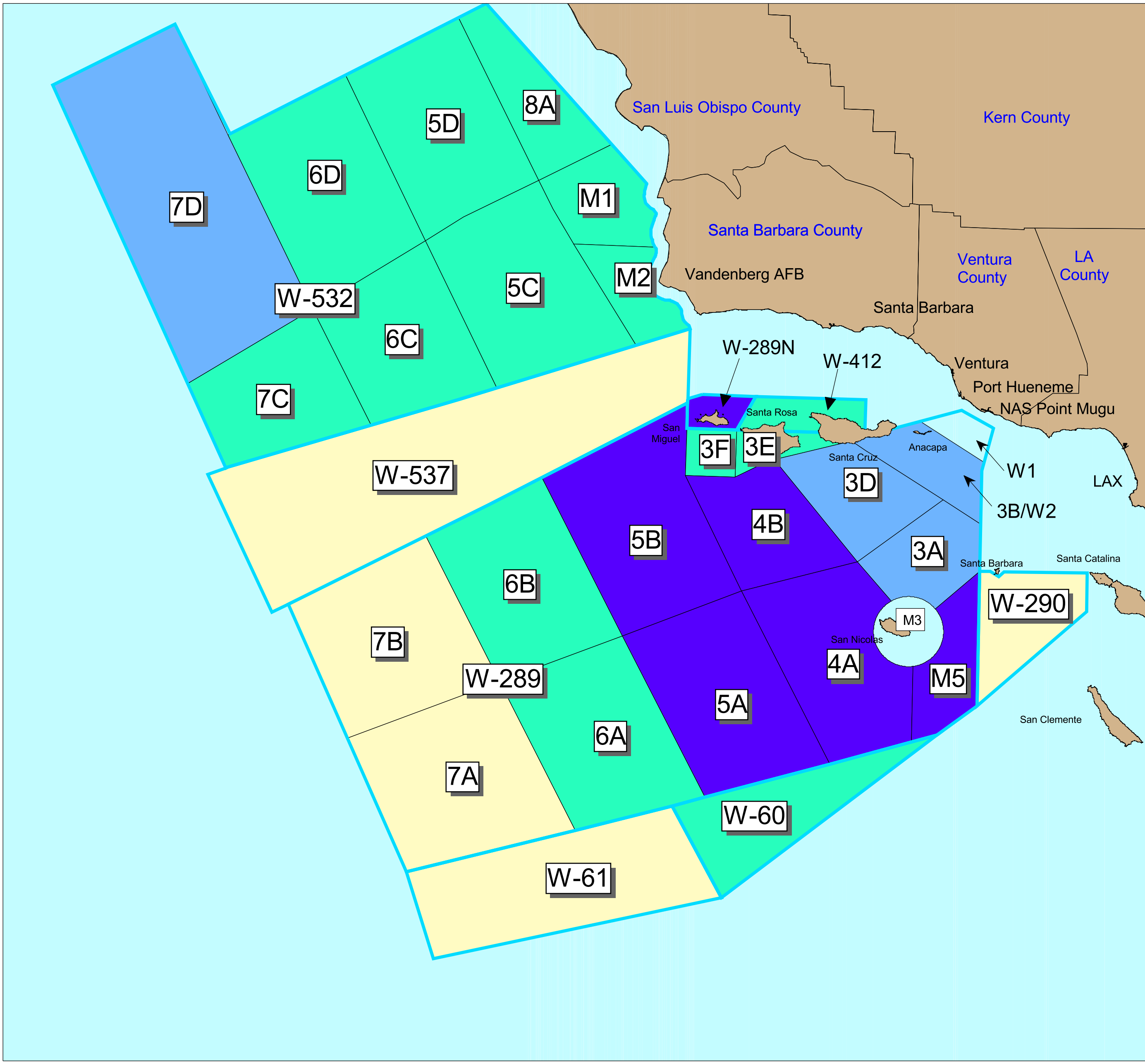
below 1,000 feet (300 m). Sound exposure level (SEL) values (refer to Appendix D) for aerial targets are unavailable. However, given the limited engine size and lack of afterburner, SEL values are considerably less for subsonic targets than those for aircraft commonly using the Sea Range. Further, aerial targets are airborne for a maximum of about 90 minutes during an exercise whereas full-scale aircraft can remain in flight for several hours. Thus, noise introduced to the Sea Range from targets would add negligible fractions to the noise levels calculated for full-scale aircraft.

The USAF aircraft noise database was used to obtain overall noise levels and SEL values for reception of noise just above the surface from aircraft overflights at 200 feet (60 m), rather than the standard altitude of 1,000 feet (300 m). The results are shown in Table 3.3-4.

3.3.2.2 Supersonic Noise

Supersonic aircraft flights on the Sea Range are usually limited to altitudes above 30,000 feet (9,100 m) and/or locations more than 30 NM (56 km) from shore. Supersonic, low-lying targets launched from San Nicolas Island fly west or northwest out over the Sea Range. Detailed data on locations of supersonic flights of aircraft on the Sea Range are unavailable. Therefore, supersonic activity is characterized based on single event parameters for F-4, F-14, and F/A-18 aircraft and supersonic missiles and targets.

Average Noise Levels on the Point Mugu Sea Range (Baseline)



Distributed Sound Level (L_{dnmr})

- 45 - 50 dB
- 50 - 55 dB
- 55 - 60 dB
- 60 - 65 dB

N S E W

50 0 50 Nautical Miles

Projection: Universal Transverse Mercator
North American Datum 1927
Zone 11

Figure 3.3-1

Table 3.3-4. Airborne Noise Parameters near Surface, in dB re 20 µPa, for Aircraft Overflight at 200 feet

Aircraft	Power Set.	Speed Kts	Max dB	Max dBA	F-SEL dB	A-SEL dB
F-4C	A/B 100%	300	133	130	134	131
F/A-18	A/B 96.7%	250	136	132	137	133
F-16	A/B 105%	450	135	131	134	130
F-14A	A/B 102%	510	129	125	128	124
F-14B	A/B 115%	570	131	127	131	127
A-6	100% RPM	250	127	125	127	125
AV-8B	96% RPM	445	116	114	121	119
P-3A	2000 ESHP	180	109	102	110	103
S-3A	97% RPM	250	115	115	115	115
C-130E	T/O	170	111	99	114	102
E-2[1]	2000 ESHP	180	NA	99	NA	NA
AH-1G	LND LITE	40	108	97	115	104
AH-1G	LFO LITE	100	102	93	112	103
OH-58	LND LITE	40	92	84	104	96
UH-1N	100% RPM	80	101	91	112	102

[1] The simulated dBA time histories for 2-engine E-2 aircraft were assumed to be 3 dBA lower than those for the 4-engine P-3 aircraft (Southwest Division 1998); P-3 and E-2 aircraft use the same engine model. This is consistent with general acoustical theory, in that doubling the number of collocated noise sources increases overall noise levels by 3 dBA.

Several factors influence sonic booms: weight, size, shape of aircraft or vehicle; altitude; flight paths; and weather or atmospheric conditions. A larger and heavier aircraft must displace more air and create more lift to sustain flight, compared with small, light aircraft. Therefore, larger aircraft create sonic booms that are stronger and louder than those of smaller, lighter aircraft. Consequently, the larger and heavier the aircraft, the stronger the shock waves will be.

Of all the factors influencing sonic booms, increasing altitude is the most effective method of reducing sonic boom intensity. The width of the boom "carpet," or area exposed to sonic boom beneath an aircraft, is about 1 mile (1.6 km) for each 1,000 feet (300 m) of altitude. For example, an aircraft flying supersonic at 50,000 feet (15,000 m) can produce a sonic boom carpet about 50 miles (80 km) wide. The sonic boom, however, will not be uniform. Maximum intensity is directly beneath the aircraft, and decreases as the lateral distance from the flight path increases until shock waves refract away from the ground and the sonic boom attenuates. The lateral spreading of the sonic boom depends only upon altitude, speed, and the atmosphere, and is independent of the vehicle's shape, size, and weight. The ratio of aircraft length to maximum cross sectional area also influences the intensity of the sonic boom. The longer and more slender the aircraft, the weaker the shock waves. The wider and more blunt the vehicle, the stronger the shock wave can be.

Sonic booms are generated as aircraft reach Mach 1.0 and increase in intensity as the Mach number increases. Increasing speeds above Mach 1.3 result in only small changes in shock wave strength. The direction of travel and strength of shock waves are influenced by wind, speed, direction, air temperature, and pressure. At speeds slightly greater than Mach 1.0, the effect of these factors can be significant, but their influence is small at speeds greater than Mach 1.3. Therefore, supersonic flight activity has been characterized for Sea Range aircraft capable of supersonic flight at a fixed speed of Mach 1.3 and at various altitudes in standard atmospheric conditions. Supersonic activity was modeled using PCBOOM3 (AAMRL 1996), a DoD single-event sonic boom program that calculates sonic boom signatures. Results of supersonic activity modeling efforts are presented in Table 3.3-5 for both maximum and minimum

Table 3.3-5. Maximum and Minimum Overpressures on the Sea Range

Airframe	Boom Overpressure (psf)									
	Altitude (MSL)									
	10,000 feet		5,000 feet		1,000 feet		500 feet		100 feet	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
F-4	5.5	2.1	9.8	3.1	31.1	6.0				
F-14	5.7	2.2	10.0	3.2	32.0	6.1				
F/A-18	5.2	2.0	9.1	2.9	28.8	5.5				
Missile Target							19.5	3.6	51.7	7.2

Source: Ogden 1997.

overpressures. Maximum values represent sonic boom characteristics directly beneath the flight trajectory and minimum values represent the lateral sonic boom boundary.

3.3.3 Point Mugu

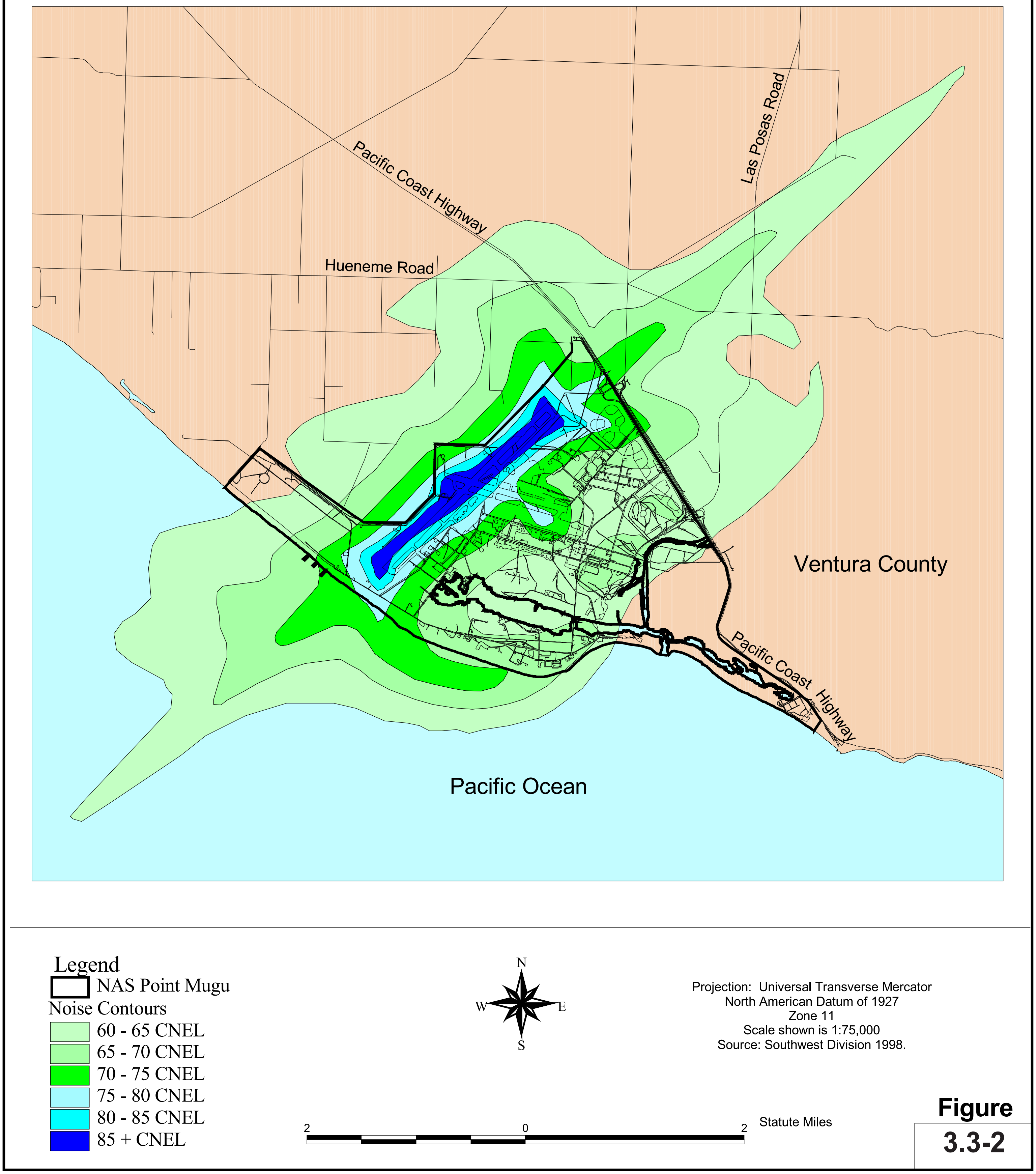
3.3.3.1 Noise from Aircraft Operations

NAS Point Mugu has supported nearly every type of aircraft in the DoD aircraft inventory. It has served as a home station for a wide variety of attack, fighter, surveillance, transport, and training aircraft in addition to several types of helicopters. In 1977, an AICUZ Study was conducted to characterize the noise environment surrounding NAS Point Mugu. Since 1977, the types of aircraft using NAS Point Mugu have remained nearly constant. However, the tempo (rate) of use by individual aircraft types has fluctuated. In 1992, a second AICUZ Study was prepared to address new missions, increased land development in areas near the base, construction of engine testing cells, modifications of flight tracks, and collocation of a California Air National Guard aircraft squadron. Subsequently, an EIS prepared for the realignment of E-2 squadrons to NAS Point Mugu characterized noise levels associated with airfield operations. The resulting noise contours are based on 1996 operational data plus the additional E-2 operations (about 20,767 aircraft operations per year).

At NAS Point Mugu, noise levels from flight operations exceeding ambient background noise typically occur only beneath main approach and departure corridors and in areas immediately adjacent to parking ramps and aircraft staging areas. As aircraft take off and gain altitude, their contribution to the noise environment drops to levels indistinguishable from the ambient background. The height at which the noise becomes indistinguishable varies depending on the aircraft and meteorological conditions.

Land use guidelines help determine acceptable levels of human noise exposure for various types of land use surrounding airports; 65 CNEL noise contours are frequently used to help determine compatibility of aircraft operations with local land use. Figure 3.3-2 presents the 60 CNEL to 80 CNEL noise contours in 5 dB increments at NAS Point Mugu and the surrounding areas. The offbase acreage exposed to CNEL values above 65 is about 1,800 acres (730 hectares). Most of this area is located under the approach and departure routes to the north (onshore) and south (offshore) of the base; a portion also occurs along the western base boundary.

Existing Noise Contours at NAS Point Mugu



Projection: Universal Transverse Mercator
North American Datum of 1927
Zone 11
Scale shown is 1:75,000
Source: Southwest Division 1998.

Figure 3.3-2

3.3.3.2 Noise from Missile and Target Launches

Missile and target launches at NAS Point Mugu are conducted at the Building 55 Launch Complex (refer to Figure 2-3a). Sound measurements were recorded for a BQM-34 target launch from Building 55 (NAWCWPNS Point Mugu 1998c). The results are shown in Table 3.3-6. This target is typical of the aerial targets and some of the surface-to-surface missiles launched from NAS Point Mugu. Of the 50 launches that occurred in the baseline year, nearly half (22) were BQM-34s. The remainder were BQM-74s, which is a smaller target – about half the size of a BQM-34 (refer to Figure 3.0-8). The closest points of approach (CPAs) for the measurements ranged from as close as 50 feet (15 m) near Building 55 to as far as 1,200 feet (370 m) along Beach Road. The A-weighted sound pressure levels (SPLs) observed for the BQM-34 ranged from 92 dB re 20 µPa at the 1,200-foot (370-m) CPA to 145 dB re 20 µPa at the 50-foot (15-m) CPA.

Table 3.3-6. BQM-34 Measured Launch and Overflight Noise (A-Weighted)

Location	Range (feet)	Duration (sec)	Peak (dB re 20 µPa)	SPL (dB re 20 µPa)	SEL (dB re $[20\ \mu Pa]^2 \cdot s$)
JATO Bottle Noise (from launch)					
Bldg. 55 (launch pad)	50	0.56	161.36	144.70	142.19
940 feet SW of launch	200	2.11	126.27	109.50	112.75
2,400 feet SW of launch	2,600	1.38	111.14	97.88	99.27
3,000 feet SW of launch	2,800	1.30	115.38	100.69	101.84
Jet Engine Noise (from flyover)					
2,400 feet SW of launch	300	3.80	108.31	93.36	99.16
3,000 feet SW of launch	1,200	6.68	100.25	83.95	92.20

Source: NAWCWPNS Point Mugu 1998c.

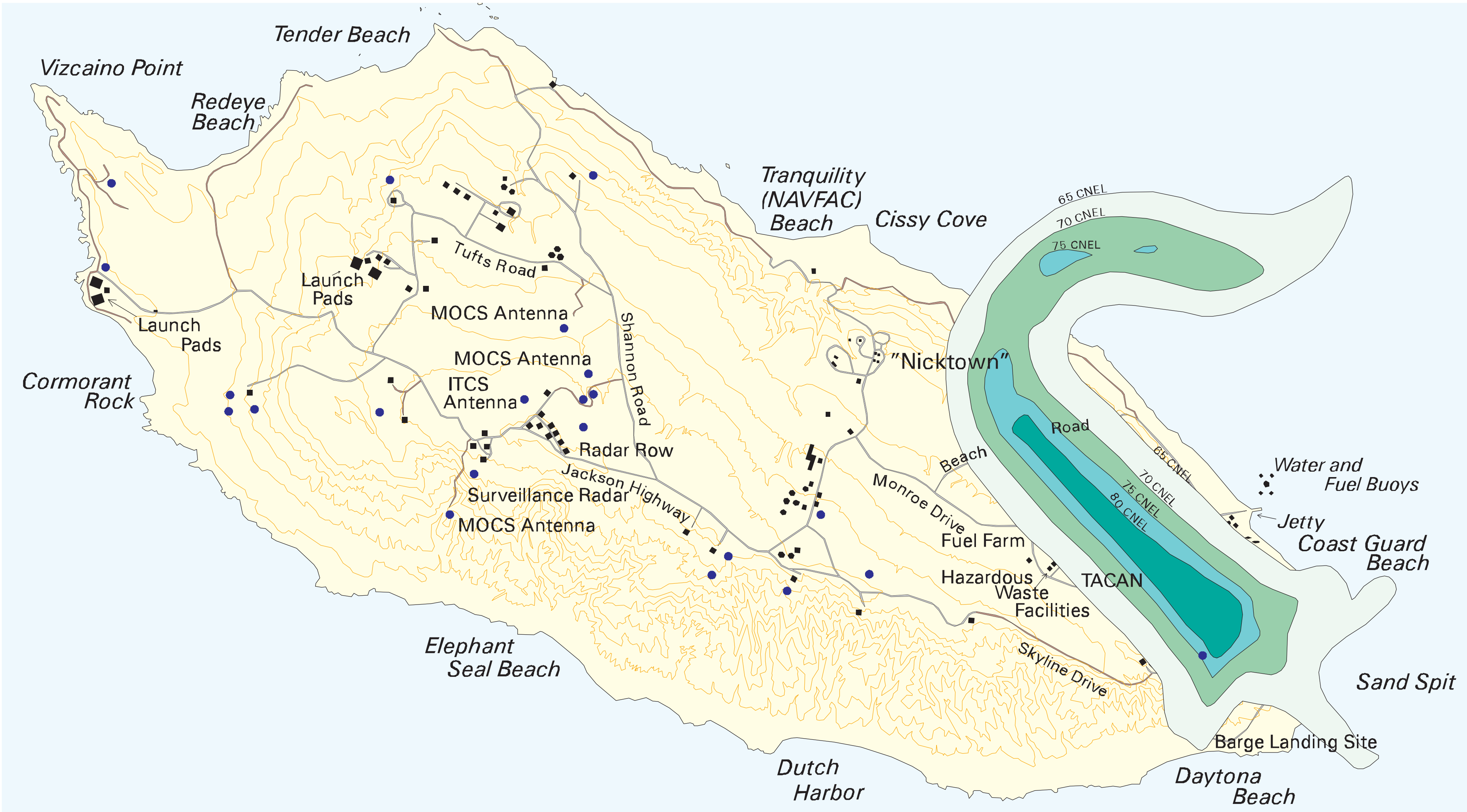
3.3.4 San Nicolas Island

3.3.4.1 Noise from Aircraft Operations

The San Nicolas Island airfield is owned, operated, and maintained by the Navy. It serves as a primary staging area for remote controlled flights conducted by F-4 aircraft. Commuter-type aircraft use the airfield several times each day, transporting personnel to and from NAS Point Mugu. Since no year-round human residents occupy areas near the airfield, AICUZ studies have not been performed. Without performing a rigorous AICUZ noise analysis, baseline noise conditions were assumed to be dominated by F-4 aircraft activity. Any noise contour produced for the airfield would show high noise levels on or immediately adjacent to the runway. These maximum noise levels would be consistent with the noise contours developed for NAS Point Mugu; however, each contour area would be much smaller considering the limited numbers of flights occurring at San Nicolas Island. Maximum noise levels experienced at the island would depend on the proximity of aircraft during an overflight and would be consistent with SEL values calculated for the specific aircraft. Figure 3.3-3 shows estimates of baseline average noise levels at San Nicolas Island, based on the average busy day estimate presented in Table 3.3-7.

Aircraft overflights in support of test operations occur at various locations away from the airfield at San Nicolas Island (NAWCWPNS Point Mugu 1998b). Measurements were conducted for F/A-18 overflight sounds at San Nicolas Island on 5 November 1997. The flights simulated "captive carry" sorties with the Standoff Land Attack Missile (SLAM) AGM-84E, typically flown at airspeeds of 300 to 500 knots (560 to 930 km per hour). ("Captive carry" refers to flights on which the SLAM missile is carried over the

Estimated Existing Noise Contours at San Nicolas Island (Baseline)



Legend

San Nicolas Island
Pacific Ocean
Structures
Instrumentation

Existing Noise Contours
65 - 70 CNEL
70 - 75 CNEL
75 - 80 CNEL
80 - 85 CNEL

N W E S

1 0 1
statute miles

Projection: Universal Transverse Mercator, Zone 11
North American Datum of 1927
Scale shown is 1:60,000
Source: Ogden 1997.

Figure 3.3-3

sninoise.aml

Table 3.3-7. Average Busy Day at San Nicolas Island Airfield[1]

Aircraft	Arrivals	Departures	Closed Loop Patterns
CV-440 commuter	3	3	0
CV-580 commuter	1	1	0
C-130	1	1	2
F-4	1	1	2
UH-1 helicopter	1	1	0

Notes:
Runway split = 95% RW 30 and 5% RW 12
All patterns on RW 12 are left hand.
All patterns on RW 30 are right hand.
[1]Average busy day aircraft activity at San Nicolas Island forms the basis for the noise contours shown in Figure 3.3-3.

target by the F/A-18 rather than released.) The A-weighted SPL for the loudest flyover (500 knots [930 km per hour] at 500 feet [150 m]) was 107 dB re 20 µPa. The A-weighted SEL was 109 dB re (20 µPa)^2·s.

3.3.4.2 Noise from Target Launches

Many types of missiles and targets are launched from San Nicolas Island. The largest target currently launched at the island is the Vandal missile (MQM-8). Sound measurements were conducted for two Vandal missile target launches from the Alpha Launch Complex at San Nicolas Island (NAWCWPNS Point Mugu 1998c). The A-weighted SPL observed for the Vandals ranged from 87 dB re 20 µPa at a CPA of 5,500 feet (1,700 m) to 133 dB re 20 µPa at a CPA of 230 feet (70 m). The results of these measurements are shown in Table 3.3-8.

Table 3.3-8. Vandal Target Launch Noise

Location	Range (feet)	Duration (sec)	Peak (dB re 20 µPa)	SPL (dB re 20 µPa)	SEL (dB re [20 µPa]^2·s)
Near launch pad	230	0.76	153.68	133.13	131.75
Redeye Beach	2,900	2.06	148.84	119.45	122.59
Vizcaino South[1]	3,100	0.17	140.04	118.74	110.96
Vizcaino South[2]	1,100	0.62	149.06	120.94	118.86
Bachelor Beach	5,500	4.58	109.70	87.20	93.89

[1] Measured 2 July 1997.
[2] Measured 2 December 1997.
Source: NAWCWPNS Point Mugu 1998c.

Other aerial targets are also launched from San Nicolas Island. The sound levels of these launches are similar to those described earlier for target launches at NAS Point Mugu (see Section 3.3.3.2).

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3.4 WATER QUALITY

3.4.1 Introduction

3.4.1.1 Definition of Resource

Water quality describes the chemical and physical composition of water as affected by natural conditions and human activities. For the purposes of this analysis, marine water quality is evaluated with respect to possible release of hazardous constituents from aircraft, missiles, and targets, and freshwater quality is evaluated with respect to possible release of petroleum hydrocarbon products from aircraft and motor vehicles, and sedimentation resulting from construction activities at San Nicolas Island.

Water resource regulations focus on the right to use water and protection of water quality. The principal federal laws protecting water quality are the Clean Water Act (CWA), as amended (33 U.S.C. § 1251 et seq.) and the Safe Drinking Water Act (42 U.S.C. § 300f et seq.). Both laws are enforced by the U.S. Environmental Protection Agency (USEPA 1995). The CWA provides protection of surface water quality and preservation of wetlands. The Safe Drinking Water Act is directed at protection of drinking water supplies.

At the state level, the Porter-Cologne Water Quality Control Act (California Water Code §§ 13000-13999.10) gives the State Water Resources Control Board (SWRCB) and nine Regional Water Quality Control Boards (RWQCBs) responsibility for protection of the waters within their regions. The regional boards are also responsible for implementing provisions of the CWA delegated to states, such as the National Pollutant Discharge Elimination System (NPDES), which regulates point (industrial) and non-point (storm water) sources of pollutants.

3.4.1.2 Regional Setting

The Sea Range straddles Point Conception which is considered a major geographic feature that affects marine water resources. North of Point Conception, the marine waters are under the influence of the cold, southward flowing California Current. The shape of California's coastline south of Point Conception creates a broad ocean embayment known as the Southern California Bight (SCB). The SCB encompasses the area from Point Conception south to Mexico and is influenced by two major oceanic currents: the southward flowing, cold-water California Current and the northward flowing, warm-water California Countercurrent (Figure 3.4-1). These currents mix in the SCB and strongly influence patterns of ocean water circulation and temperatures.

A significant marine water resource at Point Mugu is Mugu Lagoon. Mugu Lagoon is one of the largest salt marshes in southern California. Unlike most lagoons along the California coast, it is relatively undisturbed and provides a habitat for a diverse assemblage of marine organisms. Mugu Lagoon is regionally significant as it is one of the last lagoons left in southern California containing unique and sensitive resources.

3.4.1.3 Region of Influence

The region of influence (ROI) for marine water resources consists of the ocean waters off Point Mugu, Mugu Lagoon, and the Point Mugu Sea Range. The Sea Range extends offshore of San Luis Obispo County and includes the northern portion of the SCB. These water resources are valuable for economic, municipal, and recreational purposes, as well as for their relationship to the natural environment.

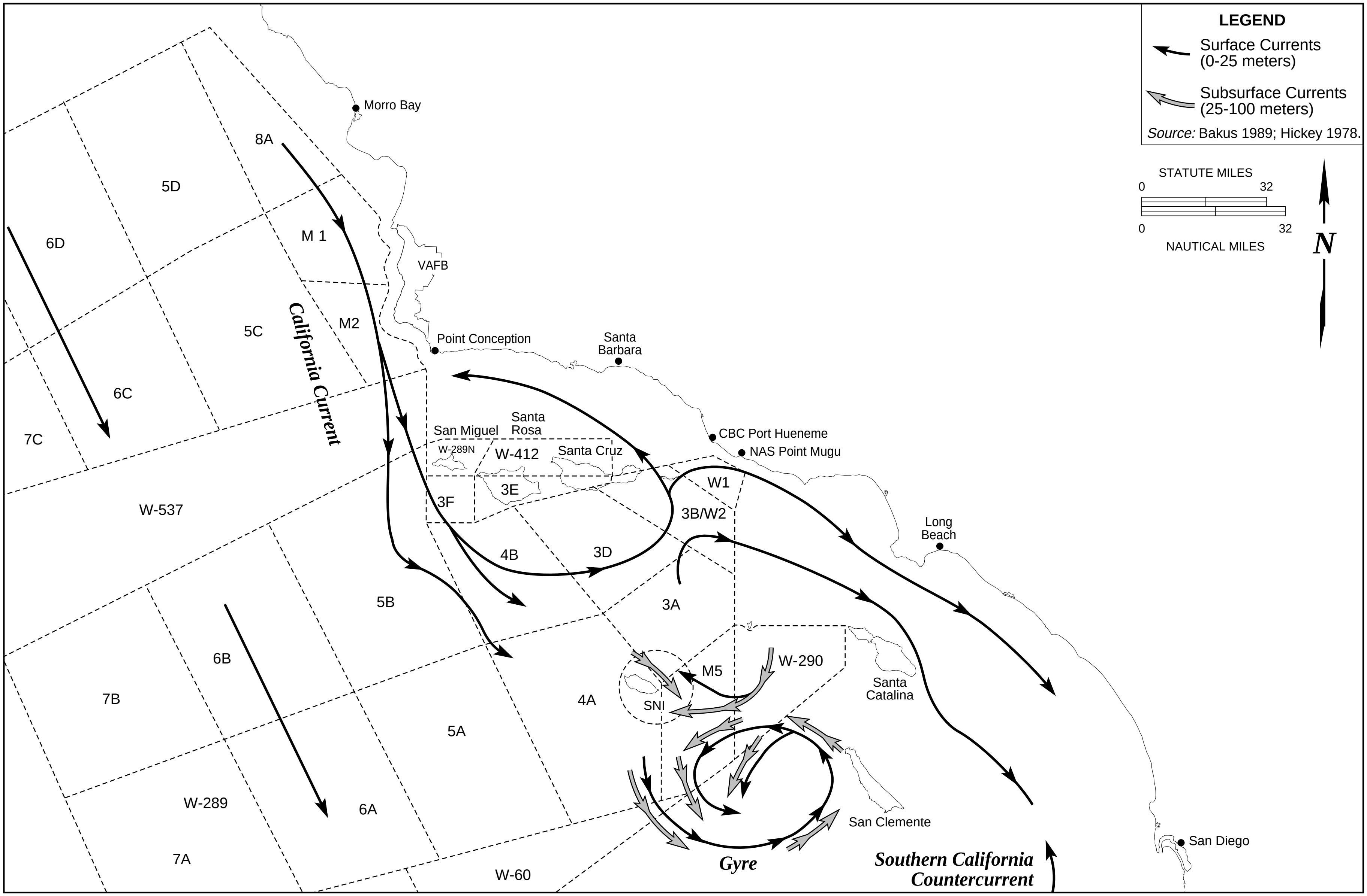


Figure 3.4-1
Ocean Circulation Patterns in the Point Mugu Sea Range

Freshwater resources include all surface water and groundwater at Point Mugu and at San Nicolas Island. Other Channel Islands where Navy support facilities are located (i.e., San Miguel Island, Santa Rosa Island, and Santa Cruz Island) are not addressed since the alternatives analyzed in this EIS/OEIS (including the No Action Alternative) would not impact freshwater resources at these sites. Freshwater resources are valuable for economic, municipal, and recreational purposes, as well as for their relationship to the natural environment.

3.4.2 Point Mugu Sea Range

3.4.2.1 General Marine Environment

A - Circulation

The Sea Range comprises the Santa Barbara Channel and Channel Islands which are located at the transition between two distinct biogeographic coastal provinces: the Oregonian and the Californian. The cold, temperate waters of the California Current flow from the north to meet the warmer waters of the California Countercurrent just south of Point Conception. These conditions influence distribution and diversity of habitats and resources throughout the area. When the cold California Current reaches Point Conception, the direction of flow carries it away from the shoreline which creates a large gyre, or eddy, in the SCB (see Figure 3.4-1). The return flow of this gyre, the California Countercurrent, moves waters from southeast to northwest, through the southern Channel Islands toward the mainland. The resulting gyres and eddies affect the distribution of marine fauna and flora leading to the presence of both cold and warm temperature species which thrive in the transition zone, and overlap in their distributions. There are also cyclical activities which contribute to the diversity of marine life. An upwelling current (where nutrient-rich deep waters are drawn to the surface) in the SCB occurs from February or March through August. High nutrient levels combined with increasing day length and light intensity produce exceptionally high phytoplankton and algae production. This increase in food supply supports even greater numbers of fish, shellfish, and other marine life.

B - Marine Water Characteristics

Water quality in the marine environment is determined by a complex set of interactions between chemical and physical processes operating continuously in the ocean system. This dynamic equilibrium can be represented by a variety of indicators including temperature, salinity, dissolved oxygen, and nutrient levels. The following discussion characterizes in general terms the major determinants of marine water quality in the SCB.

Temperature

Surface temperatures are affected by atmospheric conditions and tend to fluctuate along lines of latitude. Surface temperatures of waters along the coast of the SCB range from approximately 54° F (12° C) in the winter to 70° F (21° C) in the summer. Surface water temperatures can show seasonal variation in association with upwelling, climatic conditions, and latitude (Tait 1980).

Chemical Characteristics

Pertinent chemical features associated with marine water quality include hydrogen ion concentration (pH), dissolved oxygen, and nutrients. The majority of ions present in seawater consist of sodium, chloride, potassium, calcium, magnesium, and sulfate.

The marine environment has a high buffering capacity due to the presence of dissolved elements, particularly carbon and hydrogen. Most of the carbon in the sea is present as dissolved inorganic carbon that originates from the complex equilibrium reaction of dissolved carbon dioxide (CO_2) and water. This carbon dioxide-carbonate equilibrium system is the major buffering system in seawater which maintains a pH between 7.5 and 8.5.

Surface waters are usually saturated or supersaturated with dissolved oxygen as a result of photosynthetic activity and wave mixing. Dissolved oxygen levels at the surface fluctuate between 5.4 and 5.9 milliliters per liter (ml/L) (over 100 percent oxygen saturation), while levels at depths below the surface remain more constant between 0.4 and 0.6 ml/L (California Cooperative Fisheries Investigation [CALCOFI] 1982).

Nutrients are chemicals or elements necessary for production of organic matter. Major nutrients include dissolved nitrogen, phosphates, and silicates. Dissolved inorganic nitrogen occurs in ocean water as nitrates, nitrites, and ammonia, with nitrates as the dominant form. The nitrate concentration of water in the nearshore California Current varies annually from 0.1 to 10.0 micrograms per liter (µg/L). The lowest concentrations typically occur in the summer months. At a depth of 33 feet (10 m), concentrations of phosphate and silicate in the California Current typically range from 0.25 to 1.25 µg/L and 2 to 15 µg/L, respectively.

<u>C - Marine Sediments and Bathymetry</u>

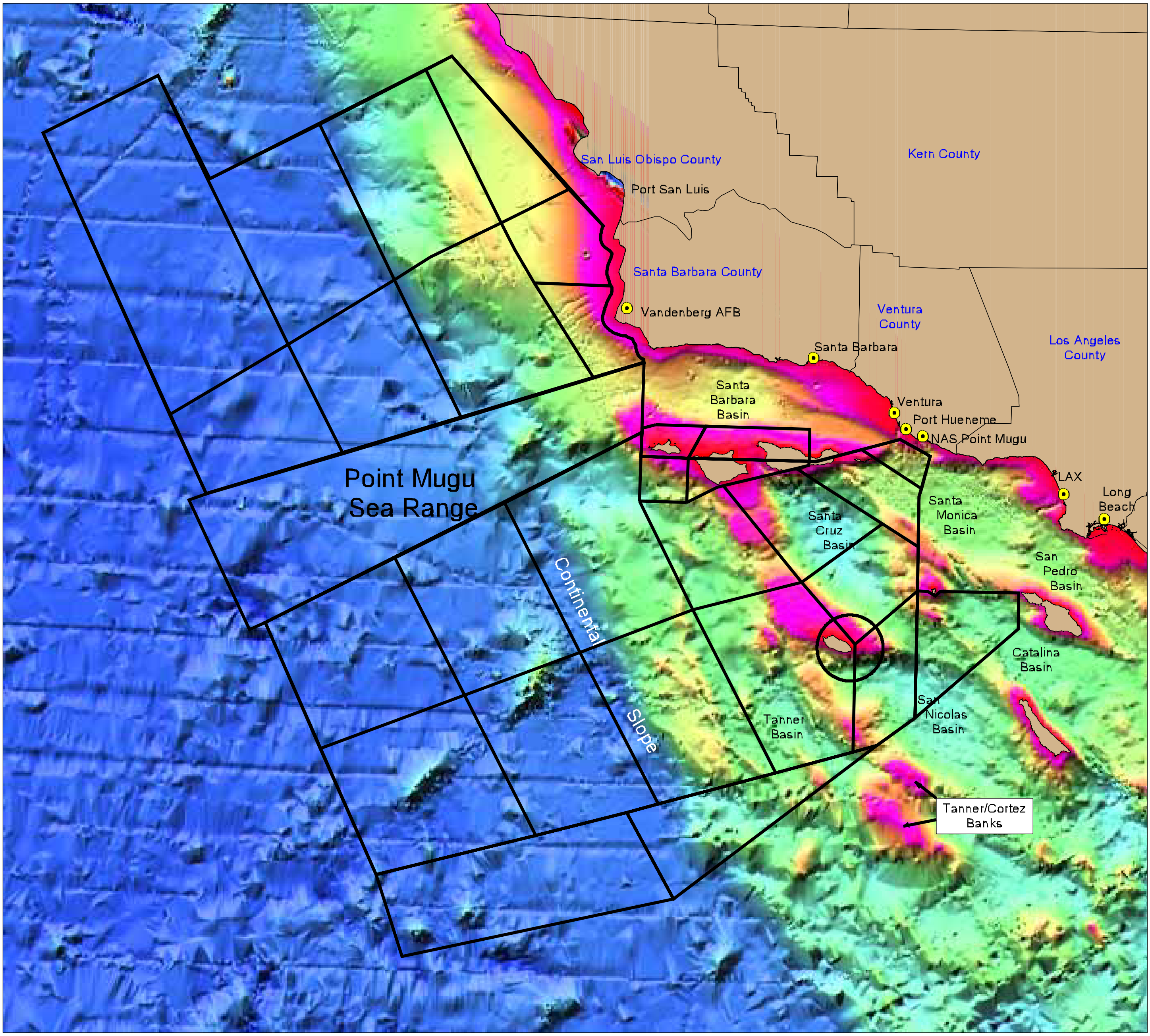
Much of the ocean floor in the northern portion of the SCB consists of the Santa Barbara, Santa Cruz, and Santa Monica basins (U.S. Department of Commerce 1980). The Santa Barbara Basin has a relatively gradual slope that reaches depths of 1,970 feet (600 m). The relatively wide Santa Monica Basin has an irregular shape, complicated by the presence of two submarine canyons, which have depths that exceed 2,300 feet (700 m). The Santa Cruz Basin also has a submarine canyon that reaches depths greater than 4,920 feet (1,500 m). North of Point Conception, the ocean floor consists of the continental shelf and slope that reaches depths exceeding 9,800 feet (3,000 m). The sediment types in these areas are generally composed of 35 to 85 percent fines (silts and clays) and 15 to 65 percent sand. There does not appear to be any significant trends in sediment distribution with respect to size, water depth, or distance offshore (SAIC and MEC 1995).

An important feature of the SCB and the northern Channel Islands is the accentuated bottom relief and varied bottom substrate. The northern Channel Islands are actually peaks of extensive offshore ridges. A relatively shallow island shelf extending to a depth of about 330 feet (100 m) surrounds the islands, usually extending from 3 to 6 NM (6 to 11 km) from the island coast. At this depth the bathymetry either plunges steeply to a deep coastal basin perhaps 1,640 to 2,460 feet (500 to 750 m) in depth or slopes more gradually to the peak of submerged ridges perhaps 600 to 1,150 feet (180 to 350 m) in depth (Figure 3.4-2). Figure 3.4-3 shows the shallow waters of the Sea Range in the vicinity of the northern Channel Islands.

3.4.2.2 Marine Water Quality

The SWRCB adopted the Water Quality Control Plan for Ocean Waters of California in 1974, and amendments have been made in 1988, 1990, and 1997 (SWRCB and California Environmental Protection Agency [Cal/EPA] 1997). The amended plan (The Ocean Plan) establishes beneficial uses and water quality objectives for waters of the Pacific Ocean adjacent to the California coast outside of enclosed bays, estuaries, and coastal lagoons. The Ocean Plan prescribes effluent quality requirements and management principles for waste dischargers and specific waste discharge prohibitions. It also contains a

Marine Bathymetry in the Point Mugu Sea Range



Legend

Depth (m)
- 0-50
- 50-150
- 150-200
- 200-500
- 500-1,000
- 1,000-2,000
- 2,000-4,000+

Point Mugu Sea Range

N S E W

50 0 50 Nautical Miles

Projection: Universal Transverse Mercator, Zone 11
North American Datum of 1927
Scale shown is 1:2,750,000
Source: NOAA.

Figure 3.4-2

Shallow Water Areas

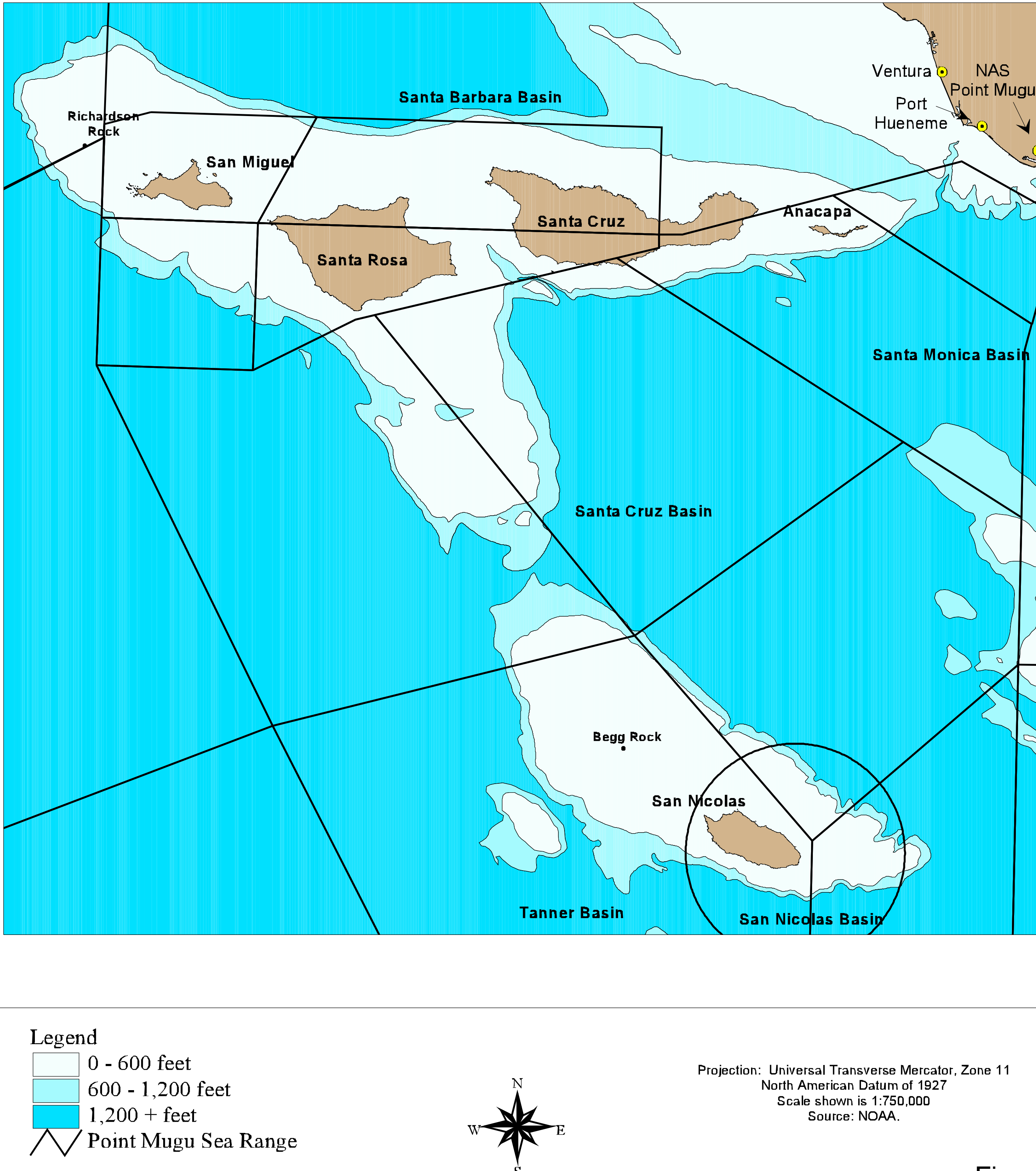


Figure 3.4-3

prohibition against discharge of specific hazardous substances and sludge, bypass of untreated waste, and discharges that impact Areas of Special Biological Significance (ASBS). However, the SWRCB may grant exceptions to allow a discharge into an ASBS provided that the exception will not compromise protection of ocean waters for beneficial uses and that the public interest will be served (California Regional Water Quality Control Board [CRWQCB] 1994). The following areas have been designated as ASBS (Figure 3.4-4):

- Latigo Point to Mugu Lagoon: Ocean water within a line originating from Latigo Point (southern boundary), following the mean high-tide line to a distance of 1,000 feet (300 m) offshore or to the 100-foot (30-m) isobath, whichever is greater, to a point lying due south of Laguna Point (northern boundary)

- San Nicolas Island and Begg Rock: Waters surrounding San Nicolas Island and Begg Rock to a distance of 1 NM (1.9 km) offshore or to the 300-foot (91-m) isobath, whichever is greater.

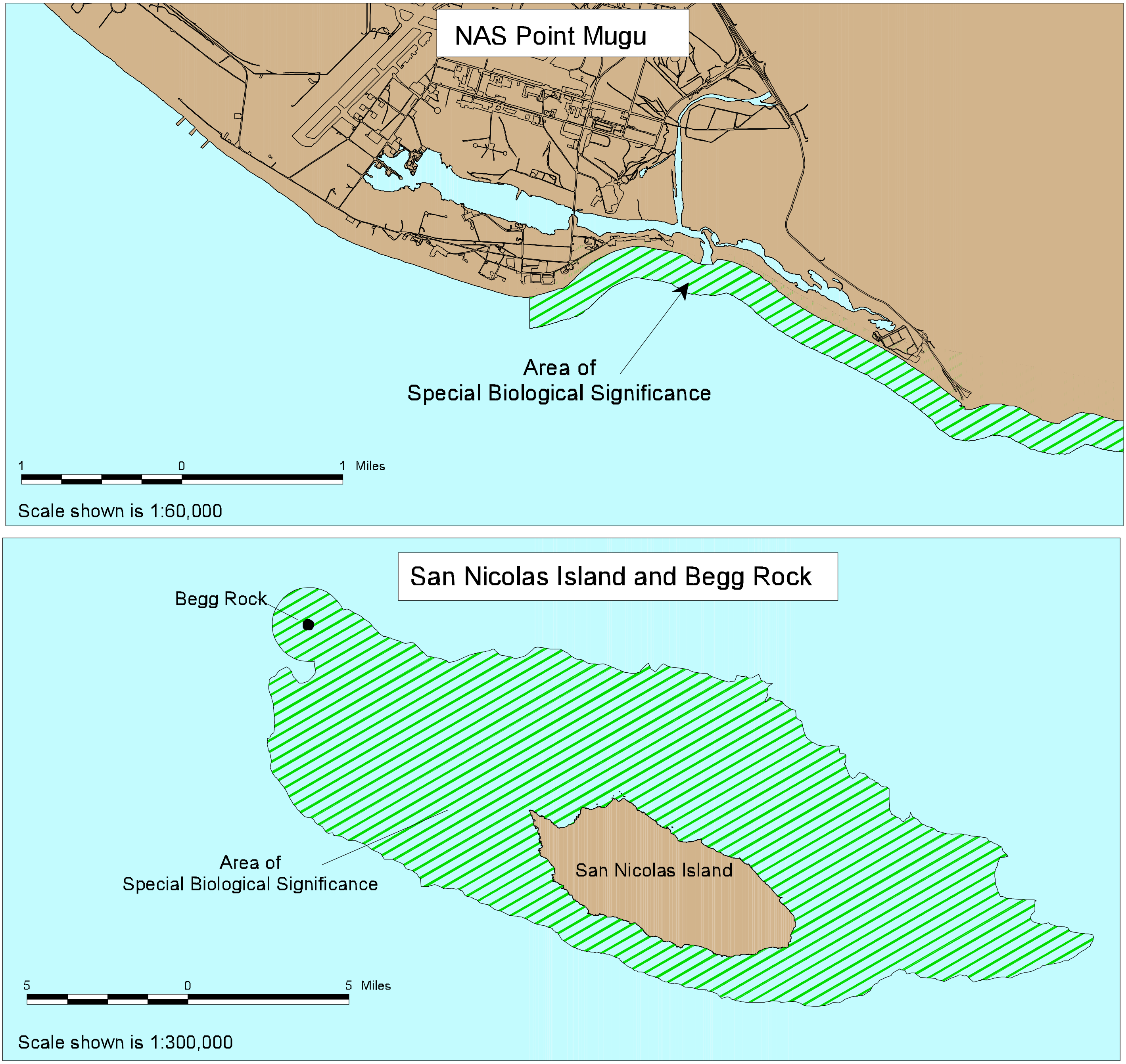
Most of the marine water pollution within the SCB area stems from municipal discharges. The distance from the mainland, the large diluting volume of the ocean, and the shelves and basins near the mainland where many pollutants settle ensure high water quality in the Sea Range. A potential source of water pollution comes from the oil and gas development industry. As activity increases from offshore oil and gas development, the potential for discharge into the Sea Range also increases. In recent years, an increase in oil leaks, accidental spills, discharge of formation water, drill mud, sediment, debris, and sludge in the area have decreased water quality (National Park Service [NPS] 1985).

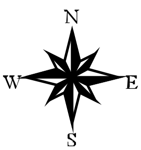
The CWA prohibits discharge of hazardous substances into or upon U.S. waters out to 200 NM (370 km). In addition, shipboard waste handling procedures for commercial and Navy vessels govern the discharge of not only hazardous wastes but also non-hazardous waste streams. The categories of wastes include the following:

- Liquids
  - "Blackwater" (sewage)
  - "Greywater" (water from deck drains, showers, dishwashers, laundries, etc.)
  - Oily Wastes (oil-water mixtures)
- Solids
  - Garbage (non-plastic)
  - Garbage (plastics, non-food contaminated)
  - Garbage (plastics, food contaminated)
- Hazardous Wastes
- Medical Wastes

Table 3.4-1 summarizes the waste stream discharge restrictions for Navy vessels at sea. Historically, vessel discharge standards have been established individually by coastal states. This has been problematic since standards vary from state to state throughout the U.S. To resolve this situation, Uniform National Discharge Standards (UNDS) for military vessels have been proposed by USEPA. These regulations will provide consistent discharge standards for all military vessels.

Areas of Special Biological Significance





Projection: Universal Transverse Mercator, Zone 11
North American Datum of 1927
Source: SWRCB & CalEPA 1997.

Legend

Areas of Special Biological Significance (ASBS)

Figure 3.4-4

Table 3.4-1. Discharge Restrictions for Navy Ships

Area	Type of Waste		
	Blackwater (Sewage)	**Greywater**	**Oily Waste**
U.S. Waters (0-3 NM)	No discharge	If vessel is equipped to collect greywater, pump out when in port. If no collection capability exists, direct discharge permitted.	Discharge allowed if waste has no visible sheen. If equipped with Oil Content Monitor (OCM), discharge < 15 ppm oil.
U.S. Contiguous Zone (3-12 NM)	Direct discharge permitted	Direct discharge permitted	Same as 0-3 NM.
12-25 NM from shore	Direct discharge permitted	Direct discharge permitted	If equipped with OCM, discharge < 15 ppm oil. Ships with an oil/water separator (OWS) but no OCM must process all bilge water through the OWS.
> 25 NM from shore	Direct discharge permitted	Direct discharge permitted	Same as 12-25 NM
> 50 NM from shore	Direct discharge permitted	Direct discharge permitted	Same as 12-25 NM
	Garbage (Non-plastic)	**Garbage (Plastic) (Non-food Contaminated)**	**Garbage (Plastic) (Food contaminated)**
U.S. Waters (0-3 NM)	No discharge	No discharge	No discharge
U.S. Contiguous Zone (3-12 NM)	Pulped garbage may be discharged	No discharge	No discharge
12-25 NM from shore	Bagged shredded glass and metal waste may be discharged > 12 NM	No discharge	No discharge
> 25 NM from shore	Direct discharge permitted	No discharge	No discharge
> 50 NM from shore	Direct discharge permitted	No discharge	No discharge
	Hazardous Materials	**Medical Wastes**	
U.S. Waters (0-3 NM)	No discharge	No discharge	
U.S. Contiguous Zone (3-12 NM)	No discharge	No discharge	
12-25 NM from shore	No discharge	No discharge	
> 25 NM from shore	No discharge	No discharge	
> 50 NM from shore	No discharge	If health and safety is threatened, discharge of negatively buoyant sterilized waste packages is permitted.	
>200 NM from shore	Discharge permitted under certain circumstances. However, to the maximum extent practicable, ships shall retain hazardous materials onboard for shore disposal.	Same as Hazardous Materials restrictions.	

Source: Northern Division 1996; Office of the Chief of Naval Operations 1994.

3.4.3 Point Mugu

NAS Point Mugu is located on a broad coastal plain adjacent to the Pacific Ocean and the Mugu Lagoon. Rainfall in the region averages approximately 10.5 inches (27 cm) per year. The base is generally level and slopes gently southward from the residential area in the north to the tidal flats surrounding Mugu Lagoon. Upland elevations range from about 7 to 12 feet (2 to 4 m) MSL, with most of the base below 10 feet (3 m) MSL.

The ROI for Point Mugu includes the nearshore marine environment, Mugu Lagoon (both marine and freshwater influences), and the onshore water environment. Water quality for these areas is discussed below.

3.4.3.1 Mugu Lagoon

<u>A - Marine Influences</u>

Mugu Lagoon is the largest surface water feature of NAS Point Mugu and encompasses 350 acres (142 ha) of water and tidal flats (Western Division 1986). The lagoon runs parallel to the coast for 3.5 miles (5.6 km) and is never greater than 0.6 mile (1.0 km) wide (Onuf 1987). It is composed of two long arms projecting out from a broader central basin (Figure 3.4-5). Mugu Lagoon is part of 2,500 acres (1,010 ha) of wetlands that have been designated a significant ecological resource protected by the CWA. A discussion of the lagoon's biological resources is included in Section 3.5.3.1.

Circulation

With the exception of freshwater influences generated during storm events, Mugu Lagoon is primarily marine-dominated. Therefore, tides are responsible for the majority of the day-to-day input and removal of materials. The tidal prism (volume of water moved in and out of the lagoon by tides) is large compared to the volume retained at lowest water. Persistent southeast longshore currents prevail along the coast in this region and assure that very little of the water departing the lagoon on the ebb tide is returned on the following flood tide.

Because of the relatively large tidal exchange of water within the lagoon and the narrow opening to the sea, currents are fast near the mouth. Currents were measured at 2.3 miles/hr (3.7 km/hr) on a neap (smallest tidal range) tide, and were estimated to be more than 6 miles/hr (10 km/hr) on spring (largest tidal range) tides (Onuf 1987). In open expanses of water away from the mouth, tidal currents are slow and are probably insufficient to cause much mixing. However, these areas are shallow, and water movement generated by light breezes is sufficient to cause mixing. Dissolved oxygen measurements of water collected near the bottom indicate anaerobic conditions do not occur. In general, dissolved oxygen levels in the lagoon are high because of abundant tidal exchange and shallow water depths. The only exception is reduced conditions beneath senescent mats of the green algae, *Enteromorpha* spp. and *Ulva* spp. that are found in the deepest parts of the lagoon and in a wrack line at the edge of the marsh.

Marine Water Characteristics

<u>Temperature.</u> Water temperatures inside the lagoon are usually similar to those of the open ocean, although temperatures may become higher and much more variable in the lagoon shallows and salt marsh ponds. The average water temperature for the June-September months is 66° F (19° C); for January, the average is 55° F (13° C). However, water temperatures up to 85° F (29° C) have been recorded during

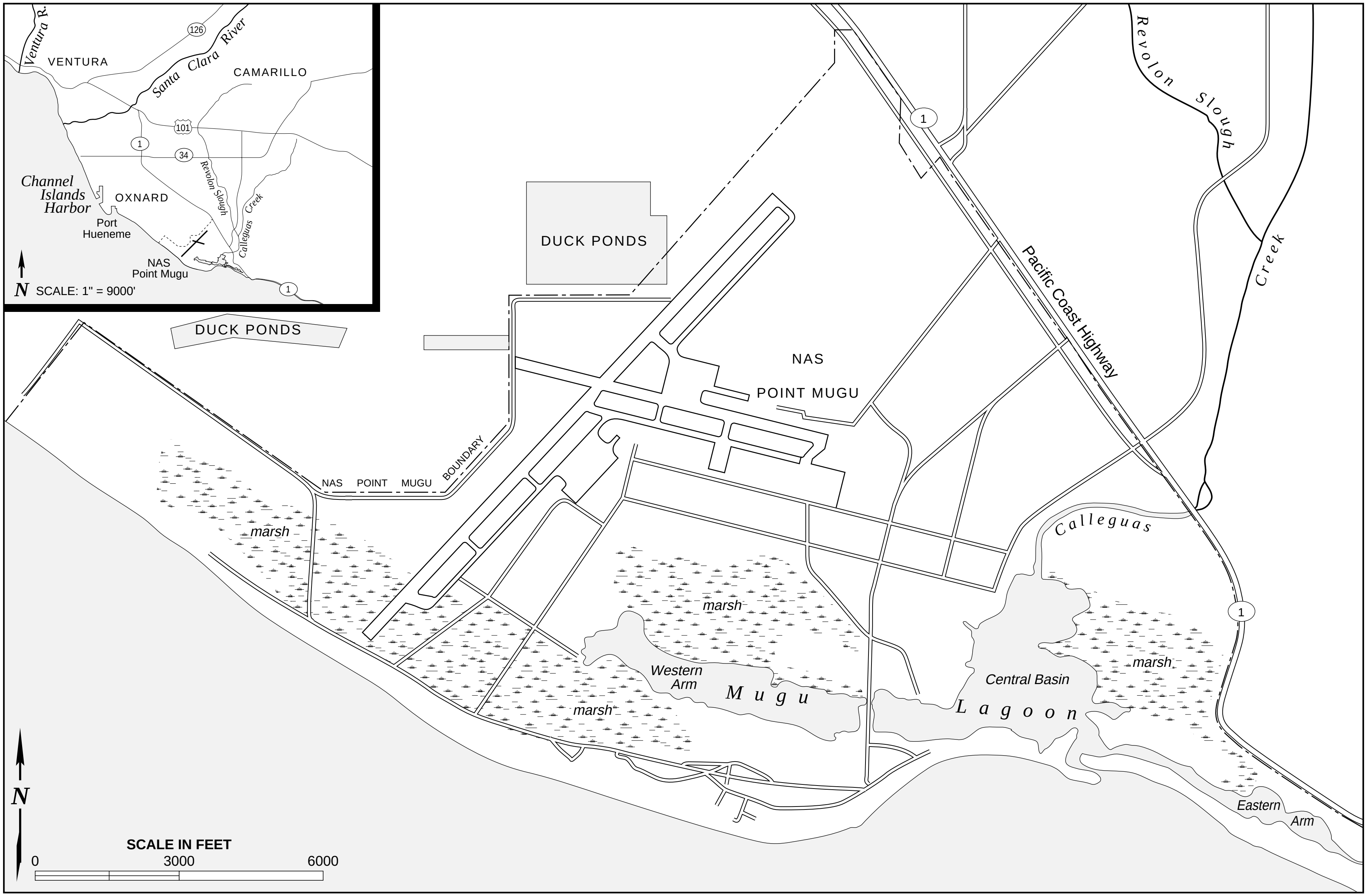


Figure 3.4-5
Surface Water Resources in the Vicinity of NAS Point Mugu

low tide conditions on hot summer days. Abrupt temperature changes of 15° F (9° C) or more are not uncommon when cold ocean waters flow into the lagoon and meet waters that have been heating up in the shallow lagoon (Onuf 1987).

Salinity. Salinities within the lagoon are generally similar to those of the ocean, with an average salinity of about 34 parts per thousand (ppt) (Onuf 1987). No long-term measurements of salinity have been taken at Mugu Lagoon. However, given the virtual absence of surface flows of freshwater except during storms, there is no reason to expect freshwater dilution except near the mouth of Calleguas Creek and during rainfall events.

The abundance of long-lived stenohaline organisms (organisms with little tolerance to salinity changes) suggests that long-term salinity concentrations below 34 ppt are rare. Poor circulation and rapid evaporation in the shallow eastern and western arms of the lagoon increase salinities, while heavy winter run-off causes dilution. Storm run-off tends to rapidly flow seaward without significantly affecting the eastern and western arms of the lagoon.

Chemical Characteristics. High-tidal exchange rates coupled with shallow water allows for mixing by the wind which keeps the dissolved oxygen concentrations in the water column high (Onuf 1987). Concentrations of other nutrients have not been studied.

Light Penetration. Light penetration varies greatly throughout the lagoon depending on tidal cycle, turbidity, water depth, and presence or absence of algae and phytoplankton blooms. Currently, at least two species of algae are found in the lagoon, and prior to the storms of 1978 eelgrass beds were found throughout the lagoon. This indicates that light penetration in the lagoon is, and has previously been, adequate to support marine flora.

Marine Sediments and Bathymetry

Onuf (1987) investigated the sediment characteristics of the eastern arm and determined that two sediment gradients existed. The sediments become finer grained from west to east (as distance from the mouth increased) and south to north (from the sand spit to the salt marsh). The east-west gradient is believed to be due to reduced water velocities of tidally generated currents as the distance away from the mouth increases. The south-north gradient appears to be due to a combination of factors. The south shore of the lagoon is enriched by sand from high surf and/or spring tides. The high water motion also appears to be able to keep fine particles in suspension. Moving northward, silt and clays are common in the salt marsh due to the weak tidal currents, small volume of moving water, and the presence of vegetation, which can further reduce water motion and can cause the settlement of fine particles.

B - Freshwater Influences

Freshwater Sources

There are two major influences on surface water hydrology within Mugu Lagoon: 1) ocean tides and the associated flushing of the lagoon waters, and 2) freshwater input from various sources. Tidal height and movement also influences groundwater flow.

Calleguas Creek is the principal stream draining NAS Point Mugu (see Figure 3.4-5); it originates in the Santa Susana Mountains and flows for about 37 miles (60 km) to the Pacific Ocean at Mugu Lagoon. Runoff to the creek from upstream areas includes treated sewage effluent and agricultural return flows potentially contaminated by pesticides. The largest tributary of Calleguas Creek is Conejo Creek, which drains an area of approximately 66 square miles (171 km^2). Conejo Creek rises in the Santa Monica Mountains and the Simi Hills and courses for 27 miles (43 km), joining Calleguas Creek at a point nearly 5 miles (8 km) upstream from the Pacific Ocean. Revolon Slough is the second largest tributary, draining 52 square miles (135 km^2) and joining Calleguas Creek about 1 mile (1.6 km) upstream from the Pacific Ocean.

Revolon Slough is also a major source of drainage to the lagoon, combining with Calleguas Creek after crossing the NAS Point Mugu boundary. Oxnard Drainage Ditches No. 2 and No. 3 enter NAS Point Mugu from the west and discharge into Mugu Lagoon. These ditches receive irrigation return flows from the surrounding farmlands. Approximately 18 square miles (47 km^2) of agricultural land north of NAS Point Mugu and west of Revolon Slough are drained by Ditch No. 2, while Ditch No. 3 drains the narrow coastal strip between the western arm of Mugu Lagoon and the adjacent Southern California Edison Company, Ormond Beach Generating Station (Western Division 1986).

The steep topography of the mountains promote rapid run-off, and extensive flooding along Calleguas Creek and its largest tributary, Conejo Creek, is common. During these times, large amounts of sediment are also transported and deposited in the lagoon. Because of the shallow nature of the lagoon, a large input of freshwater can completely flush the lagoon for short periods rather than create a longitudinal salinity gradient that moves up or down the estuary as the freshwater input changes. Agricultural irrigation and sewage plant return waters also make for a continuous, small input of freshwater into the lagoon. Because much of this water comes directly from intensively cultivated lands, toxic substances and nutrients may affect water quality.

Water Quality

Increased urbanization of the upstream watershed affects both quantity and quality of freshwater discharging into Mugu Lagoon. Within the past 30 to 40 years, agricultural development and urbanization have increased runoff into Calleguas Creek to the point that the lower creek course flows almost continually (Western Division 1986). Paving associated with increased urban development has increased the volume of runoff generated in the watersheds and, coupled with the effects of stream channelization, has caused severe stream bed and bank erosion in some areas. As a result of water quality deterioration, state and local agencies have coordinated and implemented regulatory programs to identify the source and cause of water quality degradation. These programs have been designed to classify the type of point source pollutants, and to monitor the extent of pollutants discharged into the Calleguas Creek basin.

“Beneficial uses” are the basis for water quality protection under the Los Angeles Region Basin Plan, within which NAS Point Mugu and Mugu Lagoon are located. The existing beneficial uses for Mugu Lagoon include navigation, non-contact water recreation, commercial and sport fishing, shellfish harvesting, and preservation of estuarine, wetland, and marine habitats for terrestrial and aquatic organisms (CRWQCB 1994). Water quality objectives for enclosed bays and estuaries, such as Mugu Lagoon, were established by the SWRCB to ensure the reasonable protection of beneficial uses and the prevention of nuisance. These objectives include:

- Enclosed bay and estuarine communities and populations (including vertebrate, invertebrate, and plant species) shall not be degraded as a result of the discharge of waste.
- The natural taste and odor of fish, shellfish, or other enclosed bay and estuarine resources used for human consumption shall not be impaired.

- Toxic pollutants shall not be discharged at levels that will bioaccumulate in aquatic resources to levels which are harmful to human health.
- The concentration of contaminants in waters which are existing or potential sources of drinking water shall not occur at levels which are harmful to human health.
- The concentration of toxic pollutants in the water column, sediments, or biota shall not adversely affect beneficial uses (CRWQCB 1994).

Once beneficial uses and water quality objectives are established, it is possible to form water quality standards, which are mandated for all water bodies within the state under the California Water Code (CWC) and the CWA.

Regional water quality issues in the Oxnard Plain area were first assessed by the Ventura Regional County Sanitation District during a 3-year program initiated in 1975. A second phase of the program, which sought to develop solutions to identified problems, was conducted in 1979 and 1980. The County Water Quality Planning Program identified several water quality problems, of which saltwater intrusion of groundwater supplies in the Oxnard Plain was considered to be the most significant. Other water quality problems identified included non-point sources such as septic tank discharge and hillside agricultural erosion. Records also indicate that the lagoon has received wastes from the Navy's past disposal practices including waste oil, solvents, JP-4, JP-5, aviation gas, motor gasoline, helicopter fuel, detergents, degreaser, grit, paint, stripping waste, trichloroethane, acid, hydrogen peroxide, aniline, dimethyl hydrazine, tin, and zinc. Storm sewers and drainage ditches that lead to Mugu Lagoon have also received waste oil, solvents, paint, sludge, battery acid, and other waste products generated from shop activities (Southwest Division 1996). These contaminants have been identified and remediated through the Installation Restoration Program (IRP).

The Los Angeles RWQCB (LARWQCB) administers two programs, the NPDES and the State Mussel Watch Program, which address water quality in Calleguas Creek, its tributaries, and Mugu Lagoon. There are currently 20 dischargers permitted under the NPDES program that contribute effluent flows to Calleguas Creek and its tributaries. The monitoring required for each of these dischargers varies on a case-by-case basis, but the major dischargers and those contributing potentially hazardous material regularly monitor their effluent. Under the State Mussel Watch Program, transplanted mussels and clams, fish, and sediments have been used to monitor the occurrence of anthropogenic pollutants in Mugu Lagoon, Calleguas Creek, and Revolon Slough. Mussel Watch data indicate elevated levels of organochlorine pesticides (e.g., chlordane, dichlorodiphenyltrichloroethane [DDT]), as well as other organic chemicals, are present in tissue and sediment samples from these areas (SWRCB and Cal/EPA 1995).

In general, water quality in Calleguas Creek does not meet drinking water standards due to upstream sources of agricultural chemicals and treated sanitary wastewater effluent. Water quality in Calleguas Creek and its tributaries varies significantly depending on sampling locations and flow conditions. Sampling indicates that total dissolved solids (TDS) increase as water moves toward Mugu Lagoon. For example, TDS in water samples collected north of U.S. Highway 101 have ranged between 100 and 600 milligrams per liter (mg/L); at Broome Ranch Road, measurements have ranged between 900 and 1,100 mg/L; and at the mouth of Calleguas Creek TDS values have ranged as high as 14,200 mg/L (Western Division 1993b). Surface water samples collected at Mugu Lagoon also indicate that semi-volatile organic compounds and inorganics are contaminants of concern (COC) based on human health or ecological risk (Western Division 1993b, Southwest Division 1996). The COCs and their maximum concentrations are pentachlorophenol (10 μg/L), arsenic (12.5 μg/L), copper (9.9 μg/L), and mercury (50.2 μg/L). Variability appears to be strongly correlated with flow.

A study of Revolon Slough from October 1980 to July 1981 indicates that mean concentrations of four analytes are at or above potentially hazardous levels for marine environments according to USEPA criteria: lead (equal to USEPA standard), mercury (20x), silver (10x), and methoxychlor (20x) (Onuf 1987). Revolon Slough is a tributary of Calleguas Creek that drains most of the intensively cultivated part of the Oxnard Plain. Since the flow of Calleguas Creek is approximately three times higher than that of Revolon Slough, and Calleguas Creek drains less intensively cultivated land, the pollutants may be diluted before they enter the lagoon.

The flow characteristics of Calleguas Creek strongly influence the transport of sediments and pollutants in the system. Flows are seasonal in much of the upper drainage basin where point source discharges and irrigation return flows frequently percolate into the groundwater before reaching Mugu Lagoon. Under such conditions, the contaminants associated with these sources would be expected to either infiltrate into groundwater or become bound with surface sediments, depending on the specific chemical (Western Division 1993b). During high flows, sediment and organically bound pollutants may be carried downstream and deposited into areas of channel overflow or into Mugu Lagoon.

3.4.3.2 Nearshore Marine Environment

The area that borders NAS Point Mugu adjacent to the ocean is dominated by sandy beach habitat. The topography of the sand beaches is strongly influenced by wave conditions. The beaches, composed of fairly coarse sand, are relatively steep. The foreshore extends out to a depth of about 10 to 12 feet (3 to 4 m), where the slope of the bottom decreases substantially. This marks the point of transition from beach into shallow shelf. Sand dunes are also present along most of the beaches. A detailed discussion of biological resources associated with the beach habitat is included in Section 3.5.3.2. Water quality in the nearshore area of Point Mugu is dependent upon the presence of particulates and contaminants in the outflow from Mugu Lagoon (see previous discussion in Section 3.4.3.1).

3.4.4 San Nicolas Island

San Nicolas Island is part of Ventura County and is situated in Watershed 11 which also includes Anacapa, Santa Barbara, San Clemente, and Santa Catalina islands (CRWQCB 1994). San Nicolas Island and its surrounding waters have been designated as an ASBS (see Section 3.4.3.1). The island is a mesa with the topography sloping gently upward from the northern end of the island. The average surface elevation is 500 feet (152 m) above MSL, with a maximum elevation of 908 feet (277 m) above MSL. San Nicolas Island is arid; total precipitation averages 8.40 inches (21.3 cm) per year. The dry season occurs between May and September, and the wet season occurs between November and February when the island receives 74 percent of its total rainfall. The existing beneficial uses for water resources at San Nicolas Island include navigation, water contact recreation, non-contact water recreation, commercial and sport fishing, shellfish harvesting, and preservation of terrestrial and marine habitats and rare, threatened or endangered species (CRWQCB 1994).

3.4.4.1 Marine Environment

<u>A - Circulation</u>

The Channel Islands are located in a region of variable mixing between the cold waters of the California Current and the warm nearshore water of the California Countercurrent (see Figure 3.4-1). San Nicolas Island is located far enough offshore and to the south that it is subjected both to the warmer waters of the California Countercurrent and to the colder waters of the California Current. In general, the circulation patterns around the island are similar to the patterns of the two major currents. However, some localized currents and eddies are caused by the island's shape and orientation (Engle 1994).

B - Marine Water Characteristics

The coldest sea surface temperatures occur in March (57° F [14° C]), while the warmest temperatures occur in September (66° F [19° C]) (Engle 1994). Consequently, marine biota of the island have been termed "intermediate" because both cold and warm water species occur at the island. The island is relatively isolated from the effects of human activities that typically occur in the nearshore environments of the mainland (Engle 1994). Thus, there is no reason to expect that the marine waters are degraded or different than the water quality of the Sea Range (see Section 3.4.2.1-B for a more detailed discussion).

C - Marine Sediments and Bathymetry

The bathymetry surrounding San Nicolas Island is irregular in shape. The island is basically a pinnacle that is surrounded by water depths of 2,000 feet (610 m) which slope to less than 3,900 feet (1,190 m) within less than 6 NM (11 km) of the island (see Figure 3.4-3). The subtidal area nearest the island is much shallower (less than 100 feet [30 m]) and is characterized by either sand, bedrock, or boulder. The deep bottom sediments that surround the island are similar to those of the Sea Range (see Section 3.4.2.1-C).

3.4.4.2 Nearshore Marine Water Quality

The quality of ocean water in the immediate area of the island is high. Most of the marine water pollution within the SCB area stems from municipal discharges. The distance of the island from the mainland, the large diluting volume of the ocean, and the shelves and basins near the mainland where many pollutants settle ensure high water quality at the island. As discussed in Section 3.4.2.2, a potential source of water pollution comes from the oil and gas development industry.

3.4.4.3 Freshwater Quality

Domestic water for San Nicolas Island is obtained from a combination of sources including four wells, three springs, a desalination (reverse osmosis [RO]) plant, and imported water barged to the island which is used only in the case of emergency. The hydrology of San Nicolas Island is shown in Figure 3.4-6.

A - Surface Water

Topography on the island is shaped by runoff of surface water to the ocean. A drainage divide is located at the top of the east-west trending southern escarpment of the island. Ephemeral streams along the southern portion of the island drain surface water through very steep, V-shaped canyons along straight courses with few tributaries to the ocean. The surface water runoff on the northern portion of the island drains initially through steep-walled gullies in the upland area, and as the water approaches the ocean it spreads out onto flat marine terraces and then into poorly defined, shallow channels within the sand dunes (U.S. Army 1994).

San Nicolas Island contains no perennial (i.e., year-round) bodies of water. The only perennial stream, Tule Creek, is located at the northern part of the island and runs northeastward from the highest part of the island to a sand dune area on the shore. It is fed by natural springs that flow during most of the year except during periods of drought. Zitnic Springs is located in the groundwater recharge area near Redeye

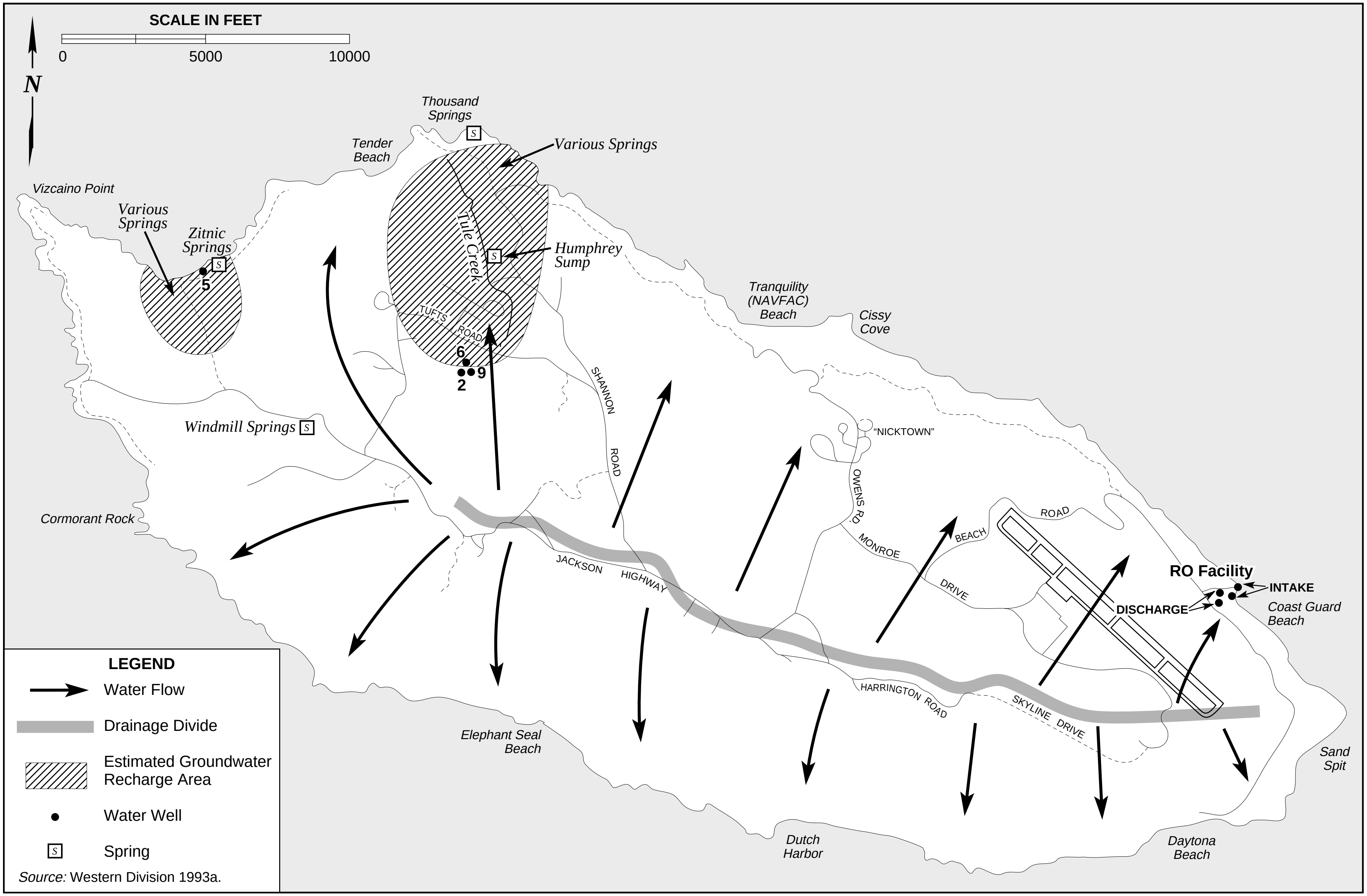


Figure 3.4-6
Hydrology of San Nicolas Island

Beach, and Windmill Springs is located 1.3 miles (2.1 km) southeast of Redeye Beach near the Alpha Launch Complex (see Figure 3.4-6).

A wetland exists on the northeast side of the airfield and supports various plant species; small wetlands are also present at Sand Spit, Twin Rivers, and Tule Creek. Although surface water on San Nicolas Island is not used as a potable water supply source, it does recharge the groundwater supply (U.S. Army 1994). The water sources are considered under the influence of surface waters on San Nicolas Island. There are no specific surface water quality objectives for selected constituents at San Nicolas Island (CRWQCB 1994).

B - Groundwater

Consolidated marine sediments that make up San Nicolas Island have limited storage capacity for groundwater. The western end of the island is covered by significant deposits of wind blown sand and is the only location where conditions support groundwater resources. Some perched aquifers are located in this area within the upper 3 feet (1 m) of weathered surficial deposits (U.S. Army 1994). The groundwater flows in a northwest direction toward the water bearing areas: the Zitnic, Upper Tule Creek, and Vizcaino basins (see Figure 3.4-6). The southern beaches and terraces lack freshwater springs and seeps, and water that infiltrates the terraces becomes saline through mixing with brackish groundwater.

The LARWQCB provides groundwater quality objectives for San Nicolas Island. The groundwater quality objectives for selected constituents include: TDS (1,100 mg/L), sulfate (150 mg/L), and chloride (350 mg/L) (CRWQCB 1994). Studies indicate that groundwater quality meets these objectives (U.S. Navy 1996b).

Due to the isolation of the island, limited access, and limited island operations, there are few potential sources of contaminants in the watershed. Overdrafting of groundwater appears to have the greatest effect on water quality, as saltwater intrusion has become evident, especially during drought years. The wastewater treatment plant is an unlikely source of contamination for the watershed areas since it is several miles from the water supply sources and does not share the same watershed (U.S. Navy 1996b). Contamination with respect to the seawater well points appears unlikely due to the location of the discharge area and low probability of surface flow. Surface flow of treated sewage as a result of irrigation operations is not likely under proper operating procedures (U.S. Navy 1996b).

As required by Section B.16 of the California Industrial Activities Storm Water General Permit, the Navy is responsible for reporting storm water discharges at San Nicolas Island. However, urban runoff is not a major concern for the island's watersheds due to the geographic separation of the compound area from the watershed. Urban storm water runoff is addressed in the station's Storm Water Pollution Prevention Program. San Nicolas Island has a NPDES General Industrial Activities Storm Water Permit which was issued by the SWRCB. To comply with permit requirements, the station has implemented a storm water pollution prevention program which includes eliminating illicit discharges, implementing best management practices, conducting storm water monitoring, conducting industrial inspections, and training employees.

Wells, Springs, and Catchments

Numerous freshwater wells and catchments have been installed at various locations and provide the major portion of freshwater for San Nicolas Island. There are various types of water catchments on the island designed to capture underground water seepage and spring water. One type of catchment, found at Thousand Springs, is a concrete barrier/wall type, similar to a small dam or retaining wall. Water from this catchment flows through an aboveground pipe, by gravity, to a nearby storage tank. Similarly, a shallow underground perforated pipe at Windmill Springs collects and directs, by gravity, subsurface water to a storage tank at a lower elevation. The other types of catchments are underground sumps (Zitnic and Thousand Springs) that pump the collected subsurface water to a nearby storage tank.

The springs are considered groundwater under the direct influence of surface water and must comply with the Surface Water Treatment Rule. These sources are also prone to flooding during rain events. A new surface water filtration plant was constructed in 1994 to treat the springs and well source. Filtration performance is monitored by turbidity measurements of the filtered water, and disinfection is monitored by measuring residuals (U.S. Navy 1996b).

San Nicolas Island has a total of 22 septic and holding tanks which are used at the outlying buildings. The buildings consist of range support facilities, office spaces, and one small living area. Septic/holding tank locations are necessary due to the size of the island and the remote locations of some of the buildings. The septic and holding tanks are inspected on a quarterly basis. Holding tanks are pumped quarterly and septic tanks are pumped as required during quarterly inspections. The septic and holding tanks do not appear to pose a significant risk of contaminating the watershed areas. The majority of the outlying buildings are used infrequently or during a limited work day schedule.

C - Desalination Plants

Two RO desalination units were installed in 1990 at Coast Guard Beach. The raw water source for the units is seawater which is pumped from two locations on the beach. The two locations are manually alternated during winter and spring. Each location has six shallow seawater well points. Water is pumped from the well points to a holding tank. Brine (highly mineralized wastewater) discharge from the RO unit is pumped to a second holding tank next to the seawater tank. When the wastewater tank is full, the brine is discharged to a brine pit located approximately 660 feet (200 m) from the RO unit and near the beach (see Figure 3.4-6), and then is dispersed through the sand. Discharge of brine wastes produced from the operation of the desalination plant and monitoring requirements are specified under NPDES Permit No. CA0058700 issued by the LARWQCB.

D - Wastewater Treatment

The wastewater treatment facility consists of a series of three aerated stabilization ponds and a gas chlorination facility. Due to the large capacity of the stabilization ponds and the small population served by the plant, the primary method of wastewater disposal is by evaporation. The secondary method of disposal is by discharging the wastewater through irrigation. Treated wastewater is discharged via spray nozzles over a 6 acre (2.4 ha) area of land which is restricted and off-limits to personnel. The sludge is stored in stabilization ponds. As required by its Waste Discharge Permit, the Navy is responsible for reporting effluent discharge (amount and concentration of potential contaminants) for the San Nicolas Island Sewage Treatment Facility. The treatment facility must meet effluent discharge limitations for the following: TDS (1,100 mg/L), sulfate (150 mg/L), chloride (350 mg/L), nitrate plus nitrite plus ammonia (10 mg/L), biochemical oxygen demand (60 mg/L), oil and grease (15 mg/L), and coliform. Monitoring reports are submitted quarterly, and a corrective action plan is in place to meet the limitations for chlorides and TDS set forth under the Waste Discharge Permit issued by the LARWQCB.

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3.5 MARINE BIOLOGY

3.5.1 Introduction

3.5.1.1 Definition of Resource

For purposes of this EIS/OEIS, marine biological resources are defined as marine flora and fauna and habitats that they occupy, occurring within the Point Mugu Sea Range, Mugu Lagoon, and the intertidal and nearshore environment of San Nicolas Island and Point Mugu. This section specifically addresses marine invertebrates and flora. Fish and sea turtles are addressed in Section 3.6, marine mammals are addressed in Section 3.7, and seabirds are addressed in Section 3.8. Threatened and endangered species, as defined by the U.S. Fish and Wildlife Service (USFWS), are also addressed. Species that are federally listed are afforded a degree of regulatory protection, which entails a permitting process including specific mitigation measures for any allowable (incidental) impacts on the species. Species that are proposed to be listed by the USFWS are treated similarly to listed species by that agency; recommendations of the USFWS, however, are advisory rather than mandatory in the case of proposed species. A federally listed endangered species is defined as any species, including subspecies, that is “in danger of extinction throughout all or a significant portion of its range.” A federally listed threatened species is defined as any species “likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.” “Proposed” endangered or threatened species are those species for which a proposed regulation has been published in the Federal Register, but a final rule has not yet been issued.

3.5.1.2 Regional Setting

The Sea Range straddles the ocean off Point Conception which is considered a major geographic feature that affects marine biological diversity. North of Point Conception, the marine resources are under the influence of the cold, southward flowing California Current. The shape of California’s coastline south of Point Conception creates a broad ocean embayment known as the Southern California Bight (SCB). The SCB encompasses the area from Point Conception south to Mexico and is influenced by two major oceanic currents: the southward flowing, cold-water California Current and the northward flowing, warm-water California Countercurrent (refer to Figure 3.4-1). These currents mix in the SCB and strongly influence patterns of ocean water circulation, sea temperatures, and distributional trends in marine flora and fauna assemblages along the southern California coast and the eight Channel Islands (Murray and Littler 1981; Engle 1994). These factors cause extreme differences in species composition and abundance both north and south of Point Conception, as well as within the SCB.

Bottom topography in the SCB varies greatly from broad expanses of well developed continental shelf lands to deep basins (refer to Figure 3.4-2). Southwest of the Channel Islands is the Patton Escarpment, a steep ridge with contours bearing in a northwesterly direction; this ridge drops approximately 4,900 feet (1,500 m) to the deep ocean floor. Between the Patton Escarpment and the mainland lie the Santa Rosa-Cortez Ridge, three deep shelf basins (Santa Cruz, Santa Monica, and Santa Catalina to the south), Santa Barbara Basin to the north, two important channels (Santa Barbara and San Pedro), and a series of escarpments, canyons, banks, and sea mounts (e.g., Cortez Bank, Tanner Bank, 60-Mile Bank, Farnsworth Bank, and Lausen Sea Mount), some of which are located outside Sea Range boundaries (refer to Figure 3.4-2). Banks and sea mounts possess unique physical characteristics that affect local biological processes. They are the focus of upwelling which results in increased primary, and perhaps secondary productivity, and attracts pelagic fishes and their predators (i.e., seabirds and marine mammals) (Cross and Allen 1993). In the SCB, nutrient rich upwelling occurs mainly from February through August when surface waters, driven offshore by winds, are replaced by colder, richer waters overturning from below. Thorough and frequent mixing of these waters create conditions which support a rich and varied marine flora and fauna year-round (Leatherwood et al. 1987).

The Channel Islands National Marine Sanctuary (CINMS) encompasses the waters within 6 NM (11 km) of San Miguel, Santa Rosa, Santa Cruz, Anacapa, and Santa Barbara islands (Figure 3.5-1). The Channel Islands National Park (CINP) boundaries extend 1 NM (1.9 km) beyond the coast of each of these islands. The CINMS was established in 1980 for the purpose of protecting areas off the southern California coast which contain significant marine resources. The CINMS is located over the continental shelf (refer to Figure 3.4-2), with water depths generally less than 360 feet (110 m). Waters surrounding the Channel Islands are relatively undisturbed and provide a habitat for a diverse assemblage of marine organisms.

A Presidential Proclamation signed on 11 January 2000 established the California Coastal National Monument, an area on the California coast extending from mean high tide to a distance of 12 NM (22 km) offshore. The monument comprises all lands above water in this area, including islands, rocks, exposed reefs, and pinnacles above the high water mark that are owned by the U.S. Government. Establishment of the California Coastal National Monument does not enlarge or diminish existing federal authority or use of adjacent waters. In addition, islands, rocks, exposed reefs, and pinnacles that are already reserved for other purposes are not affected by this designation. San Nicolas Island, as well as the other Channel Islands within the Sea Range, are located outside this designation.

EO 13089, *Coral Reef Protection*, was issued to preserve and protect the biodiversity, health, heritage, and social and economic value of U.S. coral reef ecosystems and the marine environment. EO 13089 states that each federal agency whose actions may affect U.S. coral reef ecosystems: a) identify their actions that may affect U.S. coral reef systems; b) utilize their programs and authorities to protect and enhance the conditions of such ecosystems; and c) to the extent permitted by law, ensure that any actions they authorize, fund, or carry out will not degrade the conditions of such ecosystems. No coral reefs are located within the temperate waters of the Point Mugu Sea Range.

A significant marine water resource at Point Mugu is Mugu Lagoon (refer to Section 3.4.3.1). Mugu Lagoon is one of the largest salt marshes in southern California. It is relatively undisturbed and provides a habitat for a diverse assemblage of marine organisms.

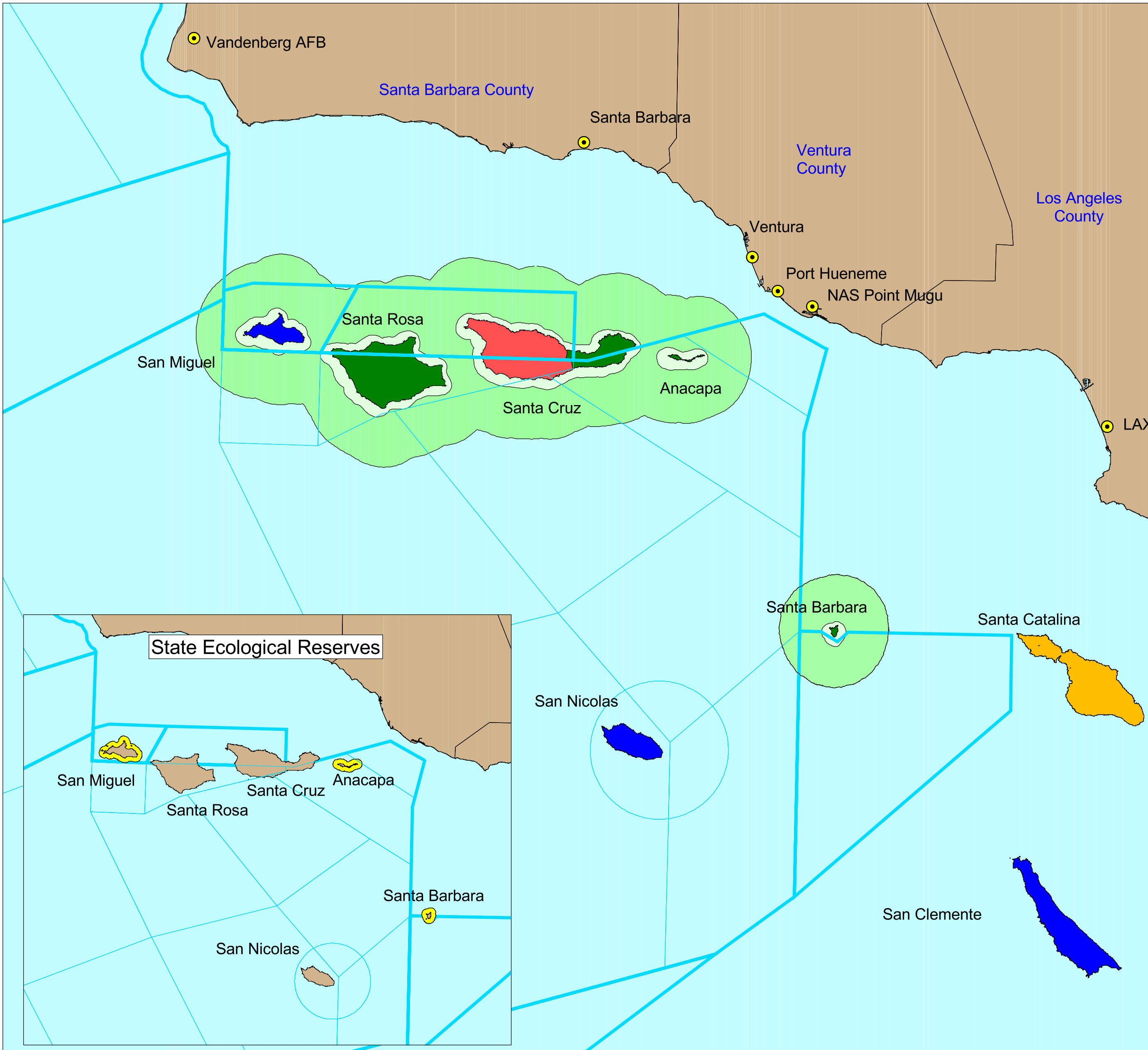
3.5.1.3 Region of Influence

This section describes the marine biological resources that occur at the Point Mugu Sea Range, Point Mugu, and San Nicolas Island. Descriptions are based on literature surveys, previously conducted field surveys, and existing Geographic Information System (GIS) databases. For the purposes of this EIS/OEIS, the region of influence (ROI) consists of three major marine habitats: the Point Mugu Sea Range, Point Mugu (Mugu Lagoon and sandy beaches/nearshore environment), and the intertidal and nearshore subtidal areas surrounding San Nicolas Island. Fish and sea turtles are discussed in Section 3.6, and marine mammals are discussed separately in Section 3.7.

3.5.2 Point Mugu Sea Range

The Point Mugu Sea Range encompasses a 36,000 square mile (93,200 km^2) area that includes regions of complex bathymetry which provide diverse habitats for a variety of marine life. Soft substrates, such as sandy beaches, shelves, and slopes, are abundant along the mainland and the offshore islands. Hard substrates, such as the rocky intertidal, shallow subtidal reefs, deep rock reefs, and kelp beds, are also common along the coasts of the mainland and islands. Beyond the depths of kelp beds (greater than

Island Ownership and Channel Islands National Park and Marine Sanctuary Boundaries



Ownership
- Private
- Nature Conservancy
- National Park Service
- Navy

National Park/Sanctuary Boundaries
- Channel Island National Park
- Channel Island National Marine Sanctuary

- State Ecological Reserves

Projection: Universal Transverse Mercator
North American Datum 1927
Zone 11
Scale shown is 1:1,375,000

Figure 3.5-1

100 feet [30 m]), approximately 3 percent of the sea floor consists of rubble and rocky outcrops inhabited by marine invertebrate assemblages (Dailey et al. 1993). On the continental shelf regions, sand and gravel substrate is typically interspersed between these rocky areas. Offshore, the Channel Island shelves, Santa Rosa-Cortez Ridge, and Tanner and Cortez banks (refer to Figure 3.4-2) consist primarily of base rock and rocky outcrops that may be covered with a thin layer of sediment. Hard substrates occur to depths of over 1,640 feet (500 m) in the ROI and include sea mounts and man-made structures. Because they exceed diving depths (typically about 100 feet [30 m]) and cannot easily be sampled with coring devices or trawls, deep, hard substrate assemblages are the least-studied benthic habitats in the Sea Range. The following subsections broadly describe the marine flora and benthic marine invertebrates of the Sea Range.

3.5.2.1 Marine Flora

Most of the marine flora in the Sea Range comprises phytoplankton. Phytoplankton are microscopic plants that live in patchy abundance throughout the water column. The distribution of plankton is dependent upon many factors including light intensity, salinity, temperature, currents, nutrients, and their reproductive cycles and predators (Smith 1977). Phytoplankton comprise mainly diatoms and dinoflagellates, which carry out photosynthesis and form the basis of the aquatic food chain. They are a food source for the larger zooplankton (microscopic animals) which in turn are a food source for invertebrates, fish, and other large marine species such as baleen whales.

About 70 percent of the known algae species from California are known to occur in the SCB, and thus within the Point Mugu Sea Range (Dailey et al. 1993). The high percentage is attributed to the wide range of coastal habitat provided by the mainland and offshore Channel Islands. Most quantitative descriptions of the seasonal abundance and distribution of marine flora focus on nearshore kelp communities; deep water (i.e., greater than 100 feet [30 m]) algae are virtually unknown despite the availability of submersibles and video technology (Dailey et al. 1993). Kelp beds form a unique shallow water community which provides habitat for a range of additional algal species, invertebrates, and fish (discussed in Section 3.6). Extensive stands of giant kelp (*Macrocystis*) extend from the sea floor to the surface to form a vertically structured habitat off the mainland and offshore islands. Although the surface area of kelp beds varies over time, aerial surveys in the mid-1970s indicated that the SCB supported a kelp canopy area of approximately 34 square miles (88 km^2) (Hodder and Mel 1978 as cited in Dailey et al. 1993). About half of the kelp occurred along the mainland of the SCB, with 28 percent attributed to the southern Channel Islands (San Clemente, Santa Catalina, Santa Barbara, and San Nicolas islands) and 20 percent attributed to the northern Channel Islands (Anacapa, Santa Cruz, Santa Rosa, and San Miguel islands). San Nicolas Island alone provided more than 14 percent of the total kelp canopy observed in the entire SCB.

Most kelp forests occur on hard, rocky substrate (although one form of *Macrocystis*—*M. angustifolia*—often forms forests attached to only sand and cobbles). Kelp forests are dynamic over both short- and long-term (greater than 80 years) scales. Changes in kelp coverage have been attributed to a variety of complex factors including water temperature fluctuations (e.g., higher water temperatures associated with El Niño events have been implicated for kelp forest reductions), nutrient availability, storm events (wave-induced surge and storm waves can detach kelp stands), and sedimentation.

3.5.2.2 Benthic Marine Invertebrates

Benthic marine invertebrates live primarily in or on the sediment. Many species, known as infauna, are sedentary and live buried in the sediments for their entire life. The mobile species typically move freely on the surface of the sediments (epifauna) but usually bury themselves in the sediment for concealment, protection, or to feed. Infaunal assemblages in the offshore region of the Sea Range are generally impoverished due to sediment type, the absence of hard-bottom reefs, and sediment transport caused by cross-shelf movement of material seaward from shallower to deeper regions (SAIC and MEC 1995).

A - Nearshore Continental Shelf

Several clam species are common or abundant on the nearshore continental shelf. Pismo clams (*Tivela stultorum*) are the predominant species on the beach foreshore. Assemblages on shallower portions of the shelf are frequently dominated by sand dollars and tubicolous polychaetes of the genera *Diopatra*, *Nothria*, *Onuphis*, *Owenia*, and *Pista*. Dominant clams include species of the genera *Tellina*, *Macoma*, and *Spisula*. In mid-depth portions of the shelf, patches of the geoduck (*Panopea generosa*) are common. In deeper portions of the shelf, deposit feeders become more important. These include tubicolous polychaetes such as maldanids, the burrowing echiuroid (*Listriolobus pelodes*), sea cucumbers, and several species of small deposit-feeding bivalves. The small clam (*Cardita ventricosa*) is one of the more common clams in deeper portions of the shelf (Jones 1969). In addition, numerous predatory and opportunistic invertebrates (i.e., scavengers) are common in these assemblages (e.g., various crabs, hermit crabs, starfish, and snails).

B - Offshore Regions

The populations in deep benthic assemblages are randomly dispersed due to physical conditions that are fairly homogeneous, and natural disturbances (e.g., predation) that are either of very low intensity or occur randomly in space and time. In general, the abundance and distribution of deep benthic assemblages appear to be persistent and stable in the SCB (Dailey et al. 1993). In general, the marine invertebrate assemblages inhabiting deep water regions (greater than 100 feet [30 m]) can be characterized by depth. As depicted in Figure 3.5-2, species composition and abundance changes with increasing water depth and with changes in the relief of the rock substrate. Species most common to each of the major deep benthic assemblages, as well as information on abundance and diversity, are briefly summarized below (as cited in Dailey et al. 1993).

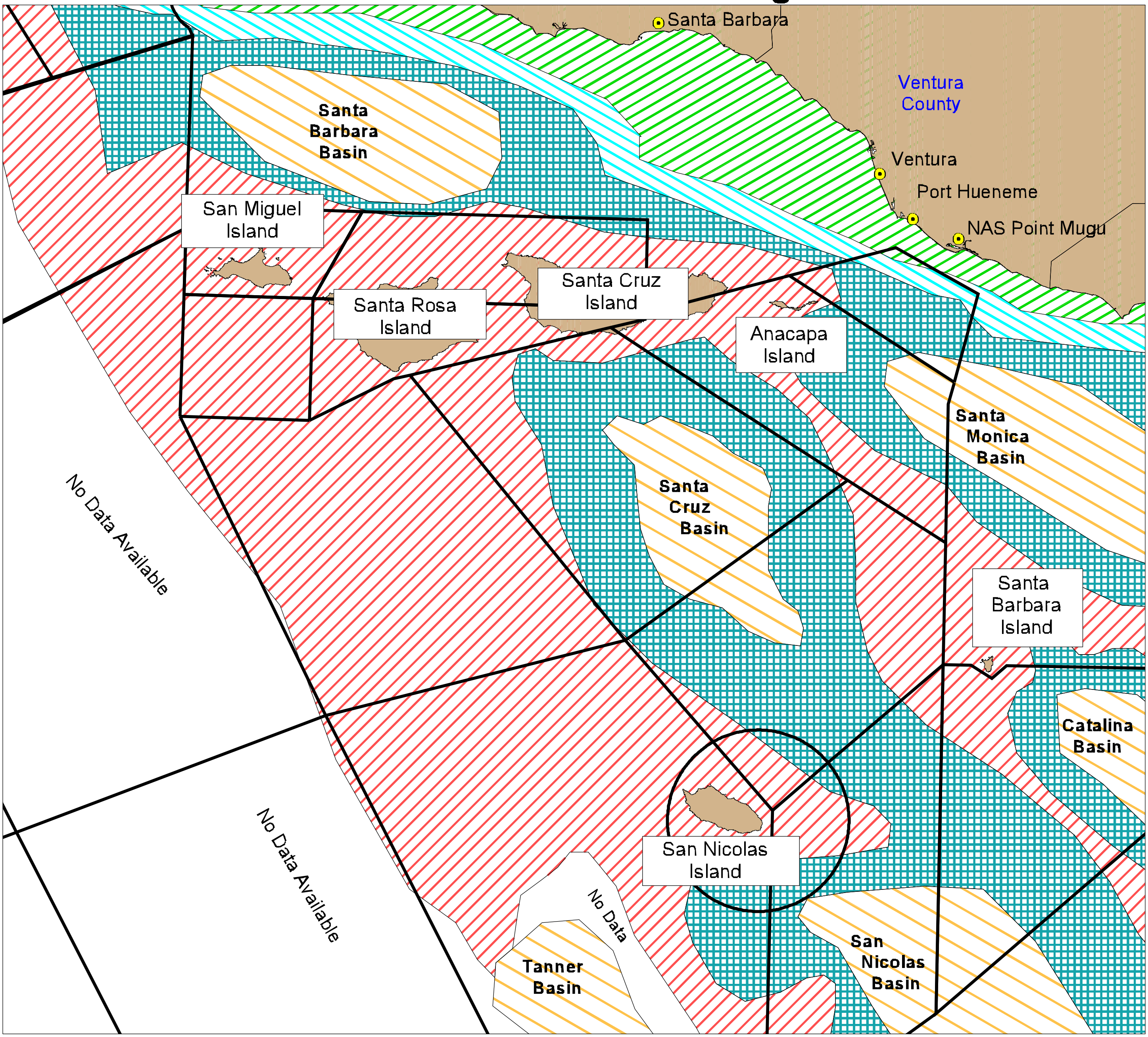
Mainland Shelf

The mainland shelf, with deep benthic marine invertebrates inhabiting areas from 100 to 492 feet (30 to 150 m) deep, has high species abundance and diversity relative to other deep benthic areas, although average diversity on the outer mainland shelf is similar to that on the offshore shelves, ridges, and banks (discussed below). Within this region, numbers of macrofaunal species, individuals, and species diversity decrease with increasing shelf depth. Most populations are randomly dispersed on the sea floor and are seldom uniformly dispersed. Dominant assemblages include polychaetes (*Spiophanes missionensis, Chloeia pinnata, Pectinaria californiensis, Paraprinospio pinnata, Maldane sarsi, Tharyx* spp.), ophiuroids (*Amphiodia urtica*), pelecypods (*Parvilucina tenuisculpta, Cyclocardia ventricosa*), ostracods (*Euphilomedes* spp.), and echiurans (*Listriolobus pelodes*).

Offshore Shelves, Ridges, and Banks

Soft sediments on the shelves of the Channel Islands, the Santa Rosa-Cortez Ridge, and the Tanner (south of the Sea Range) and Cortez banks provide unique benthic habitat. Offshore shelves, ridges, and banks exhibit the most diverse macrobenthic assemblages of the deep water regions in the Sea Range. The high species diversity is attributed mainly to the persistent upwelling (which affects the productivity of the area) and the wide range of sediment types. Assemblages that inhabit these areas extend to about 1,640 feet (500 m) and are much more spatially heterogeneous than on the mainland shelf. Dominant

Benthic Assemblages of the Southern California Bight



Legend

Point Mugu Sea Range

Benthic Assemblages

Mainland Shelf - Amphiodioa urtica, Lytechinus pictus

Offshore Shelves, Ridges, and Banks - Amphipolis squamata, Chloeia pinnata, Echnoids

Upper Slope - Maldane sarsi, Allocentrotus fragilis

Lower Slope - Anobothrus trilobata, Brissopsis pacifica, Byblis spp., Phyllochaetopterus sp.

Basins

San Nicolas Basin - Paraonid polychaetes, Nephasoma nicclasi

Catalina Basin - Tharyx sp., Ophiophthalamus normani, Scotoplanes sp.

N W E S

20 0 20 Nautical Miles

Projection: Universal Transverse Mercator, Zone 11
North American Datum of 1927
Scale shown is 1:1,000,000
Source: Dailey et al. 1993.

Figure 3.5-2

assemblages include polychaetes (*Chloeia pinnata, Lumbrineris* spp.), ophiuroids (*Amphipholis squamata, Amphiodia urtica*), pelecypods (*Parvilucina tenuisculpta*), ostracods (*Euphilomedes* spp.), and amphipods (*Photis californica*).

Nearshore Upper Slope

More of the sea floor in the SCB exists on slopes than on any other habitat. (Submarine canyons are features of slopes that provide a different habitat and are discussed separately within this section.) The nearshore upper slope, at water depths between 492 to 1,640 feet (150 to 500 m), exhibits the third-highest species diversity of the offshore regions, but abundance is low relative to the mainland shelf and the offshore shelves, ridges, and banks. More burrowing species are found among slope macrofauna than in any other benthic habitat. This is probably due to sediment instability on the slopes; turbidity transports sediment downslope, creating an unstable habitat to which benthos (i.e., bottom-dwellers) must adapt. Dominant assemblages include polychaetes (*Chloeia pinnata, Pectinaria californiensis, Paraprinospio pinnata, Maldane sarsi Lumbrineris* spp., *Tharyx* spp.), pelecypods (*Cyclocardia ventricosa*), ostracods (*Euphilomedes* spp.), gastropods (*Mitrella permodesta*), and echiurans (*Arhynchite californicus*).

Nearshore Lower Slope

Macrobenthic species diversity and biomass decrease over slope depth, and on lower slopes, these parameters approach their lowest values. Dominant assemblages in nearshore lower slope regions at water depths of 1,640 to 2,461 feet (500 to 750 m) include polychaetes (*Maldane sarsi, Lumbrineris* spp., *Anobothrus trilobata*, *Tharyx* spp.), gastropods (*Mitrella permodesta*), mollusks (Aplacophora), pelecypods (*Saturnia californica*), and echiurans (*Listriolobus hexamyotus*).

Offshore Lower Slope

Offshore lower slope regions, with water depths of 1,640 to 4,921 feet (500 to 1,500 m), are also low in species abundance and diversity. Slope assemblages consist mostly of randomly dispersed populations. Dominant assemblages include amphipods (*Byblis* spp.), polychaetes (*Lumbrineris* spp., *Tharyx* spp., Paraonidae, *Phyllochaetopterus limicolus*), and ophiuroids (*Amphipholis squamata*, *Ophiura leptoctenia*).

Basins

Deep sea basins exhibit the lowest macrofaunal species abundance and diversity of any other benthic habitat in the offshore region. This impoverishment could be due to anaerobic conditions and high sedimentation rates typical of these areas. Assemblages in most of the basins studied are composed of randomly dispersed populations occurring at depths between 2,057 to 3,077 feet (627 to 938 m) in nearshore basins and between 4,452 to 8,435 feet (1,357 to 2,571 m) in offshore basins. The benthic assemblages of different basins (e.g., Santa Cruz Basin, San Nicolas Basin) have been found to differ slightly from one another, most likely due to differences in proximity to land and sources of sediment, sedimentation rate, and productivity of overlying water. Dominant assemblages include polychaetes (*Lumbrineris* spp., *Tharyx* spp., *Phyllochaetopterus limicolus*, Paraonidae), ophiuroids (*Ophiura leptoctenia*), gastropods (*Mitrella permodesta*), and mollusks (Aplacophora).

Submarine Canyons

The Mugu submarine canyon (refer to Figure 3.1-2) is the shortest of the submarine canyons crossing the continental shelf off southern California. Originating within 150 feet (46 m) of shore at the mouth of Mugu Lagoon, this canyon approaches shore closer than any of the other coastal submarine canyons in southern California. It is eroding shoreward at an appreciable rate, and it currently poses a threat to the stability of natural beach and man-made facilities on the adjacent beach at Point Mugu. This canyon, an extension of the watershed containing Calleguas Creek, extends approximately 9 NM (16 km) offshore across the continental shelf and the basin slope. The head of the submarine canyon is eroding primarily as a consequence of the "downcutting" effects of the sand flowing into the canyon from the lagoon and from beaches to the northwest. This downcutting is a result of wave-induced longshore transport (Bascom 1980) as well as submarine slides and sloughing of the hard substrate. At a depth of about 2,400 feet (730 m), the canyon becomes indistinguishable from the basin floor (Emery and Hülsemann 1963).

Infaunal assemblages in submarine canyons are impoverished due to sediment instability and, in some cases, freshwater discharge from shallow and deep aquifers. Species abundance and numbers of individuals decline with increasing depth in the canyons. The infauna is extremely impoverished in the deeper portions of the Mugu submarine canyon, where it merges with the floor of the Santa Monica Basin. Deposit feeders such as maldanid worms and heart urchins are more common, although some suspension feeding species also occur. The change from suspension feeding to deposit feeding correlates generally with a change in sediment texture from sandy silt to fine silts and clays. Near its mouth, the Mugu submarine canyon is severely impoverished, similar to Santa Monica Basin with which it merges (Hartman 1963). It is likely that the cause of this condition is very low concentrations of dissolved oxygen, which is depleted in the deeper portions of the canyon and in the adjoining basins.

Abyssal Region

West of the Patton Escarpment lies the abyssal region, where water depths range from 3,281 feet (1,000 m) to greater than 13,123 feet (4,000 m) (refer to Figure 3.4-2). This region is the least studied of all others addressed within this EIS/OEIS. Due to the great water depths benthic assemblages in the abyssal region are similar to those found in the deep basins. Similar to the deep basins, the deep abyssal region exhibits low macrofaunal species abundance and diversity and generally can be described as an impoverished habitat. Dominant benthic assemblages would be similar to those found in the deep basins (i.e., polychaetes, ophiuroids, gastropods, and mollusks).

3.5.2.3 Threatened and Endangered Species

On 29 May 2001, the National Marine Fisheries Service (NMFS) published a final rule to list the white abalone (*Haliotis sorenseni*) as an endangered species under the Endangered Species Act (ESA) (NMFS 2001). Abalone are marine gastropods that grow slowly and have a relatively long life span of 30 years or more. Young abalone seek cover in rocky crevices and under rocks, while adults are found in open, low-relief rock or boulder habitat. White abalone are typically found in relatively deep waters (i.e., 66 to 197 feet [20 to 60 m]) and are historically most abundant between 80 and 100 feet deep (25 and 30 m; NMFS 2001). It is estimated that only about three percent of the area with appropriate depths contain rocky substrate providing suitable habitat. White abalone may be limited to depths where algae grow, a function of light levels and substrate availability, because they are reported to feed less on drift algae and more on attached brown algae (Tutschulte 1976, Hobday and Tegner 2000a, as cited in NMFS 2001). The total California population of white abalone is estimated to be about 300 individuals.

3.5.3 Point Mugu

3.5.3.1 Mugu Lagoon

A - General

Mugu Lagoon is a large, shallow estuary (refer to Figure 3.4-5). As with all wetlands along the southern California coast, the biological composition of wetlands associated with Mugu Lagoon is constantly changing due to man-made and natural disturbances (Zedler 1982). Development of NAS Point Mugu (e.g., roads and buildings) has separated and segregated some portions of the lagoon (e.g., the western arm) thus changing the lagoon's hydrology and habitat compositions. However, in contrast to all other coastal lagoons in southern California, Mugu Lagoon has been the least affected by development (Onuf 1987). This is primarily due to the Navy's presence and conservation efforts, minimizing man-made effects in the area.

Natural disturbance in this habitat is associated with storm events. In most years, rainfall is light, resulting in little freshwater flow into the lagoon from Calleguas Creek, and changes in the sediment structure of the lagoon are generally minimal. However, periodic storm events fill Calleguas Creek and cause considerable input of freshwater and fine sediments into Mugu Lagoon. The lagoon biota tend to consist of mostly marine (saltwater) species that rely on daily tidal exchange for their water supply. Although extensive freshwater flushing can cause mortality in many marine species, this is a natural short-term event that generally does not cause long-term changes in species composition. Excessive sedimentation can, however, cause long-term changes in the species composition. Prior to 1978, the subtidal portions of the eastern arm were evenly dominated by eelgrass (*Zostera marina*) and unvegetated (mud) bottom. Storm events of 1978 caused substantial deposition of new sediments that buried the eelgrass beds, which subsequently died, changing the nature of the subtidal habitat in the lagoon from eelgrass habitat to entirely mud bottom (Onuf 1987).

B - Marine Flora

Both macro- and microflora contribute to the primary production in Mugu Lagoon and provide food for the animals living in the estuary. In addition, the macroflora provides structural habitat for animals. Dominant macroflora includes seagrasses, macroalgae, and emergent vascular plants. The microflora consists of phytoplankton in the water column and benthic diatoms and blue-green algae that cover the sediment.

Due to the loss of seagrass after storms in 1978, submerged macroalgae have become the dominant primary producers in the lagoon. The macroalgae are responsible for ten times more productivity than benthic microflora, which are twice as productive as phytoplankton (Onuf 1987). Although phytoplanktonic microflora contributes much less to the overall primary production of the lagoon, it is an important source of biodiversity (Zedler 1982).

Because of the lack of hard bottom in the lagoon, the only two common macroalgae are *Enteromorpha* spp. and *Ulva* spp. (Onuf 1987; Zedler 1982). These algae can form large mats during periods of low tidal circulation and contribute greatly to primary production. These algal "blooms" have two important roles: they provide shelter to small fish and invertebrates from predators, and they are used as a food source and thus contribute to the food chain.

C - Benthic Marine Invertebrates

The benthic resources of the lagoon consist of many plant and animal taxa. Studies summarizing the marine invertebrate communities of Mugu Lagoon are lacking or are dated (e.g., MacGinitie and MacGinitie 1969). The majority of data on benthic species are from Onuf's (1987) studies of the eastern arm. These data span a number of years that include pre- and post-storm events and provide the most comprehensive species list of benthic invertebrates of the eastern arm. This study suggests that individual invertebrate species are strongly influenced by sediment type and that the invertebrate taxa of Mugu Lagoon are typical of other southern California lagoons.

Wetland species are unique in that they tolerate fluctuating conditions in salinity, temperature, and sediment composition caused by storms. Their ability to handle the fluctuating conditions also influences the type of habitat (i.e., mud flats, subtidal, or upper marsh) in which each species lives. In general, the majority of species in the eastern arm had reductions in their respective populations after the large storm of 1978, but the smaller, worm-like species were most affected (reduced or eliminated) by changes in bottom sediment composition (Onuf 1987).

Two snails (*Cerithidea californica* and *Assiminea californica*) and one crab (*Pachygrapsus crassipes*) species tend to be the dominant large invertebrates that live on the mud flats. The snails are grazers on algal mats, and their presence has been shown to influence the abundance and patchiness of algal mats (Onuf 1987). The other large invertebrates (e.g., clams, shrimp, and worms) of the mud flats burrow in the mud and require daily inundation of seawater.

The most diverse assemblages of epi- and infaunal species occur in subtidal habitats of the lagoon. The most common epifaunal invertebrates are marine snails. Dominant infauna consist of: bivalves (clams and mussels); worms or worm-like organisms such as phoronids, sipunculids, nemerteans, and oligochaetes; and crustaceans (amphipods and ghost shrimp such as *Callianassa californiensis*).

Distance from ocean water inlet, depth, and sediment type all influence the distribution and development of infaunal assemblages. Larger, longer-lived animals tend to live closer to the ocean inlet. At least five species of long-lived clams are common in the subtidal sandy and sandy/mud bottom habitats in outer reaches of the lagoon. These include Pacific littleneck (*Protothaca staminea*), purple (*Nuttallia nuttallii*), Washington (*Saxidomus nuttalli*), California razor (*Tagelus californianus*), and Pacific gaper (*Tresus nuttallii*) clams. Smaller, more ephemeral infaunal invertebrates (e.g., worms) tend to live farthest away from the ocean inlet in muddier sediments. These sediments are subjected to periodic influxes of silt and freshwater, temperature extremes, and elevated salinity levels associated with warm periods in the summer. Common organisms of these habitats include oligochaetes, polychaetes (*Nereis* spp., *Capitella capitata*, *Streblospio benedicti*, and mud-tube building worms [*Pseudopolydora* spp.]), and gammarid amphipods. Most of these are short-lived, opportunistic organisms and are often referred to as ephemeral species. The dominant marine gastropod of the upper marsh is *Melampus olivaceus*.

D - Threatened and Endangered Species

Rare, threatened, or endangered marine species are not known to occur in the Mugu Lagoon. Information on fish and sea turtles is presented in Section 3.6 and marine mammals in Section 3.7.

3.5.3.2 Sandy Beaches and Nearshore Environment of Point Mugu

A - General

The nearshore environment at Point Mugu is dominated by sandy beach habitat. Relative to other sandy beaches in southern California, recreational use is limited and this habitat remains undeveloped and in a natural state. The topography of the sandy beaches is strongly influenced by wave conditions. The beaches are composed of fairly coarse sand and are relatively steep. The foreshore extends out to a depth of about 10 to 12 feet (3 to 4 m) where the slope of the bottom decreases substantially. This slope marks the point of transition from beach into shallow shelf.

B - Marine Flora

Macroflora are not found on sandy beaches because they cannot attach to the small grains of sand. Some sandy beaches may, however, support assemblages of microflora (e.g., surf diatoms). Common genera of surf-zone diatoms include *Anaulus*, *Asterionella*, and *Chaetocerus*. Literature describing the ecological importance and abundance of surf-zone diatoms at Point Mugu is lacking. Therefore, a specific assessment of these microflora cannot be made.

C - Benthic Marine Invertebrates

Sandy beaches of Point Mugu are exposed to wave action and support fewer species than the lagoon (which is protected) or rocky shores where organisms can attach to the rock or find shelter in crevices. The dominant taxa are hard-shelled (e.g., clams and sand crabs) or soft-bodied (e.g., worms) mobile infauna that bury in the sand for protection from waves and predators.

Two clams are common (either over the long-term or seasonally) along the beaches of Point Mugu. The most important of these is the Pismo clam (*Tivela stultorum*). This large long-lived clam occurs at moderate densities along these beaches, especially between the lower edge of the surf zone and the outer edge of the foreshore; this clam is the subject of sport fishing pressure along the exposed beaches of southern and central California (Fitch 1961). The other important intertidal bivalve, the bean clam (*Donax gouldii*), is a relatively small species (Morris et al. 1980; Ricketts and Calvin 1968). It occurs sporadically in the surf zone in dense patches that can persist for up to 3 years. Animals in these patches tend to remain at a consistent tidal level regardless of tidal fluctuations. Dense bands of bean clams can extend for over 1 mile (2 km) along some beaches.

Besides clams, other important infaunal organisms include polychaete worms and crustaceans. Most of these species are seasonally abundant and are most common in spring and summer (Morris et al. 1980; Ricketts and Calvin 1984). Important polychaetes include the deposit-feeding bloodworm (*Euzonus mucronata*) and the predatory shimmy worm (*Nephtys californiensis*). The most common crustacean is the sand crab (*Emerita analoga*), a suspension feeder that also moves up and down the beach in response to changes in tidal level. Less common crustaceans include several amphipods that inhabit relatively specific tidal elevations extending from the upper intertidal level (e.g., beach hoppers of the family Talitridae) down to the lower intertidal zone (e.g., family Haustoriidae).

D - Threatened and Endangered Species

Rare, threatened, or endangered marine species have not been recorded for the nearshore environment of Point Mugu (CDFG 1994). Fish and sea turtles are addressed in Section 3.6 and marine mammals are addressed separately in Section 3.7.

3.5.4 San Nicolas Island

A - General

San Nicolas Island has few coves and is located far from the wave shadow of the other islands. Consequently, species that typically occur in calm waters are rare or absent (Engle 1994). Surface water temperature in the vicinity of San Nicolas Island typically ranges between 57° F (14° C) and 64° F (18° C). Ocean currents on the north shore of the island flow along its contours in a northwest to southeast direction at a speed of approximately 0.5 knots (0.9 km/hr). Since the island presents an obstruction to the prevailing flow of wind and swell, the southeastern shore is the most sheltered portion of the island (refer to Figure 3.4-1).

San Nicolas Island is far enough offshore to receive cold water from the California Current, yet far enough south to receive warm water from the California Countercurrent. Therefore, the subtidal species are considered to be intermediate (a combination of both northern and southern species) in relation to the other Channel Islands (Engle 1994). Another major influence on marine species distribution at San Nicolas Island is the geologic composition of the marine habitat. Bedrock is the dominant habitat type in shallow water around the Channel Islands, followed by boulder and sand. San Nicolas Island's shoreline consists of about 61 percent bedrock and 33 percent sandy beach (Engle 1994).

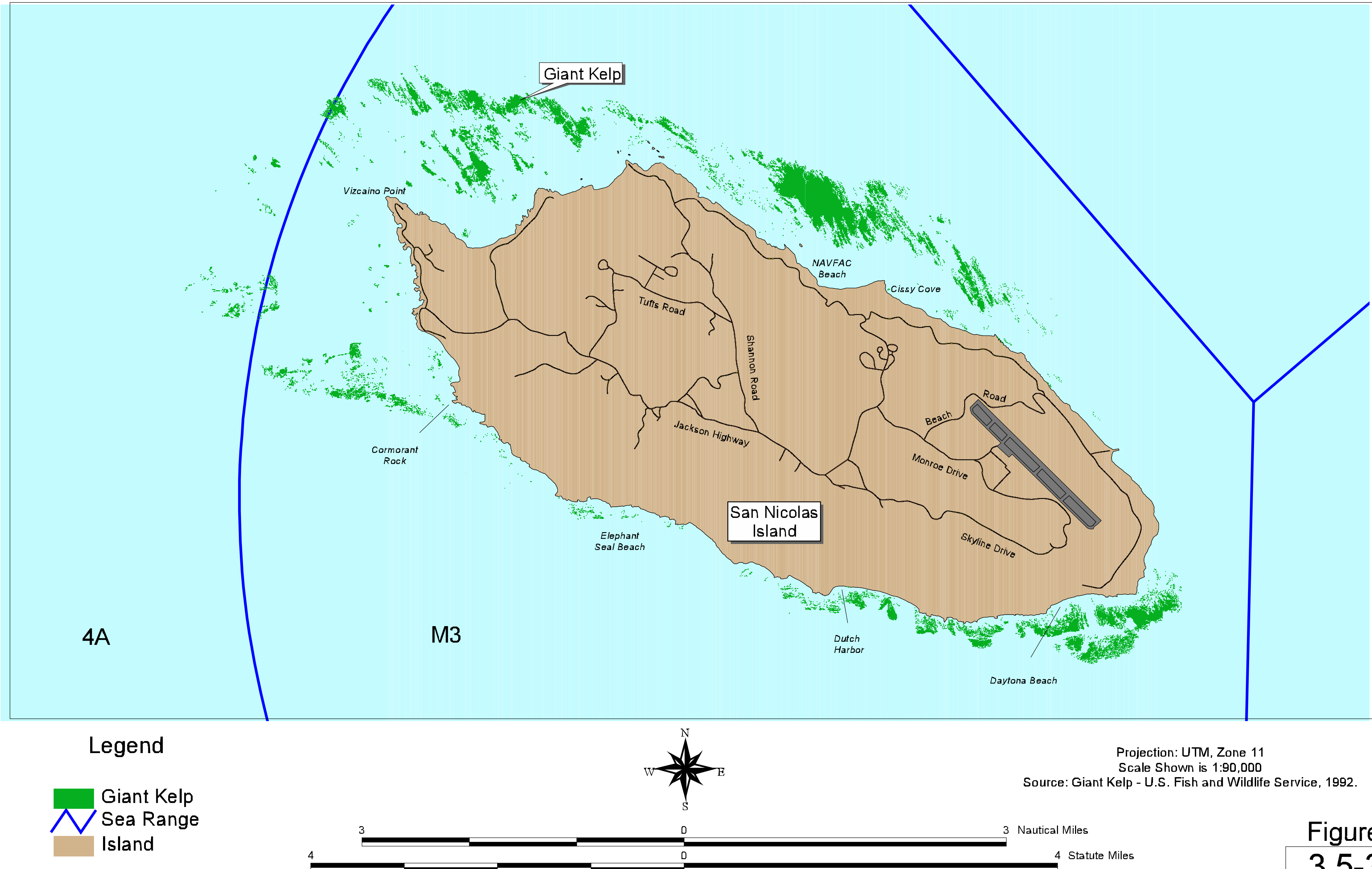
B - Marine Flora

San Nicolas Island is almost completely surrounded by marine flora (Figure 3.5-3). This is primarily due to the large amounts of rocky subtidal habitat that surrounds the island. The rocky habitat is ideal for giant kelp (*Macrocystis pyrifera*) and numerous species of red, green, and brown algae. The rocky intertidal algal assemblages at the west end of San Nicolas Island are distinctly different than algal assemblages of the other Channel Islands and the mainland (Murray and Littler 1981). This difference is primarily due to San Nicolas Island's location and oceanographic conditions (current flow and water temperature) (Murray and Littler 1981). In addition to differences in algal populations, San Nicolas Island may have some distinct differences in fish and invertebrate populations, but scientific studies to determine this have not yet been performed (Engle 1994).

Giant kelp surrounds the island except along the eastern edge. As discussed earlier in Section 3.5.2.1, San Nicolas Island provides a large percentage (14 percent) of the total kelp canopy of the entire SCB (Dailey et al. 1993) and about 30 percent of the giant kelp found in the Channel Islands (Engle 1994). Kelp forests are an important part of the marine ecosystem because they serve as food, shelter, substrate, and nursery habitat to migratory and resident species of fish and invertebrates (Richards and Kushner 1992).

Unlike the rocky habitats, sandy beaches do not support rich assemblages of different species of macroflora, the exception being surfgrass (*Phyllospadix torreyi*). In sandy areas, surfgrass is important habitat for fish and invertebrates for food and refuge. Although surfgrass is found offshore of sandy beaches, it requires hard substrate for its root structure to hold. This implies that the subtidal areas offshore of the sandy beaches have hard substrate that is buried just below the sand surface.

Kelp Distribution at San Nicolas Island



Projection: UTM, Zone 11
Scale Shown is 1:90,000
Source: Giant Kelp - U.S. Fish and Wildlife Service, 1992.

Figure 3.5-3

C - Marine Benthic Invertebrates

Benthic invertebrates are characterized by habitat type (i.e., rocky or sandy) in which they are found. Because rocky habitats are ideal for attachment of sessile (non-motile) invertebrates and are generally more stable than sandy beaches, rocky habitats support more invertebrate species than sandy habitats. Rocky habitat is common off San Nicolas Island and over 150 invertebrates are known for the island (NAWS Point Mugu 1997e). Invertebrates that inhabit rocky areas include sea stars, snails, nudibranchs, urchins, abalone, anemones, barnacles, mussels, worms, lobsters, crabs, and bryozoans. Both urchin and lobster support substantial sport and commercial fisheries (abalone has also been fished at San Nicolas Island but this fishery is currently closed [refer to Section 3.12, Socioeconomics]).

The invertebrate species that inhabit the shallow sandy areas of San Nicolas Island are similar to the species found along the sandy beach area of Point Mugu and include polychaetes, sea stars, olive snails (*Olivella biplicata*), and the spiny mole crab (*Blepharipoda occidentalis*).

D - Threatened and Endangered Species

Rare, threatened, or endangered marine species have not been recorded for San Nicolas Island (CDFG 1994). Information on fish and sea turtles is presented in Section 3.6 and marine mammals in Section 3.7.

3.6 FISH AND SEA TURTLES

3.6.1 Introduction

3.6.1.1 Definition of Resource

This section addresses marine fish and sea turtles that inhabit or are known to occur within the Point Mugu Sea Range. Species of fish and sea turtles that are currently listed as either endangered or threatened under the Endangered Species Act (ESA) of 1973 (16 U.S.C. § 1531) are specifically addressed. Section 7 of the ESA requires federal agencies to consult with the USFWS or the National Marine Fisheries Service (NMFS) to ensure that their actions do not jeopardize the continued existence of a listed species or its critical habitat.

Essential Fish Habitat

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA; 16 U.S.C. §§ 1801 - 1882) were implemented "to identify and protect important marine and anadromous fish habitat." In accordance with these amendments, NMFS has developed Fishery Conservation Management Plans (FCMPs) that identify Essential Fish Habitat (EFH). EFH is defined in the MSFCMA as "…those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The MSFCMA requires federal agencies to consult with NMFS to ensure that their actions do not adversely affect EFH.

Three EFH zones have been identified off the west coast of the U.S.: 1) Coastal Pelagic, 2) Groundfish, and 3) Pacific Salmon. Two of the three EFH zones (Coastal Pelagic and Groundfish) occur within the Point Mugu Sea Range, both extending from the coastline out to 200 miles (320 km) offshore along the entire length of the west coast of the U.S. (i.e., from the Mexican to the Canadian border). The Coastal Pelagic EFH includes surface waters or, more specifically, waters above the thermocline where sea surface temperatures range between 50° F to 79° F (10° C to 26° C). The Groundfish EFH includes surface waters and benthos, encompassing all waters from the mean higher high water line, and the upriver extent of saltwater intrusion in river mouths seaward to the 200 mile (320 km) boundary.

3.6.1.2 Regional Setting

A - Fish

About 481 species of fish inhabit the SCB (Cross and Allen 1993). The great diversity of species in the area occurs for several reasons: 1) the ranges of many temperate and tropical species extend into and terminate in the SCB; 2) the area has complex bottom topography and a complex physical oceanographic regime that includes several water masses and a changeable marine climate (Horn and Allen 1978; Cross and Allen 1993); and 3) the islands and nearshore areas provide a diversity of habitats that include soft bottom, rock reefs, extensive kelp beds, and estuaries, bays, and lagoons.

Point Conception is recognized as a boundary for the distribution of certain fish species, especially for southern species (Cross and Allen 1993). South of Point Conception, northern species tend to move into deep, colder water or upwelling areas. A few southern species occupy warm nearshore habitats such as bays and estuaries north of Point Conception. There are also seasonal migrations of temperate and subtropical species into the SCB and invasions of tropical species during warm-water years and northern species during cold-water years (Cross and Allen 1993).

During their life cycles and over the period of a day, fish may occupy more than one habitat. Some bays and estuaries serve as nursery areas for juveniles of some species. At night, some benthic and midwater species rise to the surface and other species that dwell in kelp forests may become pelagic (i.e., mid-water) or move out over soft or rock substrates (i.e., ocean bottom habitats).

For the period 1994 to 1995, the most commonly harvested commercial species in the Sea Range were Pacific sardine, Pacific mackerel, yellowfin and skipjack tuna, rockfish, northern anchovy, swordfish, Dover sole, and thresher shark (Table 3.6-1). During 1995, reported landings from the entire Sea Range (excluding tunas, bonito, sharks, and rays and other species for which California landings are not shown in Table 3.6-1) accounted for 4.1 percent of the entire California catch (Table 3.6-1). U.S. landings of tunas in the Pacific averaged 240,000 tons (220,000 metric tons) per year in 1990-92 (NMFS 1995). Total landings of all tuna on the entire Sea Range were 1,626 tons (1,475 metric tons) or about 0.7 percent of the U.S. Pacific catch of 240,000 tons (220,000 metric tons).

Table 3.6-1. Sea Range and California Commercial Fish Catch Totals (in metric tons)

	Entire Sea Range[1]	California Landings	Entire Sea Range as Percent of California Total
All tuna	1,626		
Pacific bonito	14		
Pacific mackerel	620	8,667	7.2%
Jack mackerel	38	2,640	1.4%
Swordfish	73	788	9.3%
Pacific sardine	1,952	43,450	4.5%
Northern anchovy	224	1,881	11.9%
Thresher shark	39	155	25.2%
Sharks and rays	27		
Sablefish	20	2,716	0.7%
Lingcod	12	538	2.2%
Other demersal fish	52	4,618	1.1%
Dover sole	32	6,043	0.5%
California halibut	11	347	3.2%
Other flatfish	8	3,036	0.3%
All rockfish	458	11,620	3.9%
Other fish	6		
Total	**5,212**		
Total[2]	**3,539**	**86,499**	**4.1%**

[1] Total landings of various fish species from the Sea Range, as compared with total California landings in 1995. Right column shows landings from the entire Sea Range as a percent of total California landings.
[2] Excluding tuna, bonito, sharks, rays, and other fish not listed above.
Source: CDFG 1996a,b.

B - Sea Turtles

Four species of sea turtles found in U.S. waters are known to occur at sea within the Point Mugu Sea Range. All are currently listed as either endangered or threatened under the ESA (NMFS/USFWS 1995). These include loggerhead (*Caretta caretta*), leatherback (*Dermochelys coriacea*), eastern Pacific green (*Chelonia agassizi*), and olive ridley (*Lepidochelys olivacea*) (NMFS/USFWS 1992; NMFS/USFWS 1996a). The eastern Pacific green, also known as the black sea turtle, is considered by some to be a subspecies of the green sea turtle (*C. mydas*). None of these four species is known to nest on beaches in southern California.

3.6.1.3 Region of Influence

The region of influence (ROI) for fish and sea turtles consists of the Point Mugu Sea Range and the offshore areas surrounding Point Mugu, San Nicolas Island, and the other Channel Islands. Descriptions are based on literature surveys, previously conducted field surveys, and commercial fisheries data obtained from CDFG. Marine biology (e.g., marine flora and benthic organisms) is discussed in Section 3.5, and marine mammals are discussed separately in Section 3.7.

3.6.2 Point Mugu Sea Range

This section describes fish and sea turtles that are known to inhabit or occur within the Point Mugu Sea Range. This includes fish that inhabit coastal waters of Point Mugu, San Nicolas Island, and the northern Channel Islands. Fish known to inhabit the Mugu Lagoon are also addressed within this section. Since one of the issues addressed within this EIS/OEIS is the potential for Sea Range operations to affect fish catchability, specific focus is given to commercially harvested fish species.

3.6.2.1 Fish

A - Fish Species by Depth

This section describes fish that inhabit waters of the Point Mugu Sea Range. The fish that inhabit nearshore waters of the islands and the mainland are described later in this chapter (Section 3.6.3.1-B).

Figure 3.6-1 shows the general biological zones of a vertical water column in an ocean environment. Fish on the Sea Range can be pelagic (living in the water column), benthic (living on the bottom), or demersal (associated with the bottom, but often found feeding in the water column). The pelagic habitat can be subdivided into the epipelagic, mesopelagic, and bathypelagic zones (see Figure 3.6-1). Epipelagic habitats in the SCB extend down to depths of 328 feet (100 m) and are inhabited by nearly 200 species of fish. The mesopelagic zone and the deep (greater than 1,640 feet [500 m]) bathypelagic zone, taken together, are inhabited by 124 species; coastal areas are inhabited by 79 species (Cross and Allen 1993).

The epipelagic zone is illuminated and subject to fluctuations in temperature. It is inhabited by large, active, fast-growing, and long-lived epipelagic fishes; by mesopelagic species that rise in the water column to feed at night; and by those demersal and benthic species that feed in the water column (Cross and Allen 1993). Epipelagic fish include small schooling herbivores such as northern anchovy (*Engraulis mordax*), Pacific sardine (*Sardinops sagax caeruleus*), and Pacific mackerel (*Scomber japonicus*); schooling predators such as Pacific bonito (*Sarda chiliensis*) and yellowtail (*Seriola lalandi*); and large solitary predators such as sharks and swordfish (*Xiphias gladius*) (Cross and Allen 1993). Most of this section addresses commercially harvested species that are either wholly or partially epipelagic. Mesopelagic fish are discussed near the end of this section.

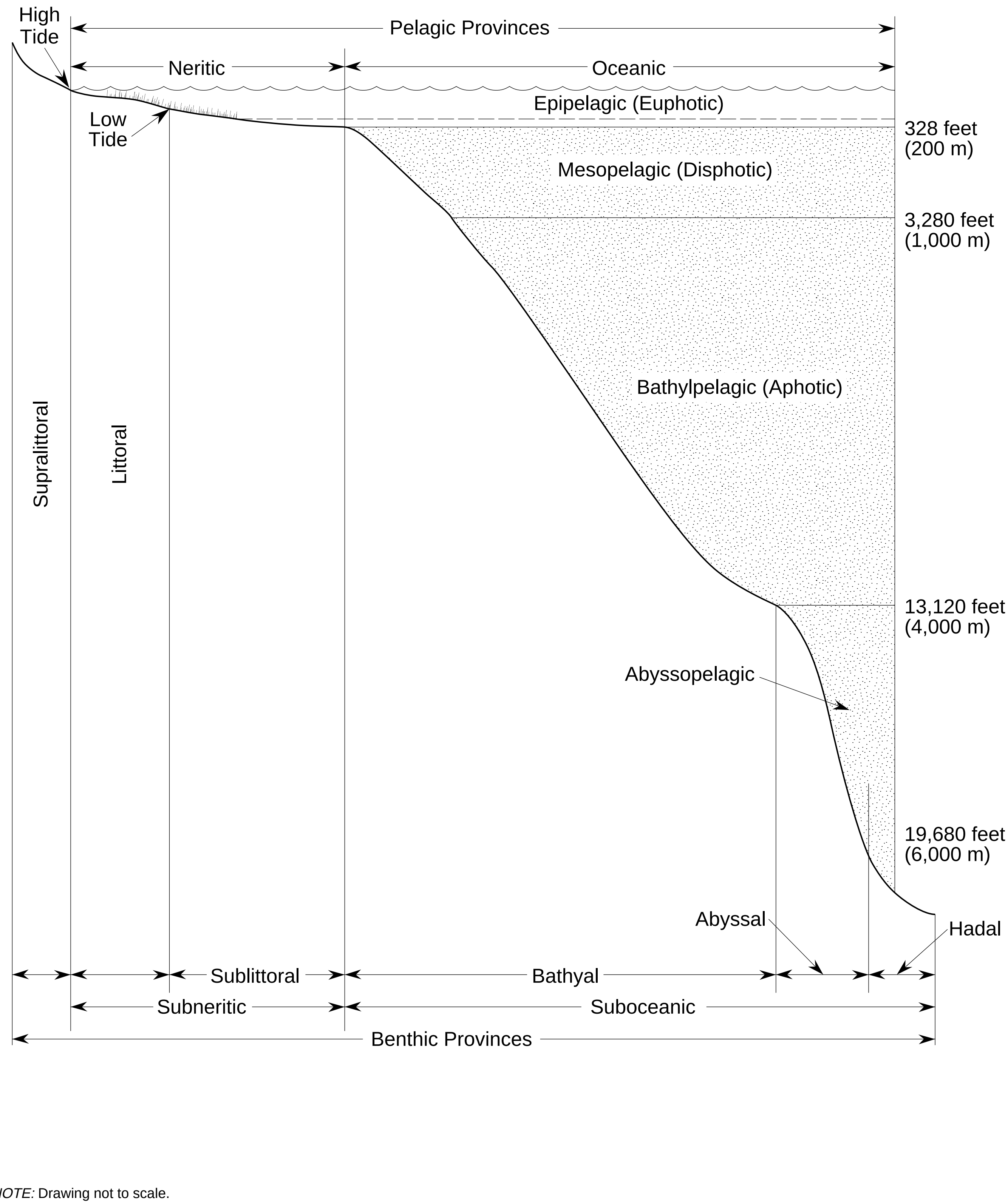


Figure 3.6-1
General Biologic Zones of the Ocean Environment

B - Commercially Harvested Species

The waters of the Sea Range support valuable commercial and recreational fisheries based on small pelagic species like sardines and anchovies, large pelagic species such as tuna and shark, and bottom or near-bottom dwelling halibut, sole, and rockfish. The recreational fishery includes fishing from commercial party vessels (chartered fishing boats), privately owned fishing boats, and shore-based fishing. Because it yields information on the distribution and relative abundance of fish, only the commercial fishery is considered in this and following sections. Recreational fishery landings are addressed in Chapter 3.10, Land Use.

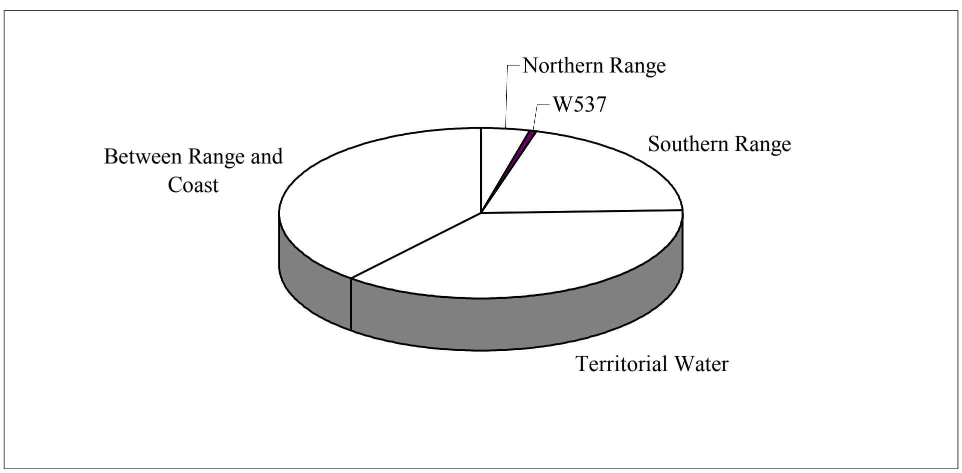
In 1994-1995, an average of 8 million pounds (3.6 million kg) of fish per year were reported as being landed from the entire Sea Range by the commercial fisheries (Table 3.6-2). An additional 5 million pounds (2.3 million kg) were reported as landed from areas between the Sea Range and the adjacent coast.

Table 3.6-2. Average Annual Landings, 1994-1995[1]

Area	pounds	kg
Sea Range		
Non-Territorial Waters	3,184,832	1,444,630
Territorial Waters	4,785,792	2,170,821
Total	**7,970,624**	**3,615,451**
Adjacent Coastal Areas	5,066,704	2,298,242

[1] Reported landings for the years 1991 to 1993 represent only 50 percent of the catch, while those for the years 1994 and 1995 represent about 80 percent of the catch. Thus, much of this discussion refers to landings in 1994 and 1995.
Source: CDFG 1996a,b.

Figure 3.6-2 shows a general distribution of commercial fish catch totals in various portions of the Sea Range. Total reported landings were much higher in the southern part of the Sea Range than in the northern part of the range (Table 3.6-3). A breakdown of total catch in the Sea Range is presented in Figure 3.6-3. Catch totals in nearshore areas adjacent to the Sea Range approached those of the entire Sea Range (Table 3.6-4).



Source: CDFG 1996c.

Figure 3.6-2
General Sea Range Commercial Fish Catch Totals

Table 3.6-3. Annual and Seasonal Commercial Fish Totals (in pounds) by Species in Non-Territorial Waters of the Sea Range

Species	Average Annual Landings on the Sea Range[1]				Seasonal Landings (pounds)[1]			
	Northern	W-537	Southern	Total	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
Yellowfin tuna	118	-	133,351	133,469	15,409	-	51	118,009
Skipjack tuna	1,653	54	1,574,672	1,576,378	14	-	213,904	1,362,459
Bluefin tuna	2,863	432	1,555	4,849	351	-	-	4,238
Other tuna	11,067	2,490	67,136	80,693	61,997	-	5,072	13,624
All tuna	**15,701**	**2,976**	**1,776,714**	**1,795,389**	**77,771**	**-**	**219,027**	**1,498,330**
Dover sole	61,324	-	11	61,335	34,188	24,732	1,708	707
California halibut	978	9	1,072	2,059	332	367	879	232
Other flatfish	29,763	92	505	30,361	19,958	1,157	633	8,565
All flatfish	**92,065**	**101**	**1,588**	**93,755**	**54,478**	**26,256**	**3,220**	**9,504**
Thornyheads	36,477	35	682	37,194	36,431	-	622	105
Red rockfish group	24,700	9,453	40,524	74,677	15,278	7,480	30,043	8,710
Other rockfish	81,486	16,423	76,589	174,497	45,094	19,867	51,617	37,274
All rockfish	**142,663**	**25,911**	**117,795**	**286,368**	**96,803**	**27,347**	**82,282**	**46,089**
Pacific bonito	2	17	12,265	12,285	12,275	-	10	-
Pacific mackerel	75,700	292	123,153	199,144	53,519	-	46,855	79,790
Jack mackerel	8	47	5,572	5,627	5,207	-	58	362
Swordfish	76,464	6,795	53,801	137,061	34,859	-	10,182	91,137
Pacific sardine	88,311	-	435,427	523,738	303,350	-	11,724	13,044
Northern anchovy	2,494	2,488	4,015	8,997	1,019	2,494	24	2,902
Other pelagic fish	232	525	5,783	6,540	653	159	1,202	731
Thresher shark	26,766	8,290	14,791	49,848	13,986	12	1,730	33,157
Sharks and rays	18,854	1,856	10,815	31,525	4,390	73	5,213	21,217
Other fish	20,666	808	15,062	36,536	12,911	5,321	11,665	3,771
Total	**559,926**	**50,106**	**2,576,781**	**3,186,813**	**671,221**	**61,662**	**393,192**	**1,800,034**

[1] Average annual landings from the Sea Range and areas between the Sea Range and coast (1994-95).
Source: CDFG 1996a.

C - Abundance of Fish

Relative Abundance of Fish on the Sea Range

Figure 3.6-4 shows average annual commercial fish landings for the years 1994 and 1995 standardized by surface area. Figures 3.6-5 through 3.6-8 show the same information broken down by season. Overall reported landings from non-Territorial Waters of the Sea Range averaged 11,273 pounds/50 NM^2 (5,113 kg/171 km^2). The reported landings in the southern portion of non-Territorial Waters of the Sea Range averaged 18,386 pounds/50 NM^2 (8,340 kg/171 km^2) and were about three times higher than landings in the northern part of the range (4,905 pounds/50 NM^2 [2,225 kg/171 km^2]). When standardized per unit area, landings from Territorial Waters of the Sea Range near San Nicolas Island, the Channel Islands, and from areas near the coast were about six times higher than landings from non-Territorial Waters of the Sea Range (Figure 3.6-4).

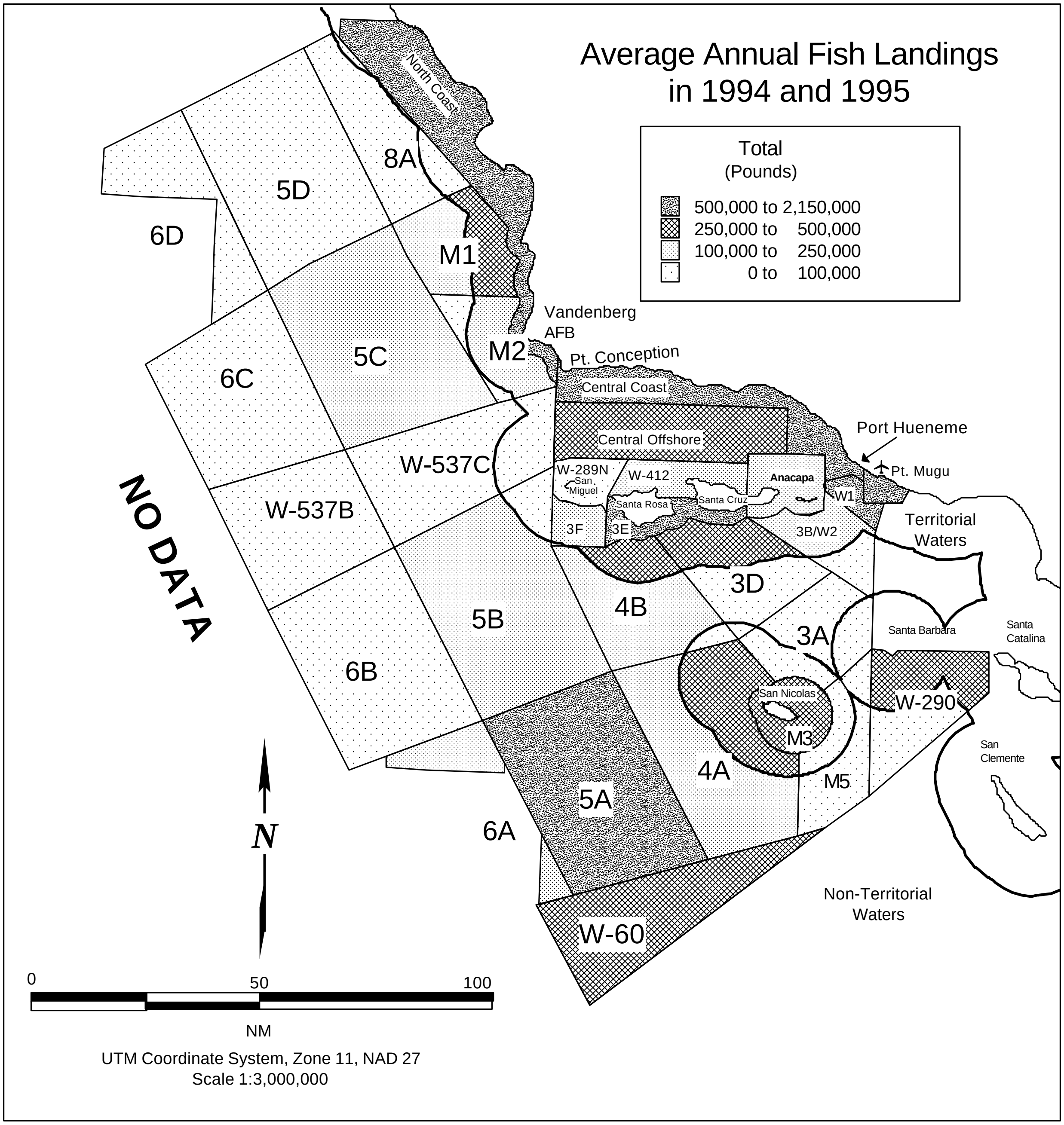
Overall, standardized landings of all fish species combined varied only by a factor of two from season to season. However, within individual areas, seasonal landings varied considerably (see Figures 3.6-5 through 3.6-8), mainly because, as shown above, some species were only caught in specific areas and the catch of these species varied considerably from season to season.

Table 3.6-4. Commercial Fish Totals by Range Area in the Sea Range

Non-Territorial Waters Range Area	Average Total Landing (pounds)
Northern Range	
5C	134,985
5D	55,473
6C	27,127
6D	84,051
M1	199,916
M2	12,609
8A	45,763
Northern Range Subtotal	559,924
W-537	
W-537B	14,966
W-537C	35,141
W-537 Subtotal	50,107
Southern Range	
3A	52,661
3B/W2	13,672
3D	42,360
3F	1,071
4A	237,175
4B	246,792
5A	1,008,289
5B	167,181
6A	121,330
6B	81,924
M5	82,803
W-290	59,618
W-60	461,528
W-61	378
Southern Range Subtotal	2,576,782
Non-Territorial Waters Subtotal	3,186,813

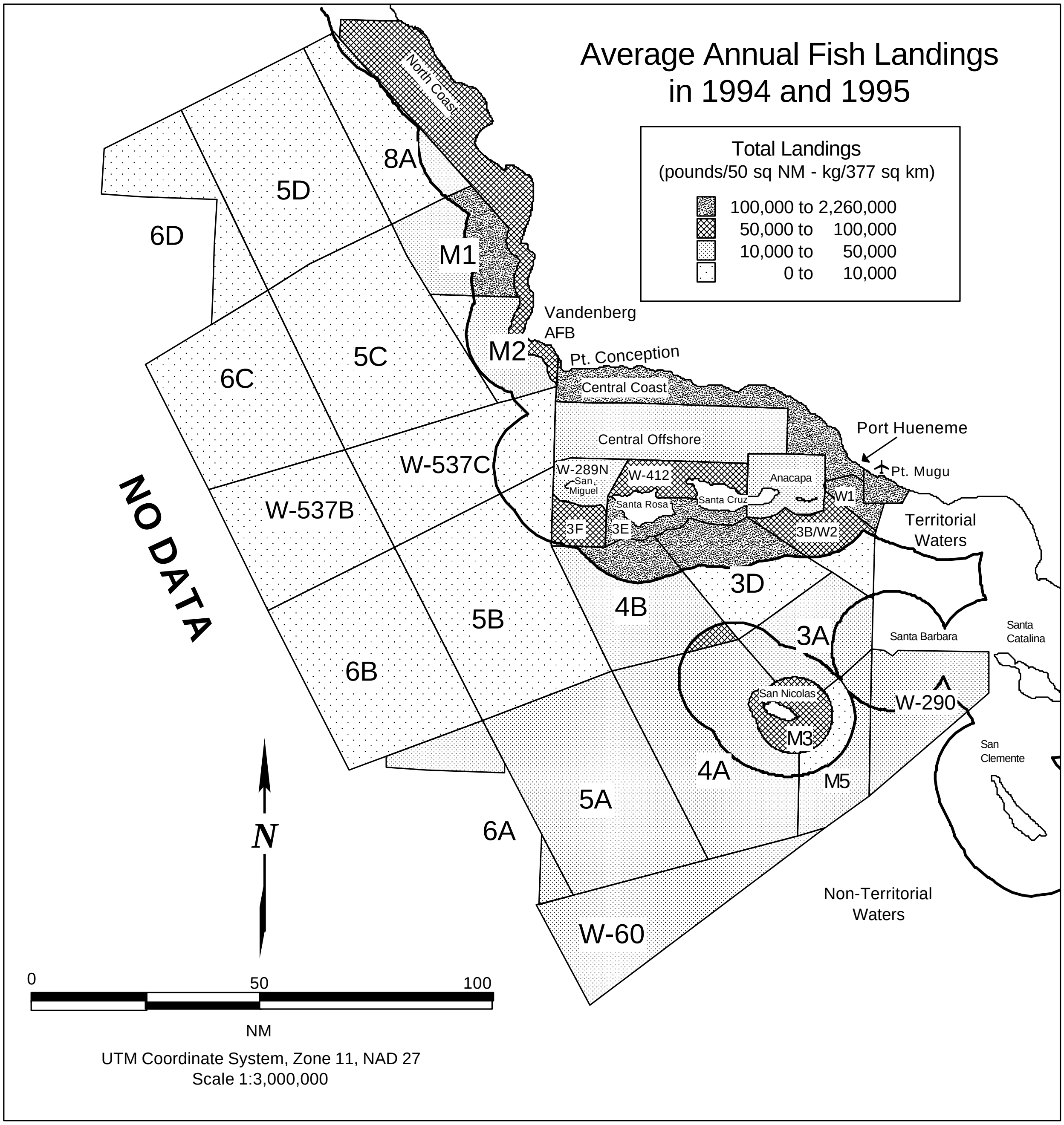
Territorial Waters Range Area	Average Total Landing (pounds)
Northern Range	
8A	24,823
M1	460,115
M2	187,918
Northern Range Subtotal	672,856
Santa Barbara Island	
M5	32,946
3A	47,628
W-290	266,629
Santa Barbara Island Subtotal	347,203
San Nicolas Island	
3D	1,375
4B	48,450
M5	16,376
4A	285,775
3A	69,147
M3	312,173
San Nicolas Island Subtotal	733,296
Channel Islands	
3E	980,276
3F	111,264
W-289N	87,429
W-412	224,762
5B	9,178
3D	498,134
4B	294,170
W-537C	20,565
3B/W2	183,076
Channel Islands Subtotal	2,408,854
Off Point Mugu	
W1	623,585
Territorial Waters Subtotal	4,785,794
Sea Range Total	7,972,607
Between Range and Coast	
East Islands	115,482
North Coast	1,459,824
Central Coast	1,096,304
Central Offshore	250,341
Off Point Mugu	2,144,753
Range/Coast Subtotal	5,066,704
All Areas Total	13,039,311

Source: CDFG 1996a.



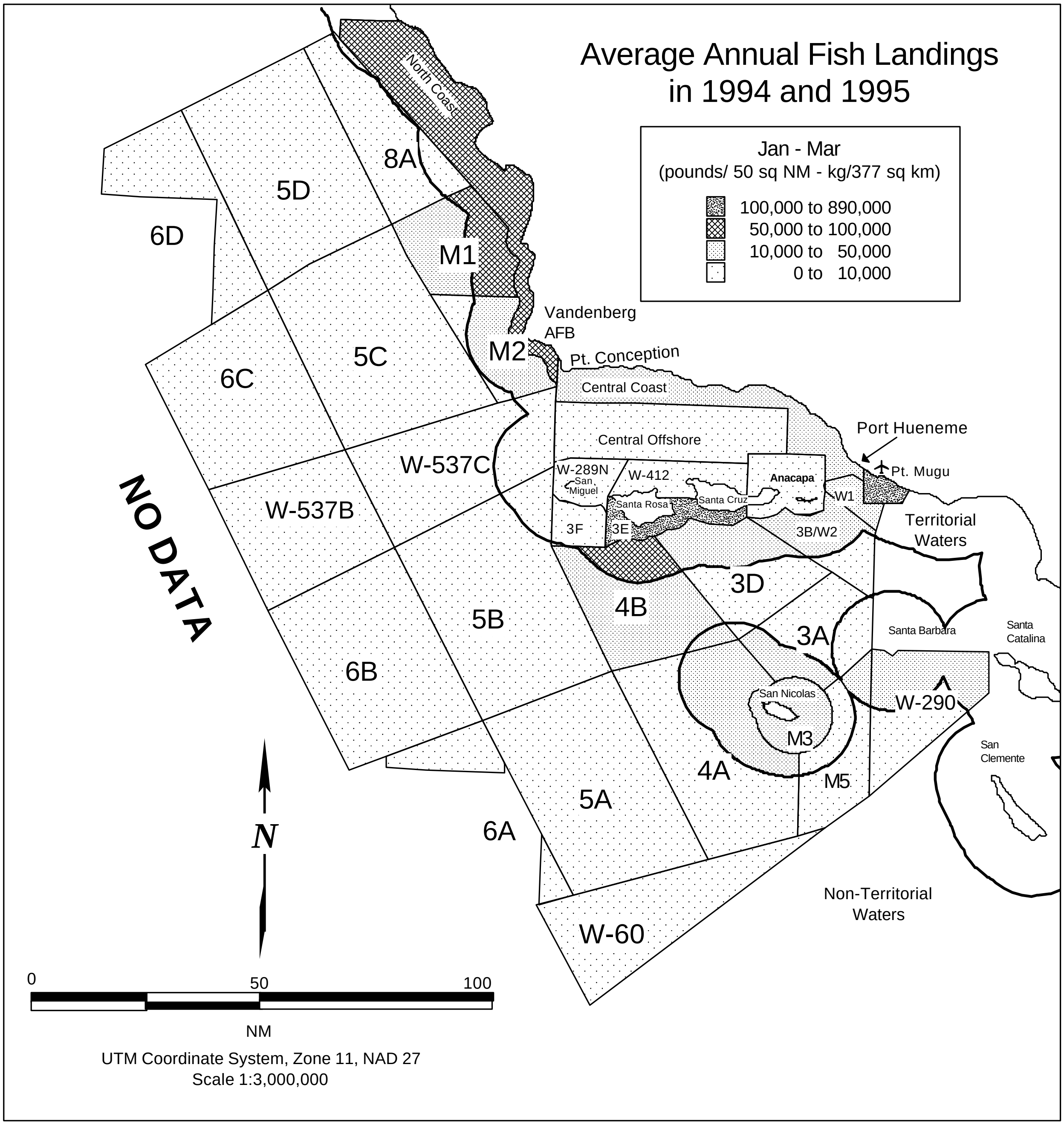
Note: Average annual commercial landings of all fish species from each range area and from areas between the Sea Range and coast for the years 1994 and 1995.
Source: CDFG 1996a.

Figure 3.6-3
Average Annual Fish Landings in 1994 and 1995



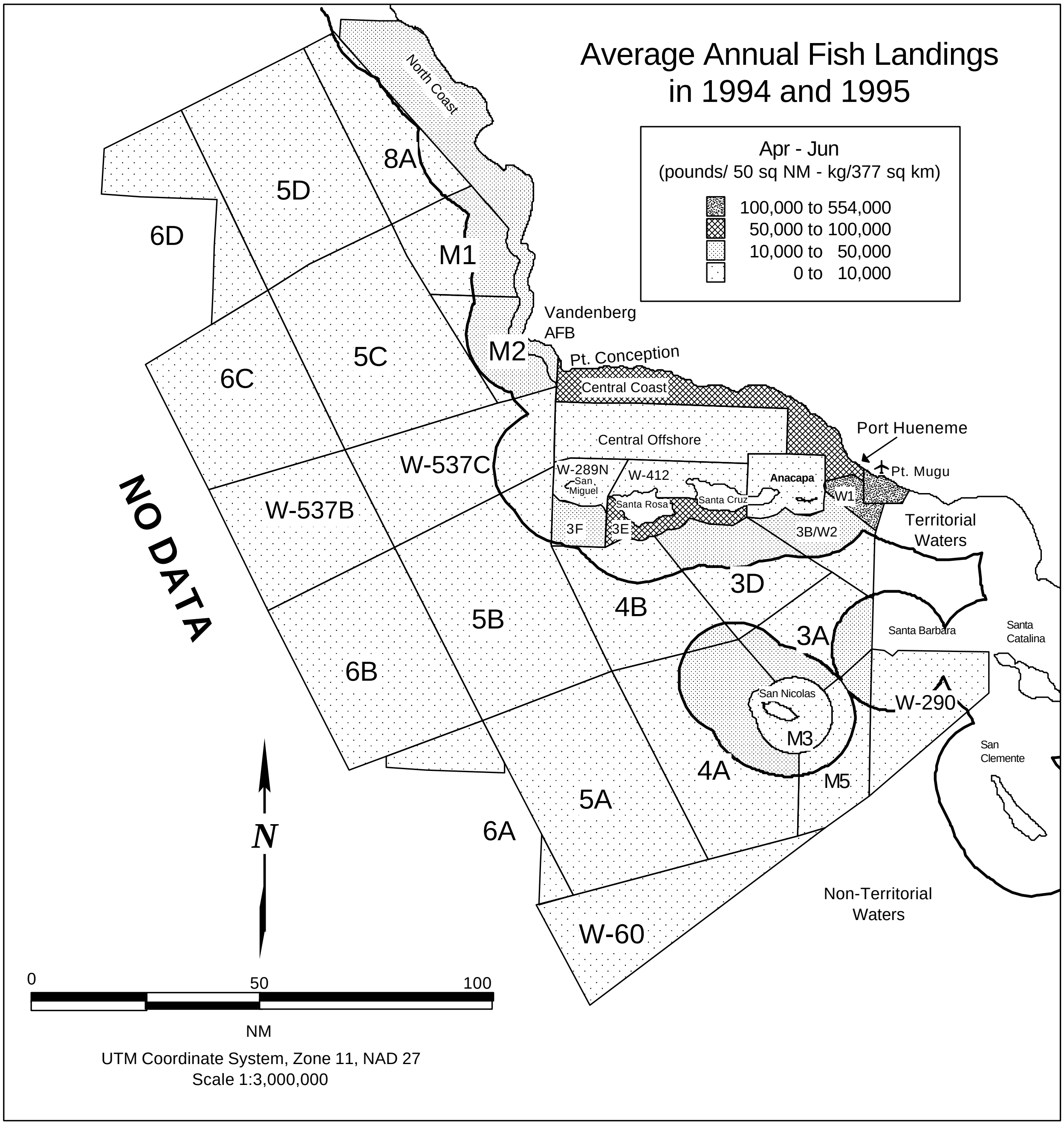
Note: Average annual landings of all species from each range area and adjacent coastal areas for the years 1994 to 1995 standardized as pounds landed/50 NM^2.
Source: CDFG 1996a.

Figure 3.6-4
Average Annual Fish Landings by Unit Area in 1994 and 1995



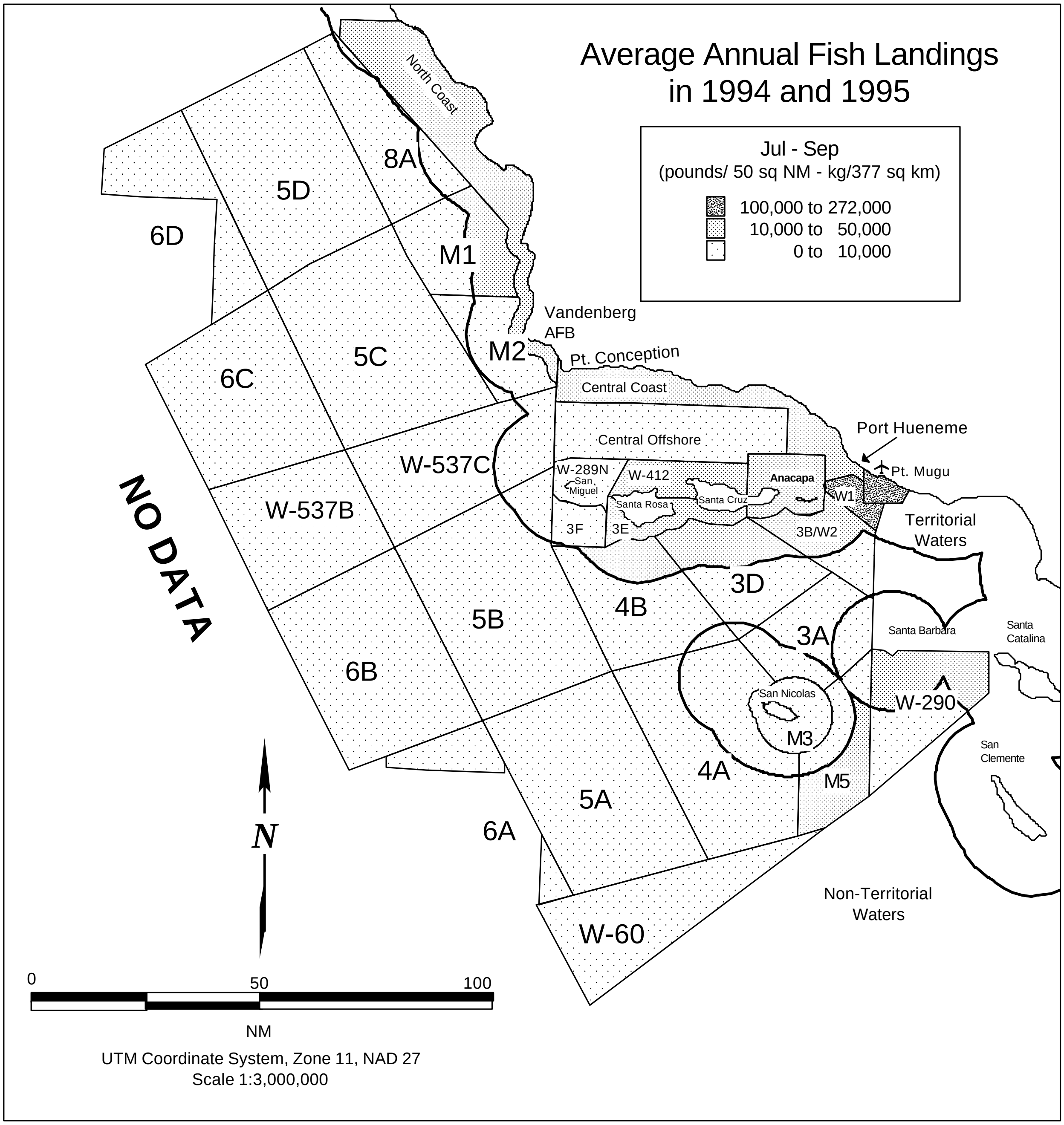
Note: Average total landings for the January to March period from each range area and adjacent coastal areas for the years 1994 to 1995 standardized as pounds landed/50 NM^2.
Source: CDFG 1996a.

Figure 3.6-5
Average Annual Fish Landings in 1994 and 1995: January - March



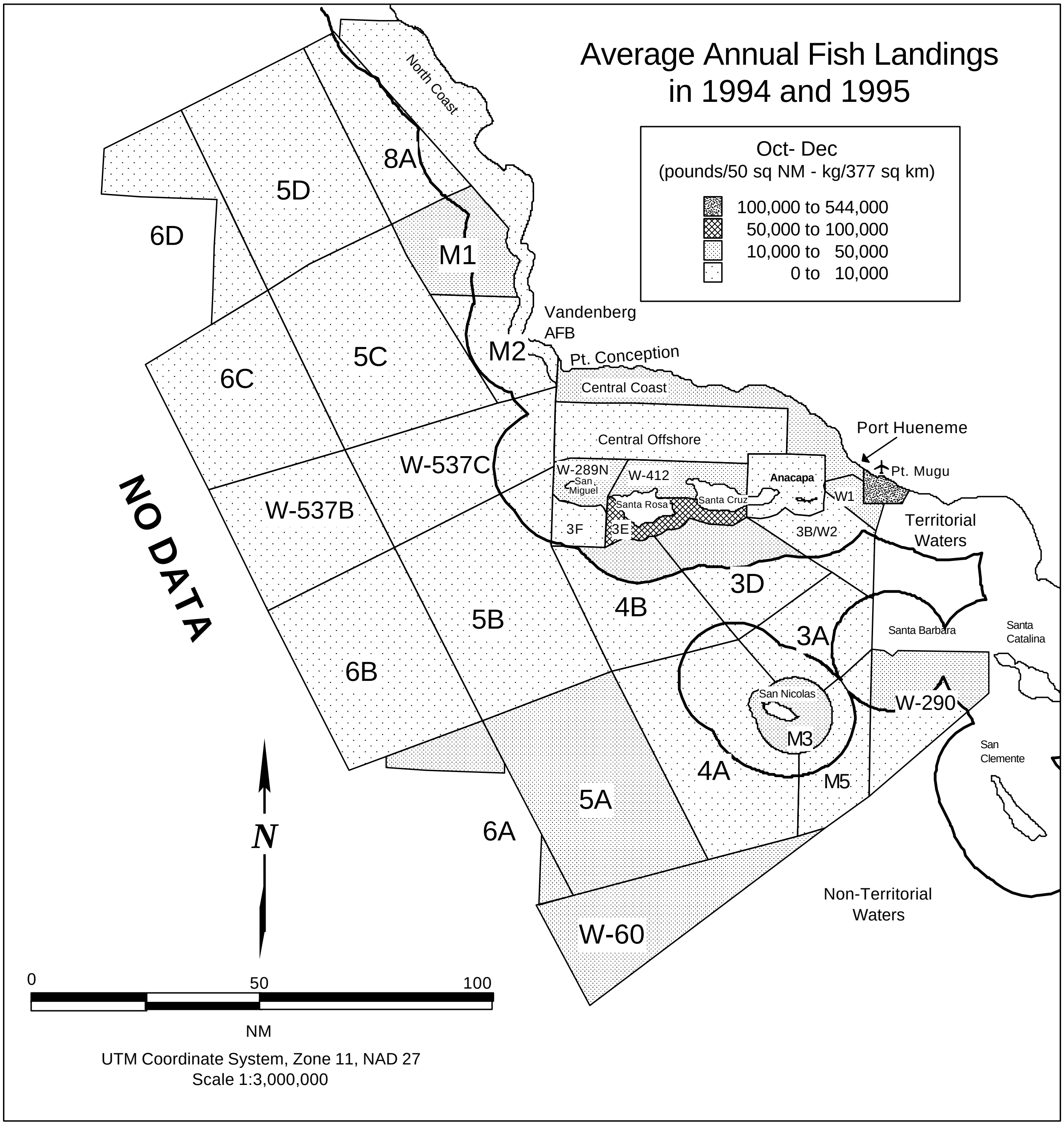
Note: Average total landings for the April to June period from each range area and adjacent coastal areas for the years 1994 to 1995 standardized as pounds landed/50 NM^2.
Source: CDFG 1996a.

Figure 3.6-6
Average Annual Fish Landings in 1994 and 1995: April - June



Note: Average total landings for the July to September period from each range area and adjacent coastal areas for the years 1994 to 1995 standardized as pounds landed/50 NM^2.
Source: CDFG 1996a.

Figure 3.6-7
Average Annual Fish Landings in 1994 and 1995: July - September



Note: Average total landings for the October to December period from each range area and adjacent coastal areas for the years 1994 to 1995 standardized as pounds landed/50 NM^2.

Source: CDFG 1996a.

Figure 3.6-8
Average Annual Fish Landings in 1994 and 1995: October - December

Attributes of Fish Schools

Squire (1972) computed the average weight of individual schools of common schooling species found off central and southern California (Table 3.6-5). He also noted whether schools were most abundant at or near the surface by day or by night.

Table 3.6-5. Average Weight of Individual Fish Schools

Species	Tons/School	At/Near Surface
Northern anchovy	36.5	night
Pacific sardine	26.5	night
Jack mackerel	24.1	night
Skipjack tuna	18.6	-
Albacore	18.2	-
Bluefin tuna	17.9	-
Pacific bonito	17.1	day
Pacific mackerel	16.9	night
Yellowtail	14.2	-
White seabass	4.9	-
Pacific barracuda	4.5	-

Source: Squire 1972.

Holliday and Larson (1979) studied the attributes of unidentified schools of fish in southern California with hydroacoustic methods and found that, since schools preferred depths near the seasonal thermocline, mean depth of schools varied with season. Fish schools apparently prefer the thermal gradient and not the temperature of the water, and the study speculated that fish schools aggregate at the thermocline because their food is most abundant there. The mean depth of schools was 148, 154, and 72 feet (45, 47, and 22 m) in December, May, and September, respectively.

D - Fish Abundance and Oceanographic Conditions

The physical oceanographic regime in the study area is dynamic and affects the abundance and distribution of fishes (Lenarz et al. 1995; MacCall 1996). Short-term fluctuations associated with an El Niño event are superimposed on long-term changes in oceanographic conditions. Many of the data presented here represent only a "snapshot" view of 5 years from a warm period during which there was an El Niño event.

During El Niño events, upwelling ceases or is much reduced and water temperatures rise, causing southern species to expand their distribution northward and northerly species to retreat farther north. During the El Niño of 1992-93, the abundance of tuna, which are tropical/subtropical species, increased dramatically in the Sea Range, while catches of the temperate northern anchovy were very low. El Niño conditions are also associated with reproductive failure of some rockfish species (Lenarz et al. 1995).

There is also a longer-term cycle in the thermal regime off California. The present warm regime began 20 years ago, and biological indicators suggest a transition to a cooler regime in the next decade (MacCall 1996). The present warm regime is associated with a decline in albacore tuna, northern anchovy, and Pacific mackerel stocks, and an increase in subtropical Pacific sardine stocks (MacCall 1996). During this time, the spawning biomass of northern anchovy decreased by a factor of four while the spawning biomass of Pacific sardine increased by a factor greater than 10.

E - Midwater Fishes

Midwater or mesopelagic fish are pelagic and inhabit depths of 164 to 1,969 feet (50 to 600 m). Many of these fish are strong swimmers; they migrate to surface waters each night and return to deep water during the day; have well developed eyes, swim bladders, and photophores; and are countershaded. In contrast, bathypelagic fish that inhabit the deepest waters are generally weak swimmers; have no or reduced eyes, swim bladders, and photophores; and are black or brown in color (Brown 1974).

There are about 120 species of midwater fishes in the SCB. Only a small percentage of them are important species commercially. Northern species are associated with the lower mesopelagic zone where Pacific subarctic water is the dominant water mass and are most common in winter and spring when intrusions of this northern water mass are greatest. Southern species are most common during summer and fall when water of southern origin intrudes. Central Pacific species are represented by only a few species (Cross and Allen 1993).

Within the study area, sampling within three deep water areas showed that three to nine species accounted for 90 percent of the individuals taken in each of the Santa Barbara Basin, the Santa Cruz Basin, and the Rodriguez Dome area (Brown 1974). The depth ranges of some epipelagic and demersal species or their juvenile or larval stages extend into the mesopelagic zone. These include Pacific hake (*Merluccius productus*), Pacific mackerel, swordfish, and sablefish.

F - Rare, Threatened and Endangered Species

On 18 August 1997 the NMFS listed the southern California Evolutionary Significant Unit (ESU) of westcoast steelhead (*Oncorhynchus mykiss*) as endangered (NMFS 1997a). The final listing took effect 17 October 1997 and ESA Section 9 (a) prohibitions (takings) became effective 60 days from the publication of the final listing (i.e., prohibitions went into effect on 16 December 1997).

Steelhead typically migrate to marine waters after spending 2 years in freshwater. They then reside in marine waters for 2 to 3 years prior to returning to their natal stream to spawn as 4- or 5-year olds. The southern California steelhead ESU occupies rivers from the Santa Maria River in San Luis Obispo County to Malibu Creek in Los Angeles County. The Sea Range encompasses the marine waters of this ESU.

3.6.2.2 Sea Turtles

Four species of sea turtles occur at sea within the Point Mugu Sea Range. Few specific data are available on use of the Sea Range by sea turtles, and no data are available on actual numbers of turtles occurring there. This section takes account of the best available information from the northeastern Pacific generally.

The distribution of sea turtles is strongly affected by seasonal changes in ocean temperature (Hubbs 1960; Radovich 1961). In general, sightings increase during summer as warm water moves northward along the coast (Stinson 1984). Sightings may also be more numerous in warm years compared to cold years.

Sea turtles typically remain submerged for several minutes to several hours depending upon their activity state (Standora et al. 1984; 1994; Renaud and Carpenter 1994). Long periods of submergence hamper detection and confound census estimates.

Young loggerhead, green/black, and olive ridley turtles are believed to move offshore into open ocean convergence zones where abundant food attracts sea turtles and other predators (Carr 1987; NRC 1990; NMFS/USFWS 1996c; d; Hunter and Mitchel 1966; Gooding and Magnuson 1967; Carr 1987). An eastern tropical Pacific survey reported that sea turtles were present during 15 percent of observations in flotsam habitats (Pitman 1990; Arenas and Hall 1992).

Stinson (1984) reported that over 60 percent of green/black and olive ridley sea turtles observed in California waters were in waters less than 164 feet (50 m) in depth. Green/black turtles were often observed along shore in areas of eelgrass. Loggerheads and leatherbacks were observed over a broader range of depths out to 3,280 feet (1,000 m). When sea turtles reach subadult size, they move to the shallow, nearshore benthic feeding grounds of adults (Carr 1987; NRC 1990; NMFS/USFWS 1996c, d). Aerial surveys off California, Oregon, and Washington have shown that most leatherbacks occur in slope waters and that few occur over the continental shelf (Eckert 1993). Tracking studies have shown that migrating leatherback turtles often travel parallel to deepwater contours ranging in depth from 660 to 11,500 feet (200 to 3,500 m) (Morreale et al. 1994).

In general, green/black and olive ridley turtles occupy shallow nearshore zones and pelagic leatherbacks and juvenile loggerheads may be found over all water depths.

A - Sea Turtle Species in the Sea Range

Loggerhead Sea Turtle

There are no known nesting sites in the central and eastern Pacific (Dodd 1988; Eckert 1993); however, juvenile loggerheads are abundant in waters of Baja California, Mexico (Bartlett 1989; Pitman 1990). Juveniles and adults are rare in western U.S. waters, and the few sightings are mostly from southern California (Guess 1981a; b; Stinson 1984). However, there have also been isolated sightings from Washington (Hodge 1982) and Alaska (Bane 1992).

Juvenile loggerhead sea turtles are common year-round in the coastal waters of southern California (Guess 1981a; b; Stinson 1984) but sightings are most common during July to September (Stinson 1984). Adult loggerheads are rare in this area. The juvenile loggerheads off southern California may represent the fringe of large aggregations that occur off the west coast of Baja California (Bartlett 1989; Pitman 1990).

Overall, loggerhead abundance in southern California waters is higher during warm years than during cold years, although during July through September the frequency of sightings is similar in warm and cold years (Stinson 1984). Decreased encounters during winter may represent decreased activity due to colder temperatures (Fritts et al. 1983). Loggerhead and green turtles have also been observed burying into soft substrate and entering a state of torpor as an adaptation to surviving seasonably cold temperatures (Carr et al. 1980).

In the Sea Range, juvenile loggerhead turtles may be encountered year-round with the greatest numbers seen during July through September. In winter, they may be more common during warm years. Adult loggerheads are rare at any time of the year.

Adult loggerhead turtles eat a wide variety of benthic invertebrates associated with hard bottom habitats including anemones, squid, snails, clams, crab, shrimp, sea urchins, and fish (Dodd 1988). Plants are occasionally taken. Large groups of juvenile loggerheads have been observed feeding on dense concentrations of pelagic red crab off the southwest tip of Baja California (Bartlett 1989; Pitman 1990).

Jellyfish have been reported in the diets of loggerhead turtles taken in north Pacific drift nets (NMFS/USFWS 1996b).

Leatherback Sea Turtle

There are no known nesting populations of Pacific leatherback turtles in U.S. waters. The coast of Mexico is generally regarded as the most important leatherback breeding ground in the world (NMFS/USFWS 1996c). Turtles from these southerly populations migrate north into U.S. waters. Sightings and incidental captures have been reported from California (van Denburgh 1905; Lowe and Norris 1955; Stinson 1984; Dutton and McDonald 1990b; 1992; Starbird et al. 1993) and from as far north as Alaska (Hodge 1979; Stinson 1984). There were 96 reported sightings of leatherbacks within 27 NM (50 km) of Monterey Bay, California, from 1986 to 1991 (Starbird et al. 1993). Fishermen "regularly" catch leatherbacks in drift/gill nets off Monterey Bay (Starbird 1991 [as cited in NMFS/USFWS 1996c]). Stinson (1984) concluded that the leatherback was the most common sea turtle in U.S. Pacific waters north of Mexico.

Off the U.S. west coast, leatherback sea turtles are most abundant from July to September and are rarely reported during winter and spring. Their appearance in southern California coincides with the arrival of the 64 to 68° F (18 to 20° C) isotherms (Stinson 1984). Stinson (1984) noted that the July appearance of leatherbacks along the U.S. west coast was "two-pronged," with turtles suddenly appearing in southern California and also in northern California, Oregon, and Washington with few sightings along the intermediate coastline. She speculated that turtles may be moving onshore from offshore areas where the water temperature is 55 to 59° F (13 to 15° C). Some of these turtles likely come from Mexico but it is possible that some have migrated from western Pacific nesting grounds via the Pacific Drift Current.

Turtle sightings tend to be more frequent in abnormally warm years or months and less so during cold years (Stinson 1984). This is particularly true in more northern areas during non-summer months. It has been suggested that unusually warm ocean temperatures are responsible for sightings of sea turtles in the northern Pacific (Radovich 1961).

In the Sea Range, leatherback sea turtles are common during the months of July, August, and September and in years when water temperatures are above normal. Their abundance is far lower during October through May.

Information concerning the diet of leatherback turtles is based mostly upon studies conducted in the western Atlantic. The pelagic leatherback turtle appears to feed primarily on jellyfish and obtains additional nutrition from the parasitic crustaceans and symbiotic fish that are associated with jellyfish (Bleakney 1965; Brongersma 1969 [as cited in NMFS/USFWS 1996c]; den Hartog and van Nierop 1984; Eckert 1993).

Green/Black Sea Turtle

The green sea turtle is a circumglobal species found in tropical waters at temperatures above 68° F (20° C). The genus *Chelonia* is often divided into two species: 1) the eastern Pacific green turtle (*C. agassizi*; Bocourt 1868), also known as the black sea turtle, is found in the eastern Pacific Basin from Baja California south to Peru and west to the Galapagos Islands, and 2) the green turtle (*C. mydas*; Linnaeus 1758) is the form found in the remainder of the global range. This taxonomic status remains controversial. The *Chelonia* spp. complex is sometimes be referred to as "green/black" sea turtles.

There are no known nesting sites along the west coast of the U.S. Along the Pacific coast, green/black turtles have been reported from Oregon (Forbes and Mckey-Fender 1968), British Columbia (Carl 1955), and southern Alaska (Hodge 1981), as well as California. Stinson (1984) reported that the green/black turtle was the most commonly observed "hard-shell" sea turtle on the U.S. west coast. Nearly 62 percent of green/black sightings are from Baja California and southern California. The northernmost reported resident population occurs in San Diego Bay (Stinson 1984; Dutton and McDonald 1990a,b, 1992; Dutton et al. 1994).

Green/black sea turtles are sighted year-round in the waters of southern California with the highest frequency of sightings being during the warm summer months of July through October (Stinson 1984). In waters south of Point Conception, Stinson (1984) found this seasonal pattern in sightings to be independent of inter-year temperature fluctuations. North of Point Conception, there were more sightings in warmer years.

The year-round presence of green/black turtles off southern California likely represents a stable north boundary of Mexican populations. As with juvenile loggerheads, the lower number of sightings during winter months may be indicative of a retreat to warmer southerly waters or perhaps dormancy and/or lower activity levels (Felger et al. 1976; Mendonca 1983).

In the Sea Range, green/black turtles may be encountered year-round with the highest concentrations being during July through September. Inter-year fluctuations are less pronounced than for juvenile loggerheads.

The green/black sea turtle is the only genus of sea turtle that is mostly herbivorous (Mortimer 1995). Throughout most of its range the green turtle forages primarily on sea grasses and algae when seagrasses are absent (Carr 1952; Pritchard 1971; Burke et al. 1992; Wershoven and Wershoven 1991; Balazs et al. 1994; Forbes 1994; Mortimer 1995). Occasionally green/black turtles will consume macrozooplankton, including jellyfish (Bustard 1976; Mortimer 1995), kelp and sponges (Carr 1952), and mangrove leaves (Pritchard 1971).

Olive Ridley Sea Turtle

The olive ridley sea turtle is distributed circumglobally throughout tropical and warm temperate waters and is widely regarded as the most abundant sea turtle in the world (NMFS/USFWS 1996d). There are no known nesting sites of this species in California (NMFS/USFWS 1996d). The olive ridley has a tropical distribution and is rarely encountered in the waters off southern California and even less so north of Point Conception (Stinson 1984). Olive ridley sea turtles are encountered only rarely in the Sea Range. Stinson (1984) reported only 10 sightings in U.S. waters south of Point Conception. From 1982 to 1993 only 10 additional records were reported to the stranding network. The highest probability of encounter will probably be during the warmest part of the summer around August, but even then encounters will be rare.

Olive ridley turtles are primarily carnivorous and opportunistic. They consume snails and clams, sessile and pelagic tunicates, bottom fish and fish eggs, crabs, oysters, sea urchins, snails, shrimp, pelagic jellyfish and pelagic red crab (Fritts 1981; Marquez 1990; Mortimer 1995). Ridleys can dive and feed at considerable depths (260 to 980 feet [80 to 300 m]) (Eckert 1993, 1995). In the open ocean of the eastern Pacific, olive ridleys are often seen near flotsam, possibly feeding on associated fish and invertebrates (Pitman 1992).

Summary

Only three species of sea turtles are likely to be encountered commonly in the Sea Range: juvenile loggerhead, leatherback, and green/black. Olive ridley turtles are present but rarely encountered. Loggerhead and green/black turtles may be encountered in the Sea Range year-round but the highest frequency of occurrence is during summer. Leatherbacks will rarely be encountered in the Sea Range during winter but will be the most common sea turtle species during summer.

3.6.3 Point Mugu

A significant marine water resource at Point Mugu is Mugu Lagoon (refer to Section 3.4.3.1). Mugu Lagoon is one of the largest salt marshes in southern California. It is relatively undisturbed and provides a habitat for a diverse assemblage of marine organisms.

3.6.3.1 Fish

A - Mugu Lagoon

Common Species and Abundance of Fish

Forty-three species of fish have been identified from samples taken in Mugu Lagoon by MacGinitie and MacGinitie (1969), Baker (1976), Quammen (1980), and Onuf and Quammen (1983, 1987). Baker (1976) set traps at six locations throughout the lagoon almost constantly for a period of 2 years beginning in January 1972. Quammen (1980) and Onuf and Quammen (1983, 1987) sampled four sites in the eastern arm monthly for a period of 5 years beginning in 1977.

The three most common resident species in the lagoon were arrow goby (*Clevlandia ios*), topsmelt (*Atherinopsis affinis*), and staghorn sculpin (*Leptocottus armatus*) (Onuf and Quammen 1987). The arrow goby inhabits the burrows of crabs and shrimp. Staghorn sculpins rest on the bottom, and fry have been collected in Mugu Lagoon (Baker 1976; Onuf and Quammen 1987). Topsmelt form schools of several hundreds to several thousands of individuals in the water column (Baker 1976; Onuf and Quammen 1987). Topsmelt and staghorn sculpin were common throughout the lagoon with the arrow goby common only in the eastern arm.

Shiner surfperch (*Cymatogaster aggregata*), California halibut, and diamond turbot (*Hypsopsetta guttulata*) were the most common species that did not reside in the lagoon year-round. Some of these non-resident species enter the lagoon to spawn or use it as a nursery area.

Depth and cover by eelgrass (*Zostera marina*) were equally important determinants of fish abundance in the eastern arm of the lagoon. Onuf and Quammen (1987) sampled deep and shallow water sites with and without eelgrass cover. Fish catch was smallest at the shallow-bare site, higher at the shallow-eelgrass and deep-bare sites, and highest at the deep site with eelgrass.

There was a strong seasonal effect on abundance of fish in the lagoon. Monthly sampling over a 5-year period showed that numbers of fish in the eastern arm increased from December/January to June by a factor of about 6 and then declined through the summer and fall (Onuf and Quammen 1987). Most of the common species were always present in the lagoon; however, their abundance peaked at different times (Table 3.6-6).

Table 3.6-6. Seasonal Abundance of Fish in Mugu Lagoon[1]

	Month											
Species	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Speckled sanddab			X	X								
Diamond turbot	X	X	X	X	X	X	X					
Topsmelt					X	X	X	X			X	
Staghorn sculpin					X	X						
Shiner surfperch					X							
Gray smoothhound shark					X	X						
California halibut					X	X	X	X	X			
California tonguefish						X	X	X	X			
Longjaw mudsucker							X	X				
Shovelnose guitarfish								X				
California killfish									X	X	X	
Bay pipefish								X	X	X	X	

[1] Months of peak abundance of the common species in the eastern arm of Mugu Lagoon averaged over a period of 5 years (from Onuf and Quammen 1987).

Fish Breeding in the Lagoon

The shiner surfperch was found to be very common only in late spring and early summer and formed dense schools in eelgrass beds in the eastern arm of the lagoon (Onuf and Quammen 1987). Since it breeds in the lagoon at this time, it may be present only during its breeding season (Baker 1976).

The shovelnose guitarfish (*Rhinobatos productus*) was abundant in the eastern arm in late summer where Baker (1976) observed breeding in the central section of the lagoon and a breeding population of up to 500 individuals in very shallow water. A concentration of round stingrays (*Urophus halleri*) entered the eastern end of the lagoon after the breeding period of the shovelnose guitarfish but Baker (1976) was unable to determine whether they were breeding in the lagoon. The round stingray does move inshore in September to bear young (Eschmeyer and Herald 1983).

The gray smoothhound shark (*Mustelus californicus*) was also observed to breed in the lagoon. The resident species, including arrow gobies, topsmelt, and staghorn sculpin, are assumed to breed in the lagoon (Baker 1976).

Mugu Lagoon as a Fish Nursery

Estuaries and embayments, including Mugu Lagoon, are important nursery areas for California halibut (MMS 1987). Pelagic larvae enter embayments in spring and summer before undergoing metamorphosis, remain there for about 2 years after metamorphosis, and then the juveniles move out to their preferred habitats of sand and mud bottoms off estuaries and embayments. California halibut are present in Mugu Lagoon year-round, but numbers peak in late spring and early summer and remain high through the summer. This species seems to prefer sand/mud bottoms in deeper waters of the lagoon.

Mugu lagoon may also be a nursery area for topsmelt, shiner surfperch, California killfish (*Fundulus parvipinnis*), longjaw mudsucker (*Gillichthys mirabilis*), diamond turbot, staghorn sculpin, starry flounder (*Platichthys stellatus*), and bay pipefish (*Sygnathus* spp.) (Baker 1976).

Rare, Threatened and Endangered Species

The tidewater goby (*Eucyclogobius newberryi*) is listed as endangered by the USFWS (CDFG 1994)[1]. It inhabits coastal lagoons and brackish bays at the mouths of freshwater streams (Eschmeyer and Herald 1983). It has not been recorded in any of the several collections totaling thousands of fish made in Mugu Lagoon.

B - Nearshore Marine Environment off Point Mugu

Sandy Beaches

Grunion (*Leuresthes tenuis*) is the single fish resource that is important on the sandy beaches of Point Mugu. The fish swim onto the beaches to spawn during nighttime spring (as opposed to neap) high tides in spring and summer (Walker 1961). The periodic availability of grunion on the beaches during spring and summer forms the basis for a minor recreational fishery along exposed sandy beaches in southern California. Spawning involves the female fish burying tail-first into the sand along the upper edges of the swash zone at high tide and extruding their eggs into the wet sand several inches below the surface. Meanwhile, beached males release their milt into the film of water beside the buried females, whose wriggling to bury and expel eggs facilitates passage of the milt into the wet sand. When the milt flows down into the sand, it comes in contact with the buried eggs, and fertilization of the eggs occurs. The eggs develop over the ensuing two weeks, hatch when exposed to seawater during the high tides of the next spring tide series, and the larvae swim free of the sand and out to sea.

Nearshore Habitats

Soft substrates are the most common benthic habitat in the SCB, including the area off Point Mugu. Love et al. (1986) sampled three stations at each of three sites that were north and south of Point Mugu. The Ormond site, north of Point Mugu, included sampling stations at Ventura, Mandalay, and Ormond. Queenfish (*Seriphus politus*) and white croaker (*Genyonemus lineatus*) were the dominant species in trawls taken at depths of 20, 40, and 60 feet (6, 12, and 18 m) on soft substrates at the Ormond sites. Northern anchovy, California halibut, and speckled sanddab (*Citharichthys stigmaeus*) were important at all depths. At three sampling sites near Redondo, south of Point Mugu, the dominant species and their corresponding depths were: queenfish, white croaker, and California halibut at 20 feet (6 m), speckled sanddab, white croaker, California halibut, and queenfish at 40 feet (12 m), and speckled sanddab and California halibut at 60 feet (18 m). At the Ormond sites, fish abundance was constant at all three depths, while off Redondo abundance decreased with increasing depth. There were considerable seasonal and annual fluctuations in the abundance of fish. At depths of 20 feet (6 m), fish were scarce during December, abundance increased in April, and peaked in late summer and early fall. The fish may have moved offshore during winter. During the study, from 1982 to 1984, there was an El Niño event (1982-1983) that was associated with a decline in the abundance of many fish species in nearshore waters. The fish may have moved out of warmer, nearshore waters to areas of cooler water.

Inner shelf, soft-substrate species include barred sand bass (*Paralabrax nebulifer*), California halibut, turbot (*Pleuronichthys* spp.), northern anchovy, queenfish, round stingray, speckled sanddab, shovelnose guitarfish, shiner, walleye (*Hyperprosopon argenteum*), white surfperch (*Phanerdon furcatus*), and white croaker (Cross and Allen 1993). Fishes of the outer shelf include calico (*Sebastes dalli*) and stripetail (*S. saxicola*) rockfish, California scorpionfish (*Scorpaena guttata*), bigmouth sole (*Hippoglossina stomata*),

[1] On 24 June 1999, the USFWS proposed to remove the northern populations of the tidewater goby from the list of endangered and threatened wildlife. A Final Rule has not yet been published.

California lizardfish (*Synodus lucioceps*), California tonguefish (*Sympharus atricauda*), curlfin turbot (*Pleuronichthys decurrens*), English sole (*Pleuronectes vetulus*), northern anchovy, and Pacific (*Citharichthys sordidus*) and speckled sanddab (Cross and Allen 1993).

Mean standing crop of fish recorded in beam trawls taken at depths of 20 to 43 feet (6 to 13 m) on soft bottoms between Hermosa Beach and Carlsbad, south of the Sea Range, was 9,778 pounds/NM^2 (12.93 kg/ha) (Allen and Herbinson 1991). Catch along exposed coasts was slightly lower at 8,328 pounds/NM^2 (11.01 kg/ha). Mean standing crop of fish on soft substrates of the outer shelf and slope of the SCB may be about 1,622 pounds/NM^2 (2.14 kg/ha) (Cross and Allen 1993).

Commercial Harvest

There is a substantial commercial harvest in open marine waters off Point Mugu. For the years 1994 and 1995 the average annual commercial catch was 2,144,973 pounds (972,953 kg) in the 62 NM^2 (213 km^2) CDFG statistical block off Point Mugu. The average annual reported landings of 1,157,750 pounds (525,152 kg) in this statistical block for the 5-year period 1991 through 1995 was greater than that in any other statistical block within the Sea Range or along the coast adjacent to the range. For the period 1991 through 1995, the next highest catch was less than half that recorded off Point Mugu and was recorded in one of the largest statistical blocks (758 NM^2 [2,600 km^2]), area 5A.

Pacific sardines comprised 85 percent of the average annual landings. The second most commonly harvested species off Point Mugu was Pacific mackerel. Landings of jack mackerel were high only in 1995 and were taken mainly between July and September. Skipjack and yellowfin tuna were taken from July to September; however, they were abundant only during 2 of the 5 years considered. Northern anchovy were relatively abundant during 4 of the 5 years. The fishery for halibut and rockfish off Point Mugu was relatively small when compared to that of adjoining and other coastal areas. On a per unit area basis, the catch off Point Mugu was much higher than that of any area within or adjacent to the Sea Range (Table 3.6-7). On a per unit area basis, the next-highest catch was recorded in Range Area W1, which is immediately offshore and adjacent to the statistical block off Point Mugu.

Table 3.6-7. Commercial Fish Densities in the Sea Range

Range Area	Pounds/50 NM^2
Off Point Mugu	2,258,205
W1	457,440
3E	377,324
Central Coast	126,953
North Coast	99,491
Channel Islands Waters	87,998
San Nicolas Island Waters	42,648

The high catches in the area off Point Mugu and in adjacent Range Area W1 may be due to the hydrography and bathymetry (ocean bottom contours) of the area. A submarine canyon approaches the shore in this area and may influence the hydrography in such a way that productivity is high and/or food for fish is concentrated. Upwelling would have a greater effect on the hydrography of this nearshore area than in areas with a gently sloping seabed. In addition, there is a freshwater outflow from Mugu Lagoon. This, in combination with the bathymetric influences on hydrography, may cause the kinds of temperature and salinity discontinuities that are generally associated with concentrations of plankton (Marra et al. 1990; Munk et al. 1995). These kinds of discontinuities are evident off the Point Mugu area in satellite imagery presented by Squire (1985) and Laurs et al. (1984).

3.6.3.2 Sea Turtles

The occurrence of four species of sea turtles within the Sea Range as a whole is described in Section 3.6.2.2. It is possible that small numbers of sea turtles could be encountered in nearshore waters off Point Mugu, especially during summer. However, there are no known sea turtle nesting beaches at Point Mugu or anywhere else in the Sea Range.

3.6.4 San Nicolas Island

3.6.4.1 Fish

The offshore islands provide a diversity of habitats for fishes including the nearshore pelagic (midwater) zone, shallow water soft and hard substrates, kelp forests, intertidal sandy beaches, rocky shores, tidepools, and the surf zone. Although some species may be found in several habitats, each of these habitats is occupied by a recognizable community of fishes.

A - Intertidal Habitats

Common inhabitants of the rocky intertidal of the SCB are the wooly sculpin (*Clinocottus maculosus*), reef finspot (*Paraclinus integripinus*), rockpool blenny (*Hypsoblennius gilberti*), spotted kelpfish (*Gibbonisa elegans*), California clingfish (*Gobiesox rhessodon*), juvenile opaleye (*Girella nigricans*), and juvenile dwarf surfperch (*Micrometrus minimus*) (Cross and Allen 1993). These fish usually eat amphipods, isopods, polychaetes, copepods, and gastropods. Some species are specially modified to cling to rocky substrates, can resist desiccation, and use holes, crevices, or algae as protection from turbulence.

B - Nearshore Habitats

Engle (1993) and Cowen and Bodkin (1993) collected fish in nearshore subtidal habitats at San Nicolas Island. Although the fish fauna of San Nicolas Island contains both northern and southern species, many southern species are noticeably absent in the kelp forests (Cowen and Bodkin 1993). "The more removed the site is from the typical current path, the less commonly recruitment of southern species will occur" (Cowen and Bodkin 1993). The southern species are better represented along the mainland and inner islands than they are at San Nicolas Island (Cowen and Bodkin 1993). Engle (1993) classified the subtidal rocky fish fauna of San Nicolas Island as "old intermediate" in that only 45 percent of the relative abundance of species was represented by southern forms. For islands to the south and closer to shore, the relative abundance of southern species was over 70 percent; for San Miguel Island, which is further north and also offshore, it was 21 percent.

Forty-eight species were recorded during the two studies at San Nicolas Island (Cowen and Bodkin 1993; Engle 1993). However, this number under-represents the actual number observed by about 50 percent since sand dwellers, rare and cryptic species, and some species that are hard to identify in the field were not counted (Engle 1993).

As shown in Table 3.6-8, average density of fish at six sampling sites in kelp forests off San Nicolas Island were 170,00 to 392,000/NM^2 (49 to 1,143/ha) (Cowen and Bodkin 1993). Biomass of fish in central California kelp beds has been estimated at 222,000 to 840,000 pounds/NM^2 (29 to 1,110 kg/ha) (Horn 1980). Most of the fish were schooling species with two resident schooling fish, señorita (*Oxyjulis californica*) and blacksmith (*Chromis punctipinnis*), typically accounting for 90 percent of all individuals. These two

Table 3.6-8. Fish Population Densities near San Nicolas Island[1]

Site	Location	Fish/ha Total	Fish/ha Non-Schooling	Number of Species	Number of Samples
NAVFAC	North-central coast	907	113	12	55
WEU	Southwest coast	627	140	16	50
WEK	Southwest coast	577	122	14	40
WDUTCH	South-central coast	1,163	407	18	50
EDUTCH	South-central coast	885	359	16	55
EDAYTONA	Southeast corner	490	158	15	45

[1] Abundance of fish at six subtidal sampling sites in nearshore waters of San Nicolas Island during 1981-86.
Source: Cowen and Bodkin 1993.

species often form large schools of hundreds to thousands of individuals. Jack mackerel, a pelagic, schooling, non-resident species, was encountered rarely but in large numbers.

Excluding the schooling species, two sites on the central southern coast of the island yielded two to four times as many fish as did other San Nicolas Island sampling sites (Cowen and Bodkin 1993). The relative abundance of species collected during the two studies in kelp forests and over soft and rocky bottoms (with and without kelp cover) are shown in Table 3.6-9.

Table 3.6-9. Relative Abundance of Fish Species off San Nicolas Island

	Engle (1993)	Cowen and Bodkin (1993)	Affinity
Smelt	C	-	I
(Calico) kelp bass	A	C	S
Sargo	C	-	S
Opaleye	A	C	S
Halfmoon	C	C	S
Kelp surfperch	A	P	N
Shiner surfperch	P	-	N
Pile surfperch	A	P	N
Black surfperch	A	P	I
Striped surfperch	A	P	N
Rainbow surfperch	A	P	N
Phanerodon spp.	P	P	I
Rubberlip surfperch	C	P	I
Blacksmith	A	A	S
Garibaldi	C	P	S
Rock wrasse	P	P	S
Señorita	A	A	I
California sheephead	A	C	S
Island kelpfish	P	-	S
Kelpfish	C	P	I
Giant kelpfish	C	P	I
Yellowfin fringehead	P	P	I
Blackeye goby	A	C	N
Blueband goby	P	P	S
Zebra goby	P	P	S
California scorpionfish	P	P	S
Kelp rockfish	A	A	I
Gopher rockfish	C	P	N
Copper rockfish	C	P	N
Black & yellow rockfish	C	P	N
Vermilion rockfish	P	C	N
Blue rockfish	A	P	N
Bocaccio	P	-	N
Grass rockfish	C	P	N
Olive rockfish	A	C	N
Treefish	C	P	I
Painted greenling	A	A	N
Coralline sculpin	C	P	N
Lavender sculpin	C	P	S
Snubnose sculpin	C	P	I
Cabezon	C	P	N
Ocean whitefish	P	P	I
Turbot	C	P	N
Jack mackerel	P	P	I
Pacific angel shark	P	P	I
Swell shark	P	P	S
Pacific electric ray	P	P	N
Bat ray	P	P	I

C = common, A = abundant, P = present, N = northern species, S = southern species, and I = intermediate species.
Source: Engle 1993; Cowen and Bodkin 1993.

Overall, Cowen and Bodkin (1993) found that within the kelp forests, areas with the greatest vertical relief supported the greatest numbers and diversity of fish and those with sand the fewest. They did not find that coverage by kelp affected abundance of fish. Most of their rocky sampling sites had enough kelp cover to accommodate fish that associate with kelp. In general, abundance of fish on rock reefs is related to abundance of kelp as well as vertical relief (Cross and Allen 1993). Garibaldi (*Hypsypops rubicundus*), blacksmith, and several rockfish species are abundant only in areas with high bottom relief and are absent from cobble substrates (Larson and DeMartini 1984). Removal of kelp can cause a decline in fish biomass of over 50 percent. Most of the decline is caused by the disappearance of midwater species that associate with the kelp canopy (Bodkin 1988).

Several pelagic species can be found in nearshore waters. These include queenfish, Pacific butterfish (*Peprilus simillimus*), juvenile lingcod (*Ophiodon elongatus*), and white croaker. The following nearshore pelagic species can also be found in the kelp canopy: walleye surfperch, silversides, jack mackerel, northern anchovy, salema (*Xenistius californiensis*), blacksmith, ocean whitefish (*Caulolatius princeps*), Pacific bonito, and Pacific mackerel (Feder et al. 1974).

Year-to-Year Variability in Abundance

Numbers of fish in kelp forests at San Nicolas Island can vary by a factor of three from year to year. This variability may be due to the variability of the influx of juvenile fish. During warm El Niño years, there can be recruitment of southern species that are not normally present at San Nicolas Island. These southern species may then disappear after a few seasons or years. Abundance of northern species may be unaffected by warm periods (Cowen and Bodkin 1993).

C - Pelagic Habitats and Commercial Harvest

Average annual reported landings from the Territorial Waters around San Nicolas Island for the period 1994-1995 were 732,601 pounds (332,306 kg) (Table 3.6-10). The major species taken off San Nicolas Island were Pacific bonito, Pacific sardine, Pacific mackerel, jack mackerel, California sheephead (*Semicossyphus pulcher*), and rockfish. Standardized on a per unit area basis, the catch in Territorial Waters of San Nicolas Island was higher than that taken in non-Territorial Waters but lower than that of other Territorial Waters of the Sea Range.

D - Rare, Threatened, and Endangered Species

Rare, threatened or endangered fish species have not been recorded from marine areas around San Nicolas Island, and such species are unlikely to be found there (CDFG 1994).

3.6.4.2 Sea Turtles

The occurrence of four species of sea turtles within the Sea Range as a whole is described in Section 3.6.2.2. It is possible that small numbers of sea turtles could be encountered in nearshore waters off San Nicolas Island, especially during summer. The kelp beds off western San Nicolas Island may attract some leatherback sea turtles (Stinson 1984) and perhaps green/black sea turtles. However, there are no known sea turtle nesting beaches at San Nicolas Island or anywhere else in the Sea Range.

Table 3.6-10. Seasonal and Average Annual Commercial Fish Totals in Territorial Waters near San Nicolas Island[1]

Species	Average Landings for 1994 and 1995 (pounds)					Annual Landings (pounds)				
	Total	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	1991	1992	1993	1994	1995
Yellowfin tuna	29	-	-	-	29	-	8,621	-	58	-
Skipjack tuna	44	-	-	-	44	-	30,826	401,383	63	25
Bluefin tuna	585	-	-	555	30	-	76,482	13,231	13	1,157
Other tuna	165	-	-	165	-	-	-	-	-	329
All tuna	**823**	**-**	**-**	**720**	**103**	**-**	**115,929**	**414,614**	**134**	**1,511**
Dover sole	3,535	-	1,222	2,303	10	-	2,555	-	-	7,070
California halibut	522	57	34	425	7	975	1,107	73	439	606
Other flatfish	2,545	16	2,123	404	2	112	829	106	180	4,910
All flatfish	**6,603**	**73**	**3,379**	**3,132**	**19**	**1,087**	**4,491**	**179**	**619**	**12,586**
Red rockfish group	32,235	10,396	3,651	11,417	6,772	7,592	18,736	46,218	50,604	13,866
Other Rockfish	73,474	37,582	11,030	11,087	13,776	24,487	59,989	138,877	104,962	41,986
All rockfish	**105,711**	**47,978**	**14,681**	**22,504**	**20,548**	**32,079**	**79,725**	**185,095**	**155,566**	**55,852**
Pacific bonito	64,145	64,096	-	49	-	146	17	113,135	128,209	81
Pacific mackerel	121,910	52,912	26,821	429	41,748	90,006	-	67,048	4,376	239,445
Jack mackerel	28,508	4,606	-	-	23,902	-	54,825	-	9,211	47,804
Swordfish	7,475	-	202	3,540	3,733	937	1,812	3,411	7,241	7,708
Pacific sardine	346,939	122,929	125,301	-	98,709	-	-	-	2,265	691,612
Northern anchovy	9,130	9,085	-	26	20	-	-	-	39	18,221
Other pelagic fish	945	-	608	301	36	1,128	132	67	823	1,067
Thresher shark	7,855	-	268	2,194	5,393	3,969	-	70	14,647	1,062
Sharks and rays	3,204	269	78	1,982	875	606	3,390	5,192	2,900	3,509
White croaker	378	38	9	210	121	3	-	3	-	757
California sheephead	21,566	4,781	6,985	5,728	4,073	14,844	23,018	18,425	30,415	12,717
Sablefish	3,910	185	1,043	1,882	801	1,026	1,624	617	1,131	6,689
Lingcod	2,430	1,911	6	346	166	315	303	13,844	4,768	92
Other demersal fish	1,067	41	23	410	593	49	-	287	135	1,998
Total	**732,601**	**308,904**	**179,404**	**43,453**	**200,840**	**146,195**	**284,266**	**821,987**	**362,479**	**1,102,711**

[1] Average annual landings in pounds for the period 1994-95 for Territorial Waters around San Nicolas Island and total landings by year for 1991-95.
Source: CDFG 1996a.

3.6.5 Other Channel Islands

3.6.5.1 Fish

A - Common Species and Abundance of Fish

The fish fauna of the northern Channel Islands changes from a typically southern assemblage in the nearshore waters of Santa Cruz Island near the eastern end of the chain to a typically northern assemblage in nearshore waters of San Miguel Island at the western end of the chain (Cross and Allen 1993). Engle (1993) rated the zoogeographic affinities of the rocky subtidal fish fauna of the Channel Islands as follows:

Warm	Santa Catalina, San Clemente
Warm intermediate	Anacapa, Santa Cruz, Santa Barbara
Cold intermediate	Santa Rosa, San Nicolas
Cold	San Miguel

Santa Catalina, San Clemente, and Santa Barbara islands are not within the boundaries of the Sea Range, although Santa Barbara Island is very close. They are included to illustrate the decrease in relative abundance of southern species from the southern (warm) islands to the northern (cooler) islands. The fish faunas of Anacapa, Santa Cruz, and Santa Barbara islands are similar (Engle 1993).

Sixty species of fish have been collected from rocky and sand substrates with and without kelp cover in the offshore islands of the SCB by Engle (1993). However, this number under-represents the actual number observed by about 50 percent. Sand dwellers, rare and cryptic species, and some species that were hard to identify in the field are not included in this estimate. If these fish had been included, total numbers of species observed would have been about 124.

B - Commercial Harvest

Average annual landings for the waters of the Sea Range near the northern Channel Islands for the period 1994-1995 totaled 2,408,854 pounds (1,092,649 kg). The most abundant commercial species around the northern Channel Island chain during 1994-1995 were Pacific sardine, Pacific mackerel, and several species of rockfish. On a per unit area basis, the reported catch off the northern Channel Islands averaged 87,998 pounds/50 NM^2 (39,916 kg/171 km^2), the second highest value of any range area.

C - Rare, Threatened, and Endangered Species

Rare, threatened, or endangered fish species have not been recorded from marine areas around the Channel Islands, and such species are unlikely to be found there (CDFG 1994).

3.6.5.2 Sea Turtles

The occurrence of four species of sea turtles within the Sea Range as a whole is described in Section 3.6.2.2. It is possible that small numbers of sea turtles could be encountered in nearshore waters off Santa Cruz Island or San Miguel Island, especially during summer. However, there are no known sea turtle nesting beaches on these islands or anywhere else in the Sea Range.

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3.7 MARINE MAMMALS

3.7.1 Introduction

3.7.1.1 Definition of Resource

Marine mammals addressed within this EIS/OEIS include members of three distinct taxa: *Cetacea*, which includes whales, dolphins, and porpoises; *Pinnipedia*, which includes seals and sea lions (the walrus is also included in this sub-order but is not relevant to this EIS/OEIS); and *Carnivora*, which includes the sea otter, a member of the *Mustelidae* family. Cetaceans—the whales, dolphins, and porpoises—spend their lives entirely at sea. Pinnipeds—the seals and sea lions—hunt and feed exclusively in the ocean but come ashore to rest, mate, and bear young. Although most mustelids (members of a family which includes otters, weasels, skunks, and wolverines) are terrestrial, sea otters regularly swim and feed in the ocean.

Section 3.7 is a summary of marine mammal use of the Sea Range. A more detailed account appears in an accompanying "Marine Mammal Technical Report" (NAWCWPNS Point Mugu 1998e), which is incorporated into the EIS/OEIS by reference in accordance with CEQ regulations (refer to Section 4.0). The Technical Report is organized in the same sequence as this summary, but provides greater detail. It includes extensive mapping and analysis of results from aerial and ship surveys, many more references to the relevant technical literature, and explanations of the basis for the numerical estimates quoted in this section of the EIS/OEIS.

3.7.1.2 Regional Setting

A - Cetaceans

At least 34 species of cetaceans have been identified from sightings or strandings in the SCB (Bonnell and Dailey 1993; Table 3.7-1). These include 26 species of toothed whales (odontocetes) and eight species of baleen whales (mysticetes). At least nine species generally can be found in the study area in moderate or high numbers either year-round or during annual migrations into or through the area. These include the Dall's porpoise (*Phocoenoides dalli*), Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), Risso's dolphin (*Grampus griseus*), bottlenose dolphin (*Tursiops truncatus*), short-beaked and long-beaked common dolphins (*Delphinus delphis* and *D. capensis*), northern right whale dolphin (*Lissodelphis borealis*), Cuvier's beaked whale (*Ziphius cavirostris*), and gray whale (*Eschrichtius robustus*). Other species are represented by small numbers, moderate numbers during part of the year, occasional sightings, or strandings.

Several species of cetaceans occurring on the Sea Range are listed as endangered or threatened. Most endangered mysticetes that occur in California waters were once commercially hunted to the point that their populations were severely depleted. The northern right (*Eubalaena glacialis*), humpback (*Megaptera novaeangliae*), blue, fin, and sei whales (*Balaenoptera musculus*, *B. physalus*, and *B. borealis*, respectively) are currently federally listed as endangered species and protected by the Endangered Species Act (ESA) of 1973 (16 U.S.C. § 1531) (Braham 1991). Gray whales have recently been removed from the endangered list due to an increase in population numbers (National Marine Fisheries Service [NMFS] 1993).

All marine mammals are protected by the Marine Mammal Protection Act ([MMPA] 1972, amended 1994 - 16 U.S.C. § 1431 et seq.). Several of the "endangered" species have also been listed as "strategic stocks" under the MMPA. The specific definition of a "strategic stock" is complex, but in general it is a

Table 3.7-1. Summary of Information on Cetaceans that Might be Encountered in the Point Mugu Sea Range

Species	Status	California Stock Size (CV)*	Abundance in Sea Range	Population Trend[1]	Seasonality	Habitat Preference
Harbor porpoise (*Phocoena phocoena*)	**None, recommended as strategic	13,370 [4,120 (0.22)[2] + 9,250 (0.23)[2]]	Rare	Evidence of decline 1986-1995; not statistically significant	Winter? Mainly inshore of Sea Range at other seasons	Coastal, temperate waters, mainly north of Point Conception
Dall's porpoise (*Phocoenoides dalli*)	**	47,661 (0.40)[3]	Common	N.A.	Year-round resident, peak numbers in autumn/winter. Low numbers in summer	Continental shelf, slope, and offshore; water <17°C
Pacific white-sided dolphin (*Lagenorhynchus obliquidens*)	**	121,693 (0.47)[4]	Common	N.A.	Year-round resident with N-S movements to colder-water areas in late spring and summer	Continental shelf, slope and offshore; prefers deep waters
Risso's dolphin (*Grampus griseus*)	**	32,376 (0.46)[4]	Common	N.A. Increased sightings during last 20 years may reflect increased survey effort	Year-round resident, peak in winter. Low numbers in summer	Mostly offshore, recently over continental shelf
Bottlenose dolphin (*Tursiops truncatus*) coastal	**	140 (CV 0.05)[1]	Rare	N.A.	Year-round resident of coastal areas east of SR	Within 0.5 NM of shore
Bottlenose dolphin (*Tursiops truncatus*) offshore	**	2,555 (0.36)[1]	Uncommon; mostly SE of SR	N.A.	Year-round resident, no seasonal peak	Continental shelf, slope, and offshore waters
Short-beaked common dolphin (*Delphinus delphis*)	**	372,425 (0.22)[3]	Common and seasonally abundant	Increasing (due to changes in distribution?)	Year-round resident in southern SR; summer resident in northern SR; lower numbers in summer	Coast to 300 NM or farther from shore
Long-beaked common dolphin (*Delphinus capensis*)	**	8,980 (0.64)[3]	Uncommon	Probably increasing (due to changes in distribution?)	Year-round resident, peak numbers in summer	Coast to 50 NM from shore

Table 3.7-1. Summary of Information on Cetaceans that Might be Encountered in the Point Mugu Sea Range (continued)

Species	Status	California Stock Size (CV)*	Abundance in Sea Range	Population Trend[1]	Seasonality	Habitat Preference
Northern right whale dolphin (*Lissodelphis borealis*)	**	21,332 (0.43)[4]	Common	N.A.	Resident in SR in winter and spring, peak numbers in winter. Few in southern SR in summer	Continental slope; water 8-19°C
Short-finned pilot whale (*Globicephala macrorhynchus*)	**Strategic	1,004 (0.37)[3]	Common before 1982, uncommon in SE part of SR now	A population shift from the SR occurred after the 1982 El Nino, some animals have returned	Year-round resident	Offshore and shallow waters
Cuvier's beaked whale (*Ziphius cavirostris*)	**	9,163 (0.52)	Uncommon	N.A.	Unknown, but catches by whalers near the SR were Oct-Jan	Pelagic
Sperm whale (*Physeter macrocephalus*)	**Endangered, depleted, and strategic	1,231 (0.39)[3] underestimated	Uncommon	Stable in coastal waters 1979-1991	Most common in autumn and winter but seasonal abundance varies	Usually pelagic; water >15°C; inshore when squid are abundant
Striped dolphin (*Stenella coeruleoalba*)	**	24,910 (0.31)[3]	Occasional visitor from offshore	Probable increase over the last decade	Probably summer and autumn	100-300 NM or more offshore
Spinner dolphin (*Stenella longirostris*)	**	N.A.	Rare	N.A.	Possible in summer	Warm nearshore waters
Spotted dolphin (*Stenella attenuata*)	**	N.A.	Rare	N.A.	Possible in summer	
Rough-toothed dolphin (*Steno bredanensis*)	**	N.A.	Rare	N.A.	Possible in summer	Warm nearshore waters
Killer Whale (*Orcinus orca*)	**	747 (0.71)[3]	Uncommon	N.A.	Probable year-round resident	Widely distributed
False killer whale (*Pseudorca crassidens*)	**	N.A.	Rare	N.A.	Possible in summer	Pelagic, tropical and sub-tropical waters

Table 3.7-1. Summary of Information on Cetaceans that Might be Encountered in the Point Mugu Sea Range (continued)

Species	Status	California Stock Size (CV)*	Abundance in Sea Range	Population Trend[1]	Seasonality	Habitat Preference
Baird's beaked whale (*Berardius bairdii*)	**	380 (0.53) [3] probably biased downwards	Rare	N.A.	Present late spring to early autumn	Continental slope and pelagic
Blainville's beaked whale (*Mesoplodon densirostris*)	**	728 (2.03) [3]	Rare	N.A.	Unknown	Pelagic
Other Mesoplodont beaked whales (Hector's, Stejneger's, Gingko-toothed, Hubbs') (*Mesoplodon* spp.)	**	1,378 (0.58) [3]	Rare	N.A.	Unknown	Pelagic
Pygmy sperm whale (*Kogia breviceps*)	**	3,145 (0.54) to 4,036 (incl. poss. dwarf sperm whales)	Rare	N.A.	Possible year round	Seaward of continental shelf
Dwarf sperm whale (*Kogia simus*)	**	Fewer than 891 (2.04) [1] (incl. poss. pygmy sperm whales)	Possible visitor	N.A.	Possible in summer	Continental shelf
Northern right whale (*Eubalaena glacialis*)	**Endangered	about 200 [5]	Rare	Near extinction	Sightings from Mar-May	Unknown, recent sightings have been nearshore
Humpback whale (*Megaptera novaeangliae*)	**Endangered, depleted, and strategic	597 (0.07)[7]	Uncommon	Possible increase 1979-1993	Migratory during spring and autumn; feeding in summer	Nearshore waters
Gray whale (*Eschrichtius robustus*)	**Delisted in 1994	23,109 (CV=0.074)[6]	Most of population passes through or east of SR during migration	Increasing	Southbound migration Dec-Feb, peaking in Jan; northbound Feb-May, peaking in March	Mostly coastal but offshore routes are used near the Channel Islands
Blue whale (*Balaenoptera musculus*)	**Endangered, depleted, and strategic	1,785 (0.24)[3]	Uncommon	Increase 1979-1991, possibly in part due to change in distribution	Migratory, resident Jun-Nov	Primarily offshore

Table 3.7-1. Summary of Information on Cetaceans that Might be Encountered in the Point Mugu Sea Range (continued)

Species	Status	California Stock Size (CV)*	Abundance in Sea Range	Population Trend[1]	Seasonality	Habitat Preference
Fin whale (*Balaenoptera physalus*)	**Endangered, depleted, and strategic	933 (0.27)[3]	Uncommon	Possible increase from 1979-1993	A few present year-round in S part of SR. Peak in summer when present throughout SR	Continental slope and offshore waters
Sei whale (*Balaenoptera borealis*)	**Endangered, depleted, and strategic	A few to several 10's	Rare	N.A. but North Pacific population expected to have grown since mid-1960s	Migratory. Possible in spring, likely in summer	Primarily offshore, temperate waters
Bryde's whale (*Balaenoptera edeni*)	**	24 (2.0)	Rare	N.A.	Summer?	Tropical to subtropical waters
Minke whale (*Balaenoptera acutorostrata*)	**	201 (0.65) [3]	Uncommon, primarily in SE part of SR	N.A.	Migratory, peak in spring and summer, a few are present year-round	Primarily over continental shelf but some offshore

*CV (coefficient of variation) is a measure of a number's variability. The larger the CV, the higher the variability.
**Protected under the Marine Mammal Protection Act.

[1] Barlow et al. (1997).
[2] Central and Northern California stocks (Barlow and Forney 1994).
[3] Barlow and Gerrodette (1996).
[4] Forney et al. (1995).
[5] Braham and Rice (1984).
[6] Small and DeMaster (1995).
[7] Calambokidis and Steiger (1994).

stock in which human activities may be having a deleterious effect on the population and may not be sustainable. The stocks of blue, fin, sei, and humpback whales occurring off California are considered "strategic" (Barlow et al. 1997). In addition, the California stocks of the short-finned pilot whale (*Globicephala macrorhynchus*) and sperm whale (*Physeter macrocephalus*) have been designated as "strategic." The stocks of minke whales (*Balaenoptera acutorostrata*) and mesoplodont beaked whales (collectively) off the coast of California, Oregon, and Washington have recently been reclassified as non-strategic (NMFS 1998; Barlow et al. 1998).

The species accounts that follow deal explicitly with species that occur regularly in the study area in moderate to high numbers, are designated as depleted or are part of a strategic stock under the MMPA, or are listed as endangered under the ESA. Other species that occur less regularly and have no special status are listed in Table 3.7-1.

Overall, a comparison of cetacean abundance in 1979/80 vs. 1991 indicates that numbers of mysticetes and odontocetes have increased in offshore California waters over the 12-year period. However, this is not so for the harbor porpoise (*Phocoena phocoena*) and the short-finned pilot whale which appear to have decreased in numbers (Barlow 1994, 1995; Forney et al. 1995). The status of cetacean stocks and their abundance estimates for California are summarized in Table 3.7-1 from marine mammal stock assessments prepared by the NMFS/Southwest Fisheries Science Center (SWFSC) (Barlow et al. 1997).

B - Pinnipeds

Six species of pinnipeds occur in the Point Mugu Sea Range (Table 3.7-2). The four most abundant species include the harbor seal (*Phoca vitulina*), northern elephant seal (*Mirounga angustirostris*), California sea lion (*Zalophus californianus*), and northern fur seal (*Callorhinus ursinus*). These four species breed on land within the Sea Range. The overall abundance of these species increased rapidly on the Channel Islands between the end of commercial exploitation in the 1920s and the mid-1980s. The growth rates of populations of some species appear to have declined after the mid-1980s, and some recent survey data suggest that localized populations of some species may be declining. These declines may be due either to interspecific competition or to population numbers having exceeded the carrying capacity of the environment (Stewart et al. 1993; Hanan 1996). However, most populations continue to increase rapidly, and in some cases seals have recently occupied new rookeries and haul-out areas. These four pinniped species are not listed as endangered or threatened under the ESA (Barlow et al. 1997).

Two of the six pinniped species on the Sea Range are less common. The Guadalupe fur seal (*Arctocephalus townsendi*) is an occasional visitor to the Channel Islands and breeds only on Guadalupe Island, Mexico, which is approximately 250 NM (460 km) south of the Sea Range. The Steller sea lion (*Eumetopias jubatus*) was once abundant in the region, but numbers have declined rapidly since 1938. No adult Steller sea lions have been sighted since 1983 (NMFS 1992). The Guadalupe fur seal and the Steller sea lion are federally designated as threatened and depleted species and their stocks are considered to be strategic stocks. The Guadalupe fur seal is listed as threatened and fully protected by California state legislation.

Populations of seals may be impacted by changes in the distribution and abundance of their prey species. The El Niño event of 1983 temporarily reduced resources for most pinnipeds in the Channel Islands (Trillmich et al. 1991). As a consequence, pinnipeds spent more time at sea searching for prey (Stewart and Yochem 1991), and there was a decline in the number of pups and adults counted at rookeries. However, overall population declines may have been less pronounced than suggested by shore counts. Specific information about population changes during the 1998 El Niño event are not yet available.

Table 3.7-2. Summary of Information on Pinnipeds and Sea Otters that Might Be Encountered in the Point Mugu Sea Range

Pinnipeds	Status	California stock size	Abundance in study area	Population trend	Foraging locations	Common prey
Harbor seal (*Phoca vitulina richardsi*)	*	30,293 [1]	3,600-4,600 [2]	+1.9%/yr in study area; +3.5%/yr in California	most <5km from shore; occasionally to 50 km	rockfish, spotted cusk-eel, octopus, plainfin midshipman, shiner surfperch
Northern elephant seal (*Mirounga angustirostris*)	*	84,000 [1]	71,000	+8.3%/yr; may have slowed or declined since 1994	40° and 45° N lat. for females, further N for males [3]	squid, Pacific whiting, pelagic red crab, octopus, hake, ratfish, rockfish, angel and blue shark, stingray [4,5]
California sea lion (*Zalophus californianus californianus*)	*	167,000-188,000 [1]	159,000-179,000 >95% of US stock	+8.3%/yr	1-100 km from rookery, mean 54.2 km; mean depth 323 m [6]	northern anchovy, Pacific whiting, market squid, nail squid, red octopus, rockfish, jack mackerel [7]
Steller sea lion (*Eumetopias jubatus*)	*threatened	2,000 in 1989 [8]	rare	declining	?	fish diet on Sea Range uncertain
Guadalupe fur seal (*Arctocephalus townsendi*)	*threatened	7,408 for Guadalupe Is. in 1993 [9]	occasional	+13.7%/yr	up to 444 km from rookery [10]	unknown, but includes squid [9]
Northern fur seal (*Callorhinus ursinus*)	*	10,036 [1]	10,036	+25%/yr since 1983	1-137 km from San Miguel, mean 72.3 km; mean water depth 933 m; 92% forage NW of San Miguel [6]	northern anchovy, lanternfish, Pacific whiting, market squid, nail squid, Pacific saury [11]
Fissiped						
Southern sea otter (*Enhydra lutris nereis*)	*threatened	2,377 [12]	17 [12]	+5-7%/yr in California [12]	rocky coastline with kelp beds; 20 m deep (max. 100 m) [12]	mussels, clams, abalone, sea urchins, sea stars [12]

*Protected under the Marine Mammal Protection Act.

[1]Barlow et al. (1997).
[2]Stewart and Yochem (1985).
[3]Stewart and DeLong (1995).
[4]Condit (1984).
[5]Antonelis et al. 1987.
[6]post-partum females on San Miguel, Antonelis et al. (1990).
[7]Lowry et al. (1991).
[8]Loughlin et al. 1992.
[9]Hanni et al. 1997.
[10]Hanan and Besson 1994.
[11]Stroud et al. (1981).
[12]USFWS (1996).

C - Sea Otter

The southern sea otter (*Enhydra lutris nereis*) occurs along the coast of central California between Point Año Nuevo and Purisima Point, and a small experimental population has been translocated to San Nicolas Island. Sea otters were heavily harvested during the 18th and 19th centuries and were nearly exterminated from California waters. The existing population is believed to have expanded primarily from a remnant population at Bixby Creek along the coast of southern Monterey County (Leatherwood et al. 1978). These sea otters were protected in 1911, and the population has slowly increased and expanded its range. Aside from the small translocated population at San Nicolas Island, few sea otters are expected to occur within the Point Mugu Sea Range because of their preference for relatively shallow (approximately 66 feet [20 m] deep) coastal waters. (The Sea Range does not include any of the mainland coastline.) The information on sea otter distribution and abundance has come from surveys and reports by the USFWS and the CDFG.

The southern sea otter is federally listed as threatened under the ESA and designated as depleted under the MMPA.

3.7.1.3 Region of Influence

The species accounts that follow deal explicitly with species that occur regularly in the study area in moderate to high numbers, or are designated as depleted or part of a strategic stock under the MMPA, or are listed as endangered under the ESA. Marine mammals inhabiting the entire Sea Range and areas between the Sea Range and coast are discussed in this section. Populations and population trends of pinnipeds that haul out on islands that are not included within the scope of the EIS are discussed because these data provide the best estimates of populations that could be found in marine waters of the Sea Range.

3.7.2 Sea Range

This section describes the occurrence of marine mammals at sea within the Sea Range. Species occurring on land or close to shore are further described in subsequent sections concerning Point Mugu, San Nicolas Island, and Other Channel Islands (Sections 3.7.3-3.7.5, respectively). For additional details, refer to the "Marine Mammal Technical Report" (NAWCWPNS Point Mugu 1998e).

A - Previous Estimates

Forney et al. (1995), Barlow and Gerrodette (1996), Barlow (1995), and Forney and Barlow (1998) have estimated population sizes for cetaceans off southern California, although not specifically for the waters included in the Point Mugu Sea Range. Their estimates are based on aerial survey data collected during winter (February to April) and ship-based surveys conducted during summer (August to October). The NMFS estimates include correction factors to account for animals at the surface but missed by the observers and to account for the greater likelihood of spotting large groups vs. small groups. However, these estimates generally do not include correction factors to account for animals that were missed because they were below the surface as the aircraft or ship passed the animals (availability bias). This problem causes a greater underestimation of the number of animals present during aerial than during ship-based surveys, given the shorter potential observation time from a rapidly-moving aircraft. Correction factors for availability bias are under development by NMFS/SWFSC but are available for only a few species (Barlow and Sexton 1996; Forney and Barlow 1998; Carretta et al. 1998).

B - Normalization

In order to assess the impacts of proposed Navy activities on different species of marine mammals, it was necessary to estimate the average numbers of each species that might be present in various areas within the Sea Range at different times of year. Because of the different biases associated with different survey methods, it was not valid to use the data from the above studies as direct indicators of mammal densities or numbers at sea in various parts of the Sea Range. In addition to the above biases, the densities computed in the SWFSC reports and publications were computed for large areas that are subject to considerable variation in oceanographic conditions. Thus, the SWFSC mean densities were not directly applicable to the specific conditions in the Sea Range. Densities needed to be computed for smaller areas with geographic and oceanographic conditions that were similar to those in the Sea Range.

With the guidance of NMFS/SWFSC personnel, a method was developed to account for the known biases, to the degree possible, and to summarize the existing data according to the seasons and geographic areas required for this assessment. This method is described in detail in the "Marine Mammal Technical Report" (NAWCWPNS Point Mugu 1998e), specifically its Section 3.7.1.5 and its Appendix A. Densities of marine mammals at sea were derived primarily from recent SWFSC ship and aerial survey data. In addition, the large amount of information from older surveys conducted for the Minerals Management Service (MMS) has been taken into account in estimating relative numbers of cetaceans and absolute numbers of pinnipeds present in different seasons. Pinniped sightings were corrected to account for changes in population sizes since the surveys. Densities were calculated separately for each species and for each of four seasons (see Section 3.7.2-C, Seasonal Presentation). Densities were computed separately for the eight "strata" outlined in green on Figure 3.7-1. Computed densities included correction factors to account for animals missed because they were below the surface (availability bias). Computed densities also included correction factors for animals at the surface but not sighted by the observers. These correction factors differ with type of marine mammal and type of survey. Also, incompletely identified animals (e.g., "unidentified pinniped" or "unidentified dolphin") have been taken into account by apportionment. A detailed description of the methods used to estimate marine mammal densities and associated confidence intervals can be found in Appendix A of the "Marine Mammal Technical Report" (NAWCWPNS Point Mugu 1998e).

The "corrected estimates" presented in this document are higher and presumably less biased than previous estimates based on the SWFSC data because the new estimates include factors to account for availability bias and unidentified animals. The individual estimates represent mean numbers expected during each of the seasons for which estimates could be computed. However, it is emphasized that these estimates are subject to much uncertainty and variability. A large number of assumptions and correction factors are involved. On any given day, considerably larger or smaller numbers of marine mammals could be present in each range area.

The stated coefficients of variation (CV) are indicators of the uncertainty in the estimated numbers present during the surveys on which the estimate is based. The uncertainty associated with movements of animals into or out of an area due to factors such as availability of prey or changing conditions is much larger than is indicated by the CVs that are given. (Note: The CV is an index of uncertainty. It can range from zero, indicating no uncertainty, upward to high values. When CV exceeds 1.0, the estimate is very uncertain – actual values could range from zero to more than twice the "best" estimates.)

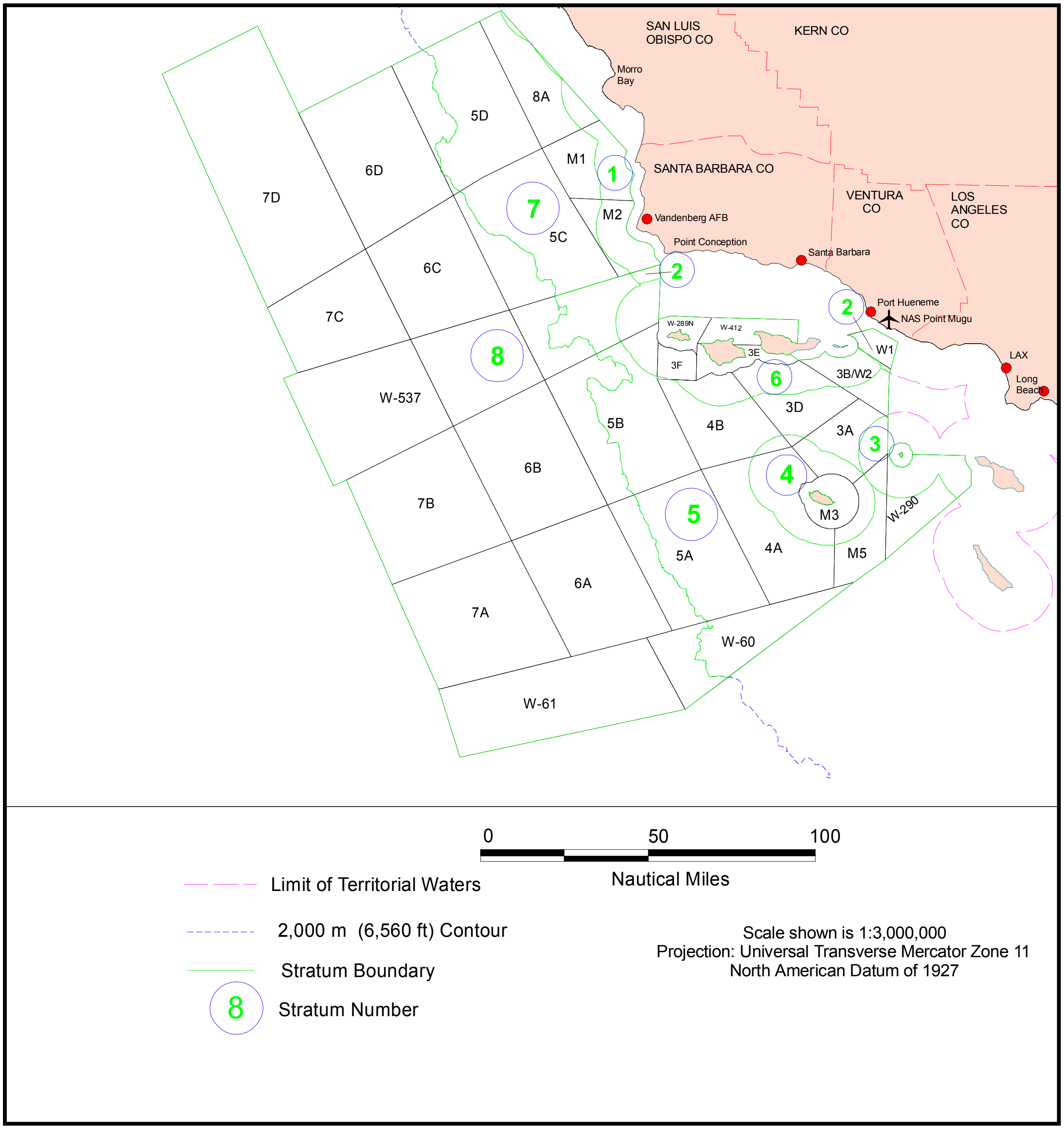

Figure 3.7-1
Boundaries of strata used to calculate densities and numbers of marine mammals in various portions of the Sea Range.

C - Seasonal Presentation

Previous studies conducted in southern California, including the Bureau of Land Management (BLM)/MMS surveys of southern and central California, have generally summarized marine mammal data by calendar quarter (i.e., January to March, April to June, July to September, and October to December).

Recent studies by SWFSC have recognized that changes in marine mammal distribution in southern California are often related to changes in oceanographic conditions that do not coincide with calendar seasons. Winter oceanographic conditions typically extend from February to April, spring conditions from May to July, summer conditions from August to October, and autumn conditions from November to January. When presenting and discussing seasonal distribution and abundance of marine mammals in the Sea Range, the "oceanographic seasons" have been used because they better coincide with changes in marine mammal distribution (Forney 1997) and with the timing of recent SWFSC surveys. The original reports of pre-1990 studies were analyzed and presented by calendar quarter. Therefore, in some cases, the data have been interpreted differently here than in the original reports. Table 3.7-3 presents estimated numbers of marine mammals of each species present in the Sea Range during each season. Table 3.7-4 shows the estimated densities for the various strata shown in Figure 3.7-1.

3.7.2.1 Odontocetes (Toothed Whales)

<u>Harbor Porpoise, *Phocoena phocoena*</u>

Harbor porpoises do not have a special status in California and fewer than 200 individuals are expected to be found within the Sea Range. However, the species is common inshore of the northern part of the Sea Range. They are more abundant in the Sea Range during autumn and winter than during spring and summer. They dive to depths less than 660 feet (200 m) and feed mainly on bottom-dwelling fish and invertebrates. Supporting literature references and additional details for this and other species on the Sea Range are given in the "Marine Mammal Technical Report" (NAWCWPNS Point Mugu 1998e).

<u>Dall's Porpoise, *Phocoenoides dalli*</u>

The Dall's porpoise does not have a special status. It is the most abundant cetacean in the North Pacific Ocean, although not on the Sea Range (see Common Dolphin, below). During the winter, it is common throughout the Point Mugu Sea Range and approximately 9,500 individuals are present in this area at that time (see Table 3.7-3). There are seasonal changes in distribution and abundance; these changes are probably related to changes in water temperature. During the spring and autumn, lower numbers are present in the Sea Range. Relatively few Dall's porpoises are present in the southern part of the Sea Range during summer, but low to moderate numbers remain in the northern part. Juveniles are more likely to be found close to shore and large adults farther offshore. Females with calves remain mainly outside of the Sea Range. Dall's porpoises feed primarily at night on fish and cephalopods.

<u>Pacific White-sided Dolphin, *Lagenorhynchus obliquidens*</u>

The Pacific white-sided dolphin does not have a special status and it is probably the most abundant delphinid in temperate waters of the North Pacific Ocean. It is widely distributed throughout the Sea Range except for shallow and nearshore areas. The number present in the Sea Range at any time of year may be highly variable and there may be year-to-year or seasonal shifts in abundance that are related to changes in water temperature and/or changes in prey abundance. In most years, this species is abundant in the Sea Range during autumn to spring when an estimated 23,000 to 28,000 animals are present (see Table 3.7-3). Most Pacific white-sided dolphins move northward during summer when only about 1,000 individuals remain in the Sea Range. As many as 25,000 animals are found in non-Territorial Waters and as many as 9,500 in Territorial Waters. Mean group size in the study area is about 80 animals. Pacific white-sided dolphins feed primarily on fish at night in the epipelagic zone where they may dive to depths of 700 feet (210 m) or more.

Table 3.7-3. Estimated numbers of marine mammals of each species present in the Point Mugu Sea Range during each season. The estimated numbers incorporate estimates of availability bias.

Species	Numbers Estimated to be Present During Months (CV)[1]								Maximum Numbers Present
	Feb-Apr		May-Jul		Aug-Oct		Nov-Jan		
Harbor porpoise[2]	188	(>0.86)	85	(>0.99)	92	(>0.98)	208	(>0.84)	208
Territorial Waters	188	(>0.86)	85	(>0.99)	92	(>0.98)	208	(>0.84)	208
non-Territorial Waters	0	(>1.00)	0	(>1.00)	0	(>1.00)	0	(>1.00)	0
Dall's porpoise	9,500	(0.54)	3,763	(>0.50)	2,514	(>0.60)	8,718	(0.50)	9,500
Territorial Waters	1,126	(0.72)	1,879	(0.88)	1,527	(0.87)	1,581	(0.80)	1,879
non-Territorial Waters	8,375	(0.60)	1,884	(0.46)	987	(0.76)	7,137	(0.59)	8,375
Pacific white-sided dolphin	22,765	(>0.50)	27,875	(0.50)	966	(>0.65)	24,739	(0.46)	27,875
Territorial Waters	103	(>1.46)	3,028	(1.07)	216	(>0.94)	9,467	(0.81)	9,467
non-Territorial Waters	22,662	(0.50)	24,847	(0.55)	750	(0.80)	15,273	(0.55)	24,847
Risso's dolphin	40,536	(0.45)	14,761	(>0.38)	11,645	(0.35)	41,865	(0.43)	41,865
Territorial Waters	8,272	(0.62)	75	(>0.94)	4,611	(0.62)	1,218	(0.85)	8,272
non-Territorial Waters	32,263	(0.54)	14,686	(0.38)	7,034	(0.42)	40,647	(0.44)	40,647
Coastal bottlenose dolphin	0	(>1.00)	0	(>1.00)	0	(>1.00)	0	(>1.00)	0
Territorial Waters	0	(>1.00)	0	(>1.00)	0	(>1.00)	0	(>1.00)	0
non-Territorial Waters	0	(>1.00)	0	(>1.00)	0	(>1.00)	0	(>1.00)	0
Offshore bottlenose dolphin	534	(>0.94)	0	(>1.00)	2,942	(>0.47)	949	(>0.73)	2,942
Territorial Waters	0	(>1.00)	0	(>1.00)	1,776	(0.65)	409	(1.16)	1,776
non-Territorial Waters	534	(0.94)	0	(>1.00)	1,166	(0.63)	540	(0.94)	1,166
Common dolphin[3]	220,565	(0.34)	239,938	(>0.28)	154,461	(0.24)	233,639	(>0.40)	239,938
Territorial Waters	117,658	(0.50)	109,264	(>0.52)	81,134	(0.42)	88,969	(>0.54)	117,658
non-Territorial Waters	102,907	(0.47)	130,674	(>0.29)	73,326	(0.21)	144,670	(>0.55)	144,670
Northern right whale dolphin	87,128	(0.38)	77,774	(0.53)	4,058	(>0.63)	15,372	(0.56)	87,128
Territorial Waters	5,862	(0.79)	231	(1.37)	348	(>1.33)	1,477	(1.11)	5,862
non-Territorial Waters	81,266	(0.40)	77,543	(0.53)	3,710	(>0.68)	13,895	(0.61)	81,266
Short-finned pilot whale	Possible		Possible		Present		Possible		0
Territorial Waters	Possible		Possible		Present		Possible		0
non-Territorial Waters	Possible		Possible		Present		Possible		0
Cuvier's beaked whale	2,044	(>0.52)	2,044	(>0.52)	2,044	(>0.52)	2,044	(>0.52)	2,044
Territorial Waters	0	(>1.00)	0	(>1.00)	0	(>1.00)	0	(>1.00)	0
non-Territorial Waters	2,044	(>0.52)	2,044	(>0.52)	2,044	(>0.52)	2,044	(>0.52)	2,044
Sperm whale	3,744	(>0.61)	0	(>1.00)	345	(>0.63)	5,013	(>0.78)	5,013
Territorial Waters	0	(>1.00)	0	(>1.00)	0	(>1.00)	0	(>1.00)	0
non-Territorial Waters	3,744	(>0.61)	0	(>1.00)	345	(>0.63)	5,013	(>0.78)	5,013
Striped dolphin	0	(>1.00)	4,605	(>0.94)	7,887	(>0.57)	Present		7,887
Territorial Waters	0	(>1.00)	0	(>1.00)	0	(>1.00)	0	(>1.00)	0
non-Territorial Waters	0	(>1.00)	4,605	(>0.94)	7,887	(>0.57)	Present		7,887
Spinner dolphin	0	(>1.00)	0	(>1.00)	Possible		0	(>1.00)	0
Territorial Waters	0	(>1.00)	0	(>1.00)	Possible		0	(>1.00)	0
non-Territorial Waters	0	(>1.00)	0	(>1.00)	0	(>1.00)	0	(>1.00)	0
Spotted dolphin	0	(>1.00)	0	(>1.00)	Possible		0	(>1.00)	0
Territorial Waters	0	(>1.00)	0	(>1.00)	Possible		0	(>1.00)	0
non-Territorial Waters	0	(>1.00)	0	(>1.00)	0	(>1.00)	0	(>1.00)	0
Rough-toothed dolphin	0	(>1.00)	0	(>1.00)	Possible		0	(>1.00)	0
Territorial Waters	0	(>1.00)	0	(>1.00)	Possible		0	(>1.00)	0
non-Territorial Waters	0	(>1.00)	0	(>1.00)	0	(>1.00)	0	(>1.00)	0

Table 3.7-3. Estimated numbers of marine mammals of each species present in the Point Mugu Sea Range during each season (continued)

Species	Numbers Estimated to be Present During Months (CV)[1]								Maximum Numbers Present
	Feb-Apr		May-Jul		Aug-Oct		Nov-Jan		
Killer whale	361	(0.48)	361	(0.48)	361	(0.48)	361	(0.48)	361
Territorial Waters	43	(0.88)	43	(0.88)	43	(0.88)	43	(0.88)	43
non-Territorial Waters	318	(0.53)	318	(0.53)	318	(0.53)	318	(0.53)	318
False killer whale	0	(>1.00)	0	(>1.00)	Possible		0	(>1.00)	0
Territorial Waters	0	(>1.00)	0	(>1.00)	Possible		0	(>1.00)	0
non-Territorial Waters	0	(>1.00)	0	(>1.00)	0	(>1.00)	0	(>1.00)	0
Baird's beaked whale	<148	(>0.71)	148	(>0.71)	>148	(>0.71)	148	(>0.71)	148
Territorial Waters	0	(>1.00)	0	(>1.00)	0	(>1.00)	0	(>1.00)	0
non-Territorial Waters	<148	(0.71)	148	(0.71)	>148	(0.71)	148	(0.71)	148
Other beaked whales	573	(>0.71)	573	(>0.71)	573	(>0.71)	573	(>0.71)	573
Territorial Waters	0	(>1.00)	0	(>1.00)	0	(>1.00)	0	(>1.00)	0
non-Territorial Waters	573	(0.71)	573	(0.71)	573	(0.71)	573	(0.71)	573
Pygmy sperm whale	Possible		Possible		Present		Possible		0
Territorial Waters	0	(>1.00)	0	(>1.00)	0	(>1.00)	0	(>1.00)	0
non-Territorial Waters	Possible		Possible		Present		Possible		0
Dwarf sperm whale	0	(>1.00)	0	(>1.00)	Possible		0	(>1.00)	0
Territorial Waters	0	(>1.00)	0	(>1.00)	Possible		0	(>1.00)	0
non-Territorial Waters	0	(>1.00)	0	(>1.00)	0	(>1.00)	0	(>1.00)	0
Northern right whale	Possible		Possible		0	(>1.00)	0	(>1.00)	0
Territorial Waters	Possible		Possible		0	(>1.00)	0	(>1.00)	0
non-Territorial Waters	Possible		Possible		0	(>1.00)	0	(>1.00)	0
Humpback whale	0	(>1.00)	125	(>0.59)	220	(>0.48)	13	(>0.94)	220
Territorial Waters	0	(>1.00)	8	(0.83)	101	(0.62)	0	(>1.00)	101
non-Territorial Waters	0	(>1.00)	117	(0.63)	119	(0.71)	13	(0.94)	119
Gray whale	2,345	(>0.41)	61	(>0.63)	0	(>1.00)	1,747	(>0.37)	2,345
Territorial Waters	1,704	(0.51)	61	(>0.63)	0	(>1.00)	1,505	(0.42)	1,704
non-Territorial Waters	641	(>0.65)	0	(>1.00)	0	(>1.00)	242	(>0.69)	641
Blue whale	266	(>0.94)	1,235	(>0.51)	1,612	(>0.29)	0	(>1.00)	1,612
Territorial Waters	0	(>1.00)	35	(>1.00)	135	(>0.72)	0	(>1.00)	135
non-Territorial Waters	266	(>0.94)	1,200	(>0.52)	1,478	(0.31)	0	(>1.00)	1,478
Fin whale	262	(>0.72)	182	(>0.68)	1,477	(>0.38)	492	(>0.58)	1,477
Territorial Waters	0	(>1.00)	11	(>0.94)	0	(>1.00)	253	(>0.94)	253
non-Territorial Waters	262	(>0.72)	171	(>0.72)	1,477	(>0.38)	239	(>0.65)	1,477
Sei whale	0	(>1.00)	0	(>1.00)	9	(>0.94)	0	(>1.00)	9
Territorial Waters	0	(>1.00)	0	(>1.00)	0	(>1.00)	0	(>1.00)	0
non-Territorial Waters	0	(>1.00)	0	(>1.00)	9	(>0.94)	0	(>1.00)	9
Bryde's whale	0	(>1.00)	0	(>1.00)	0	(>1.00)	0	(>1.00)	0
Territorial Waters	0	(>1.00)	0	(>1.00)	0	(>1.00)	0	(>1.00)	0
non-Territorial Waters	0	(>1.00)	0	(>1.00)	0	(>1.00)	0	(>1.00)	0
Minke whale	179	(0.68)	179	(0.68)	179	(0.68)	179	(0.68)	179
Territorial Waters	21	(0.89)	21	(0.89)	21	(0.89)	21	(0.89)	21
non-Territorial Waters	158	(0.62)	158	(0.62)	158	(0.62)	158	(0.62)	158
Harbor seal	914	(>0.65)	2,860	(>0.49)	927	(>0.69)	2,065	(>0.64)	2,860
Territorial Waters	914	(>0.65)	2,026	(>0.57)	306	(>0.82)	2,065	(>0.64)	2,065
non-Territorial Waters	0	(>1.00)	834	(>0.94)	621	(>0.94)	0	(>1.00)	834

Table 3.7-3. Estimated numbers of marine mammals of each species present in the Point Mugu Sea Range during each season (continued)

Species	Numbers Estimated to be Present During Months (CV)[1]								Maximum Numbers Present
	Feb-Apr		May-Jul		Aug-Oct		Nov-Jan		
Northern elephant seal	26,623	(>0.39)	6,495	(>0.50)	7,409	(>0.33)	11,356	(>0.48)	26,623
Territorial Waters	9,221	(>0.55)	3,976	(>0.71)	1,617	(>0.54)	1,737	(>0.58)	9,221
non-Territorial Waters	17,401	(0.52)	2,519	(>0.65)	5,792	(0.39)	9,619	(0.56)	17,401
California sea lion	45,227	(0.27)	163,512	(0.18)	72,276	(0.15)	133,414	(0.20)	163,512
Territorial Waters	22,692	(0.32)	87,635	(0.22)	45,579	(0.19)	47,964	(0.21)	87,635
non-Territorial Waters	22,535	(0.42)	75,876	(0.29)	26,696	(0.24)	85,449	(0.28)	85,449
Northern fur seal	44,641	(>0.23)	3,828	(>0.46)	2,553	(>0.31)	22,914	(>0.36)	44,641
Territorial Waters	807	(>0.65)	36	(>0.83)	195	(>0.62)	441	(>0.87)	807
non-Territorial Waters	43,834	(0.23)	3,792	(0.47)	2,358	(>0.33)	22,474	(0.36)	43,834

1 CV = coefficient of variation of the estimate. CVs that are given underestimate the true variation because they do not take account of variation associated with the diving behavior of marine mammals.
2 Includes separate estimates for central and northern California.
3 Includes both short-beaked and long-beaked common dolphins.

Risso's Dolphin, *Grampus griseus*

Risso's dolphin does not have a special status and is common throughout the range and throughout the year. Maximum numbers are present in the Sea Range during autumn and winter when about 32,000 animals, or most of the California population, are expected to be present. Lowest numbers are present during summer when about 11,600 animals are present in the Sea Range. Numbers present in specific areas are highly variable and are likely related to sea surface temperature and the abundance of squid, their major prey. Estimated numbers of Risso's dolphins in Territorial Waters vary from 75 individuals (spring) to 8,272 (winter) and numbers in non-Territorial Waters vary from 7,034 (summer) to 40,647 (autumn). The mean group size in the Sea Range is 42 (or 25 if five large groups are excluded); one group of 2,500 has been sighted. Both adult and immature Risso's dolphins are likely to occur in the Sea Range at all times of year.

Bottlenose Dolphin, *Tursiops truncatus*

There are two stocks of bottlenose dolphins in and near the Sea Range: a coastal stock and an offshore stock. Neither stock has a special status but the coastal stock is small and is vulnerable to any population declines. Coastal bottlenose dolphins have not been identified within the Point Mugu Sea Range although they are commonly sighted in coastal and nearshore areas east and southeast of the Sea Range. Offshore bottlenose dolphins are present year-round but are more abundant during summer, when approximately 2,942 dolphins are present. Highest densities of bottlenose dolphins are found in the southeastern part of the Sea Range. During summer about 60 percent of the bottlenose dolphins in the Sea Range are found in Territorial Waters. During other times of the year, they are probably more common in non-Territorial than Territorial Waters. Bottlenose dolphins are opportunistic feeders that regularly forage near the bottom on fish.

Common Dolphin, *Delphinus* spp.

The common dolphin does not have a special status, and the population off the coast of California has increased substantially in the past 20 years. There are two species: the long-beaked common dolphin,

Table 3.7-4. Estimated densities of marine mammals (number/km^2) and coefficients of variation (CV) (in parenthesis) of each species present in the Point Mugu Sea Range during each oceanographic season. The estimated densities incorporate estimates of availability bias. Densities in bold type are based on NMFS/SWFSC and MMS/BLM data. All CVs* are underestimated because they did not include estimates of the variance associated with diving behavior. All CVs for estimates using both NMFS/SWFSC and MMS/BLM data have additional uncertainty associated with combining the data from different survey methods and from different time periods.

	February-April		May-July		August-October		November-January	
Stratum	**No/km^2**	**CV**	**No/km^2**	**CV**	**No/km^2**	**CV**	**No/km^2**	**CV**
Harbor porpoise								
1	**0.10608**	(0.86)	**0.04793**	(0.99)	**0.05198**	(0.98)	**0.11687**	(0.84)
5	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)
6 (2, 3, 4, 6)	0.00000	(>1.00)	**0.00000**	(>1.00)	**0.00000**	(>1.00)	**0.00000**	(>1.00)
7	**0.00000**	(>1.00)	**0.00000**	(>1.00)	**0.00000**	(>1.00)	**0.00000**	(>1.00)
8	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)
All Strata	**0.00202**	(>0.86)	**0.00091**	(>0.99)	0.00099	(>0.98)	**0.00223**	(>0.84)
Dall's porpoise								
1	**0.10189**	(1.33)	**0.17520**	(0.49)	**0.16287**	(0.60)	**0.14634**	(0.54)
5	0.10189	(0.74)	0.05256	(0.83)	0.04129	(0.94)	0.16945	(0.68)
6 (2, 3, 4, 6)	0.10189	(0.82)	**0.16912**	(1.05)	**0.13346**	(1.07)	**0.14245**	(0.95)
7	**0.10189**	(1.12)	**0.10928**	(0.48)	**0.03293**	(1.27)	**0.09903**	(0.55)
8	0.10189	(0.83)	0.00000	(>1.00)	0.00000	(>1.00)	0.06068	(1.08)
All Strata	**0.10189**	(0.54)	**0.04035**	(>0.50)	0.02696	(>0.60)	**0.09350**	(0.50)
Pacific white-sided dolphin								
1	**0.05815**	(1.46)	**0.02109**	(0.83)	0.00000	(>1.00)	**0.09836**	(0.72)
5	0.40703	(0.68)	0.42818	(0.63)	0.00000	(>1.00)	0.41177	(0.68)
6 (2, 3, 4, 6)	0.00000	(>1.00)	**0.32262**	(1.08)	0.02328	(0.94)	1.00227	(0.83)
7	1.06252	(0.94)	**0.25636**	(0.48)	0.06678	(0.94)	**0.22862**	(0.45)
8	0.10748	(0.76)	0.27307	(0.83)	0.00227	(0.94)	**0.11271**	(1.10)
All Strata	**0.24414**	(>0.50)	**0.29894**	(0.50)	0.01036	(>0.65)	**0.26531**	(0.46)
Risso's dolphin								
1	**0.19529**	(1.26)	**0.04196**	(0.94)	**0.14649**	(1.40)	**0.25369**	(0.76)
5	0.59335	(0.63)	0.27931	(0.68)	0.08831	(0.76)	0.69258	(0.57)
6 (2, 3, 4, 6)	0.85487	(0.65)	**0.00000**	(>1.00)	0.46926	(0.65)	**0.08278**	(1.27)
7	0.35979	(0.94)	**0.52688**	(0.48)	0.33361	(0.76)	**1.25914**	(0.36)
8	0.33922	(0.83)	0.09180	(0.76)	0.04384	(0.59)	**0.31043**	(0.93)
All Strata	**0.43472**	(0.45)	**0.15830**	(0.38)	0.12488	(0.35)	**0.44898**	(0.43)
Bottlenose dolphin								
1	**0.00000**	(>1.00)	**0.00000**	(>1.00)	0.00000	(>1.00)	**0.00000**	(>1.00)
5	0.03240	(0.94)	0.00000	(>1.00)	0.05652	(0.76)	0.03278	(0.94)
6 (2, 3, 4, 6)	0.00000	(>1.00)	0.00000	(>1.00)	0.19157	(0.65)	**0.04412**	(1.16)
7	0.00000	(>1.00)	**0.00000**	(>1.00)	0.00000	(>1.00)	**0.00000**	(>1.00)
8	0.00000	(>1.00)	0.00000	(>1.00)	0.00415	(0.83)	0.00000	(>1.00)
All Strata	**0.00573**	(>0.94)	**0.00000**	(>1.00)	0.03155	(>0.47)	**0.01018**	(>0.73)

Table 3.7-4. Estimated densities of marine mammals (number/km^2) and coefficients of variation (in parenthesis) of each species present in the Point Mugu Sea Range during each oceanographic season (continued)

	February-April		May-July		August-October		November-January	
Stratum	**No/km^2**	**CV**	**No/km^2**	**CV**	**No/km^2**	**CV**	**No/km^2**	**CV**
Common dolphin								
1	23.33505	(0.83)	14.46994	(>1.00)	7.66789	(0.76)	14.46994	(>1.00)
5	1.42719	(0.65)	1.77636	(0.39)	1.00386	(0.54)	2.44465	(0.63)
6 (2, 3, 4, 6)	8.21981	(0.63)	9.01302	(0.68)	7.28223	(0.48)	6.82394	(0.76)
7	2.90402	(0.94)	1.41911	(>1.00)	0.51117	(0.76)	1.41911	(>1.00)
8	0.92809	(0.72)	1.56338	(0.41)	0.92227	(0.23)	1.61623	(0.83)
All Strata	2.36543	(0.34)	2.57319	(>0.28)	1.65650	(0.24)	2.50564	(>0.40)
Northern right whale dolphin								
1	**0.17436**	(1.40)	**0.01741**	(0.94)	**0.19599**	(1.33)	**0.09484**	(0.83)
5	2.39314	(0.48)	1.57550	(0.68)	0.00000	(>1.00)	0.33666	(0.60)
6 (2, 3, 4, 6)	0.59887	(0.83)	**0.02155**	(1.57)	0.00000	(>1.00)	**0.14112**	(1.25)
7	2.28260	(0.94)	**0.28256**	(0.53)	0.00000	(>1.00)	**0.19449**	(0.49)
8	0.36474	(0.83)	0.86773	(0.76)	0.06577	(0.68)	**0.11586**	(1.19)
All Strata	**0.93440**	(0.38)	**0.83408**	(0.53)	**0.04352**	(>0.63)	**0.16485**	(0.56)
Cuvier's beaked whale								
1	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)
5	0.02487	(0.66)	0.02487	(0.66)	0.02487	(0.66)	0.02487	(0.66)
6 (2, 3, 4, 6)	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)
7	0.02487	(1.11)	0.02487	(1.11)	0.02487	(1.11)	0.02487	(1.11)
8	0.02487	(0.71)	0.02487	(0.71)	0.02487	(0.71)	0.02487	(0.71)
All Strata	0.02193	(>0.52)	0.02193	(>0.52)	0.02193	(>0.52)	0.02193	(>0.52)
Sperm whale								
1	**0.00000**	(>1.00)	**0.00000**	(>1.00)	**0.00000**	(>1.00)	**0.00000**	(>1.00)
5	0.03835	(0.76)	0.00000	(>1.00)	0.01254	(0.94)	0.00000	(>1.00)
6 (2, 3, 4, 6)	0.00000	(>1.00)	**0.00000**	(>1.00)	0.00000	(>1.00)	**0.00000**	(>1.00)
7	0.00000	(>1.00)	**0.00000**	(>1.00)	0.00000	(>1.00)	**0.03247**	(0.83)
8	0.05517	(0.72)	0.00000	(>1.00)	0.00245	(0.68)	0.08352	(0.83)
All strata	**0.04015**	(>0.61)	**0.00000**	(>1.00)	0.00370	(>0.63)	**0.05376**	(>0.78)
Striped dolphin								
1	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)
5	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)
6 (2, 3, 4, 6)	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)
7	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)
8	0.00000	(>1.00)	0.08164	(0.94)	0.13983	(0.57)	0.00000	(>1.00)
All strata	0.00000	(>1.00)	0.04938	(>0.94)	0.08459	(>0.57)	0.00000	(>1.00)
Killer whale								
1	0.00387	(1.37)	0.00387	(1.37)	0.00387	(1.37)	0.00387	(1.37)
5	0.00387	(0.84)	0.00387	(0.84)	0.00387	(0.84)	0.00387	(0.84)
6 (2, 3, 4, 6)	0.00387	(1.01)	0.00387	(1.01)	0.00387	(1.01)	0.00387	(1.01)
7	0.00387	(1.24)	0.00387	(1.24)	0.00387	(1.24)	0.00387	(1.24)
8	0.00387	(0.71)	0.00387	(0.71)	0.00387	(0.71)	0.00387	(0.71)
All strata	0.00387	(0.48)	0.00387	(0.48)	0.00387	(0.48)	0.00387	(0.48)

Table 3.7-4. Estimated densities of marine mammals (number/km²) and coefficients of variation (in parenthesis) of each species present in the Point Mugu Sea Range during each oceanographic season (continued)

Stratum	February-April		May-July		August-October		November-January	
	No/km²	CV	No/km²	CV	No/km²	CV	No/km²	CV
Baird's beaked whale								
1	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)
5	0.00180	(0.92)	0.00180	(0.92)	0.00180	(0.92)	0.00180	(0.92)
6 (2, 3, 4, 6)	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)
7	0.00180	(1.37)	0.00180	(1.37)	0.00180	(1.37)	0.00180	(1.37)
8	0.00180	(0.97)	0.00180	(0.97)	0.00180	(0.97)	0.00180	(0.97)
All strata	0.00159	(>0.71)	0.00159	(>0.71)	0.00159	(>0.71)	0.00159	(>0.71)
Other beaked whales								
1	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)
5	0.00697	(0.92)	0.00697	(0.92)	0.00697	(0.92)	0.00697	(0.92)
6 (2, 3, 4, 6)	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)
7	0.00697	(1.37)	0.00697	(1.37)	0.00697	(1.37)	0.00697	(1.37)
8	0.00697	(0.97)	0.00697	(0.97)	0.00697	(0.97)	0.00697	(0.97)
All strata	0.00614	(>0.71)	0.00614	(>0.71)	0.00614	(>0.71)	0.00614	(>0.71)
Humpback whale								
1	**0.00000**	(>1.00)	**0.00475**	(0.83)	0.02334	(0.94)	**0.00000**	(>1.00)
5	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)
6 (2, 3, 4, 6)	0.00000	(>1.00)	0.00000	(>1.00)	0.00640	(0.83)	0.00000	(>1.00)
7	0.00000	(>1.00)	**0.01257**	(0.63)	0.00904	(0.94)	**0.00137**	(0.94)
8	0.00000	(>1.00)	0.00000	(>1.00)	0.00062	(0.83)	0.00000	(>1.00)
All strata	**0.00000**	(>1.00)	**0.00135**	(>0.59)	0.00236	(>0.48)	**0.00014**	(>0.94)
Gray whale								
1	**0.42056**	(0.77)	**0.03409**	(0.63)	0.00000	(>1.00)	**0.49440**	(0.26)
5	0.03376	(0.72)	0.00000	(>1.00)	0.00000	(>1.00)	0.00997	(0.94)
6 (2, 3, 4, 6)	0.10326	(0.68)	0.00000	(>1.00)	0.00000	(>1.00)	0.06765	(0.94)
7	**0.00904**	(1.33)	**0.00000**	(>1.00)	0.00000	(>1.00)	**0.00831**	(0.83)
8	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)
All strata	**0.02515**	(>0.41)	**0.00065**	(>0.63)	0.00000	(>1.00)	**0.01874**	(>0.37)
Blue whale								
1	**0.00000**	(>1.00)	**0.01988**	(>1.00)	0.00000	(>1.00)	**0.00000**	(>1.00)
5	0.00000	(>1.00)	0.01426	(0.63)	0.02650	(0.60)	0.00000	(>1.00)
6 (2, 3, 4, 6)	0.00000	(>1.00)	0.00000	(>1.00)	0.01453	(0.72)	0.00000	(>1.00)
7	0.00000	(>1.00)	**0.00000**	(>1.00)	0.05140	(0.65)	**0.00000**	(>1.00)
8	0.00471	(0.94)	0.01710	(0.63)	0.00997	(0.37)	0.00000	(>1.00)
All strata	**0.00285**	(>0.94)	**0.01325**	(>0.51)	0.01729	(>0.29)	**0.00000**	(>1.00)
Fin whale								
1	**0.00000**	(>1.00)	**0.00647**	(0.94)	0.00000	(>1.00)	**0.00000**	(>1.00)
5	0.01591	(0.72)	0.01035	(0.72)	0.02342	(0.65)	0.01207	(0.76)
6 (2, 3, 4, 6)	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)	0.02731	(0.94)
7	0.00000	(>1.00)	**0.00000**	(>1.00)	0.09709	(0.54)	**0.00429**	(0.94)
8	0.00000	(>1.00)	0.00000	(>1.00)	0.00332	(0.54)	0.00000	(>1.00)
All strata	**0.00281**	(>0.72)	**0.00195**	(>0.68)	0.01584	(>0.38)	**0.00528**	(>0.58)

Table 3.7-4. Estimated densities of marine mammals (number/km^2) and coefficients of variation (in parenthesis) of each species present in the Point Mugu Sea Range during each oceanographic season (continued)

Stratum	February-April		May-July		August-October		November-January	
	No/km^2	CV	No/km^2	CV	No/km^2	CV	No/km^2	CV
Sei whale								
1	**0.00000**	(>1.00)	**0.00000**	(>1.00)	0.00000	(>1.00)	**0.00000**	(>1.00)
5	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)
6 (2, 3, 4, 6)	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)
7	0.00000	(>1.00)	**0.00000**	(>1.00)	0.00000	(>1.00)	**0.00000**	(>1.00)
8	0.00000	(>1.00)	0.00000	(>1.00)	0.00016	(0.94)	0.00000	(>1.00)
All strata	**0.00000**	(>1.00)	**0.00000**	(>1.00)	0.00010	(>0.94)	**0.00000**	(>1.00)
Minke whale								
1	0.00192	(1.31)	0.00192	(1.31)	0.00192	(1.31)	0.00192	(1.31)
5	0.00192	(0.80)	0.00192	(0.80)	0.00192	(0.80)	0.00192	(0.80)
6 (2, 3, 4, 6)	0.00192	(1.03)	0.00192	(1.03)	0.00192	(1.03)	0.00192	(1.03)
7	0.00192	(1.25)	0.00192	(1.25)	0.00192	(1.25)	0.00192	(1.25)
8	0.00192	(0.85)	0.00192	(0.85)	0.00192	(0.85)	0.00192	(0.85)
All strata	0.00192	(0.68)	0.00192	(0.68)	0.00192	(0.68)	0.00192	(0.68)
Harbor seal								
1	0.16218	(0.65)	0.02184	(0.94)	0.02336	(0.94)	0.05307	(0.94)
2	0.06432	(0.94)	0.27560	(0.83)	0.00000	(>1.00)	0.41884	(0.72)
3	0.00000	(>1.00)	0.38638	(0.94)	0.00000	(>1.00)	0.00000	(>1.00)
4	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)
5	0.00000	(>1.00)	0.05061	(0.94)	0.03769	(0.94)	0.00000	(>1.00)
6	0.13117	(0.94)	0.29600	(0.76)	0.05748	(0.94)	0.39558	(0.72)
7	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)
8	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)
All strata	0.00981	(>0.65)	0.03067	(>0.49)	0.00994	(>0.69)	0.02214	(>0.64)
Northern elephant seal								
1	0.00000	(>1.00)	0.15205	(0.83)	0.15493	(0.68)	0.48638	(0.68)
2	0.31211	(0.94)	0.00000	(>1.00)	0.34894	(0.83)	0.00000	(>1.00)
3	1.71193	(0.83)	0.00000	(>1.00)	0.57295	(0.94)	0.64088	(0.94)
4	1.56227	(0.94)	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)
5	0.58278	(0.76)	0.00000	(>1.00)	0.07437	(0.65)	0.18958	(0.83)
6	0.47188	(0.83)	0.80635	(0.76)	0.09452	(0.94)	0.00000	(>1.00)
7	0.18144	(0.72)	0.27061	(0.65)	0.07224	(0.65)	0.09540	(0.83)
8	0.10827	(0.83)	0.00000	(>1.00)	0.06903	(0.53)	0.09939	(0.83)
All strata	0.28551	(>0.39)	0.06966	(>0.50)	0.07946	(>0.33)	0.12179	(>0.48)
California sea lion								
1	1.20327	(0.35)	4.62960	(0.27)	1.50389	(0.25)	2.60351	(0.28)
2	2.12053	(0.43)	13.73869	(0.29)	4.61864	(0.28)	2.70838	(0.36)
3	1.96798	(0.65)	6.31971	(0.57)	5.43780	(0.42)	5.63699	(0.43)
4	2.74751	(0.72)	4.71374	(0.65)	5.88287	(0.42)	5.29362	(0.50)
5	0.13008	(0.83)	3.24533	(0.38)	1.16072	(0.32)	1.54458	(0.36)
6	1.95824	(0.47)	11.29354	(0.31)	3.58401	(0.19)	4.14797	(0.29)
7	0.33133	(0.47)	1.60679	(0.34)	0.70401	(0.31)	0.96698	(0.35)
8	0.30682	(0.53)	0.13171	(0.83)	0.01794	(0.60)	0.90397	(0.43)
All strata	0.48503	(0.27)	1.75356	(0.18)	0.77511	(0.15)	1.43078	(0.20)

Table 3.7-4. Estimated densities of marine mammals (number/km²) and coefficients of variation (in parenthesis) of each species present in the Point Mugu Sea Range during each oceanographic season (continued)

	February-April		May-July		August-October		November-January	
Stratum	**No/km²**	**CV**	**No/km²**	**CV**	**No/km²**	**CV**	**No/km²**	**CV**
Northern fur seal								
1	0.07088	(0.68)	0.02017	(0.83)	0.03095	(0.65)	0.01491	(0.94)
2	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)	0.02412	(0.94)
3	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)
4	0.00000	(>1.00)	0.00000	(>1.00)	0.00000	(>1.00)	0.13748	(0.94)
5	0.32509	(0.57)	0.01583	(0.94)	0.00000	(>1.00)	0.14446	(0.57)
6	0.14828	(0.76)	0.00000	(>1.00)	0.03043	(0.83)	0.00000	(>1.00)
7	0.48312	(0.28)	0.12967	(0.43)	0.11028	(0.39)	0.05241	(0.63)
8	0.60237	(0.28)	0.04121	(0.72)	0.02360	(0.50)	0.34756	(0.41)
All strata	0.47875	(>0.23)	0.04106	(>0.46)	0.02738	(>0.31)	0.24574	(>0.36)

* CV (coefficient of variation) is a measure of a number's variability. The larger the CV, the higher the variability.

found within 50 NM (90 km) of shore, and the short-beaked common dolphin, found to greater than 300 NM (560 km) from shore. Most studies have not distinguished the two species so they are treated together here. The common dolphin is the most common cetacean in the Point Mugu Sea Range but it exhibits large seasonal changes in distribution and abundance, probably related to seasonal changes in water temperatures. During autumn to spring, common dolphins are most common in the southeastern part of the Sea Range, and south and east of there (Figure 3.7-2). During summer, their numbers decrease in the Sea Range as they disperse northward (Figure 3.7-2). In autumn to spring, an estimated 220,000 to 240,000 common dolphins are found in the Sea Range.

During summer, about 150,000 common dolphins are scattered throughout the Sea Range. Within the Sea Range, roughly equal proportions of common dolphins are found in Territorial and non-Territorial Waters during winter to summer (see Table 3.7-3). During autumn, only about 38 percent are found in Territorial Waters. The mean group size within the Sea Range is 141 individuals, but group sizes vary with species, season, and geographic location. The short-beaked common dolphin feeds primarily on squid and Pacific hake and occasionally northern anchovy. The long-beaked common dolphin feeds equally on hake and anchovy.

Northern Right Whale Dolphin, *Lissodelphis borealis*

The northern right whale dolphin has not been assigned any special status and the trends in population size are unknown. It is abundant throughout the inner half of the Sea Range during winter and spring when approximately 87,000 and 77,000 animals, respectively, may be present (Figure 3.7-3). During autumn, smaller numbers are present in the same area; many animals have moved north of the Sea Range. During summer, only 4,000 animals are present in the Sea Range, most in the northern part (Figure 3.7-3). During all times of year the majority (greater than 90 percent) of northern right whale dolphins are found in non-Territorial Waters. Mean group size within the Point Mugu Sea Range was 89 individuals (214 groups) but groups of up to 2,500 animals have been seen there. Northern right whale dolphins feed on squid, lanternfish, and other mesopelagic fish at depths less than 985 feet (300 m).

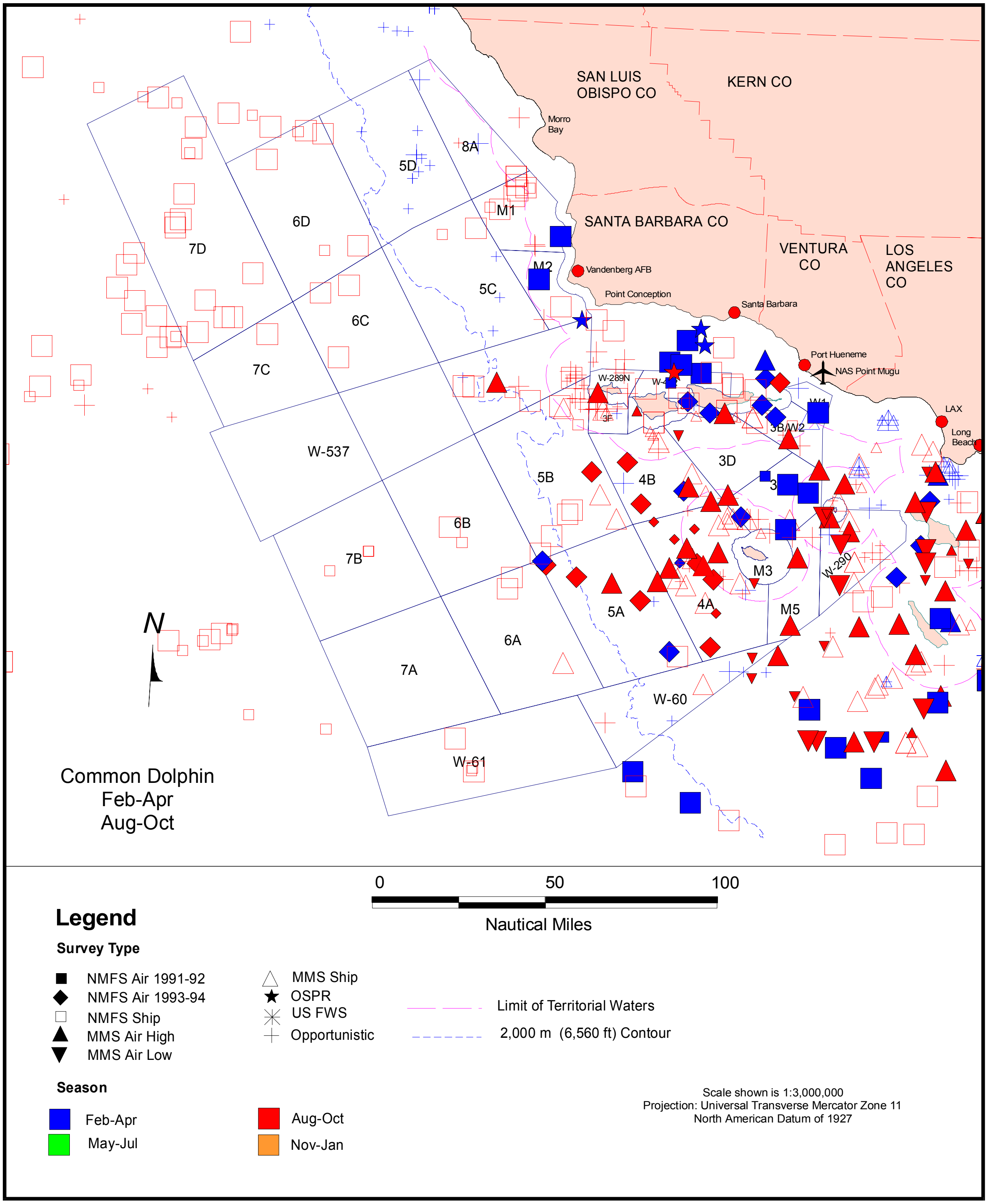

Figure 3.7-2
Sightings of common dolphins during the February-April and August-October 1975-96 surveys summarized.
Survey effort was not uniform throughout the area or at different times of the year; thus sightings cannot be assumed to represent relative abundance either geographically or seasonally. Small and large symbols denote sightings of 1-20 animals vs. 21 or more animals, respectively.

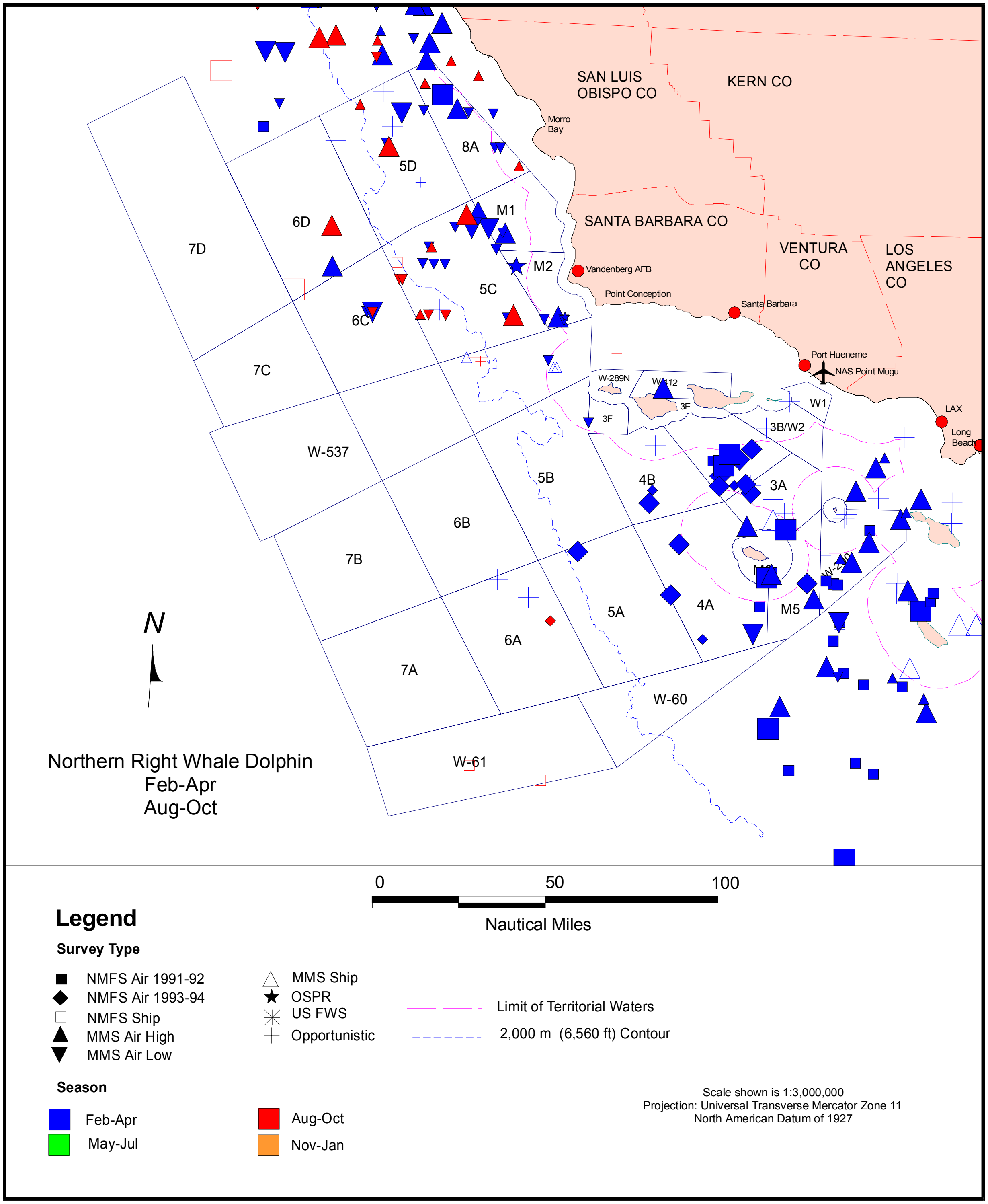

Figure 3.7-3
Sightings of northern right whale dolphins during the February-April and August-October 1975-96 surveys summarized.
Survey effort was not uniform throughout the area or at different times of the year; thus sightings cannot be assumed to represent relative abundance either geographically or seasonally. Small and large symbols denote sightings of 1-10 vs. 11 or more animals, respectively.

Short-finned Pilot Whale, *Globicephala macrorhynchus*

The California population of the short-finned pilot whale is considered a strategic stock under the MMPA (Barlow et al. 1997). Its distribution changed following the El Niño event of 1982-1983 and it has only recently started to return to its former range in California. It is found primarily south and east of the Sea Range. During most years at most a few tens of animals might be found in the Sea Range, primarily during autumn and winter. However, if oceanographic conditions are suitable, large numbers and a large fraction of the California population might be found in the Sea Range. In former years, short-finned pilot whales occurred in groups averaging about 20 animals, and they fed primarily on squid.

Cuvier's Beaked Whale, *Ziphius cavirostris*

Cuvier's beaked whale does not have a special status. Beaked whales are distributed throughout offshore waters of the Sea Range throughout the year (Figure 3.7-4). About 2,044 Cuvier's beaked whales may occur on the Sea Range (see Table 3.7-3). This species is found in small groups averaging 2.3 individuals and feeds on squid and fish found in deep water in offshore areas.

Sperm Whale, *Physeter macrocephalus*

The sperm whale is listed as endangered and depleted, and the stock that occurs in the Sea Range is considered to be a strategic stock (Barlow et al. 1997). It is found throughout deep offshore waters warmer than 59° F (15° C) and is present throughout offshore waters of the Sea Range in all seasons except possibly spring (Figure 3.7-5). The sperm whale is probably present in largest numbers during autumn and winter when about 3,744 to 5,013 may be present in the Sea Range (see Table 3.7-3). Almost all sperm whales are expected to be found in non-Territorial Waters. This species is generally found in small groups (with a mean number of 5.6 individuals). Sperm whales dive to great depths (to 9,840 feet [3,000 m]) and feed on medium to large cephalopods.

Other Odontocetes

Many other species of odontocetes have been reported as occasional or rare visitors to the SCB. None of these additional species are listed as endangered or depleted and none of the stocks that occur in the Sea Range are considered to be strategic stocks (Barlow et al. 1997). Although none to a few animals of these species are expected to be found within the Sea Range, any animals that do occur are likely to represent a significant fraction (possibly all) of the California population. For additional details, refer to the "Marine Mammal Technical Report" (NAWCWPNS Point Mugu 1998e).

Striped Dolphin, Stenella coeruleoalba

Striped dolphins are abundant in eastern tropical Pacific waters where they form large mixed schools with spinner and spotted dolphins. Approximately 7,887 striped dolphins are found in the Sea Range during summer. Because the striped dolphin is a pelagic species and there has not been adequate survey coverage in offshore waters during seasons other than summer, its abundance in the outer Sea Range is unknown during autumn to spring. All of the estimated 7,887 striped dolphins occurring in the Sea Range during summer are found in non-Territorial Waters.

Spinner Dolphin, Stenella longirostris

Spinner dolphins are common in nearshore areas off Central America but no spinner dolphins were identified in or near the study area during the recent studies from which sightings were mapped for this

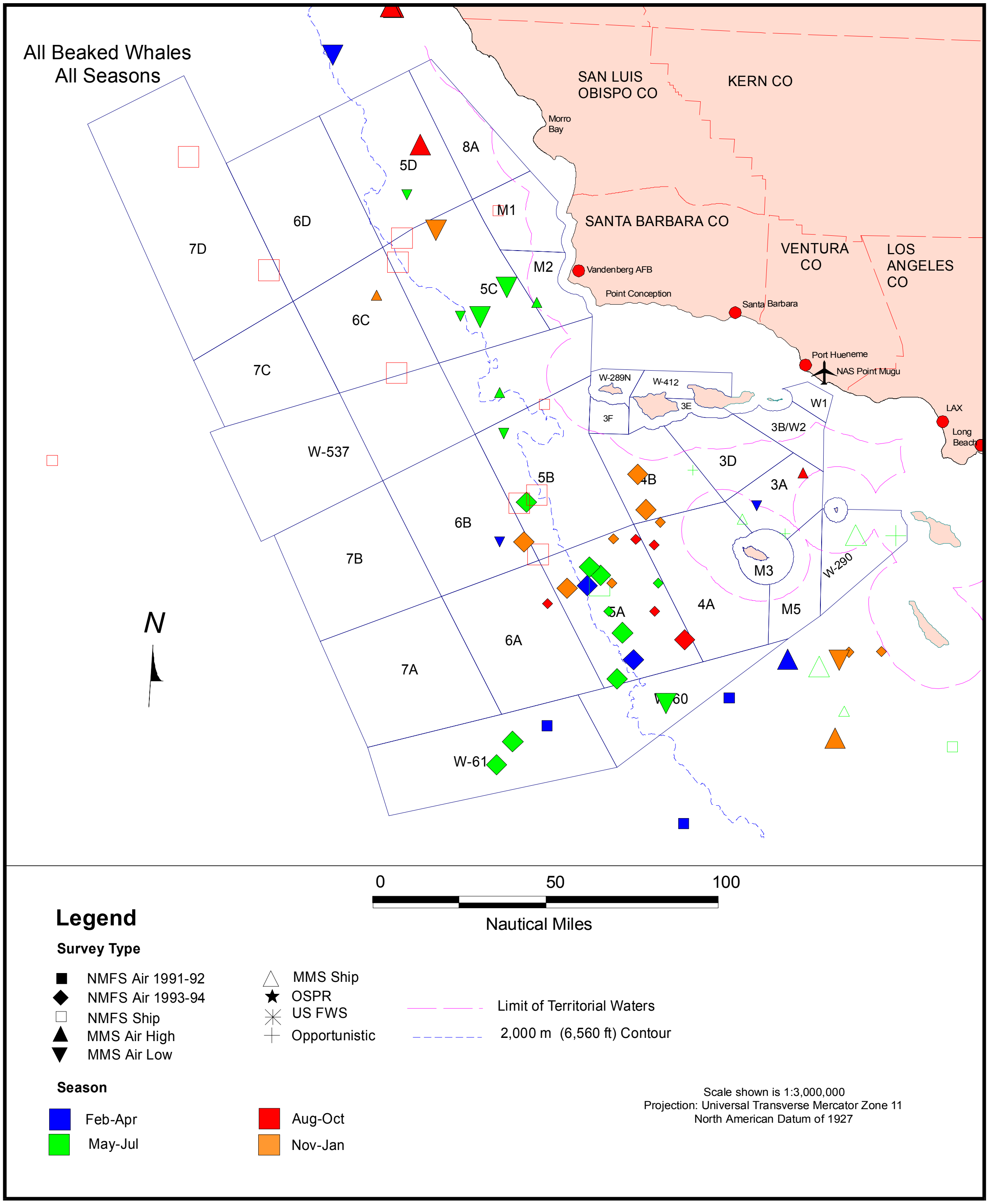

Figure 3.7-4
Sightings of all beaked whales during the 1975-96 surveys summarized.
Survey effort was not uniform throughout the area or at different times of the year; thus sightings cannot be assumed to represent relative abundance either geographically or seasonally. Small and large symbols denote sightings of single animals vs. 2 or more animals, respectively. Beaked whales are especially difficult to survey because they are below the surface most of the time.

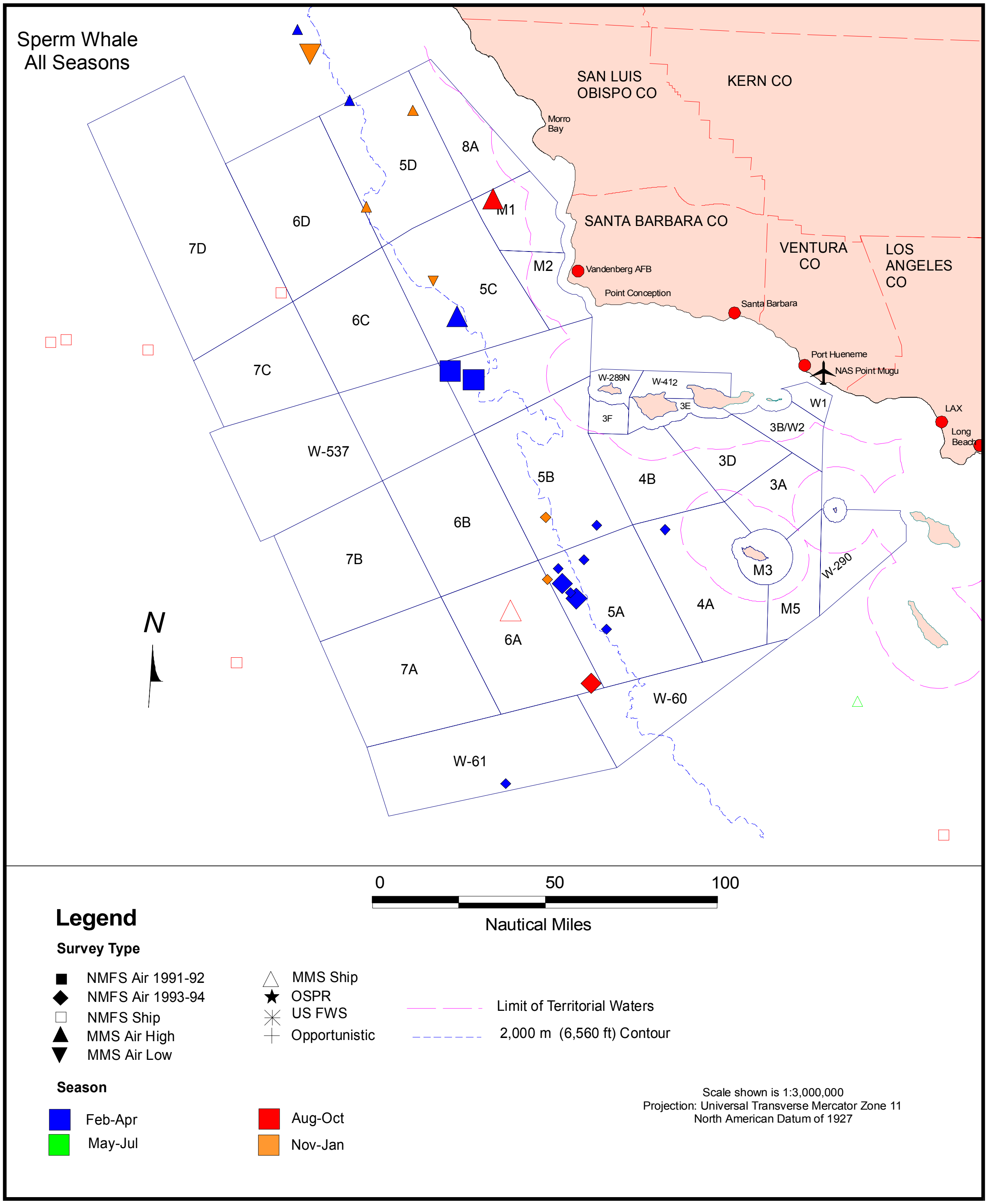

Figure 3.7-5
Sightings of sperm whales during the 1975-96 surveys summarized.
Survey effort was not uniform throughout the area or at different times of the year; thus sightings cannot be assumed to represent relative abundance either geographically or seasonally. Small and large symbols denote sightings of 1-5 vs. 6 or more animals, respectively. Sperm whales are especially difficult to survey because they are below the surface most of the time.

analysis. Thus, no or at most a few spinner dolphins are expected to be present in the Sea Range. If they are present, they are likely to be in Territorial Waters (see Table 3.7-3).

Spotted Dolphin, Stenella attenuata

Spotted dolphins are typically found in tropical and temperate pelagic waters. No sightings of spotted dolphins have been made at sea in California waters, but a stranding has been reported approximately 25 NM (46 km) north and east of the Sea Range. No, or at most a few, spotted dolphins are likely to occur in the Sea Range.

Rough-toothed Dolphin, Steno bredanensis

Rough-toothed dolphins are typically found in tropical and warm temperate waters. This species has not been positively identified alive in coastal temperate waters, but a few specimens have been collected from central and northern California. None to a few rough-toothed dolphins might be present in the Sea Range during summer. They are most likely to be found in Territorial Waters.

Killer Whale, Orcinus orca

Killer whales are sighted occasionally in California waters, but no resident populations have been identified (Forney et al. 1995). Forney et al. (1995) estimated that 747 (CV=0.71) killer whales occur in waters off California. Approximately 361 killer whales are estimated to be present in the Sea Range throughout the year. Approximately 12 percent (43) of them are in Territorial Waters and 88 percent (318) are in non-Territorial Waters (Table 3.7-3).

False Killer Whale, Pseudorca crassidens

False killer whales occur predominantly in tropical to subtropical pelagic waters and have rarely been reported north of Baja California. This species is a sporadic visitor in California waters and records of strandings and sightings along the California coast are rare. None to a few false killer whales might be present in the Sea Range during summer, primarily in non-Territorial Waters.

Baird's Beaked Whale, Berardius bairdii

Baird's beaked whales are infrequently encountered along the continental slope and throughout deep waters of the eastern North Pacific. Little is known about their seasonal movements or distribution, but it is suspected that they move into continental slope waters during the late spring through early autumn period and move farther offshore during other periods (Barlow et al. 1997). The best estimate of the number of Baird's beaked whales off California is 380 (CV=0.52, Barlow and Gerrodette 1996). Approximately 148 Baird's beaked whales are present in the Sea Range, with greater than 148 probably being present from late spring to early autumn and fewer than 148 present during the rest of the year. All Baird's beaked whales are expected to be found in non-Territorial Waters.

Mesoplodont Beaked Whales, Mesoplodon spp.

Mesoplodont beaked whales (including Hubbs', Hector's, gingko-toothed, Blainville's, and Stejneger's beaked whales as a group) are distributed throughout deep waters and along the continental slopes of the eastern North Pacific. These five species are known to occur near or in the Point Mugu Sea Range. All beaked whales are difficult to identify so most beaked whale sightings are not identified to the species level. None of the five species is listed as endangered under the ESA or depleted or a strategic stock under the MMPA. Until recently, the California/Oregon/Washington "population" of this species group has collectively been considered to be a strategic stock (Barlow et al. 1997). However, due to new information on population size, its status was recently changed to "non-strategic" (NMFS 1998; Barlow et al. 1998). The available data about occurrence of particular mesoplodont species in and near the Sea Range has come mostly from stranding records. The paucity of sightings and strandings precludes any determination of spatial or seasonal patterns in mesoplodont beaked whale distribution or abundance. Barlow and Gerrodette (1996) estimated that 2,106 (CV=0.79) mesoplodont beaked whales were present in offshore waters within 300 NM (556 km) of the California coast. Approximately 573 mesoplodont beaked whales are present in the Sea Range throughout the year, primarily in non-Territorial Waters (see Table 3.7-3).

Pygmy Sperm Whale, Kogia breviceps

The pygmy sperm whale normally remains seaward of the continental shelf. Only one pygmy sperm whale was sighted in the Sea Range during studies since 1990. The best estimate of the California population size for pygmy sperm whales is 3,145 (CV=0.45, Barlow and Sexton 1996). A few pygmy sperm whales are probably present in autumn in non-Territorial Waters in the Sea Range. Pygmy sperm whales are found singly or in groups of up to 6 individuals. Their diet consists of squid, benthic fish, and crabs, suggesting that they dive to considerable depths when feeding.

Dwarf Sperm Whale, Kogia simus

The dwarf sperm whale may inhabit waters over or near the edge of the continental shelf or the open sea, primarily south of the Sea Range. Thus, occasional dwarf sperm whales may be found in the Sea Range during summer and early autumn, when water temperatures are high, but they are unlikely to be present at other times of year. There is no good estimate of the California population size for the dwarf sperm whale, but Barlow and Gerrodette estimated that there are about 891 (CV=2.04) pygmy and/or dwarf sperm whales (*Kogia* sp.) in California waters. This species is found singly or in small groups of up to about 6 animals. Their diet consists of squid, benthic fish, and crabs.

3.7.2.2 Mysticetes (Baleen Whales)

All species of baleen whales that occur in the Sea Range have extensive ranges in the North Pacific, extending from high-latitude feeding grounds in the summer to subtropical calving grounds in the winter (Bonnell and Dailey 1993).

Blue, fin, and humpback whales are present in southern California offshore waters during the summer and autumn months (Heyning and Lewis 1990). Minke whales appear to be present year-round off the Channel Islands (Rice 1974; Leatherwood et al. 1987). In the autumn and winter, migrating gray whales are abundant both close to shore and in offshore migration corridors along and between the Channel Islands. Northern right, sei, and Bryde's whales are uncommon or rare in the area.

Northern Right Whale, *Eubalaena glacialis*

The northern right whale is federally listed as endangered under the ESA and the North Pacific stock is considered a strategic stock under the MMPA. In the northeastern Pacific its numbers may have been reduced beyond the point of recovery. No live northern right whales have been seen in the Sea Range proper during the last 100 years. (The few recent sightings near the Sea Range are listed in the "Marine Mammal Technical Report" [NAWCWPNS Point Mugu 1998e]). The scarcity of sightings and the very low population numbers indicate that it is very unlikely that right whales will be encountered in the Sea Range.

Gray Whale, *Eschrichtius robustus*

The gray whale no longer has a special status since its recent removal from the "endangered" list. During its autumn migration southward and its winter migration northward, most of the approximately 23,100 gray whales in the eastern North Pacific stock pass through or inshore of the Point Mugu Sea Range. The southbound migration begins in late December, peaks in early-to-mid January and extends through February. The northbound migration begins in mid-February, peaks in March and extends through May. North of Point Conception, the migration corridor is largely inshore of the Sea Range (Figure 3.7-6). In the SCB, gray whales follow three general routes through or near the Sea Range: 1) a nearshore route follows the coast and is primarily east of the Sea Range; 2) an inshore route goes from Point Conception to the Channel Islands, east to Santa Cruz Island, southeast to Santa Barbara Island and thence east and southeast to Santa Catalina and San Clemente islands; and 3) an offshore route goes from Point Conception to the western Channel Islands, southeast to San Nicolas Island, and southeast from there. (For a map of migration corridors in the SCB, see Figure 3.7-15 later in this chapter.) Survey data suggest that about 86 percent of gray whales traverse Territorial Waters within the Sea Range during their southbound migration in autumn and that 73 percent traverse Territorial Waters during their northbound migration in winter. Gray whales do not spend much time feeding in the Sea Range and typically pass through it in a few days or less. Northbound mothers and calves travel more slowly than other whales and tend to be seen later in the season than other northbound gray whales.

Humpback Whale, *Megaptera novaeangli*ae

The humpback whale is listed as endangered and depleted and the stock that occurs in the Sea Range is designated as a strategic stock (Barlow et al. 1997). The population that occurs in the Sea Range winters as far south as Costa Rica and summers as far north as southern British Columbia, but most individuals of this stock are found off Mexico during winter and off central and northern California during summer. There are about 600 animals in this population and the stock size appears to be increasing slowly. Most of these whales pass through the Sea Range during their north-south migration to and from feeding areas farther north but only a fraction of the population is present in the Sea Range at one time. Feeding concentrations totaling approximately 220 humpback whales are found in the Sea Range during summer. Almost half of the feeding whales are found in Territorial Waters (Figure 3.7-7; see Table 3.7-3). Humpback whales are rarely found in the Sea Range during winter and only a fraction of the population is present in the Sea Range during the spring and autumn migration periods. During the spring and autumn periods most whales are found in non-Territorial Waters. Humpbacks are found singly or in small groups (average 2.9 individuals) and they feed primarily on krill.

Blue Whale, *Balaenoptera musculus*

The blue whale is listed as endangered and depleted and the stock that occurs in the Sea Range is designated as a strategic stock (Barlow et al. 1997). The population that occurs in the Point Mugu Sea Range winters off Central America and summers as far north as northern California. This species is common in offshore areas of the Sea Range during late spring and summer (Figure 3.7-8). There are about 1,800 animals in this population and it appears to be increasing, although some of the apparent increase is likely due to changes in distribution rather than population increase. Most of this population summers in and north of the Sea Range. Feeding concentrations of up to 100 blue whales are found near the Sea Range during summer in some years. Waters west of San Nicolas Island are often used for feeding (Figure 3.7-8). Blue whales are rarely found in the Sea Range during autumn and early winter

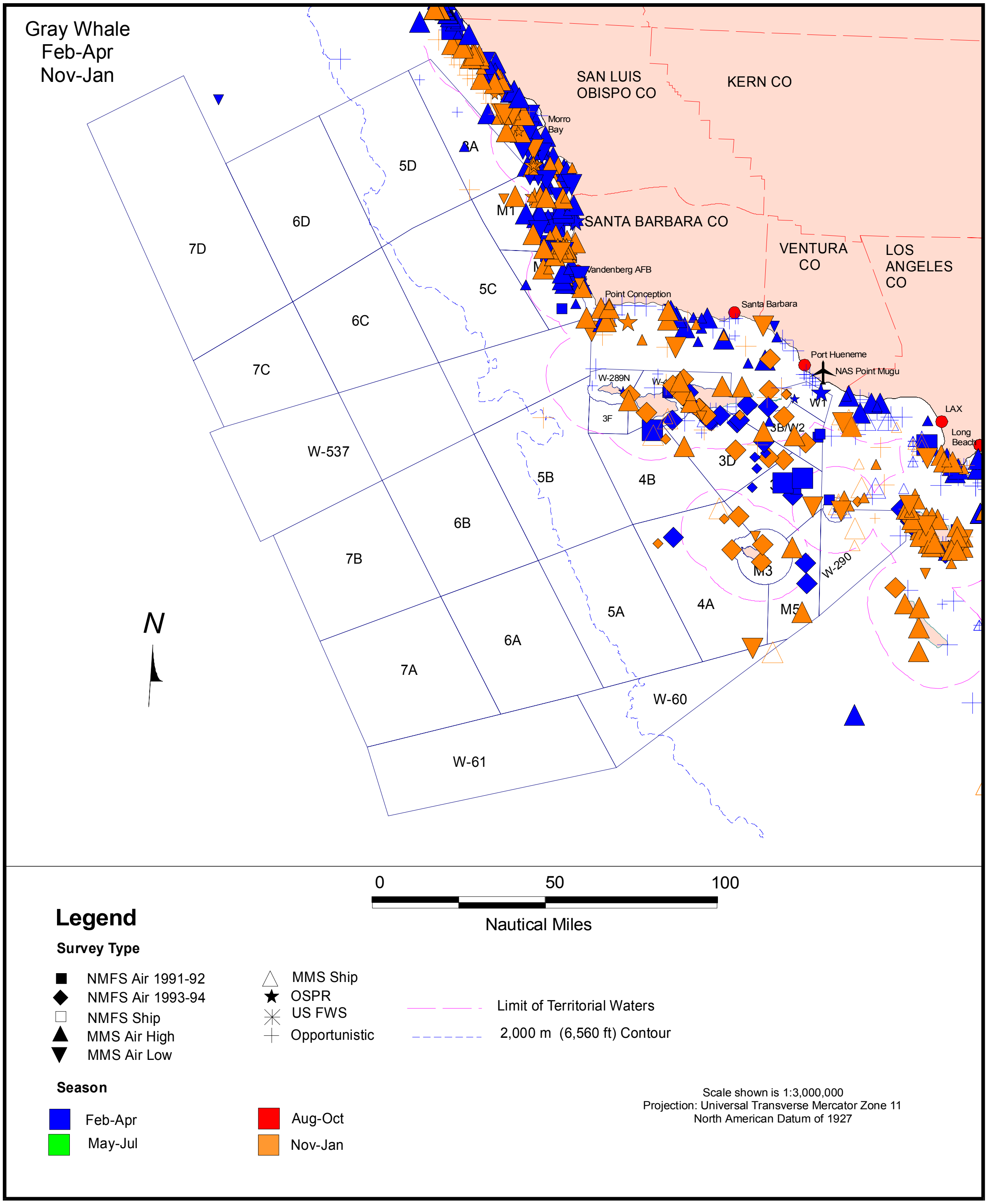

Figure 3.7-6
Sightings of gray whales during the February-April and November-January 1975-96 surveys summarized.
Survey effort was not uniform throughout the area or at different times of the year; thus sightings cannot be assumed to represent relative abundance either geographically or seasonally. Small and large symbols denote sightings of single animals vs. 2 or more animals, respectively.

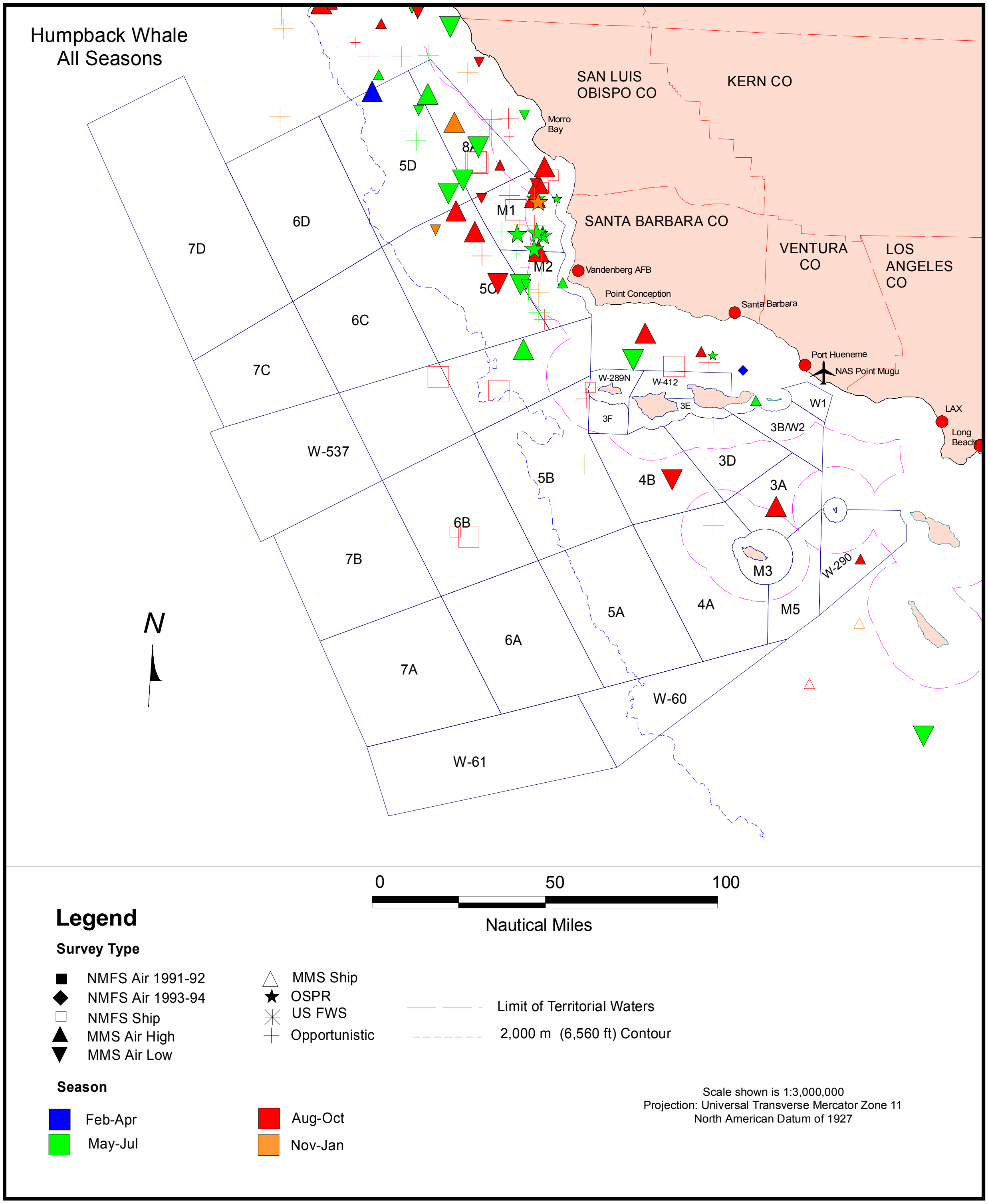

Figure 3.7-7
Sightings of humpback whales during the 1975-96 surveys summarized.
Survey effort was not uniform throughout the area or at different times of the year; thus sightings cannot be assumed to represent relative abundance either geographically or seasonally. Small and large symbols denote sightings of single animals vs. 2 or more animals, respectively.

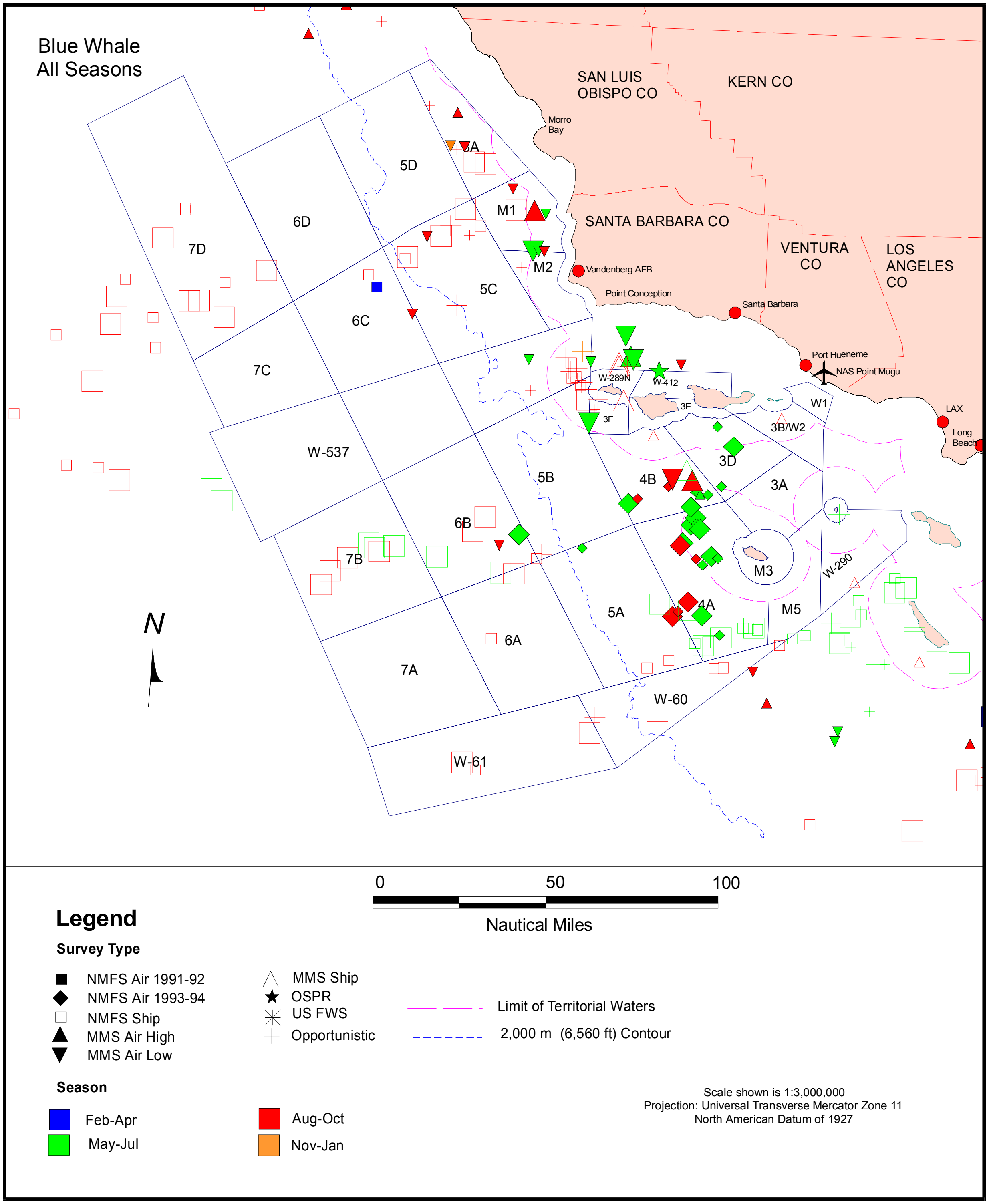

Figure 3.7-8
Sightings of blue whales during the 1975-96 surveys summarized.
Survey effort was not uniform throughout the area or at different times of the year; thus sightings cannot be assumed to represent relative abundance either geographically or seasonally. Small and large symbols denote sightings of single animals vs. 2 or more animals, respectively.

and only very small numbers are found there during late winter and early spring (see Table 3.7-3). During summer there are approximately 1,600 blue whales in the Sea Range; only 135 (8 percent) of them are found in Territorial Waters. Blue whales usually are found singly or in small groups (average 2.5 individuals). They feed in deep offshore waters primarily on euphausiids, often near the surface (less than 52 feet [16 m]) but sometimes to considerably deeper depths.

Fin Whale, *Balaenoptera physalus*

The fin whale is listed as endangered and depleted, and the stock that occurs in the Sea Range is designated as a strategic stock (Barlow et al. 1997). The population that occurs in the Point Mugu Sea Range winters offshore of Mexico and southern California and summers in the Sea Range and possibly as far north as Washington. This species is one of the most commonly encountered large cetaceans in the Sea Range. During summer, an estimated 1,477 fin whales (probably overestimated) are present in the continental slope and offshore areas of the Sea Range in non-Territorial Waters (Figure 3.7-9). During summer, the highest concentrations tend to be found in offshore waters north of Point Conception. During other times of year, an estimated 182-492 fin whales are present, primarily in the southern part of the Sea Range and primarily in non-Territorial Waters (see Table 3.7-3). This population appears to be increasing. Fin whales are generally found in small groups (average 3.5 individuals), but groups of 130 and 81 animals have been found in the Sea Range. They feed on euphausiids, copepods, squid, and small schooling fish.

Sei Whale, *Balaenoptera borealis*

The sei whale is listed as endangered and depleted, and the stock that occurs in the Sea Range is designated as a strategic stock (Barlow et al. 1997). This species is rare in the continental slope and offshore areas of the Sea Range during spring and summer and is not seen during other times of year. There is no estimate of the size of the stock that inhabits California waters but the number is presumed to be small. None to a few tens of sei whales may occur in the Sea Range, primarily during spring and summer and primarily in offshore waters. Sei whales are generally found in small groups averaging 2 to 5 individuals. They feed on copepods, euphausiids, amphipods, squid, and small schooling fish.

Bryde's Whale, *Balaenoptera edeni*

Bryde's whale is not federally listed as endangered under the ESA and is not considered depleted or a strategic stock under the MMPA. This species is rarely seen in or near the Sea Range. The best estimate of the California population size is 24 (CV=2.0, Barlow et al. 1997). At any given time, the number on the Sea Range could vary from none to the entire California population. Bryde's whales are more likely to be found in non-Territorial Waters but are occasionally sighted in nearshore areas.

Minke Whale, *Balaenoptera acutorostrata*

Minke whales found in the Sea Range are not federally listed as endangered under the ESA or depleted or a strategic stock under the MMPA. Until recently, the stock that inhabits offshore waters from Baja California to Washington has been considered a strategic stock (Barlow et al. 1997); however, its status was recently changed to "non-strategic" (NMFS 1998; Barlow et al. 1998). Their seasonal distributions and movements are not well known because they are inconspicuous as compared with other baleen whales. Available data suggest that minke whales move into nearshore and continental slope waters of the southeastern part of the Sea Range during late spring and leave in late summer (for additional details, refer to the "Marine Mammal Technical Report" [NAWCWPNS Point Mugu 1998e]). During the

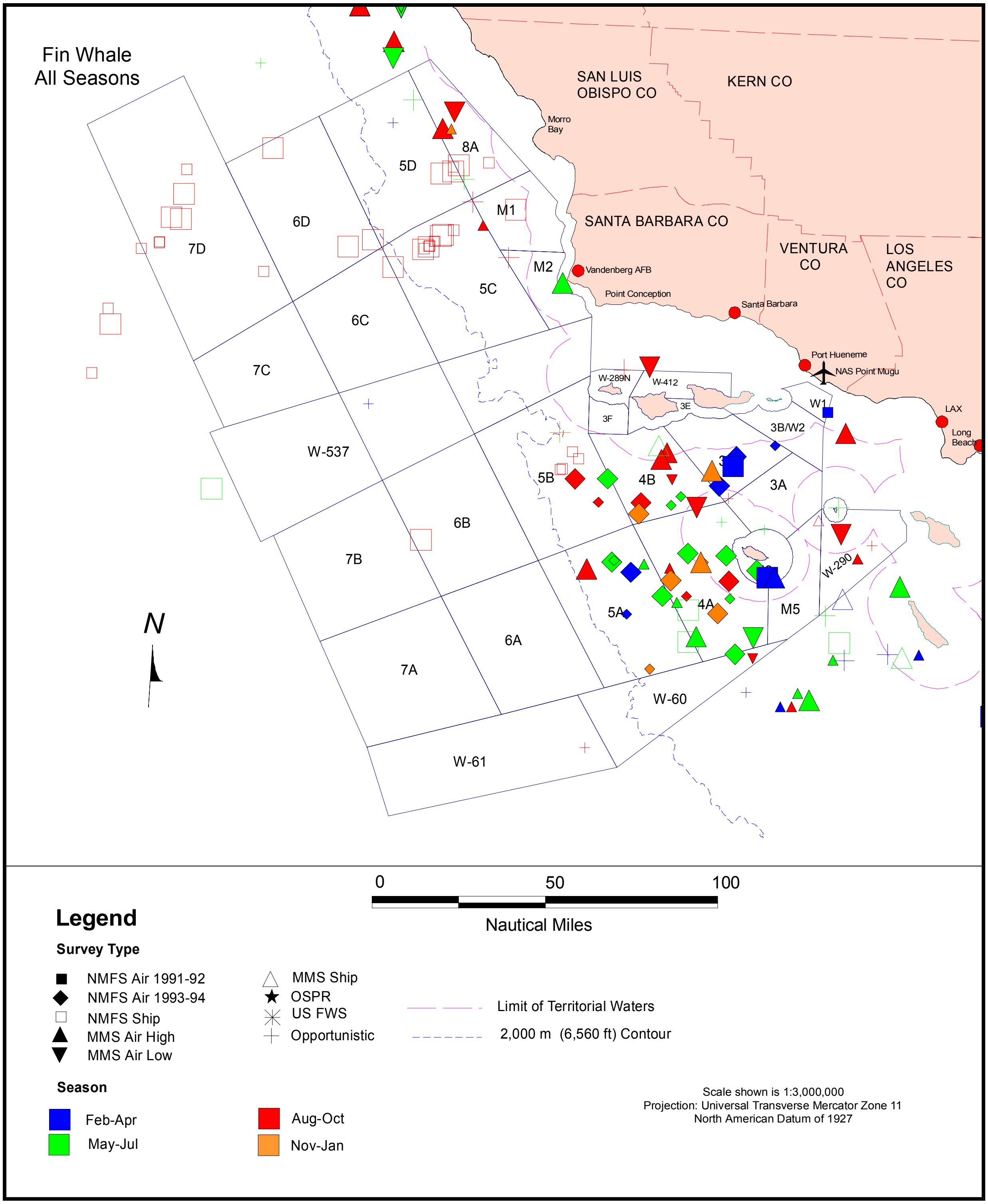

Figure 3.7-9
Sightings of fin whales during the 1975-96 surveys summarized.
Survey effort was not uniform throughout the area or at different times of the year; thus sightings cannot be assumed to represent relative abundance either geographically or seasonally. Small and large symbols denote sightings of single animals vs. 2 or more animals, respectively.

remainder of the year they may disperse into offshore waters and possibly south of the Sea Range. During summer, many of the minke whales that inhabit offshore waters of California may be found in the southeastern part of the Sea Range, particularly south of and offshore of the Channel Islands. About 180 minke whales are present in the Sea Range throughout the year. Minke whales in the Sea Range usually occur in groups of 1 to 3 individuals (mean group size 1.4), and probably feed on euphausiids and small shoaling fish.

3.7.2.3 Pinnipeds

Four pinniped species (harbor seal, northern elephant seal, California sea lion, and northern fur seal) are found regularly in the Point Mugu Sea Range and two additional species, Steller sea lion and Guadalupe fur seal, are seen occasionally. Of the four regularly occurring species, only one species, the California sea lion, is common throughout offshore waters of the Sea Range throughout the year. Large numbers of northern elephant seals pass through offshore waters four times per year as they travel to and from breeding, pupping, and molting areas on islands within the Sea Range. Large numbers of northern fur seals may be found in offshore waters during the winter and spring when animals from northern populations may feed there. During the rest of the year, moderate numbers of northern fur seals are found in offshore waters of the Sea Range. They include only the animals that breed and raise their young on San Miguel Island. Moderate numbers of harbor seals are found hauled out on land and in coastal waters of the Sea Range, but because of their preference for shallow coastal waters, few are found in offshore areas.

This section emphasizes the distribution and activities of pinnipeds while they are in offshore waters. However, there are relatively few data on pinniped distribution and abundance while at sea. The details of their occurrence and numbers while ashore are given in later sections on Point Mugu (Section 3.7.3.3), San Nicolas Island (Section 3.7.4.3), and the other Channel Islands (Section 3.7.5.3). Many additional details, literature citations, maps, and graphs of numerical trends are given in the "Marine Mammal Technical Report" (NAWCWPNS Point Mugu 1998e).

Harbor Seal, *Phoca vitulina*

The harbor seal does not have a special status and the California population has dramatically increased in size since the mid-1960s (Figure 3.7-10). In some areas, including parts of the Channel Islands, the populations are stable or declining either because numbers may have reached the carrying capacity of the available habitat or due to interspecific competition with northern elephant seals. Individual harbor seals spend considerably more time in the water than they do on land, except during the molting period, which peaks in late May to early June and for adult females, during the pupping and nursing period from late February to mid-May (Figure 3.7-11). The California stock includes 28,000 to 35,600 seals, of which 3,600 to 4,600 inhabit coastal haul-out sites and waters in the Point Mugu Sea Range. During most of the year they remain near their haul-out sites and most feeding occurs in nearshore waters 30 to 130 feet (10 to 40 m) deep (nursing females) or 260 to 390 feet (80 to 120 m) deep (others). Their diet consists of rockfish, spotted cusk-eel, octopus, plainfin midshipman, and shiner surfperch.

Northern Elephant Seal, *Mirounga angustirostris*

Northern elephant seals do not have a special status and the California population has dramatically increased in size since the early 1900s. They spend 8 to 10 months of the year feeding in offshore waters north of the Sea Range and most of the remaining time hauled out on beaches where they give birth to pups, breed, and molt (see Figure 3.7-11). They migrate through the Sea Range four times per year during movements to and from haul-out sites. The California stock is estimated to be approximately

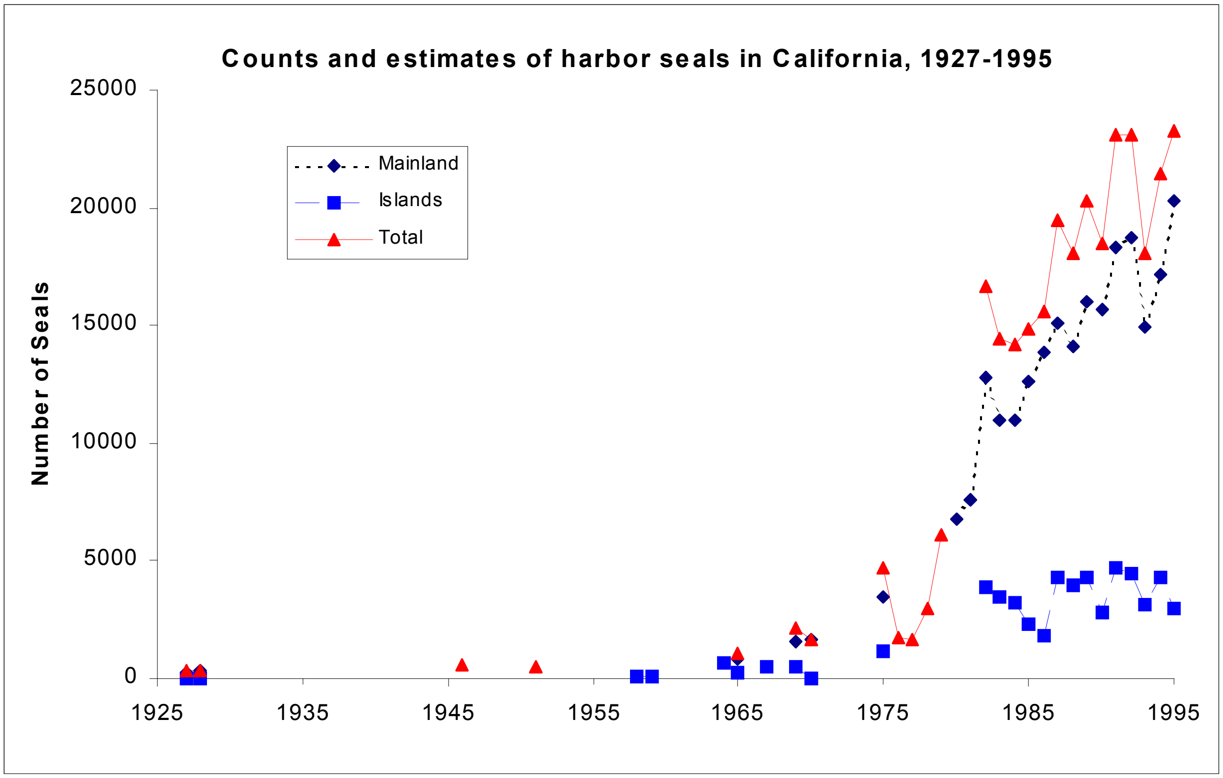

Figure 3.7-10
Counts of harbor seals in California, 1927-95.
Plotted from shore-count data in Table 1 of Hanan (1996), which do not include seals at sea at the time of the coastal counts.

84,000 seals of which about 71,000 (85 percent) use islands within the Sea Range. Two-thirds of the seals in the Sea Range use haul-out sites on San Miguel Island, 32 percent on San Nicolas Island, and small numbers on Santa Rosa, Santa Cruz, Anacapa, and Santa Barbara islands. Maximum numbers are present at sea in the Sea Range during winter and lowest numbers occur there during spring and summer. Different age and sex categories have somewhat differing annual cycles (see Figure 3.7-11) and different migration patterns. Most northern elephant seals seen at sea in the Sea Range are moving between haul-out sites for breeding, pupping, and molting and feeding areas north of the Sea Range (Figure 3.7-12). Almost all feeding occurs outside of the Sea Range, mainly far to the north, on bottom-dwelling fishes, squid, and numerous other prey species. Northern elephant seals routinely dive to depths of 492 to 2,625 feet (150 to 800 m) to feed and spend 2 to 3 minutes on the surface after dives lasting 21 to 25 minutes.

California Sea Lion, *Zalophus californianus*

The California sea lion does not have a special status and its population has been increasing at 8.3 percent per year since 1983. It is the most commonly seen pinniped at sea in the Sea Range (Figure 3.7-13). More than 95 percent of the U.S. stock, or more than 159,000 to 179,000 animals, is associated with haul-out sites in the Point Mugu Sea Range, primarily on San Miguel and San Nicolas islands. Adult males haul out from mid-May to late July to defend territories and breed (see Figure 3.7-11). After the breeding season they migrate north of the Sea Range to feeding areas as far north as Puget Sound and British Columbia where they remain until the following spring. Females give birth to their pups in mid-June to mid-July and breed 3 to 4 weeks later. They initially nurse their pups for 8 days and then

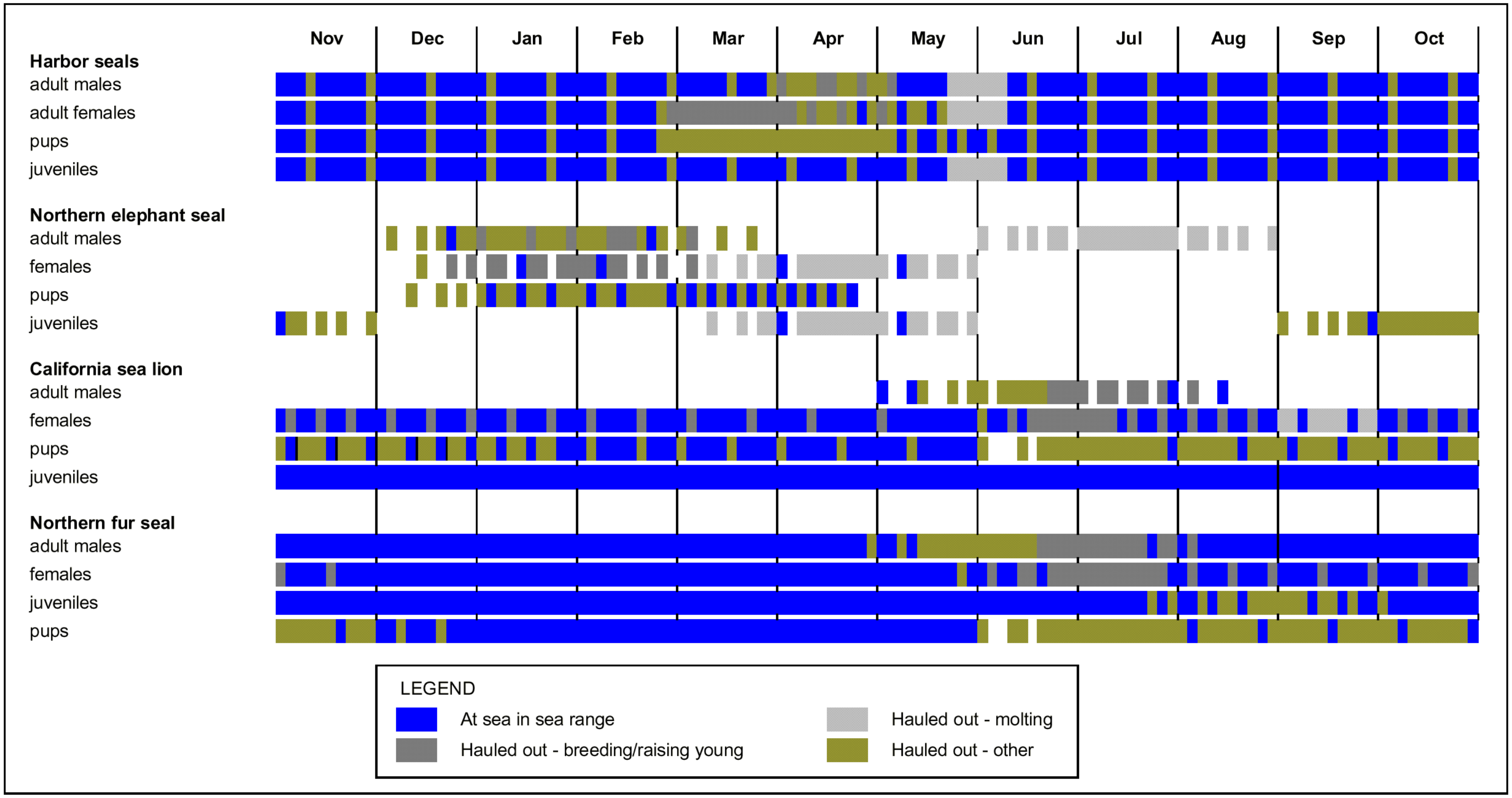

Figure 3.7-11
Activities of pinnipeds throughout the year in the Point Mugu Sea Range. Blanks indicate that animals are found outside of the Sea Range, or in the case of pups, that most pups are not born. Alternating activities indicate that not all animals are engaged in one activity. The width of each segment indicates approximate proportions of animals or of time engaged in each activity.

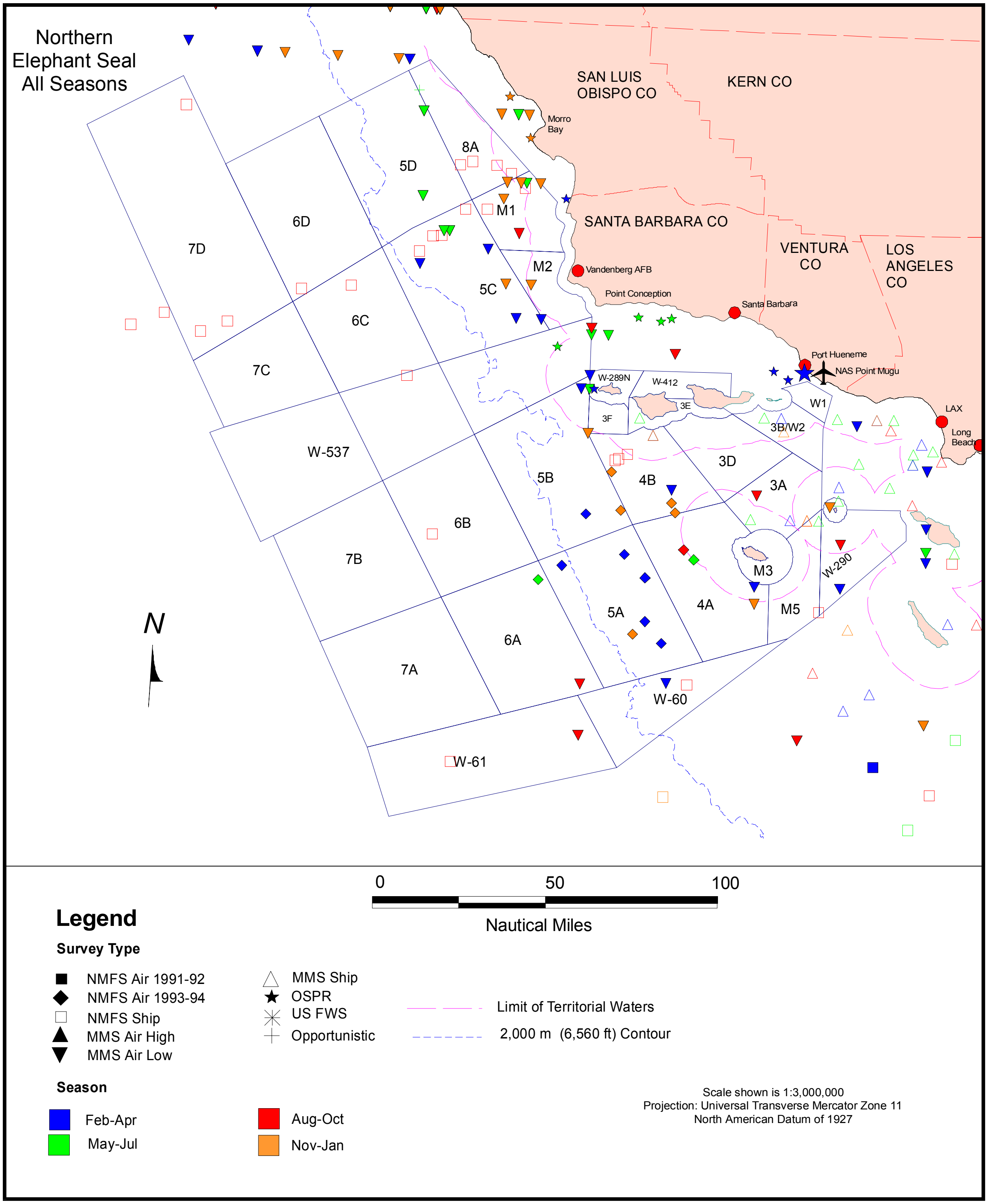

Figure 3.7-12
Sightings of northern elephant seals during the 1975-96 surveys summarized. Survey effort was not uniform throughout the area or at different times of the year; thus sightings cannot be assumed to represent relative abundance either geographically or seasonally. Small and large symbols denote sightings of single animals vs. 2 or more animals, respectively. Elephant seals are especially difficult to survey because they are below the surface most of the time.

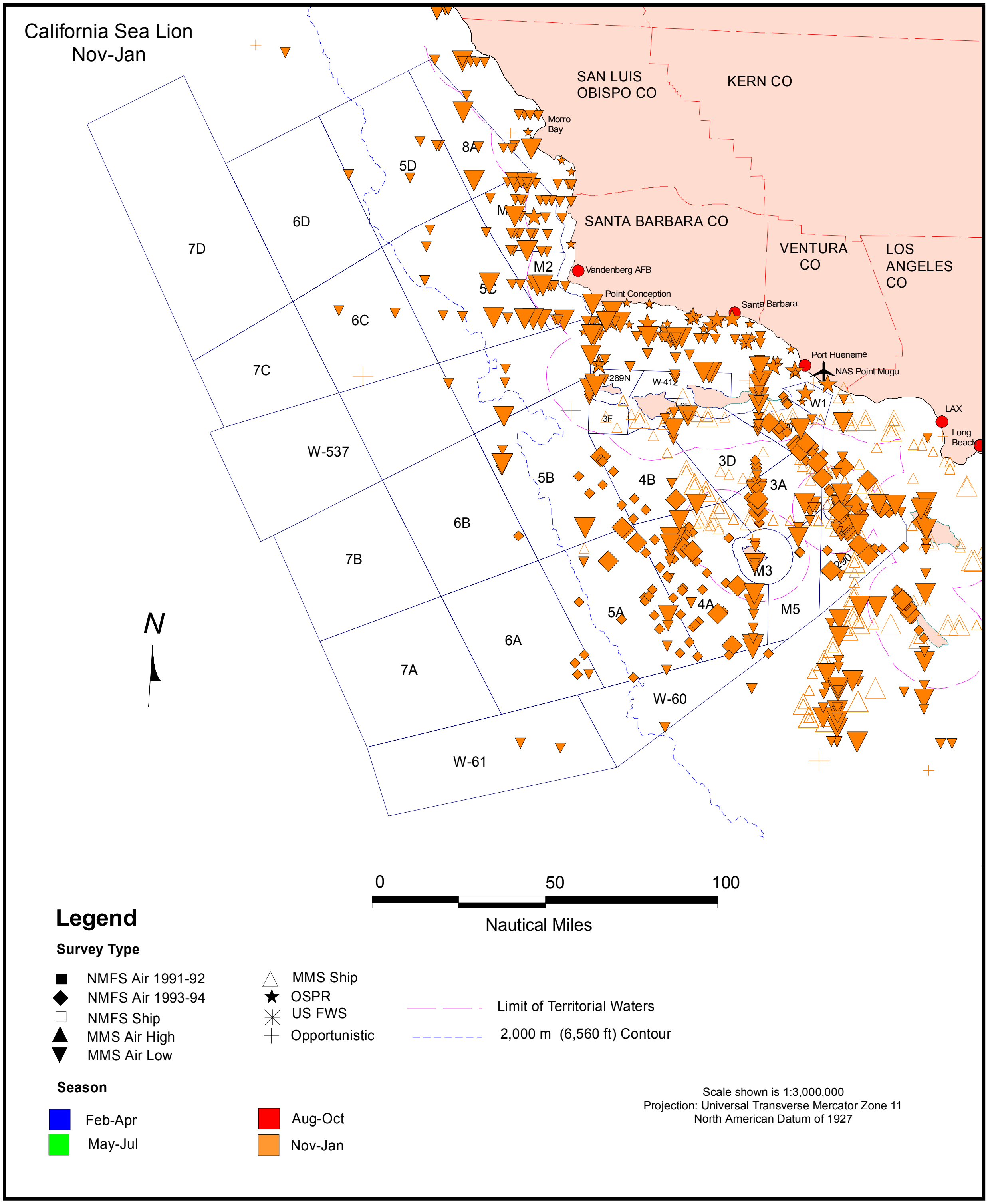

Figure 3.7-13
Sightings of California sea lions during the November-January 1975-96 surveys summarized. Survey effort was not uniform throughout the area or at different times of the year; thus sightings cannot be assumed to represent relative abundance either geographically or seasonally. Small and large symbols denote sightings of single animals vs. 2 or more animals, respectively.

alternate between feeding trips to sea of 2 to 4 days and nursing periods of about 2 days. Pups are usually weaned at about 8 months (range 4 to 12 months), but some are nursed for more than a year. Adult females and probably most subadults remain near the haul-out sites throughout the year and spend most of their time feeding at sea. Numbers appear to be lowest in offshore waters of the Sea Range (approximately 72,000) during summer when females are molting or nursing their pups, adult males are feeding north of the Sea Range, and pups are still nursing. Total numbers in offshore waters appear similar at other times of year (approximately 130,000 to 160,000; see Table 3.7-3), except at the peak of the breeding and pupping season in mid-June to early July when a large fraction of adult males and females is hauled out at rookeries. The principal prey species in the Point Mugu Sea Range are northern anchovy, Pacific whiting, and market squid. Most (75 percent) dives are less than 3 minutes in duration and to depths of 70 to 160 feet (20 to 50 m), although dives of up to 10 minutes and 900 feet (274 m) have been recorded. The longer and deeper dives tend to be during the day and the shorter and shallower dives during the night.

Steller Sea Lion, *Eumetopias jubatus*

The Steller sea lion is threatened and the stock occurring in California waters is considered a strategic stock (Barlow et al. 1997). Stocks in southwestern Alaska have declined to about half of their 1956-1960 levels. The Eastern stock, which includes the California population, has remained stable since 1965, but colonies in California declined from 6,000 to 7,000 in 1970 to approximately 2,000 in 1989. Steller sea lions now are rarely sighted in the Sea Range and no animals have been sighted at former colonies on San Miguel Island since 1983.

Northern Fur Seal, *Callorhinus ursinus*

The northern fur seal does not have a special status and the San Miguel Island stock has increased steadily since recolonization in the late 1950s to about 10,000 animals now. This stock remains in or near the Point Mugu Sea Range throughout the year. In addition, some of the females and juveniles from the eastern Pacific stock migrate south into offshore waters of the Sea Range during autumn and winter (Figure 3.7-14). During autumn and winter, approximately 22,914 and 44,641 northern fur seals, respectively, are present in offshore waters of the Sea Range. When not hauled out on land almost all (98-99 percent) fur seals are found in non-Territorial Waters except during summer when pups are commonly found in the water near their haul-out sites. Northern fur seals feed in the upper water layers (mean dive depth is approximately 225 feet [69 m]) in deep offshore waters on pelagic fish and squid. An average dive is 2.6 minutes in duration.

Guadalupe Fur Seal, *Arctocephalus townsendi*

The Guadalupe fur seal is threatened and depleted; the only remaining stock is considered a strategic stock (Barlow et al. 1997). This species has been seen occasionally in the Sea Range (46 sightings from 1969-1986), but the entire population (7,400 animals) is centered on Guadalupe Island, Mexico, approximately 250 NM (460 km) south of the Sea Range. The population has been growing at 13.7 percent per year since 1954 and may be expanding its range. Little is known about its foraging behavior and food preferences but squid is likely an important part of its diet.

3.7.2.4 Sea Otter, Enhydra lutris

The southern sea otter is threatened and depleted and this stock is considered a strategic stock. It was nearly extirpated during the 18th and 19th centuries by hunters who killed sea otters for their pelts. The present population size in California is about 2,400 animals and has been increasing at 5-7 percent per

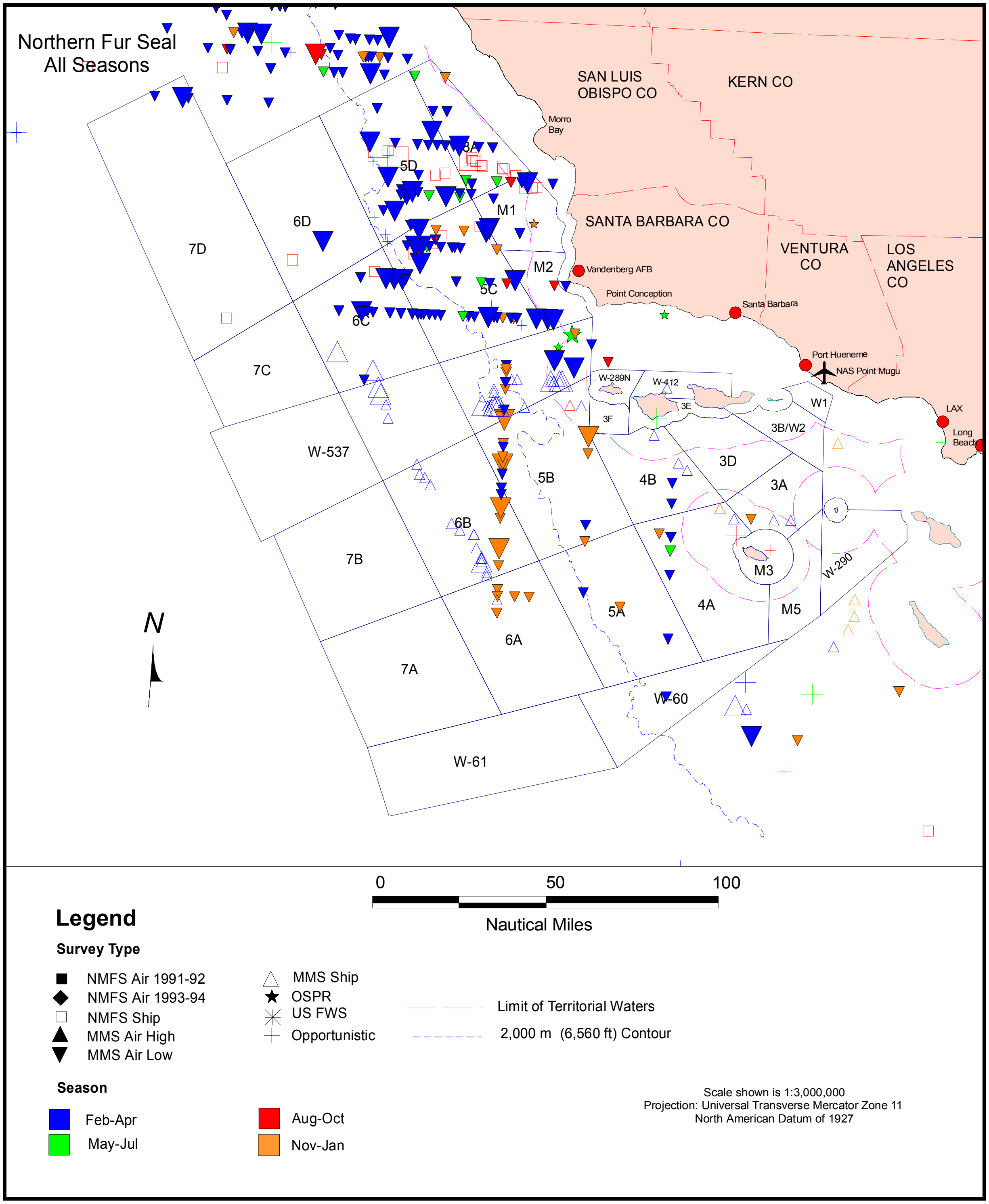

Figure 3.7-14
Sightings of northern fur seals during the 1975-96 surveys summarized.
Survey effort was not uniform throughout the area or at different times of the year; thus sightings cannot be assumed to represent relative abundance either geographically or seasonally. Small and large symbols denote sightings of single animals vs. 2 or more animals, respectively.

year. The primary range is along the central California coast north of and inshore of the northern part of the Sea Range. However, the sea otter is expanding its range southward along the coast, including a recent expansion south of Point Conception into the Santa Barbara area. Sea otters prefer rocky shorelines and water about 66 feet (20 m) deep. They feed on benthic invertebrates, including mussels, clams, crabs, abalone, sea urchins, and sea stars. Their predation on the latter species may help to maintain the kelp forests. Sea otters are very rarely seen in offshore waters in the Sea Range.

In 1987-1990, an attempt was made to establish an "experimental population" of sea otters at San Nicolas Island by translocating 139 individuals to that location. This population has diminished to about 17 animals (Ralls et al. 1996; USFWS 1996). The San Nicolas Island experimental population is discussed further in Section 3.7.4.4. The translocation plan included establishment of a "no otter" zone elsewhere south of Point Conception. Because of the potential for sea otters to affect shellfisheries, it was agreed that sea otters found in the "no otter" zone would be captured and moved to San Nicolas Island or to the main range along the central California coast (Ladd 1986). However, the sea otter population has now expanded south from the central California coast into the "no otter" zone.

3.7.3 Point Mugu

Many of the species of marine mammals occurring in the Sea Range tend to occur in deep waters and are expected to be rare or absent from nearshore waters within 3 NM (5.6 km) of Point Mugu. In fact, only five species of cetaceans, one species of pinniped, and the sea otter were seen within 3 NM (5.6 km) of Point Mugu during the studies that were summarized for this document (for details, refer to Section 3.7.3 of the "Marine Mammal Technical Report" [NAWCWPNS Point Mugu 1998e]). However, there has been only a very limited amount of survey coverage in nearshore waters off Point Mugu. On rare occasions, other species might be encountered in these waters.

3.7.3.1 Odontocetes (Toothed Whales)

Only four odontocete species were sighted within 3 NM (5.6 km) of shore in the vicinity of Point Mugu. They were Dall's porpoise, bottlenose dolphin, common dolphin, and pilot whale.

Dall's Porpoise

Dall's porpoises are normally found well offshore except in locations where deep canyons approach the coast, as occurs at Point Mugu. These nearshore sightings are most often made in winter. In November of 1975, one pod of four Dall's porpoises was sighted near the coast east-southeast of Point Mugu.

Bottlenose Dolphin

The coastal stock of bottlenose dolphins may be found in nearshore waters off Point Mugu because they are commonly seen along the coast 80 to 100 NM (148 to 185 km) southeast of there, and are occasionally seen along the coast northwest of there. However, only two sightings were made near Point Mugu during the studies summarized. Both sightings involved groups of 10 dolphins, one group seen during August and the other during December.

Common Dolphin

Common dolphins are abundant throughout offshore areas of the Sea Range, but there was only one sighting of 20 animals in nearshore waters near Point Mugu during the studies summarized. This sighting was during spring (May).

Pilot Whale

Within the general study region, the pilot whale was found mainly south and east of Point Mugu during the years when the species was common in the area (i.e., prior to 1983). However, four sightings were made near Point Mugu during the studies summarized. They were all seen during October to December, and all involved groups of about 20 whales. Pilot whales have been rare in the SCB in recent years.

3.7.3.2 Mysticetes (Baleen Whales)

The only mysticete occurring regularly in nearshore waters adjacent to Point Mugu is the gray whale.

Gray Whale

A significant proportion of the 23,100 gray whales in the California stock migrate through or near the nearshore waters adjacent to Point Mugu during their southward and northward migrations. The numbers passing Point Mugu at various distances from shore have not been specifically documented. The onshore-offshore distribution is likely to differ from that at some other locations where it has been studied, as gray whales migrating through the SCB follow several migration corridors and do not all travel close to the mainland shoreline (Figure 3.7-15).

The occurrence of gray whales in nearshore waters off Point Mugu is strongly seasonal. Significant numbers are present only during late autumn to winter (December-April). The peak of southbound migration is in early-to-mid January and the peak of northbound migration is in March. Mothers and calves tend to migrate later in the spring than do other whales. Mothers and calves tend to use offshore migration routes and, therefore, most do not pass close to Point Mugu. On the other hand, movements of mothers and calves tend to be more leisurely, so that any mother/calf pairs occurring near Point Mugu are likely to remain there longer than would other gray whales.

3.7.3.3 Pinnipeds

The only pinniped that is seen in large numbers near Point Mugu is the harbor seal, which hauls out at the entrance to Mugu Lagoon. Small numbers of California sea lions feed and haul out near Point Mugu, but northern elephant seals and northern fur seals are seldom seen near there.

Harbor Seal

The harbor seal is a year-round resident at the entrance to Mugu Lagoon. Like coastal haul-out populations farther north, the colony at the Mugu Lagoon entrance appears to be steadily increasing in numbers. In the early-to-mid 1980s, less than 100 harbor seals were counted there during the molting period (Figure 3.7-16). From 1988 to 1995, from 120 to 243 seals were counted in June during the index counts conducted by D.A. Hanan (1996). (Aerial counts of this type underestimate total numbers using the area as animals at sea during the time of the count are not recorded.)

Since early April 1992, Navy scientists have conducted year-round counts of harbor seals hauled out at NAS Point Mugu. The peak counts have been slightly higher than the index counts (Figure 3.7-16). However, even the Navy counts probably do not include all of the seals using the site.

Surprisingly high numbers of seals were hauled out at NAS Point Mugu on most days with Navy counts during August-February (Figure 3.7-17). Other studies have suggested that harbor seals spend most of their time foraging at that time of year, and that they may spend up to a week away from their haul-out

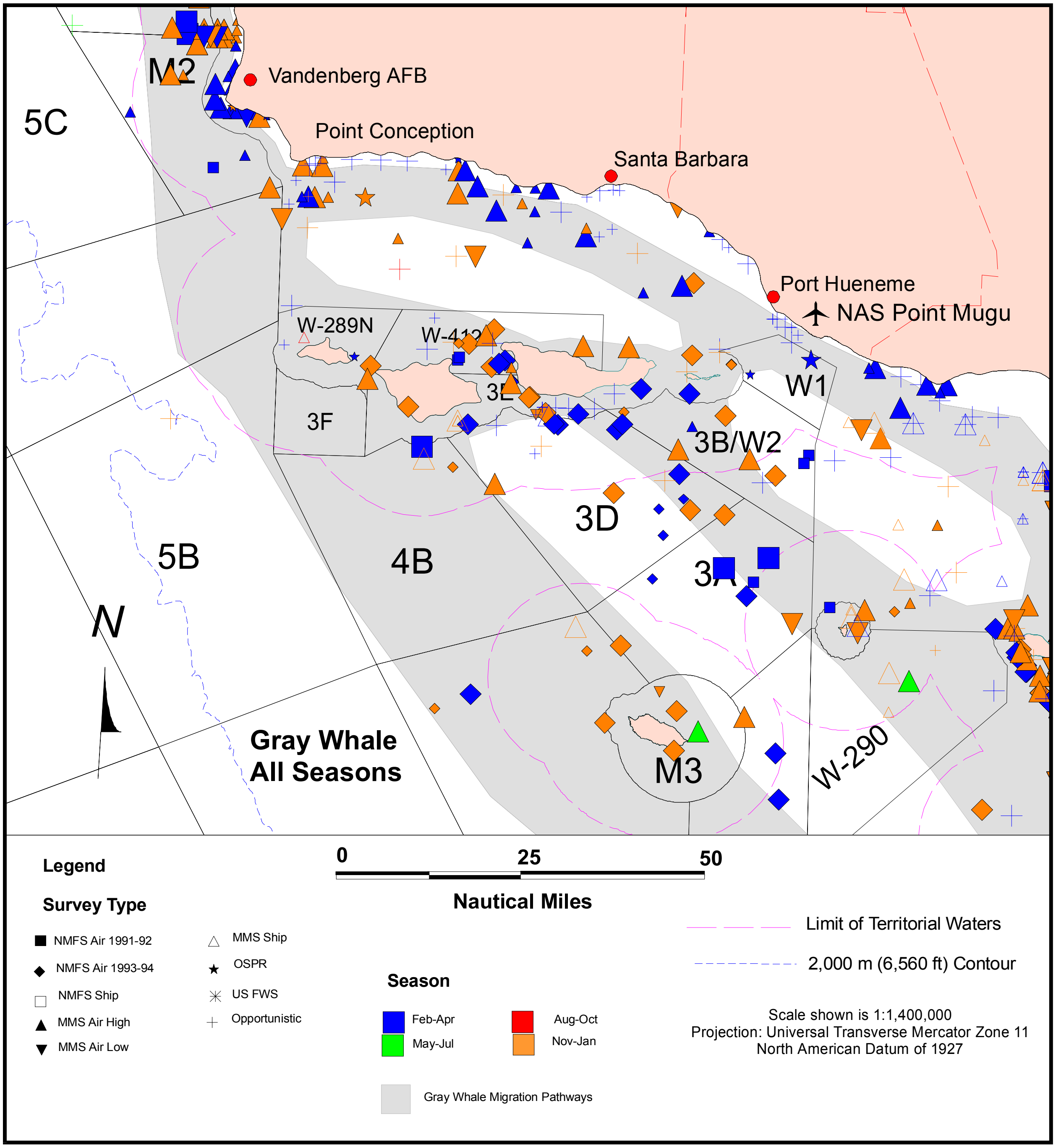

Figure 3.7-15
Sightings of gray whales in and near the Channel Islands during the 1975-96 surveys summarized. Survey effort was not uniform throughout the area or at different times of the year; thus sightings cannot be assumed to represent relative abundance either geographically or seasonally. Small and large symbols denote sightings of single animals vs. 2 or more animals, respectively. Generalized migration routes, from Bonnell and Dailey (1993), are superimposed on the actual sightings.

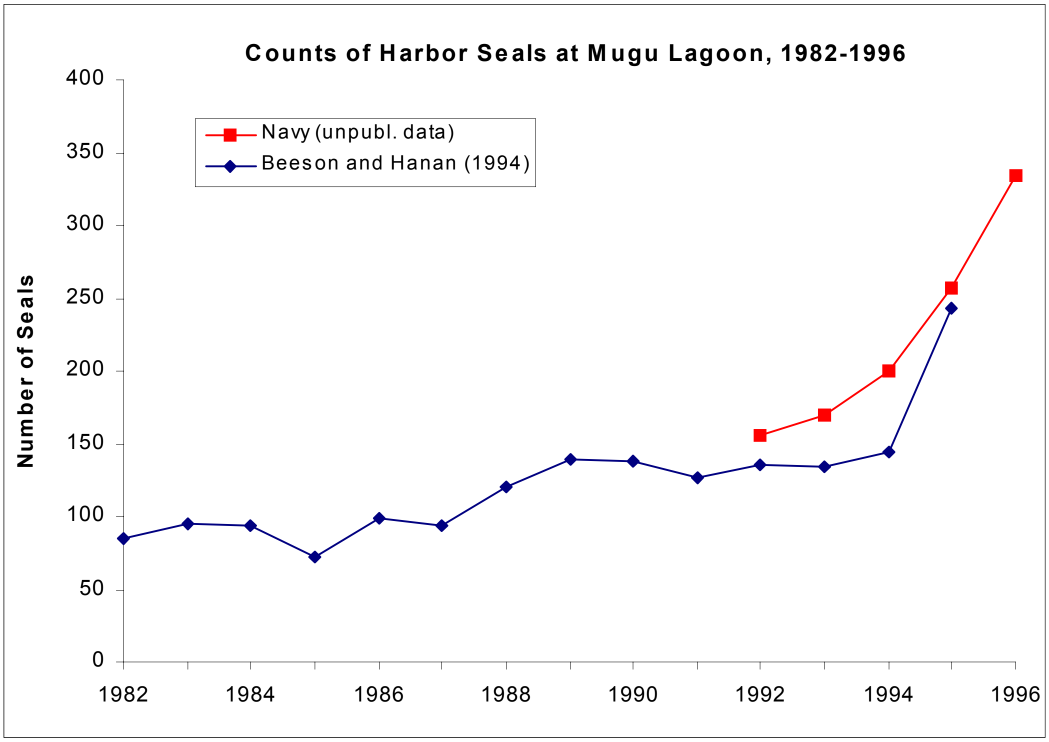

Figure 3.7-16
Counts of harbor seals at Mugu Lagoon, 1982-96.
Aerial counts are from Beeson and Hanan (1994) and Hanan (pers. comm.). Ground counts are from peak counts obtained by the U.S. Navy in each year (see Figure 3.7-17).

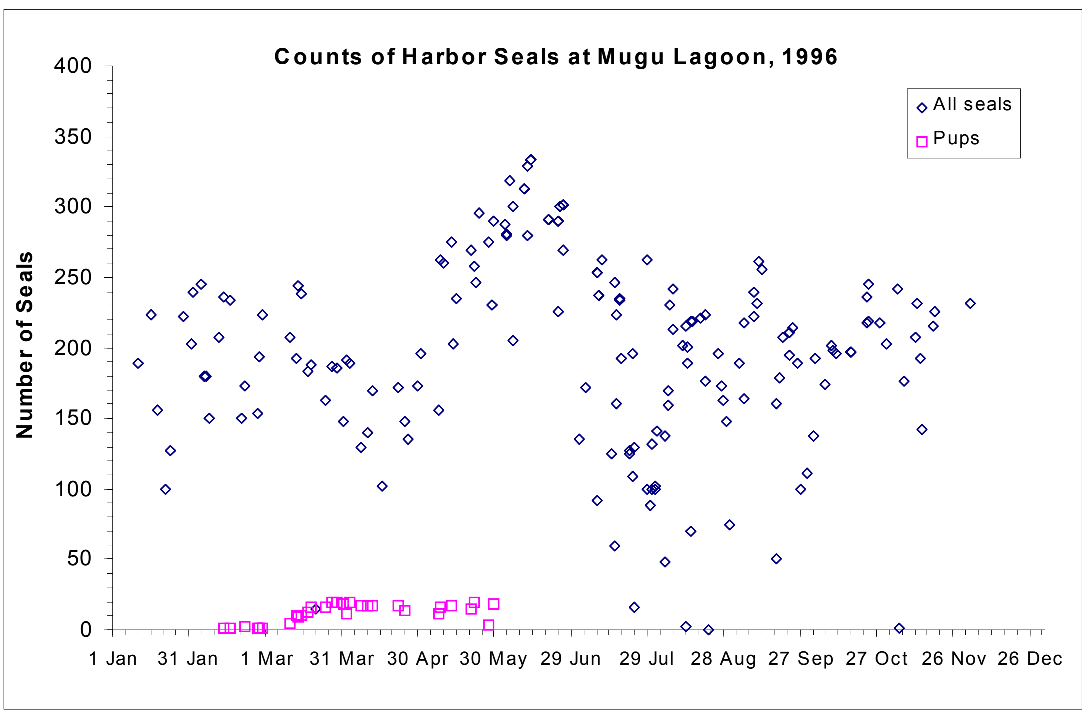

Figure 3.7-17
Counts of harbor seals at Mugu Lagoon by the U.S. Navy (unpublished data), 1996.

site. It is possible that abundant food resources near the NAS Point Mugu haul-out site permit harbor seals to spend more time hauled out there than at other sites where food may be less abundant.

The peak number of harbor seals hauled out at NAS Point Mugu during 1996 was 334 adults (13 June) and the population appears to be increasing. This represents about 1.4 percent of the entire California population and about 8 percent of the harbor seals found south of 35°N latitude. From July to April as many as 150 to 250 seals may be hauled out each day, although there is a great deal of day-to-day variation. NAS Point Mugu is not a major pupping area; 25 to 30 pups are born there annually (NAWS Point Mugu 1998h).

California Sea Lion

California sea lions have been sighted in large numbers in nearshore areas near Point Mugu during all seasons except summer. Even during summer small numbers have been seen hauled out near the harbor seals at Mugu Lagoon entrance. California sea lions that haul out at NAS Point Mugu are probably subadults because they are seen primarily during June and July when adults tend to be found at or near their breeding beaches.

3.7.3.4 Sea Otter

There was one sighting of a sea otter along the coast south of Point Mugu during winter (February) and the carcass of an adult male was found at NAS Point Mugu on 24 April 1998 (NAWS Point Mugu 1998f). South of Point Conception, sea otters are rare but expanding southward along the coast (see Section 3.7.2.4).

3.7.4 San Nicolas Island

Only a few species of cetaceans are known to occur in waters near San Nicolas Island, and then only in small numbers. However, San Nicolas Island and adjacent waters are important for northern elephant seals, California sea lions, and harbor seals. The Guadalupe fur seal has been seen here in recent years. San Nicolas Island is also the location to which southern sea otters have been translocated in an attempt to establish a population separate from that in central California. Additional details about marine mammals at San Nicolas Island are given in Section 3.7.4 of the "Marine Mammal Technical Report" (NAWCWPNS Point Mugu 1998e).

3.7.4.1 Odontocetes (Toothed Whales)

Two species of odontocetes (Dall's porpoise and northern right whale dolphin) were recorded in waters within 3 NM (5.6 km) of San Nicolas Island during the studies summarized here. Three other species, the common dolphin, pilot whale, and Risso's dolphin, were seen in Range Area M3 (see Figure 3.7-1) of the Sea Range, but they were sighted more than 3 NM (5.6 km) from the coast. There are two records of Cuvier's beaked whales stranded on San Nicolas Island (Leatherwood et al. 1987; NAWS Point Mugu 1998f), but at least the first of those animals probably drifted there after it died at sea. Other species of odontocetes may occasionally occur in these waters in small numbers.

Dall's Porpoise

Dall's porpoise is one of the most abundant cetacean species in the continental slope and offshore regions of the Sea Range (see Section 3.7.2.1), but it is not common near land. Only one sighting of Dall's porpoise was made within 3 NM (5.6 km) of the south shore of San Nicolas Island during the studies summarized here. This sighting was of a group of 2 animals during January. A second sighting was made within Range Area M3 during January but that sighting was farther than 3 NM (5.6 km) from shore.

Northern Right Whale Dolphin

Northern right whale dolphins are common in continental slope and offshore waters of the Sea Range during winter and spring. However, only one group was sighted within 3 NM (5.6 km) of San Nicolas Island during the studies summarized here. It was a group of 20 animals sighted northeast of the island during January of 1977. Two additional groups were sighted greater than 3 NM (5.6 km) from shore south of San Nicolas Island during February-April.

3.7.4.2 Mysticetes (Baleen Whales)

Two species of mysticetes, gray and humpback whales, have been recorded within 3 NM (5.6 km) of San Nicolas Island. Two other species, fin and minke whales, were recorded in Range Area M3 but were greater than 3 NM (5.6 km) from the coast of San Nicolas Island.

Blue whales may occasionally occur within 3 NM (5.6 km) of San Nicolas Island. Blue whales are common in summer beyond 3 NM (5.6 km) west of San Nicolas Island (see Figure 3.7-8). This species was occasionally sighted "near" San Nicolas Island in autumn during the mid-1960s to early 1980s (Dohl et al. 1981), and a blue whale stranded on the north side of the island in August 1993 (NAWS Point Mugu 1998f).

Humpback Whale

No humpback whales were sighted within 3 NM (5.6 km) of San Nicolas Island during the studies summarized here (see Figure 3.7-7). However, Leatherwood et al. (1984) reported a single animal near the kelp beds off the south shore of San Nicolas Island during July 1984.

Gray Whale

The most offshore of the known migration corridors of gray whales through the SCB passes near San Nicolas Island (see Figure 3.7-15). Most sightings of gray whales near the island are during late autumn and winter when the peak of the southbound migration (early-to-mid January) and the peak of the northbound migration occur (March). There were two late autumn sightings less than 3 NM (5.6 km) from shore during the summarized studies, plus two additional late autumn sightings just beyond 3 NM (5.6 km) offshore (see Figure 3.7-15). There was also a spring (July) sighting of four gray whales just off the east coast of the island; these whales seen outside the migration seasons may have remained near San Nicolas Island for an extended period. A calf stranded on the southeast side of San Nicolas Island in January 1994 (NAWS Point Mugu 1998f).

3.7.4.3 Pinnipeds

Three species of pinnipeds presently breed on San Nicolas Island. They include the harbor seal, the northern elephant seal, and the California sea lion. The Guadalupe fur seal may have bred there historically and has been an occasional recent visitor. Steller sea lions have been sighted on the island in the past (Bartholomew 1951) but apparently did not breed there (Stewart and Yochem 1984). They are not likely to occur there now given their general abandonment of southern California waters.

Harbor Seal

Harbor seals remain near their terrestrial haul-out sites and frequently haul out on land throughout the year, at least for brief periods. However, at most haul-out sites large numbers of seals are seen on land only during the pupping, nursing, and molting periods (see Figures 3.7-11 and 3.7-18). Peak counts represent, at most, 65 to 83 percent of the individuals that use a haul-out site (Huber 1995; Hanan 1996). The pupping period extends from late February to early April with a peak in pupping in late March. The nursing period extends from late February to early May. Females and pups are hauled out for long periods at this time of year. The molting period is in late May to June and all ages and sexes of harbor seals haul out at this time. During winter when most seals spend most of their time feeding at sea, the number of seals hauled out at most sites is approximately 15 percent of the maximum count during the peak of haul out (i.e., 10 to 12 percent of those using the site).

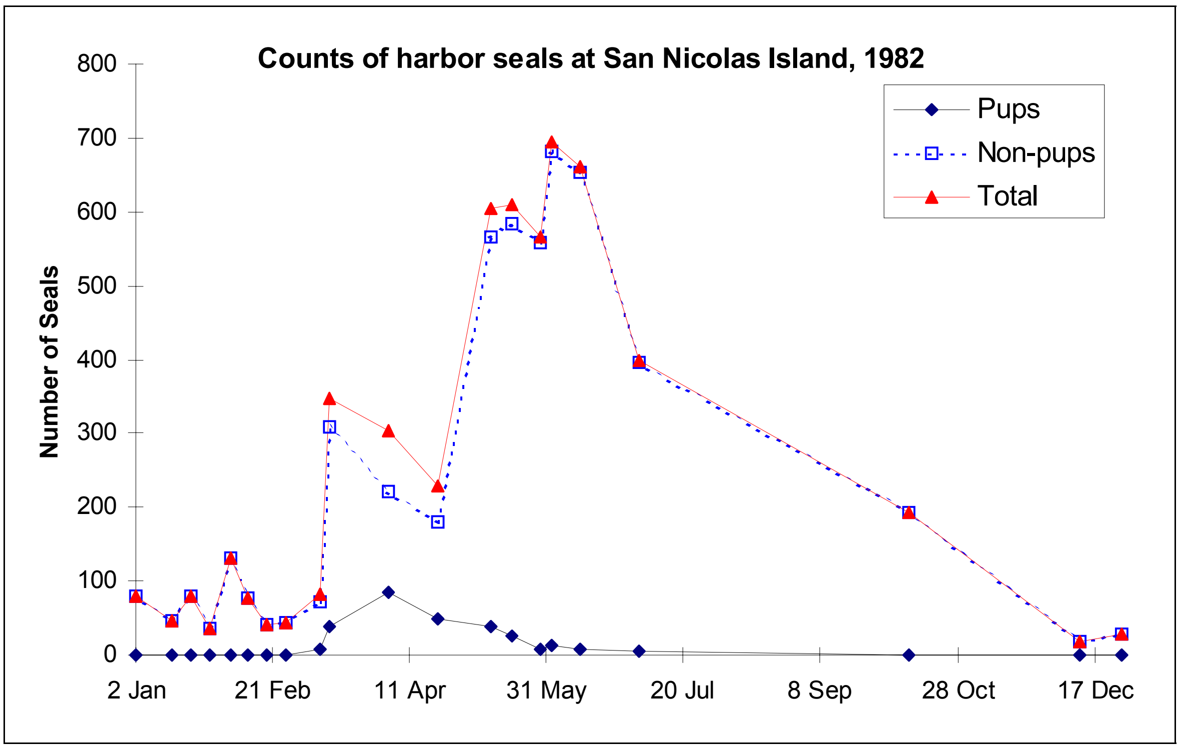

Figure 3.7-18
Counts of harbor seals throughout the year on San Nicolas Island, 1982.
From Stewart and Yochem (1984).

On San Nicolas Island, most seals haul out at several specific traditionally used sandy, cobble, and gravel beaches (Figure 3.7-19). A few seals haul out at onshore and offshore ledges and reefs, mostly during the pupping and molting seasons (Stewart and Yochem 1994). There is sex and age segregation at many of the sites. There is no recent published information on the number of harbor seals at specific haul-out sites on San Nicolas Island.

Harbor seal abundance increased at San Nicolas Island from the 1960s until 1981, but since then the average counts have not changed significantly. The most recent aerial count at San Nicolas Island was of 457 harbor seals during 1994. This represented 11.9 percent of the 3,826 harbor seals counted in the Point Mugu Sea Range and 2.1 percent of the 21,462 harbor seals counted along California shorelines (Beeson and Hanan 1994). The actual number of harbor seals using San Nicolas Island is probably

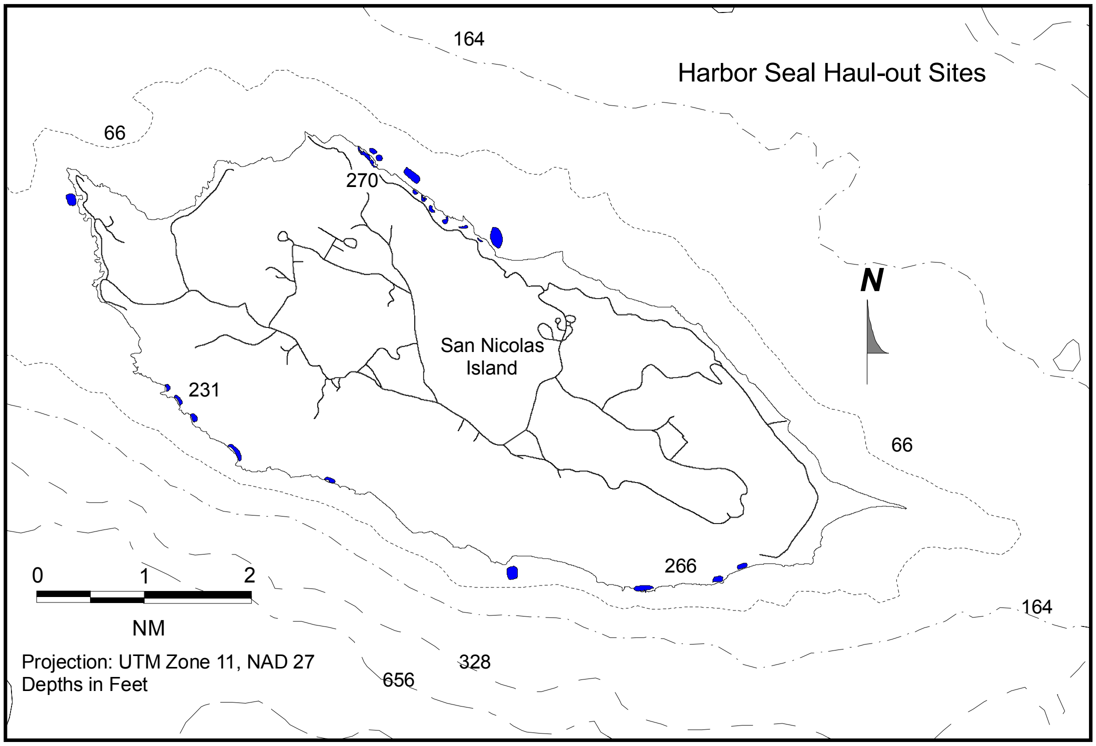

Figure 3.7-19
Map of San Nicolas Island showing areas used by harbor seals.

higher than 457 because not all seals are detected on shore during any one aerial survey, and because the 1994 count was lower than in some other recent years (refer to Section 3.7.4.3 of the "Marine Mammal Technical Report" [NAWCWPNS Point Mugu 1998e]).

Northern Elephant Seal

San Nicolas Island has the second-largest population of northern elephant seals in southern California. Since 1988 the San Nicolas Island population has continued to increase at an average rate of 15.4 percent per year. As of 1995, approximately 23,000 elephant seals of all ages and sexes used San Nicolas Island over the course of the year (refer to Section 3.7.4.3 of the "Marine Mammal Technical Report" [NAWCWPNS Point Mugu 1998e]); this is about 27 percent of the California stock and 32 percent of the population that occurs in the Sea Range. Northern elephant seals haul out at traditional sites twice annually: once to breed and give birth, and a second time to molt (see Figures 3.7-11 and 3.7-20). When not hauled out they travel to feeding areas far north of the Sea Range. Bulls haul out in early December to early February to defend territories and breed, and during June to August to molt. Adult females haul out for one month in mid-December to early March to give birth and breed, and during mid-March to May to molt. Juveniles and nonbreeding adults molt during this latter period; they return to San Nicolas Island to haul out from September through November, with pubertal subadult males remaining until adult males arrive in December. Haul-out areas occur around much of the western, southern, and eastern sides of San Nicolas Island and are expanding around the island (Figure 3.7-21).

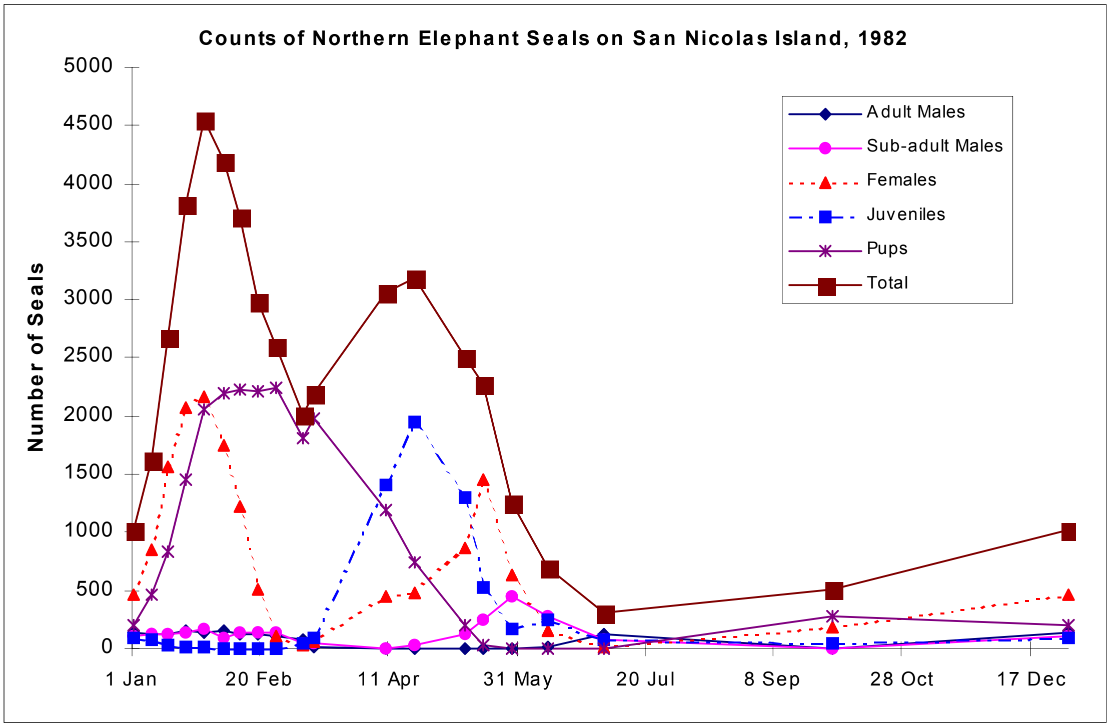

Figure 3.7-20
Counts of northern elephant seals throughout the Year at San Nicolas Island, 1982. Plotted from Table 1 in Stewart and Yochem (1984).

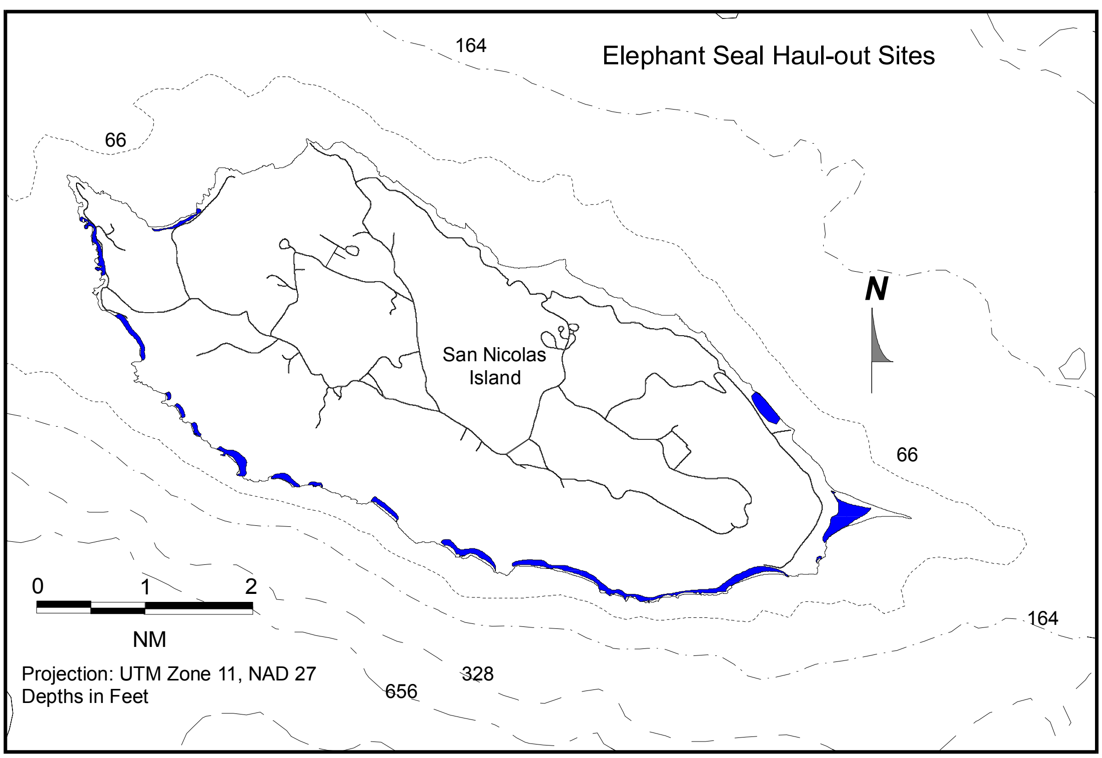

Figure 3.7-21
Map of San Nicolas Island showing areas used by northern elephant seals.

California Sea Lion

California sea lions do not have a special status. The San Nicolas Island population has increased at 21.4 percent per year since 1983. The 1995 size was 78,000 to 88,000 animals of all ages and sexes, which was about 47 percent of the U.S. population. About half of the San Nicolas Island population may be hauled out on land at one time during the peak of the breeding season (refer to Section 3.7.4.3 of the "Marine Mammal Technical Report" [NAWCWPNS Point Mugu 1998e]). Sea lions have recently occupied new areas on San Nicolas Island and they now occur along most of the southern shore (Figure 3.7-22). There is no evidence that numbers have reached the carrying capacity of the available habitat.

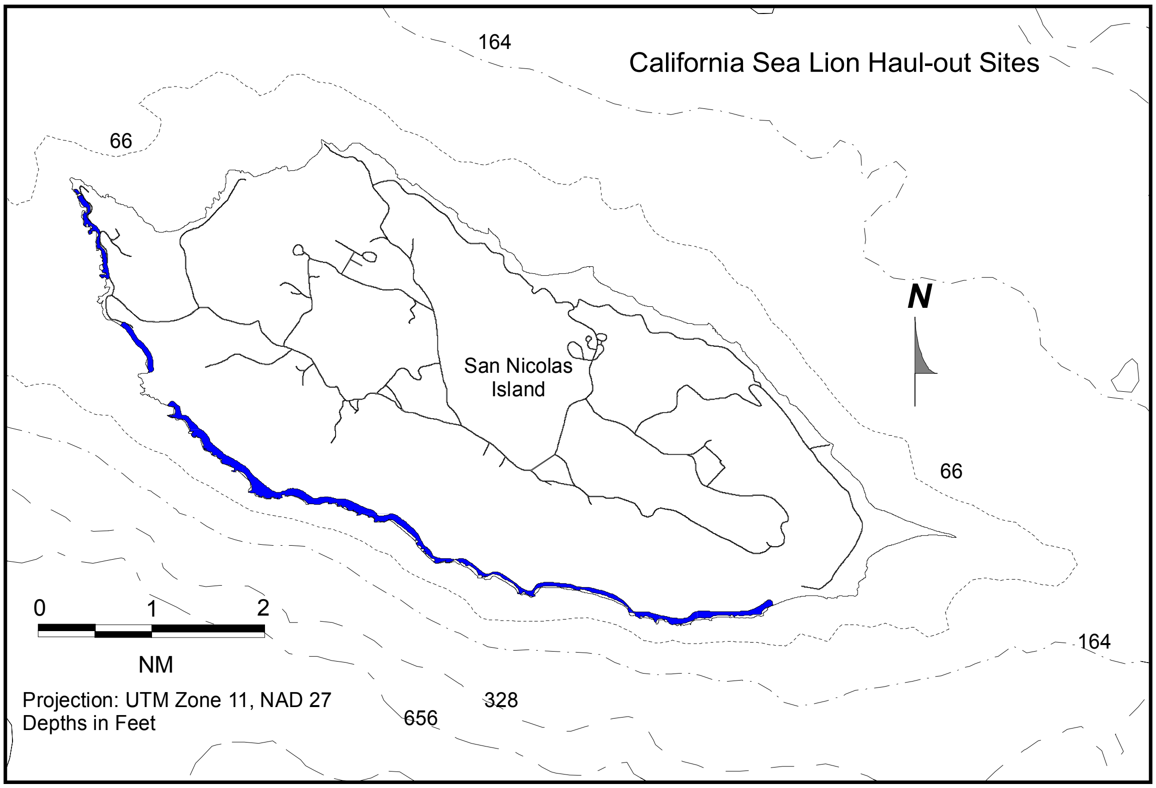

Figure 3.7-22
Map of San Nicolas Island showing areas used by California sea lions.

Guadalupe Fur Seal

Eighteen sightings of Guadalupe fur seals were made on San Nicolas Island between 1949 and 1986. Most sightings were either juveniles of undetermined sex or adult males. One male defended a territory among breeding California sea lions each year from 1981 to 1986. Observations suggest that Guadalupe fur seals are capable of obtaining space for breeding among California sea lions, and that they may successfully recolonize the Channel Islands once the species is abundant enough to establish a breeding population (Stewart et al. 1987).

3.7.4.4 Sea Otter

Prior to the fur trade, sea otters were common throughout the Channel Islands. Commercial hunting probably began there by 1811 and by the 1850s sea otters were possibly completely hunted out (Schwartz 1994).

From 1987 to 1990, 139 California sea otters were translocated from central California to San Nicolas Island in an attempt to re-establish a sea otter population there. Of this "experimental population," at least 17 remained at the island as of 1995 (Ralls et al. 1996; USFWS 1996). The number of sea otters at San Nicolas Island has been relatively stable since November 1989 (USFWS 1996), and to date at least 10 pups have been successfully weaned into the population.

San Nicolas Island sea otters occur throughout the year in subtidal kelp beds at the western end of the island and, in smaller numbers, on the northern side of the island. Their range extends from Vizcaino Point to Dutch Harbor and from Thousand Springs to Tranquility Beach (see Figure 3.7-23). The kelp beds in these areas provide the primary cover and foraging areas preferred by southern sea otters.

3.7.5 Other Channel Islands

The other Channel Islands in or adjacent to the Sea Range include San Miguel, Santa Rosa, Santa Cruz, Anacapa, and Santa Barbara islands. Eight species of odontocetes and five species of mysticetes were recorded within 3 NM (5.6 km) of these islands during the studies summarized here. Two more species of cetaceans, the sperm whale and northern right whale, have been reported there during studies not included in the summaries. Most cetacean species utilize primarily offshore waters and are seen infrequently near the Channel Islands (Leatherwood et al. 1987).

Some of the Channel Islands are very important to pinnipeds, including the harbor seal, northern elephant seal, California sea lion, and the northern fur seal. Small numbers of sea otters dispersing from San Nicolas Island and perhaps from the central California population have been seen near some of the other islands. Sea otters are regularly sighted around San Miguel and Santa Rosa islands (Channel Islands National Park, DEIS Comment #MM-1). Additional details beyond those summarized below are given in Section 3.7.5 of the "Marine Mammal Technical Report" (NAWCWPNS Point Mugu 1998e).

3.7.5.1 Odontocetes (Toothed Whales)

Although nine species of odontocetes have been seen in nearshore waters within 3 NM (5.6 km) from the other Channel Islands addressed within this subsection, these nearshore areas are not preferred habitat or important feeding, mating, or resting locations for any of these species. All of these species are found in higher numbers in continental slope and offshore waters farther offshore from the Channel Islands. For example, there have been moderate numbers of sightings of common and Pacific white-sided dolphins near the Channel Islands, but these two species are more common in offshore waters near there. Similarly, a few Dall's porpoises have stranded on San Miguel Island in recent years and small numbers occur year-round near Santa Cruz and Santa Rosa islands. Section 3.7.2.1 describes the seasonal distribution, numbers, and life history of each species in offshore waters where they are more abundant.

3.7.5.2 Mysticetes (Baleen Whales)

Six species of mysticetes have been recorded near the other Channel Islands addressed within this subsection, but these areas are heavily used by only two species, the gray whale and minke whale. A northern right whale was found stranded on Santa Cruz Island in 1916, but no sightings of that species have been made in the Sea Range since then. Humpback, blue, and fin whales have been seen

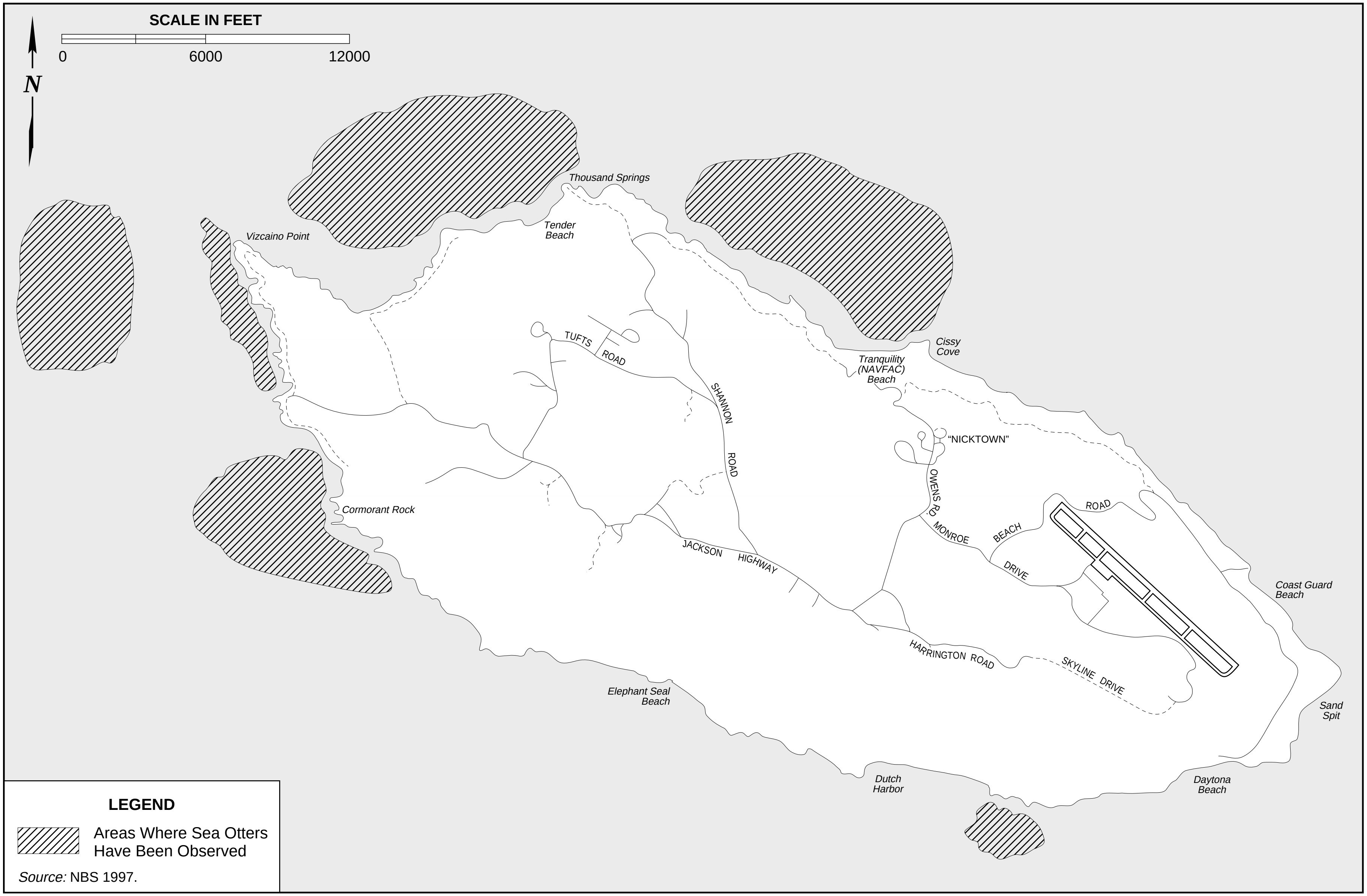

Figure 3.7-23
Sea Otter Distribution at San Nicolas Island

occasionally in nearshore waters near some of the Channel Islands and have been seen regularly in Territorial Waters greater than 3 NM (5.6 km) from shore. Sightings of northward migrating humpback whales, including calves, have been made during late June through September. Blue whales are commonly seen during September to October, particularly near San Miguel Island. Fin whales are generally seen near the Channel Islands during spring and summer.

Gray Whale

Gray whale migrations near the Channel Islands are described in Section 3.7.2.2 and mapped in Figure 3.7-15. In addition, gray whales that have not migrated north are occasionally seen near the Channel Islands at times of year outside the normal migration seasons.

Gray whales using the nearshore and offshore migration route pass close to the Channel Islands. During special nearshore aerial surveys of the northern Channel Islands in mid-January 1986, about a third of the whales were found 0 to 2 NM (0 to 3.7 km) from the coasts of the islands, and over 80 percent were found within 4 NM (7.4 km) of the coast (Jones and Swartz 1987a,b) (for additional details, refer to Section 3.7.5.2 of the "Marine Mammal Technical Report" [NAWCWPNS Point Mugu 1998e]; sightings during those special surveys are not included in Figures 3.7-6 and 3.7-15). However, virtually all of the special aerial survey coverage was within 5 NM (9.3 km) of the coast, so any offshore movements would not have been detected. Southbound migrants are generally found farther from shore than are those returning north.

Most mothers and calves were seen near the islands that were closest to the mainland coast (i.e., Santa Cruz, Anacapa and Santa Barbara islands). These mother/calf pairs often were not actively migrating. Resting and milling comprised about a third of the activities performed by mothers and calves, and some calves probably were nursing (Jones and Swartz 1987a).

Radio-tagging studies indicate that migrating gray whales pass through the Channel Islands National Marine Sanctuary in 1 to 4 days (from 6 NM [11.1 km] north of San Miguel Island to 6 NM [11.1 km] south of Santa Barbara Island) (Jones and Swartz 1987b). Although a significant fraction of the 21,100 eastern North Pacific gray whales follow the nearshore and offshore migration routes past the Channel Islands, only 613 to 756 have been estimated to be present at one time (Jones and Swartz 1987a,b).

Minke Whale

Minke whale movements in the Sea Range are described in Section 3.7.2.2. Their summer distribution includes the western Santa Barbara Channel; the undersea ridge that extends between Santa Rosa and San Nicolas islands; the coastal shelves south of San Miguel, Santa Rosa, and Santa Cruz islands; and the east side of San Nicolas Island (Bonnell and Dailey 1993). Minke whales are also seen near Anacapa Island and southward over the eastern rim of Santa Cruz Basin. During the summer, a significant fraction of the approximately 180 animals that inhabit waters off California would be found in the areas described above.

3.7.5.3 Pinnipeds

Harbor seals are present on all of the Channel Islands in the Sea Range, as well as on Santa Barbara Island near the range (Table 3.7-5). The numbers of harbor seals shown in Table 3.7-5 represent aerial survey counts of animals hauled out at the time of the survey. Counts include animals of all ages and both sexes. Populations of harbor seals were relatively stable between 1982 and 1995 on all other Channel Islands addressed in this subsection except for Santa Cruz Island. Santa Cruz Island had a mean

Table 3.7-5. Indices of abundance of pinnipeds that might be encountered in the Point Mugu Sea Range. The given numbers are from counts during the indicated year. For each species the most recent year with counts from all known haul-out sites is given. In many cases, higher numbers were present in other years. Because not all animals are hauled out at one time, even peak counts underestimate the total number of animals using each site each year.

	San Miguel	Santa Rosa	Santa Cruz	Anacapa	Santa Barbara	San Nicolas
Harbor seal (1994)[a]	1,040	868	1,147	285	29	457
Elephant seal (1995)						
- pups[b,c]	13,462[c]	186[c]	Unknown[g]	Unknown[g]	44[b]	6,575[c]
- adults & subadults[b,c]	16,020[c]	246[c]	Unknown[g]	Unknown[g]	61[c]	6,983[c]
California sea lion pups (1990)[d]	13,023	0	Unknown[g]	Unknown[g]	1,286	11,766[h,i]
Northern fur seal pups (1995)[e]	2,509	0	0	0	0	0
Steller sea lion[f]	Formerly	0	0	0	0	0
Guadalupe fur seal[f]	Occasional	0	0	0	Rare	0

[a] Aerial photos, Beeson and Hanan (1994).
[b] Ground counts, Lowry et al. (1996).
[c] Aerial photos, Lowry et al. (1996).
[d] Ground counts, Lowry et al. (1992).
[e] Barlow et al. (1997).
[f] Ground counts, Stewart et al. (1993).
[g] DeMaster et al. (1984), mention presence.
[h] Aerial photos, Lowry et al. (1992);
[i] Counts of 16,889 pups and 16,020 adults and subadults are available for San Nicolas Island for 1994 (Lowry n.d.). 1994 data are not available for the other islands.

annual population growth of 5.7 percent (Hanan 1996). Harbor seal populations in most other parts of California are increasing (see Section 3.7.2.3). The populations on several of the Channel Islands may be constrained by interspecific competition with northern elephant seals for haul-out sites.

Two-thirds of the California stock of northern elephant seals breed and pup on San Miguel Island. Elephant seals also breed and pup in small numbers on Santa Rosa and Santa Barbara islands (Lowry et al. 1996; see Table 3.7-5). Small numbers have been reported on Santa Cruz and Anacapa islands (DeMaster et al. 1984).

In 1990, the largest colony of California sea lions in California was found on San Miguel Island, but now the San Nicolas Island colony may be larger. Small numbers are also found on Santa Barbara Island (see Table 3.7-5; Lowry et al. 1992a).

Steller sea lions were historically present on San Miguel Island, but have not been sighted there since 1983. Guadalupe fur seals are occasional visitors there. San Miguel Island and the adjacent Castle Rock have the only rookery of northern fur seals in the region.

A - San Miguel Island

San Miguel Island, the northwesternmost of the Channel Islands, is located 61 NM (113 km) west of Point Mugu. It provides haul-out sites for large rookeries of California sea lions and northern elephant seals, for small rookeries of northern fur seals, and for harbor seals (see Table 3.7-5).

Harbor Seal

Harbor seals have been found around most of the island except on the western tip (DeMaster et al. 1984). Numbers increased greatly from the early 1950s to the early 1980s, with an average annual increase of 22 percent from 1958 to 1976. From 1982 to 1995, the harbor seal population on San Miguel Island has declined slightly at a mean rate of 1.15 percent per year (Hanan 1996). This decline may be due to interspecific competition for terrestrial sites with northern elephant seals.

Northern Elephant Seal

San Miguel Island is extremely important to northern elephant seals; two-thirds of the California stock hauls out on San Miguel Island to have their pups, breed, and molt. The general biology, seasonal distribution, and movements of northern elephant seals through the Sea Range are described in Section 3.7.2.3 and their activities while hauled out on land are described in Section 3.7.4.3.

Northern elephant seals haul out all along the south coast and along most of the northwest coast of San Miguel Island (Figure 3.7-24). Occupation of the latter areas began in 1988 (Lowry et al. 1992b). The number of births increased by an average of 14 percent annually from 1964 to 1981; by 10 percent annually from 1981 to 1985 (Stewart et al. 1993); and by 4.0 percent annually from 1986 to 1995.

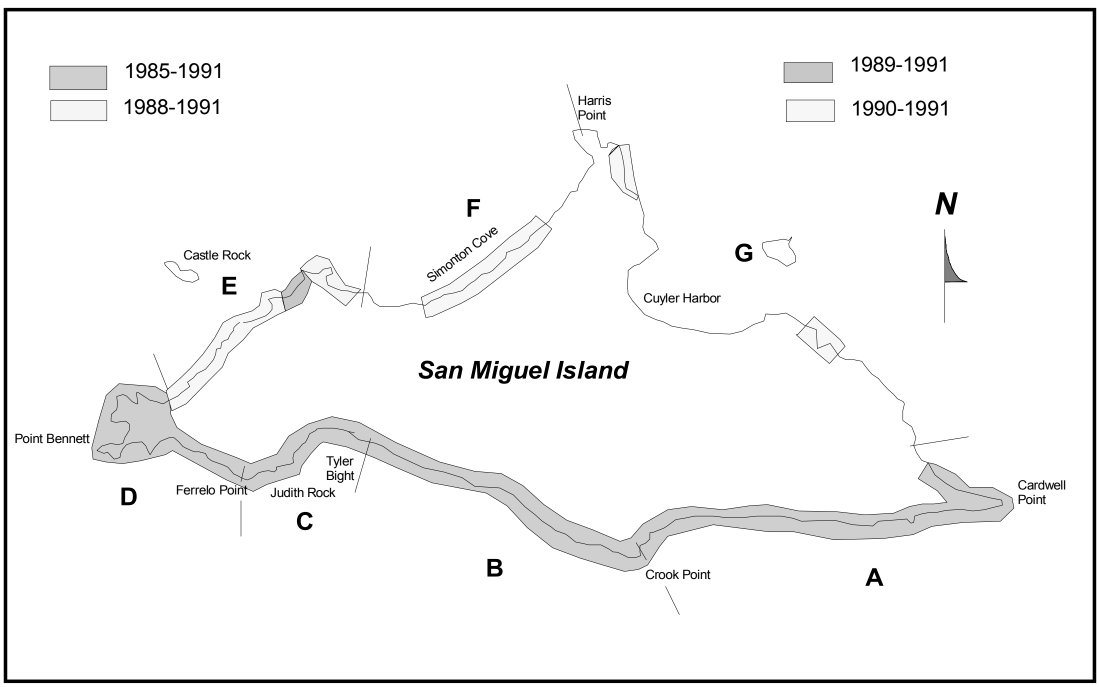

Figure 3.7-24
Map of San Miguel Island showing shaded areas where northern elephant seals were photographed and area codes used to document counts in specific areas of the island. From Lowry et al. (1992).

California Sea Lion

California sea lions are found along the southwest coast of San Miguel Island and at Castle Rock adjacent to San Miguel Island (Lowry et al. 1992a). Most are found on Point Bennett and the coast immediately north of there. California sea lion births have increased on San Miguel Island since counts were started in 1971, but the rate of increase during 1983-1990 (10.8 percent annually) has been lower there than at San Nicolas Island (21.2 percent annually), the other major haul-out area. In 1990, 49 percent of the U.S. stock was associated with San Miguel Island. Based on the 1995 estimate of the size of the U.S. stock, 81,800-92,100 California sea lions use the coast of San Miguel Island to haul out, breed, and give birth to pups. As the population has continued to increase, the areas used have expanded and new haul-out areas have been used.

Northern Fur Seal

Northern fur seal colonies are found at Adams Cove on Point Bennett and also at nearby Castle Rock. These are the only northern fur seal colonies found in California. Based on counts of pups in 1995, the population associated with these haul-out sites is estimated to be approximately 10,000 animals and has increased dramatically in recent years (Figure 3.7-25). These colonies are occupied from early May to late November with different age and sex classes being present at different times (see Figure 3.7-11). Adult males are the first animals to arrive; upon arrival they establish territories which they defend from other males. Females arrive several weeks later and give birth within 1 to 2 days of their arrival. After nursing their pups for an average of 8.3 days, the females alternate between periods of 6.9 (±1.4 standard deviation [SD]) days at sea feeding and 2.1 (±0.3 SD) days nursing. Pups are weaned at 4 to 5 months of age and go to sea immediately (Antonelis et al. 1990). Adult males leave the haul-out sites in late July to early August and go to sea to feed until the following May. Juveniles and other non-breeding animals haul out from mid-August to early October to molt.

Guadalupe Fur Seal

There have been at least 25 sightings of Guadalupe fur seals at San Miguel Island since 1969; nearly all sightings were of subadult and adult males (Stewart et al. 1987). As mentioned for San Nicolas Island in Section 3.7.4, Guadalupe fur seals are able to compete with California sea lions for territories and they may recolonize San Miguel Island if numbers on Guadalupe Island, Mexico, continue to increase (Gallo-Reynoso 1994).

<u>B - Santa Rosa Island</u>

Harbor seals and northern elephant seals are present on Santa Rosa Island. Harbor seals are distributed around the coastline of Santa Rosa Island (see Table 3.7-5; DeMaster et al. 1984). Numbers increased from 1958 to 1981, but since then have remained relatively stable (Hanan 1996).

In 1985, Stewart and Yochem (1986) observed two northern elephant seal pups and two females at the southwestern tip of Santa Rosa Island. Since then, numbers of pups born there have increased substantially. In 1994 and 1995, 315 and 186 pups, respectively, were counted there (Lowry et al. 1996). The rapid rate of increase is at least partially due to immigration of females from other rookeries.

Figure 3.7-25
Counts of live northern fur seal pups on San Miguel Island, 1972-95.
From Barlow et al. (1997).

C - Santa Cruz Island

Harbor seal haul-out sites are distributed all around the coastline of Santa Cruz Island (DeMaster et al. 1984). As on other Channel Islands, the Santa Cruz Island population increased dramatically from 1958 to 1981. However, unlike the situation on the other islands, the population has continued to grow at a rate of 5.7 percent annually from 1982-1995 (Hanan 1996). Based on a single photographic count, 1,147 harbor seals were hauled out on Santa Cruz Island in 1994 near the peak period of haul out (Beeson and Hanan 1994).

DeMaster et al. (1984) report that California sea lions and northern elephant seals have been seen on Santa Cruz Island. Breeding or pupping has not been documented there for either species. The use of Santa Cruz Island by California sea lions and northern elephant seals is probably sporadic.

D - Anacapa Island

Harbor seals regularly haul out and pup in small numbers on Anacapa's component islets (three distinct islets comprise Anacapa Island). California sea lions and northern elephant seals occasionally haul out there but no pupping has been observed (DeMaster et al. 1984).

Harbor seals haul out in small numbers at all three of the Anacapa islets (DeMaster et al. 1984; Hanan et al. 1992). There was an increase in the harbor seal population there from 1958 to 1981, but the increase was not as dramatic as at San Miguel and Santa Cruz islands. Since 1982 the population has remained relatively stable (Hanan 1996). A total of 285 harbor seals were counted there during a single photographic survey in 1994 (Beeson and Hanan 1994).

E - Santa Barbara Island

Santa Barbara Island is along the edge of the Sea Range but is not actually within it. Moderate numbers of California sea lions and small numbers of harbor and northern elephant seals occur there.

Harbor Seal

Very few harbor seals haul out at Santa Barbara Island and no pupping is thought to occur there (Hanan et al. 1992). The counts have been variable and have ranged from 0 to 35 seals. The most recent count was 29 in 1994.

Northern Elephant Seal

Small numbers of northern elephant seal pups have been born on Santa Barbara Island in recent years. From 1984 to 1991, 69 to 106 pups were born there annually, but in 1993 to 1995 (the last years with published census data) only 44 to 53 pups were born annually.

California Sea Lion

Moderate numbers of California sea lions haul out and give birth to pups on Santa Barbara Island, which is just outside the border of the Sea Range. The population has doubled since counts were initiated in 1975. In 1990, 1,286 pups were counted there, suggesting a total population of 5,700 to 6,400.

3.7.5.4 Sea Otter

In 1990 a group of 10 sea otters was found near Point Bennett on San Miguel Island. These may have been animals that had been translocated to San Nicolas Island but had left there (USFWS 1996). From 1990-1993, 14 sea otters were captured on San Miguel Island and relocated to the mainland population, as called for under the provisions of the "no otter" zone (see Section 3.7.2.4). The most recent survey indicated that at least two sea otters were still present at San Miguel Island (USFWS 1996).

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3.8 TERRESTRIAL BIOLOGY

3.8.1 Introduction

This section describes existing terrestrial resources of the Point Mugu Sea Range, Point Mugu, San Nicolas Island, and the Sea Range support facility sites on San Miguel, Santa Rosa, and Santa Cruz islands. *Terrestrial* refers to those species that habitually live on the land or ground surface. For purposes of this document, the discussion of terrestrial resources also includes species that spend a portion of their life on land, such as seabirds that may nest on the land but forage and loaf (i.e., rest) on open water. Detailed background information on terrestrial resources at Point Mugu and San Nicolas Island is presented in the *Natural Resources Summary Report* (NAWCWPNS Point Mugu 1999).

3.8.1.1 Definition of Resource

For purposes of this document, terrestrial natural resources are defined as flora and fauna and the habitats they occupy. Regionally and locally sensitive species (as defined by the USFWS and CDFG) and endemic species (i.e., species native to and restricted to a particular geographic region) are also addressed.

Plant or wildlife species may be designated as *sensitive* because of their overall rarity, endangerment, unique habitat requirements, and/or restricted distribution. In general, a combination of these factors leads to a sensitivity designation. Sensitive plant and wildlife species include those listed as *threatened* or *endangered* by the USFWS and CDFG. In addition, plants may be listed by the California Native Plant Society (CNPS) with regard to their rarity, endangerment, and distribution (Skinner and Pavlik 1994).

Species that are federally or state-listed are afforded a degree of regulatory protection which entails a permitting process including specific mitigation measures for any allowable (incidental) impacts to the species. Species that are proposed to be listed by the USFWS are treated similarly to listed species by that agency; recommendations of the USFWS, however, are advisory rather than mandatory in the case of proposed species. A federally listed endangered species is defined as any species, including subspecies, that is "in danger of extinction throughout all or a significant portion of its range." A federally listed threatened species is defined as any species "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." "Proposed" endangered or threatened species are those species for which a proposed regulation has been published in the Federal Register, but a final rule has not yet been issued. A "Federal Candidate" is any species being considered by the USFWS for listing as an endangered or threatened species but which is not yet the subject of a proposed rule. Federal Candidates are "taxa for which the USFWS currently has substantial information on biological vulnerability and threat(s) to support a proposal to list the taxa as endangered or threatened." Federally and state-listed threatened and endangered species that are known to occur on the Sea Range, Point Mugu, and San Nicolas Island are summarized in Table 3.8-1.

Also included in this high sensitivity category, for the purposes of this report, are species listed by the State of California as endangered, threatened, or rare for which similar definitions apply. A California Species of Special Concern is a species or subspecies native to California that has become vulnerable to extinction because of declining population levels, limited ranges, or rarity, and may be considered for listing or for special management and protection measures. Species are placed in this category so issues related to their decline may be addressed during the environmental assessment process.

Table 3.8-1. Federally and State-Listed Sensitive Terrestrial Species Occurring on Sea Range, Point Mugu, and San Nicolas Island

Scientific Name	Common Name	Status[1]	Habitat[2]	Location[3]
Plants				
Astragalus traskiae	Trask's milkvetch	CDFG: R	COD, sandstone	SNI
Cordylanthus maritimus ssp. *maritimus*	Salt marsh bird's-beak	USFWS: E	CSM	PM
Dithyrea maritima	Beach spectacle pod	CDFG: T	COD	SNI
Eriogonum grande timorum	San Nicolas Island buckwheat	CDFG: E	CS	SNI
Reptiles and Amphibians				
Xantusia riversiana	Island night lizard	USFWS: T	All terrestrial habitats	SNI
Birds				
Passerculus sandwichensis beldingi	Belding's savannah sparrow	CDFG: E	CSM	PM
Charadius alexandrinus ssp. *nivosus*	Western snowy plover	USFWS: T	Sandy beaches and adjacent coastal strand	PM SNI
Falco peregrinus anatum	American peregrine falcon	USFWS: E[4] CDFG: E	Open water and terrestrial habitats	PM SNI
Pelecanus occidentalis ssp. *californicus*	California brown pelican	USFWS: E CDFG: E	Open water	PM SNI
Rallus longirostrus levipes	Light-footed clapper rail	USFWS: E CDFG: E	CSM	PM
Sterna antillarum ssp. *browni*	California least tern	USFWS: E CDFG: E	Open water, sandy areas	PM
Mammals				
Urocyon littoralis dickeyi	San Nicolas Island fox	CDFG: T	All terrestrial	SNI

[1] Sensitivity Status
U.S. Fish and Wildlife Service (USFWS)
E = Endangered
T= Threatened

California Department of Fish and Game (CDFG)
T = Threatened R = Rare
E = Endangered

[2] Habitat Codes
CS = Coastal scrub
CSM = Coastal salt marsh
COD = Coastal dunes

[3] Location Codes
PM = Point Mugu
SNI = San Nicolas Island

[4] Removed from USFWS endangered listing status on 25 August 1999.
Source: NAWCWPNS Point Mugu 1998d.

3.8.1.2 Regional Setting

The Sea Range is a biologically important area encompassing California's Channel Islands and coastal waters; Mugu Lagoon is the largest relatively undisturbed coastal salt marsh along the southern California coastline. San Nicolas Island provides important breeding habitat for sensitive birds and mammals. Nearshore and open water areas of the Sea Range are used by resident and migratory seabirds for foraging and loafing. (Marine mammals are discussed in Section 3.7.)

Coastal salt marsh habitats in California have declined by over 90 percent of their original acreage (Zedler 1997). Mugu Lagoon is no exception; approximately 50 percent of its original acreage has been lost to development, erosion, and sea level rise. Coastal wetlands provide a variety of functions including sensitive species support, improvement of water quality, and flood flow reduction. Generally, the larger the acreage of diverse healthy habitat, the more functions the wetland is capable of supporting and the more individuals it is capable of supporting; consequently, species diversity tends to increase with size. Mugu Lagoon is home to seven sensitive species and provides a significant stop-over area in association with the Pacific Flyway, the migratory route used by many waterbird species.

Eight islands off the southern California coast comprise the Channel Islands. The four northern Channel Islands—San Miguel, Santa Rosa, Santa Cruz, and Anacapa—form a chain that is the southern boundary of the Santa Barbara Channel. The southern Channel Islands consist of San Nicolas, Santa Barbara, Santa Catalina, and San Clemente. Isolation from the mainland and a combination of geography, wind patterns, and ocean currents has created unique and diverse ecosystems. There are over 80 endemic species on the Channel Islands and over 60 of them are endangered or rare (California Coastal Commission 1987). San Nicolas Island is of moderate size (13,370 acres [5,410 ha]) when compared to the other Channel Islands (ranging from 640 to 48,000 acres [260 to 19,400 ha]) and supports the fewest number of endemic and sensitive species. Following Santa Catalina, San Nicolas Island is the second-most developed of the Channel Islands.

3.8.1.3 Region of Influence

The region of influence (ROI) for the alternatives addressed in this EIS/OEIS includes the Point Mugu Sea Range, Point Mugu, and San Nicolas, San Miguel, Santa Rosa, and Santa Cruz islands.

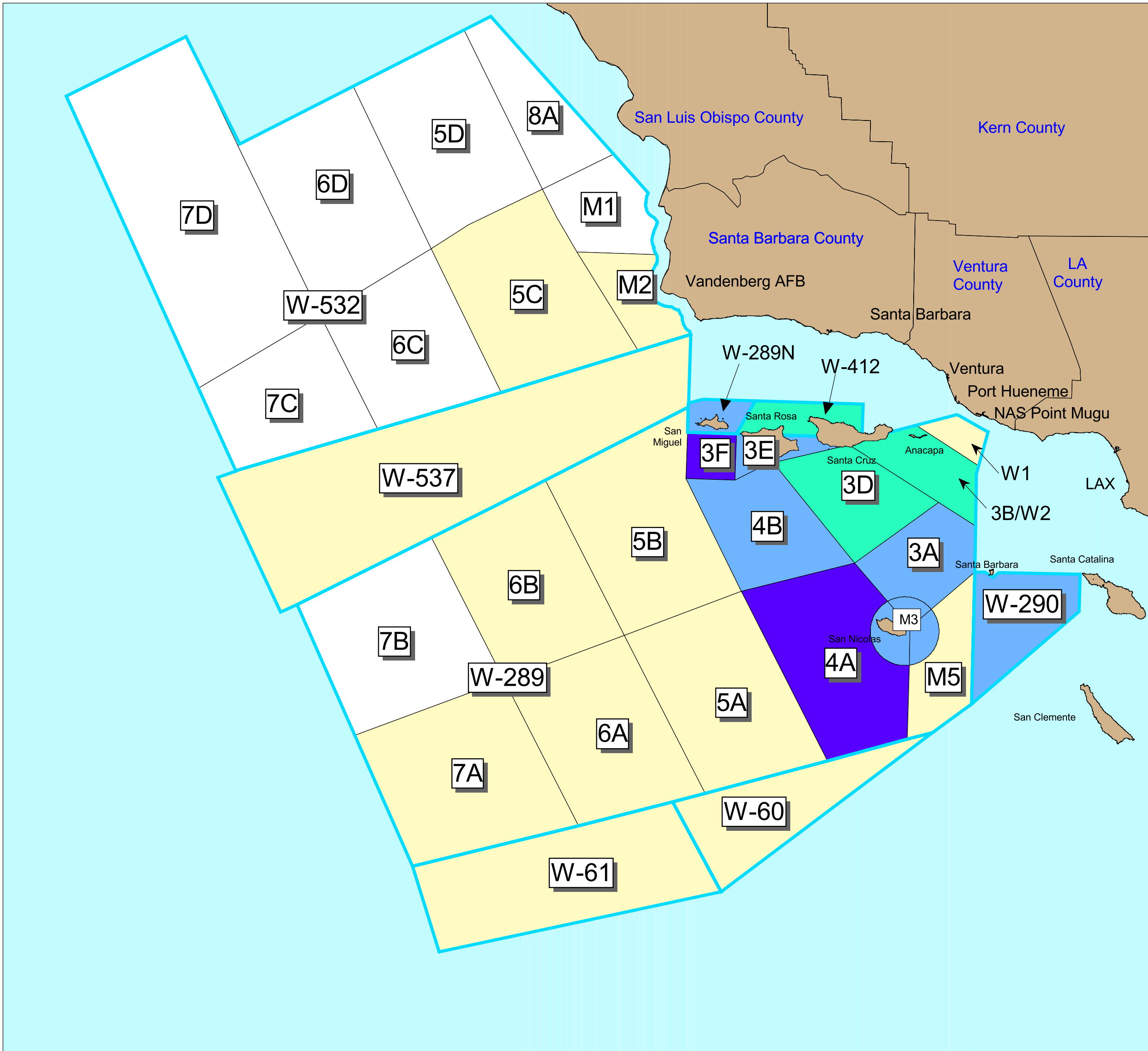
3.8.2 Point Mugu Sea Range

Seabirds may be associated with the marine environment or with their terrestrial habitats. For purposes of this document, seabirds are discussed in the terrestrial resource section because the majority of potential impacts analyzed in Section 4.8 may occur when the seabirds are using terrestrial habitats.

Over 195 species of seabirds use open water, shore, or island habitats in the SCB (Baird 1990). The majority of seabirds that are found in the SCB and the Sea Range are transitory, migrating in and out of the area according to breeding season. All seabirds that breed within the SCB, with the exception of terns, do so on the Channel Islands (Baird 1990). Seabird species that are known to occur within the Sea Range are summarized in the *Natural Resources Summary Report* (NAWCWPNS Point Mugu 1999); seabird densities are shown in Figure 3.8-1. The greatest seabird species diversity occurs during the fall and spring migration, and the least diversity occurs in June and July (Baird 1990). Seabird density throughout the Sea Range is low most of the time except for areas adjacent to the California coast and the coastlines of the Channel Islands (see Figure 3.8-1).

Seabird density within the Sea Range was calculated using density data collected from May 1975 through March 1978 (MMS 1993). Aerial and ship surveys were conducted along pre-established transects designed to systematically sample seabird abundance in the SCB. Since a large scale, systematic seabird survey has not been conducted subsequent to this effort, these data represent the best available for the ROI. Density data from these surveys was put into a Geographic Information System (GIS) database, and seabird density per cell within the Sea Range was calculated. Seabird density ranges from 2.56 to 295.37 birds per square mile (0.99 to 114.09 birds/km^2), or less than 0.01 to 0.46 birds per acre (0.02 to 1.14 birds/hectare) (Table 3.8-2).

Seabird Density in the Point Mugu Sea Range



Seabird Density

- 0 - 50 Birds per Square Mile
- 50 -100 Birds per Square Mile
- 100 - 200 Birds per Square Mile
- 200 + Birds per Square Mile
- No data available

* Areas 5C, 6B, M2, 7A, W-537, and W-61 were partially surveyed.

N S W E

50 0 50 Nautical Miles

Projection: Universal Transverse Mercator
North American Datum 1927
Zone 11
Source: MMS 1993.

Figure 3.8-1

Table 3.8-2. Average Seabird Density within the Sea Range

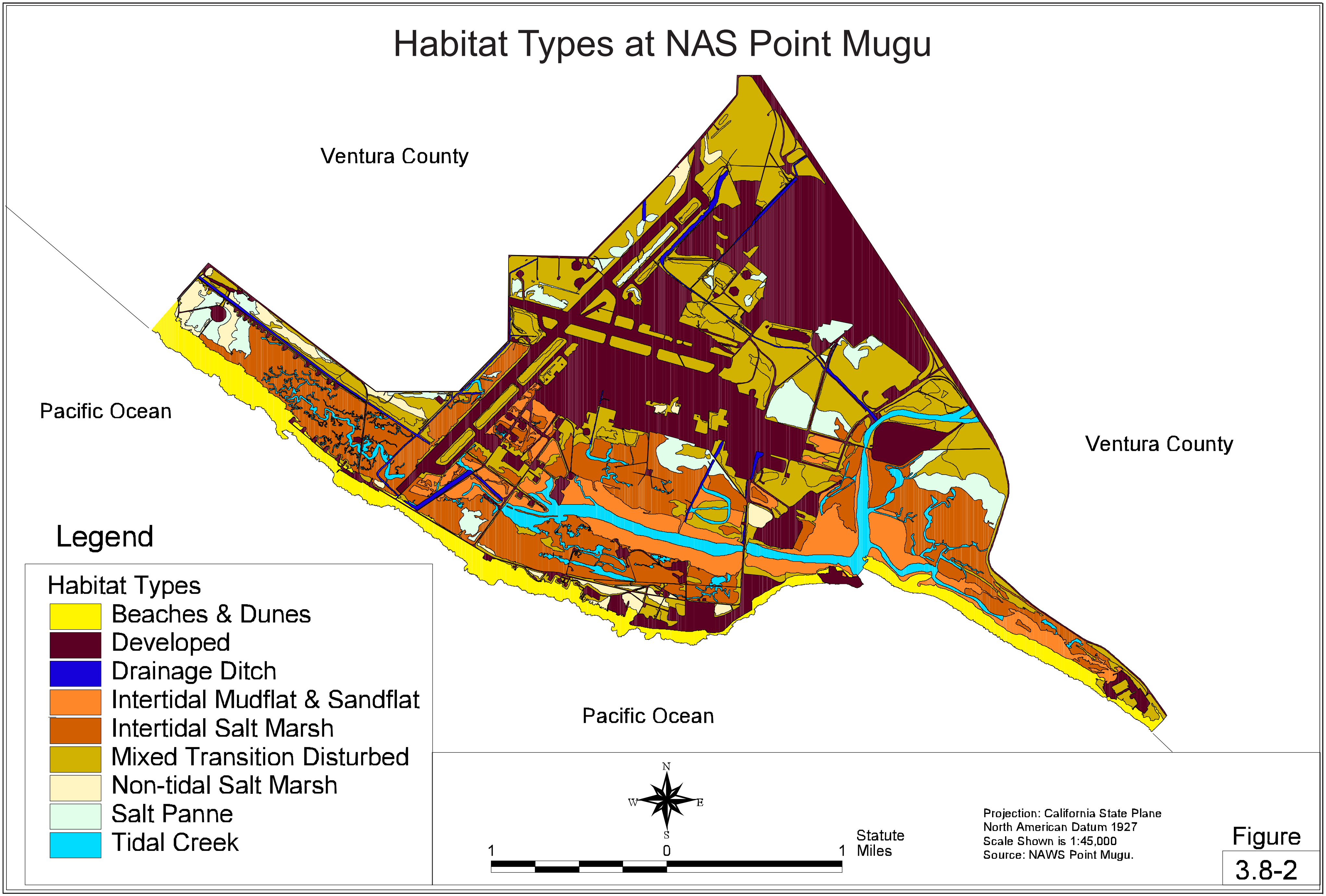
Range Area[1]	Average Number of Birds per Square Mile[2]	Average Number of Birds per Acre
3A	63.09	0.09
3B/W2	196.71	0.31
3D	126.70	0.20
3E	52.47	0.08
3F	208.84	0.33
4A	295.37	0.46
4B	68.95	0.11
5A	2.93	<0.01
5B	17.02	0.03
5C[3]	3.47	<0.01
6A	2.56	<0.01
6B[3]	4.61	<0.01
M2[3]	2.59	<0.01
M3	64.88	0.10
M5	48.95	0.08
W1	22.92	0.04
7A[3]	9.84	0.02
W-537[3]	13.16	0.02
W-289N	92.85	0.15
W-412	122.22	0.19
W-290	51.75	0.08
W-60	6.19	<0.01
W-61[3]	6.45	<0.01
C1177[3]	55.35	0.09

[1] Range areas are depicted on Figure 1-2.
[2] Based on MMS 1993 surveys.
[3] Partially surveyed.

3.8.3 Point Mugu

NAS Point Mugu lies within the SCB; with the exception of Mugu Lagoon, this location provides relatively minor amounts of plant and wildlife habitat. Several habitats occur at Point Mugu (Figure 3.8-2). Habitat designations are based on dominant plant species or physical features using a modified classification from Zedler (1992). The most prominent combination of habitats at Point Mugu is associated with Mugu Lagoon, an approximately 2,500-acre (1,010-ha) coastal salt marsh that provides food, nesting, roosting, breeding, and nursery habitat for numerous benthic invertebrate, fish, bird, and plant species. Other habitats found at Point Mugu include beach and dunes, drainage ditch, transition disturbed, and developed areas.

Wildlife species may use a variety of habitats but are discussed under the vegetation community they tend to occupy the most. Mugu Lagoon and adjacent beach areas provide diverse and valuable habitat that supports several threatened and endangered plant and wildlife species (discussed in the *Natural Resources Summary Report* [NAWCWPNS Point Mugu 1999]) and numerous common migratory and resident species.


Habitat Types at NAS Point Mugu
Ventura County
Pacific Ocean
Ventura County
Pacific Ocean
Legend
Habitat Types
Beaches & Dunes
Developed
Drainage Ditch
Intertidal Mudflat & Sandflat
Intertidal Salt Marsh
Mixed Transition Disturbed
Non-tidal Salt Marsh
Salt Panne
Tidal Creek
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Statute Miles
Projection: California State Plane
North American Datum 1927
Scale Shown is 1:45,000
Source: NAWS Point Mugu.
Figure
3.8-2

3.8.3.1 Coastal Salt Marsh

Coastal salt marsh is considered a sensitive and declining resource by several regulatory agencies including the CDFG and USFWS. Wetlands are specifically addressed under the jurisdiction of the U.S. Army Corps of Engineers (USACE) section 404 permit process (§ 404, 33 U.S.C. § 1251 et seq.). Clean Water Act, as amended (33 U.S.C. § 1251 et seq.), permit provisions regulating dredge and fill operations are enforced by the USACE and USEPA, with technical input from the USFWS.

Coastal salt marsh at Mugu Lagoon is defined by the presence of hydrophytic (salt-tolerant) vegetation and water levels that fluctuate daily due to tidal action. Salt marshes may appear to be monotypic; however, they often exhibit complex zonation based primarily on adaptation of plant and wildlife species to salinity fluctuations and hydrology. For purposes of mapping, the salt marsh at Mugu Lagoon is divided into intertidal salt marsh and salt panne, intertidal mud flat and sand flat, open water and tidal creeks, and non-tidal salt marsh. These habitat categories are discussed below.

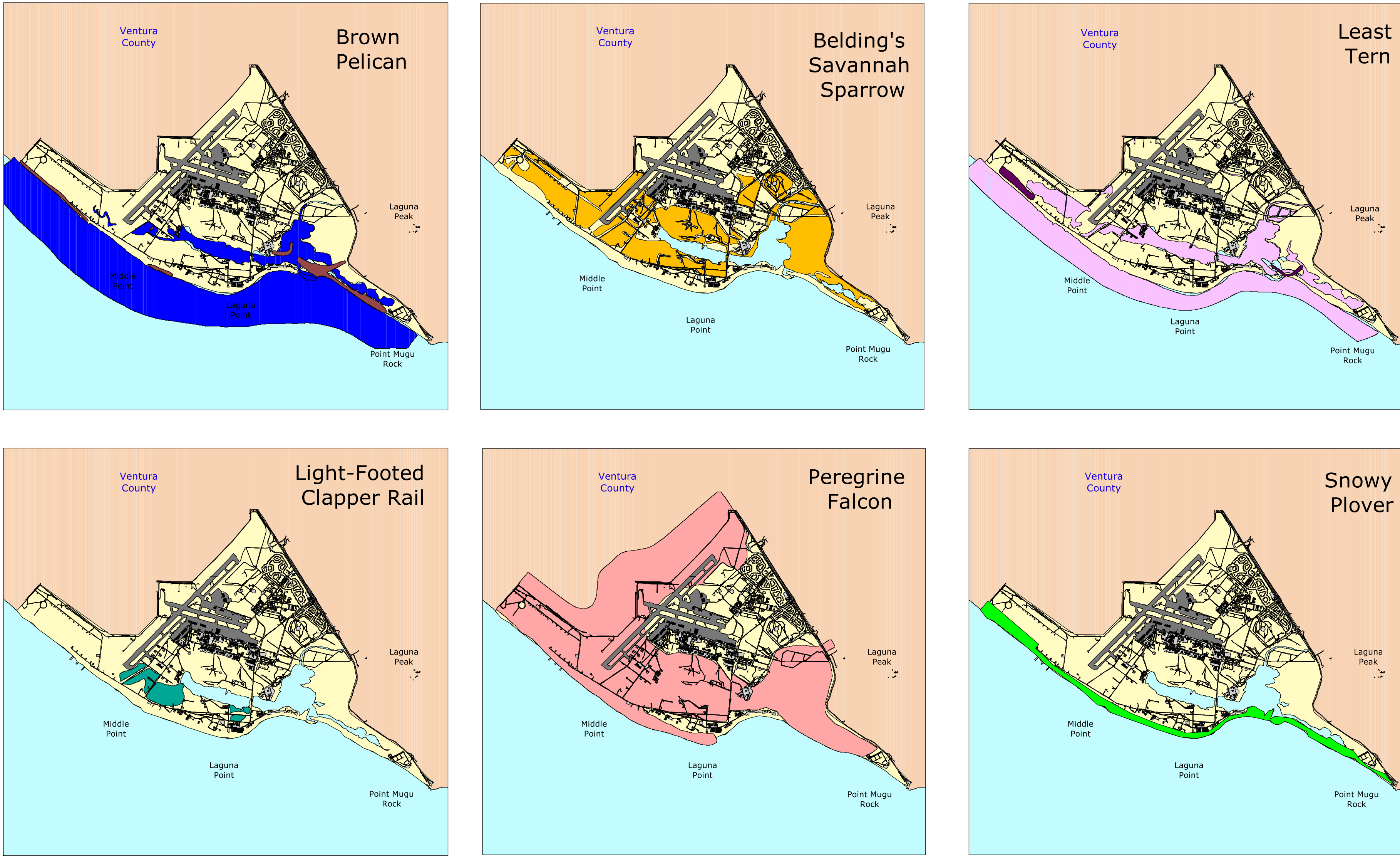
A - Intertidal Salt Marsh and Salt Panne

These two habitat categories are discussed together because they often share similar plant and animal species. Intertidal salt marsh accounts for 783.9 acres (317.2 ha) of habitat; salt panne accounts for 210.6 acres (85.2 ha) of habitat. Salt marsh habitat can be further divided into upper and lower marsh. Lower marsh is dominated by pickleweed (*Salicornia virginica*) and is characterized by more frequent and longer periods of tidal inundation than the upper marsh. *Juncus* sp. provides habitat for the federally and state-endangered light-footed clapper rail (*Rallus longirostrus levipes*), which typically uses cordgrass (*Spartina foliosa*) for nesting habitat. The light-footed clapper rail is found in salt marshes dominated by tall, dense vegetation, which it uses for nesting and cover, and pickleweed, which it uses for foraging and high tide refuge (Figure 3.8-3). A 1995 population survey conducted throughout the clapper rail's California range found 262 breeding pairs (Zembel et al. 1996). Of these, five pairs were found at Mugu Lagoon. There have been four to seven pairs present at the lagoon since 1985, and there is a male-biased pool of singles: 12 and three single males in 1994 and 1995, respectively (Zembel et al. 1996). Surveys conducted in 1996 and 1997 found three pairs and three additional males (NAWS Point Mugu 1998d).

The upper marsh is a more diverse vegetation community than the lower marsh. Pickleweed is still dominant, but other species are also present including sea lavender (*Limonium californicum*), alkali heath (*Frankenia grandifolia*), jaumea (*Jaumea carnosa*), saltwort (*Batis maritima*), arrowgrass (*Triglochin concinna*), sea blite (*Suaeda californica*), and annual pickleweed (*Salicornia bigelovii*). Salt pannes occur in upper marsh areas and are characterized by their lack of vegetation. Soils within salt pannes have a high salt content which inhibits the growth of salt marsh and upland plant species.

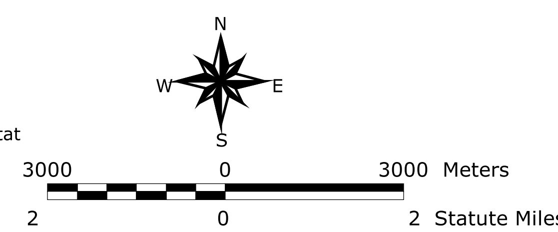
Belding's savannah sparrow (*Passerculus sandwichensis beldingi*), listed by the State of California as endangered (CDFG 1997), is common throughout the salt marsh but prefers pickleweed-dominated areas (see Figure 3.8-3). Mugu Lagoon previously supported the largest population of Belding's savannah sparrows in the state: 466 pairs were observed in 1986 (James and Stadtlander 1991). A partial survey of the lagoon conducted in 1991 indicates that population levels have remained relatively stable (James and Stadtlander 1991). A complete survey of Mugu Lagoon conducted in 1993 found 935 territorial males (NAWS Point Mugu 1998d). Statewide censuses of breeding populations have been conducted in California. All potential breeding sites were surveyed in 1977, and 1,610 breeding pairs were estimated to occur (NAWS Point Mugu 1998d). In 1986, 2,274 pairs were estimated to occur (NAWS Point Mugu 1998d). The last statewide survey in 1991 found 1,844 pairs. Restricted access to the lagoon may be responsible for the stable population at Mugu Lagoon.

Sensitive Avian Species at NAS Point Mugu



Legend

- Brown Pelican Feeding Areas
- Brown Pelican Roosting Areas
- Belding's Savannah Sparrow Areas
- Least Tern Breeding Areas
- Least Tern Foraging Areas
- Light-Footed Clapper Rail Habitat
- Peregrine Falcon Feeding Areas
- Designated Snowy Plover Critical Habitat



Projection: Universal Transverse Mercator, Zone 11
North American Datum of 1927
Source: Geographical Information System-
NAWS Point Mugu 1997.

Figure 3.8-3

The federally and state-listed endangered salt marsh bird's-beak (*Cordylanthus maritimus* ssp. *maritimus*) is an annual plant, blooming from May to October. It is found primarily in coastal salt marshes. This species is hemiparasitic, meaning it augments its nutrient supply by feeding on a host plant or uses its host plant for mechanical support. Salt marsh bird's-beak is considered sensitive at Mugu Lagoon, where a fluctuating population has been observed annually in the upper portions of the western marsh (Figure 3.8-4) (Smith 1993). The primary population occurs west of Runway 03 and smaller populations occur east of Runway 03.

B - Intertidal Mudflat and Sandflat

Intertidal mudflats and sandflats occur adjacent to areas of open water and are exposed during low tides and inundated during high tides. Approximately 346.7 acres (140.3 ha) of intertidal mudflat and sandflat occur within Mugu Lagoon. These areas usually support a high number of benthic and epibenthic invertebrates and are frequently used by foraging shorebirds.

C - Open Water and Tidal Creeks

Although a large component of the salt marsh at Mugu Lagoon is not vegetated, it provides important wildlife habitat. Based on topography and hydrology, open water habitats may be divided into subtidal channels, ponds, tidal creeks, and permanent open water. Generally, subtidal channels always have some amount of water in them regardless of the tide and serve as connections between the tidal inlet and arms of the lagoon. Subtidal ponds are channels that have been scoured so that they now form ponds. Tidal creeks (232 acres [94 ha]) are usually shallow, narrow channels that carry the flood (incoming) tide into vegetated areas of the marsh, and drain the marsh during the ebb (outgoing) tide.

Fish and aquatic invertebrate assemblages found in open water habitat are similar to those in coastal salt marshes throughout southern California and serve as an important forage base for other wildlife species. A total of 39 fish species have previously been identified in the lagoon (Onuf 1987), and 24 species were found during a fall survey in 1993 (Saiki 1994). The most common fish species are arrow goby (*Clevelandia ios*), topsmelt (*Atherinops affinis*), staghorn sculpin (*Leptocottus armatus*), and shiner surfperch (*Cymatogaster aggregata*) (Onuf 1987). Invertebrate species diversity and abundance within Mugu Lagoon is primarily influenced by substrate type and inundation. Crustaceans are common in the intertidal areas, while bivalves are common in the lower to middle tidal channels. Polychaetes are common throughout the tidal channels. A more detailed discussion of aquatic organisms occurring in Mugu Lagoon is presented in Sections 3.5 and 3.6, Marine Biology and Fish and Sea Turtles, respectively.

D - Non-tidal Salt Marsh

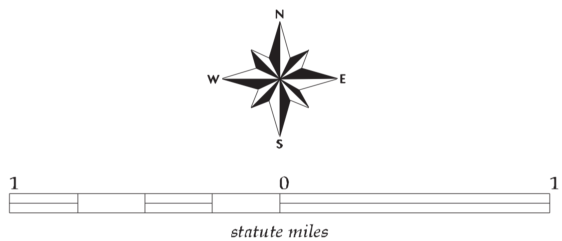
Approximately 49.3 acres (20.0 ha) of non-tidal salt marsh occur within Mugu Lagoon. Non-tidal salt marsh is characterized by the same vegetation species found in higher marsh habitats, but they are not exposed to tidal fluctuations. Non-tidal salt marsh receives water from rainfall and extremely high tides. Non-tidal salt marsh may be used as a refuge for salt marsh inhabitants during high tides and as foraging and resting areas by resident and migratory birds.

Brackish marsh habitats (46 acres [19 ha]) have reduced water salinity (between 0.5 and 30 parts per thousand) and are considered part of non-tidal salt marsh for the purposes of this document. Brackish marshes typically occur as a transition area between freshwater and marine water resources, such as a creek flowing into an estuary or lagoon. Vegetation more commonly associated with freshwater marsh habitats, such as cattails (*Typha* sp.) and bulrushes (*Scirpus* sp.), is found in brackish marshes.

Salt Marsh Bird's-Beak Distribution at NAS Point Mugu

Legend

- NAS Point Mugu
- Surface Water
- Roads
- Airfield
- Structures
- Salt Marsh Bird's Beak Distribution



Scale shown is 1:45,000
Projection: Universal Transverse Mercator, Zone 11
North American Datum of 1927

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Figure **3.8-4**

The federally and state-listed endangered California brown pelican (*Pelecanus occidentalis* ssp. *californicusi*) is a regular inhabitant of Mugu Lagoon (see Figure 3.8-3). A study conducted from October 1991 to 1993 found pelicans roosting at Mugu Lagoon regularly, with abundance peaking from June to September (Jacques et al. 1996). Mugu Lagoon serves as an evening staging area for pelicans that forage or roost elsewhere during the night. The majority of pelican activity and highest density occurs at the mouth of the lagoon, while the western portion of the lagoon is used by fewer than 10 birds per day. Small numbers of pelicans also forage in the lagoon and in the adjacent nearshore waters (Jacques et al. 1996). Mugu Lagoon is the closest mainland roost to the major breeding colony and night roost at Anacapa Island; it serves as a staging area for birds using the island (Jacques et al. 1996). Mugu Lagoon provides a relatively secure roost due to restricted public access.

California least terns (*Sterna antillarum* ssp. *brownii*) can be found foraging in shallow open water and breeding in sandy areas adjacent to Mugu Lagoon (see Figure 3.8-3). For a more detailed description of this species see Section 3.8.3.3.

Numerous other wildlife species inhabit the salt marsh year-round; 351 species of birds have been identified at Mugu Lagoon, including 151 species of waterbirds. Species diversity and abundance varies seasonally with migration; while December through February traditionally support the highest number of birds within the SCB, Point Mugu experiences high bird densities during the spring migration. Mugu Lagoon also provides habitat for transient species such as the white-faced ibis, which is a common winter visitor. The peregrine falcon (*Falco peregrinus anatum*) can be found throughout the year at Point Mugu. Peregrines are primarily found near large bodies of water where they feed on waterbirds. Peregrine falcon populations declined before the 1970s due to pesticide contamination which caused eggshell thinning and reduced reproductive success (Johnsgard 1990). Recovery goals for peregrine falcon in California have recently been achieved. Peregrines nest on western Anacapa Island and may be observed foraging in undeveloped areas of NAS Point Mugu (see Figure 3.8-3).

Amphibians and reptiles are uncommon in the salt marsh but do occur in the adjacent upland areas. Mammals, such as coyote (*Canis latrans*), gray fox (*Urocyon cinereoargenteus*), mule deer (*Odocoileus hemionus*), and striped skunk (*Mephitis mephitis holzneri*), inhabit the upland areas of Point Mugu and may make frequent foraging trips into Mugu Lagoon. Mugu Lagoon also supports numerous terrestrial invertebrates including spiders, wasps, and moths.

3.8.3.2 Beaches and Dunes

Beach and dune habitat is characterized by shifting sand within the intertidal zone. The intertidal zone is the area between the highest high tide and the lowest low tide and can be divided into three areas (upper, middle, and lower) based on the frequency and duration of inundation. Organisms that live within this zone have adapted to a continually changing environment and physical factors such as grain size, slope, and biological tolerances which influence species diversity, abundance, and distribution. Approximately 290.3 acres (117.5 ha) of beach and dune habitat occur on NAS Point Mugu.

The federally and state-listed endangered California least tern can be found foraging in shallow open water and breeding along the beach habitat adjacent to Mugu Lagoon (see Figure 3.8-3). California least terns nest in two locations at Mugu Lagoon: the western and eastern arm of the Mugu Lagoon barrier beach. For some sites, breeding takes place in two waves, with the second wave dominated by first-time breeders and re-nesting older adults. California least tern populations have increased throughout their range to 4,009 pairs in the 1997 breeding season; at Mugu Lagoon, populations increased from 69 pairs in 1996 to 75 pairs in 1997 (NAWS Point Mugu 1998d).

The federally listed threatened western snowy plover (*Charadius alexandrinus* ssp. *nivosusi*) nests on sandy beaches and dried mudflats adjacent to Mugu Lagoon from the beginning of April to mid-September. This species has been extensively observed at Point Mugu during the breeding season (Smith 1993). Overall, the breeding population of plovers has decreased at Point Mugu (NAWS Point Mugu 1998d). In 1996, the eastern arm of Mugu Lagoon beach had an average adult population of about 25 birds during the nesting season, and in 1997, there was an average adult population of less than nine birds (NAWS Point Mugu 1998d). Declines in the average adult population also occur for the Holiday Beach population; less than 20 birds were observed in 1996, and less than 11 birds were observed in 1997 (NAWS Point Mugu 1998d).

On December 7, 1999, the USFWS published a final rule designating 28 areas along the Pacific coast of the U.S. as critical habitat for the western snowy plover. Critical habitat is defined as: 1) the specific areas within the geographic area occupied by a species on which are found those physical or biological features (a) essential to the conservation of the species and (b) that may require special management consideration or protection; and 2) specific areas outside the geographic area occupied by a species at the time it is listed, upon determination that such areas are essential for the conservation of the species. The coast of Point Mugu includes designated western snowy plover critical habitat (see Figure 3.8-3).

3.8.3.3 Mixed Transition Disturbed and Urban/Industrial

Disturbed areas are lands on which the native vegetation has been significantly altered by construction or other land-clearing activities, and the species composition and site conditions are not characteristic of disturbed phases of natural plant associations within NAS Point Mugu. Such habitat typically occurs in vacant lots, along roadsides, and in construction staging areas; it is usually dominated by nonnative annual species and perennial broadleafed species. Disturbed habitat occurs throughout Point Mugu. Approximately 1,124.9 acres (455.3 ha) of mixed transition disturbed habitat occur on NAS Point Mugu.

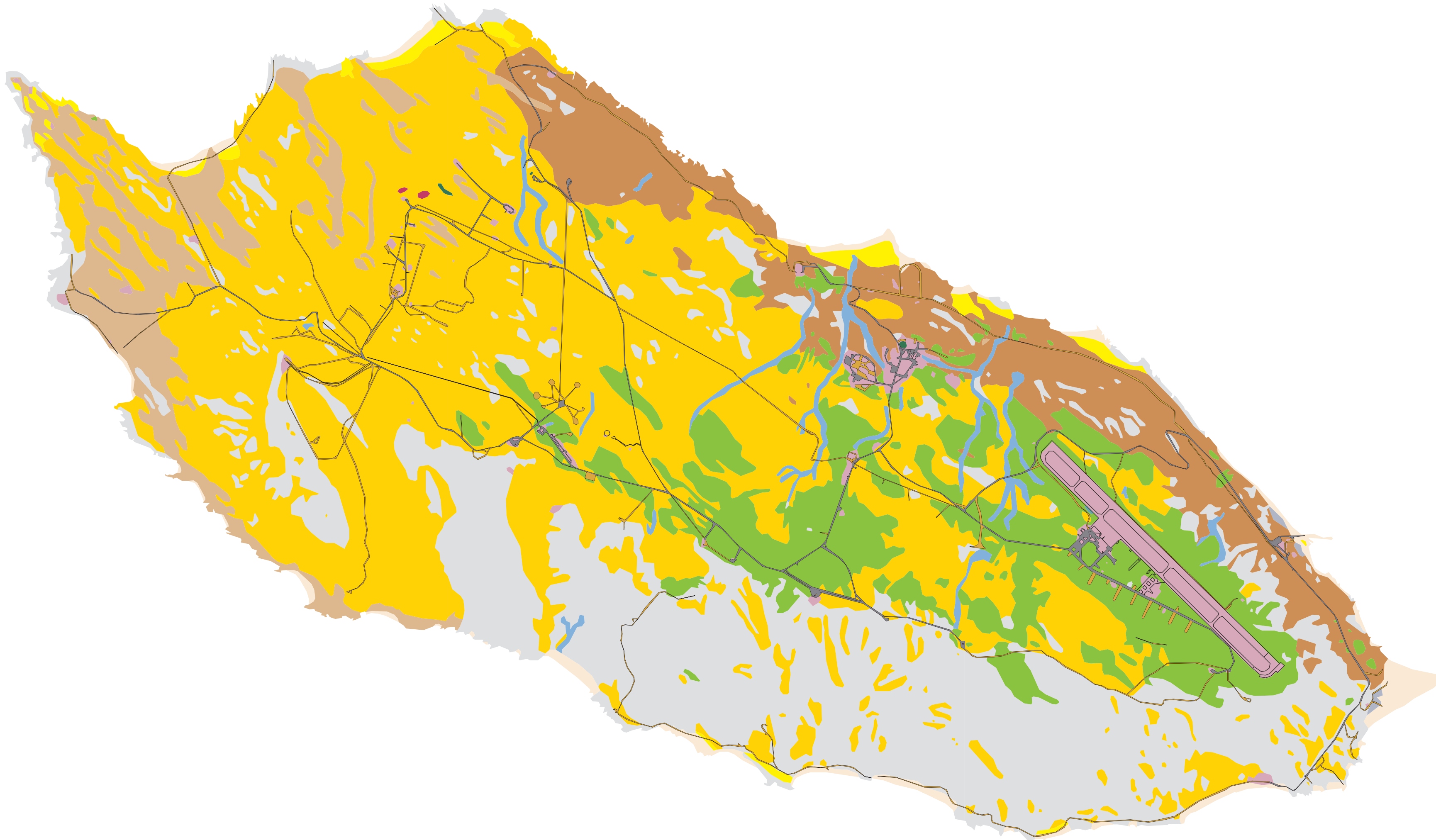
Developed land supports no native vegetation and is dominated by man-made structures and exotic landscaping. These areas usually include commercial and private buildings, industrial sites, and roads. Developed areas occur throughout NAS Point Mugu. Approximately 1,348.8 acres (545.9 ha) of developed habitat occur on NAS Point Mugu.

3.8.4 San Nicolas Island

San Nicolas Island lies approximately 65 miles (105 km) southwest of Point Mugu and covers 13,370 acres (5,411 ha). Twelve vegetation communities have been identified on San Nicolas Island (Halverson et al. 1996) (Figure 3.8-5). This includes five scrub communities (caliche, isocoma, baccharis, lupinus, and coreopsis scrub) which comprise 7,349 acres (2,974 ha) of habitat. Freshwater aquatic vegetation communities include vernal pools and riparian habitats. Coastal and inland dunes are found along the coastline of San Nicolas Island, and coastal marsh is found in three small areas. Annual iceplant, native and nonnative grasslands, and disturbed and developed habitats also occur. Barren areas which support no vegetation comprise 3,468 acres (1,476 ha) of habitat.

San Nicolas Island provides breeding habitat for several seabirds, including California brown pelican, western gull (*Larus occidentalis*), Brandt's cormorant (*Phalacrocorax penicillatus*), and black oystercatcher (*Haematopus bachmani*). California brown pelican has not bred on San Nicolas Island, but NAS Point Mugu staff believe it may start in the near future (NAWS Point Mugu 1997e). Species of special concern and species that breed or use the island as a rookery are summarized below. Vegetation communities and wildlife species are discussed together in this section to provide the reader with an

San Nicolas Island Vegetation



Legend

- Barren
- Beach
- Coastal Dune
- Coastal Marsh
- Coastal Scrub
- Coreopsis
- Developed
- Grassland
- Inland Dune
- Lupine
- Pine Trees
- Riparian/Deep Drainage

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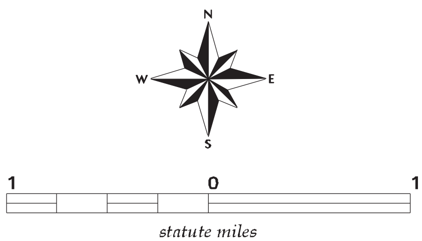


California State Plane Coordinate System, Zone VI
North American Datum of 1927
Scale shown is 1:60,000
Source: Geographic Information System -
NAWS Point Mugu 1997.

Figure 3.8-5

overall picture of existing conditions. Wildlife species may use a variety of habitats but are discussed under the vegetation community they occupy the most.

3.8.4.1 Scrub Habitats

Five scrub habitats (caliche, isocoma, baccharis, lupinus, and coreopsis scrub) occur on San Nicolas Island and are its dominant land cover (see Figure 3.8-5). Caliche scrub occurs at the southern boundary of the island's mesa. Isocoma scrub is the most commonly found scrub on San Nicolas Island, with 67 percent of the native species on the island occurring in this scrub community. Baccharis scrub is found in scattered patches on the mesa, particularly in drainages or other locations that are protected from wind; this species may pond water. Lupinus scrub occurs in two small patches of less than 3 acres (1.2 ha) and is rare on San Nicolas Island; it occurs in sandy areas of coastal scrub and is dominated by silver lupine. Giant coreopsis scrub is found on north-facing slopes on the north side of the island and accounts for 1,348 acres (546 ha).

The federally listed threatened island night lizard (*Xantusia riversiana*) may be found in any habitat on the island that provides abundant cover. In prickly-pear (*Opuntia* sp.) habitats, the majority of lizards are found in older stands of cactus where growth is thick and dead pads have accumulated on the ground, providing adequate refuge (USFWS 1984).

The state-listed threatened San Nicolas Island fox (*Urocyon littoralis dickeyi*) is an opportunistic feeder, with insects and fruits comprising the majority of its diet. Birds, eggs, grasses, and small mammals constitute a lesser portion of its diet (Collins and Laughrin 1979). This species may be found in any of the habitat types present on the islands.

Bird species commonly found on the mainland also occur in a variety of habitats on San Nicolas Island, including rock wren (*Salpinctes obsoletus*), European starling (*Sturnus vulgaris*), orange-crowned warbler (*Vermivora celata*), house sparrow (*Passer domesticus*), western meadowlark (*Sturnella neglecta*), and house finch (*Carpodacus mexicanus*).

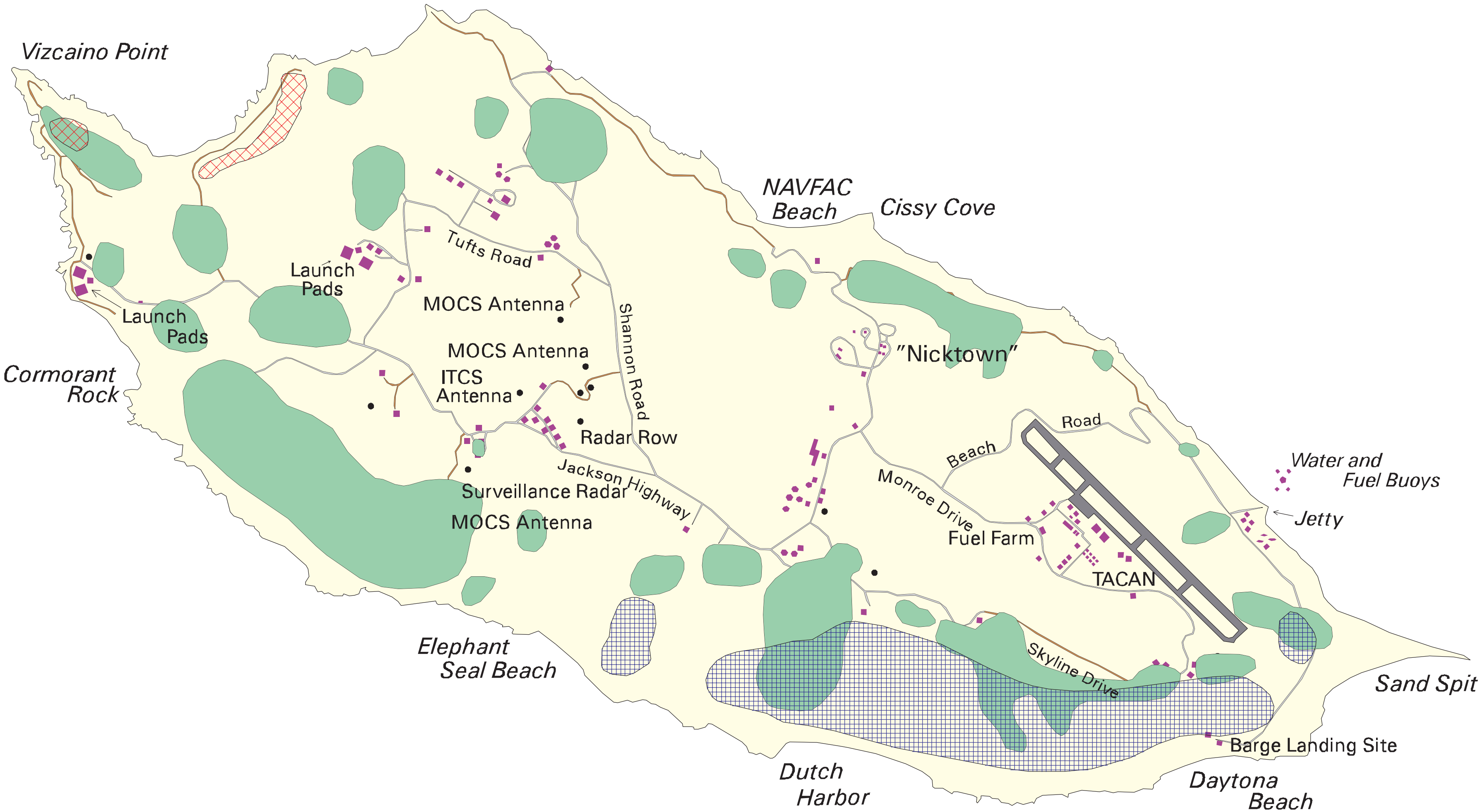
San Nicolas Island supports the highest percentage (46 percent) of nonnative plant species of all the southern Channel Islands (Junak and Vanderwier 1990). Of the 18 native plant species found on one or more of the Channel Islands, San Nicolas Island buckwheat (*Eriogonum grande* var. *timorum*) and leafy malacothrix (*Malacothrix foliosa* ssp. *polycephla*) are endemic only to San Nicolas Island (Junak and Vanderwier 1990).

San Nicolas Island buckwheat is a perennial shrub, often growing 4 to 8 inches (10 to 20 cm) high and flowering from March through June. This is the only species of *Eriogonum* that occurs naturally on San Nicolas Island, but two additional species have been introduced (Junak et al. 1995). San Nicolas Island buckwheat occurs on open, south-facing slopes and on adjacent canyon walls between 100 and 500 feet (30 and 152 m) elevation on the mid-slope and lower-slope portions of the southern escarpment. It can also be found on sandstone ridgetops and slopes and coastal flats (Figure 3.8-6).

Leafy malacothrix is also endemic to San Nicolas Island. This annual blooms in the spring and occurs in coastal scrub habitats.

Trask's milkvetch (*Astragalus traskiae*), a state-listed rare species, is a perennial herb with spreading branches; it blooms from March through July. This species is widespread and abundant along the perimeter of the island, especially in dunes, sandy coastal flats, and open sandstone slopes (Junak et al.

Sensitive Plant Species of San Nicolas Island



Legend

- Trask's Milkvetch
- San Nicolas Island Buckwheat
- Beach Spectaclepod

Projection: Universal Transverse Mercator, Zone 11
North American Datum of 1927
Scale shown is 1:60,000
Source: Junak et al 1995.

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Figure 3.8-6

1995). Populations range in size from a few scattered individuals to dense stands with thousands of plants (see Figure 3.8-6).

3.8.4.2 Vernal Pools

Several vernal pools totaling 0.8 acre (0.3 ha) occur on the western and northeastern portions of the mesa (Halverson et al. 1996). Vernal pools are rare meadow-like habitats that support a unique flora and fauna which have adapted to ephemeral (lasting for a short time) aquatic conditions. These habitats are typically inundated during and after winter rains, flourish with rapid plant and aquatic invertebrate growth and reproduction in the spring, and become dry and dormant during the summer months. The dominant plant species identified in San Nicolas Island vernal pools is pale spike-sedge (*Eleocharis macrostachya*).

3.8.4.3 Riparian Habitats

Deep drainages on the south side of the island are bare and eroded; those on the mesa top and on the north side of the island have areas of erosion as well as areas with plant communities. There are currently only small disturbed patches of riparian habitat on San Nicolas Island which comprise about 201 acres (81 ha).

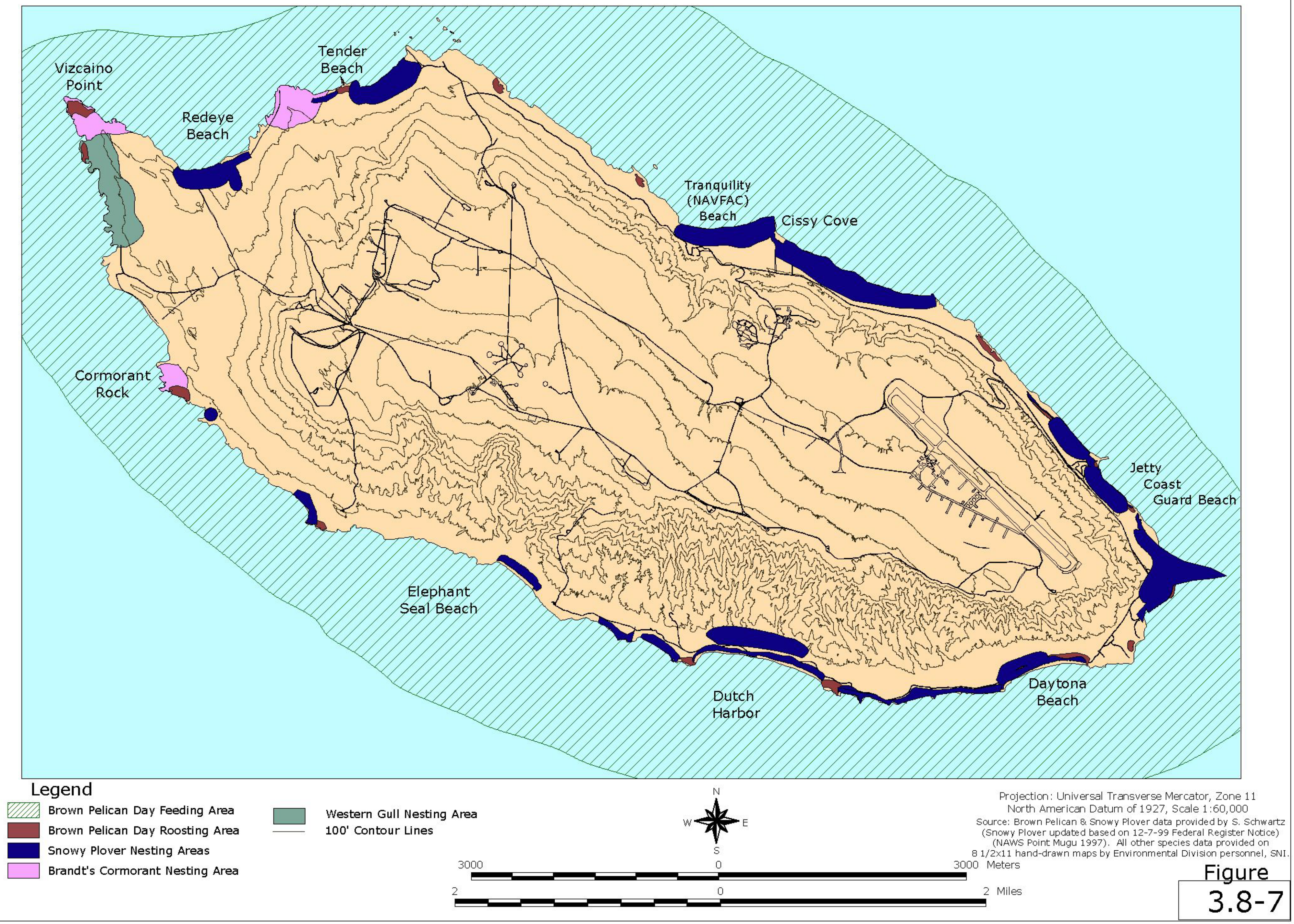
3.8.4.4 Beaches and Dunes

Beach habitat (234 acres [95 ha]) is similar to that defined in Section 3.8.3.3. Two types of dune habitat, coastal and inland, occur on San Nicolas Island (see Figure 3.8-5). Coastal dunes covering 138 acres (56 ha) are scattered along the perimeter of the island. Plant communities on active dunes are diverse and scattered, with no species dominating over large areas. Sticky sand verbena (*Abronia maritima*) occurs near the water and is the most abundant. Dune malacothrix (*Malacothrix incana*), silver lupine (*Lupinus albifrons*), beach sand-verbena (*Abronia umbellata*), beach bur (*Ambrosia chamissonis*), iceplant (*Mesembryanthemum* sp.), island morning glory (*Calystegia macrostegia* ssp. *amplissima*), beach-primrose (*Camissonia cheiranthifolia*), and silver lotus (*Lotus argophyllus*) also occur on the coastal dunes. Inland dunes (782 acres [316 ha]) occur behind the coastal dunes and have more stable sandy substrates. Hottentot-fig (*Carpobrotus edulis*) and Trask's milkvetch are the dominant species in this community. Non-native weedy species also occur here.

Beach spectaclepod (*Dithyrea maritima*) is a perennial species, occurring in coastal dunes. It blooms from March to May. The species has been observed on the western end of San Nicolas Island. Beach spectaclepod is considered sensitive because of its limited distribution on San Nicolas Island.

Western snowy plovers nest and forage on the beaches and in the intertidal zone of San Nicolas Island (Figure 3.8-7). Snowy plovers breed from March 1 to September 15. Two to three eggs are laid in a shallow depression scraped into the sand and incubated for 24 days, mostly by the male. The scrape usually has small pieces of shell, vegetation, or driftwood associated with it. Young fledge and are independent within 29 to 47 days (Ehrlich et al. 1988). Western snowy plovers forage primarily on the wet sand at the beach-surf interface, where they feed on small crustaceans, marine worms, insects, and amphipods. Snowy plovers are year-round residents on San Nicolas Island. A 1993 survey (Wehtje and Baron 1993) found a total of 78 nest initiations, of which 59 hatched and 33 successfully fledged for a total of 53 chicks. Some of the beaches around San Nicolas Island have been designated by the USFWS as western snowy plover critical habitat.

Special Interest Avian Species of San Nicolas Island



Projection: Universal Transverse Mercator, Zone 11
North American Datum of 1927, Scale 1:60,000
Source: Brown Pelican & Snowy Plover data provided by S. Schwartz
(Snowy Plover updated based on 12-7-99 Federal Register Notice)
(NAWS Point Mugu 1997). All other species data provided on
8 1/2x11 hand-drawn maps by Environmental Division personnel, SNI.

Figure 3.8-7

3.8.4.5 Coastal Marsh

Coastal marsh is found primarily in three small areas along the eastern end of San Nicolas Island, covering a total of 9 acres (4 ha). Pickleweed and alkali heath (*Frankenia salina*) are the dominant species. Additional species include small-flowered iceplant (*Mesembryanthemum nodiflorum*), saltgrass (*Distichilis spicata*), California saltbush (*Atriplex californica*), island morning glory, and sickle grass (*Parapholis incurva*).

3.8.4.6 Annual Iceplant

Crystalline iceplant is found in areas that have been disturbed; it also occurs in a small area on the west end of the island. Additional species found among iceplant include sand peppergrass (*Lepidium lasiocarpum*), matscale (*Atriplex watsonii*), small-flowered iceplant, and sickle grass.

3.8.4.7 Grasslands

The grassland community is a mixture of native and non-native species covering 1,738 acres (703 ha). Grasslands occur on the mesas of San Nicolas Island primarily along the northern half of the island. Dominant grasses are slender wild oats, foxtail (*Hordeum murinum*), ripgut brome, and red brome. Dominant forbs, which are all nonnative species, include bur-clover (*Medicago polymorpha*), common sow-thistle (*Sonchus oleraceus*), and filaree (*Erodium* spp.). Australian saltbush (*Atriplex semibaccata*), a herbaceous (i.e., not woody) perennial, is an important component of the nonnative grassland found on the island. The native perennial purple needlegrass (*Nassella pulchra*) is found primarily in association with shrubs such as lupine (*Lupinus* spp.) and coreopsis (*Coreopsis* spp.).

The island horned lark (*Eremophila alpestris insularis*) is a common resident of grassland habitat on San Nicolas Island.

3.8.4.8 Rock Headlands, Cliffs, and Barren Areas

Rock headlands, cliffs, and barren areas are primarily non-vegetated areas that occur along the perimeter of the island. They consist of exposed rocks and may be sparsely vegetated where soil has been trapped in rock crevices.

Western gulls breed along the Pacific coast, nesting on the ground either in solitary pairs, small colonies, or in very large colonies involving thousands of birds (Carter et al. 1992). San Nicolas Island has a large breeding colony which is considered sensitive to human disturbance (Smith 1993) (see Figure 3.8-7). The breeding western gull population is stable on the island.

Brandt's cormorant is a common year-round resident of San Nicolas Island, nesting along the western end (see Figure 3.8-7). Carter et al. (1992) estimated 5,089 breeding cormorants at San Nicolas Island. They are colonial nesters, breeding from March through August on open ground in rocky areas; nests are packed close to each other and are perennial, with fresh material added every year. Cormorants feed chiefly on fish obtained by diving. When disturbed, cormorants leave their nests and western gulls typically destroy the eggs and chicks.

California brown pelican day-roosting areas are scattered along the coastline, particularly along the eastern end of San Nicolas Island (see Figure 3.8-7). Storm-petrels and black storm-petrels are not known to nest on San Nicolas Island but do occur within the Channel Islands; therefore, they do forage adjacent to San Nicolas Island and may expand their nesting activities to the island in the future. These species are known to forage within the Sea Range.

3.8.4.9 Disturbed and Developed

Disturbed habitat is typified by non-native grasses and invasive weedy species. This habitat displays a distinct lack of any native vegetation, and shows signs of brushing, off-road vehicle use, ornamental planting, or other disturbance. Developed land supports no native vegetation and often contains man-made structures such as buildings or roads. Developed areas occur primarily on the eastern end of San Nicolas Island, covering 324 acres (131 ha). Mockingbirds (*Mimus polyglottos*) and house finches (*Carpodacus mexicanus*) are often found within the developed areas.

3.8.5 Other Channel Islands

Sea Range facilities are located on San Miguel, Santa Rosa, and Santa Cruz islands (refer to Section 3.0.1.3). These sites are characterized as disturbed and developed habitat typified by a lack of native vegetation. The sites offer limited habitat value for terrestrial wildlife species.

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3.9 CULTURAL RESOURCES

3.9.1 Introduction

3.9.1.1 Definition of Resource

Cultural resources are defined as any prehistoric or historic sites, buildings, districts, structures, traditional use areas, or objects considered to be important to a culture, subculture, or community for scientific, traditional, religious, or any other reasons. Cultural resources are generally divided into three groups: archaeological resources (both historic and prehistoric), architectural resources, and traditional cultural resources.

A - Archaeological Resources

Prehistoric and historic archaeological resources are locations (sites) where human activity measurably altered the earth or left deposits of physical remains. Prehistoric sites consist of various forms of evidence indicative of human activities that spanned the time from about 9,000 years ago until the time of the first European contact in 1635. Prehistoric artifacts frequently include utilitarian and non-utilitarian objects, such as flaked and ground stone tools (e.g., spear points, arrowpoints, and scrapers) as well as bone and shellfish ornaments and tools (e.g., abalone pries, fishhooks, and beads). Occasionally remnants of basketry or cordage, remains of a housefloor or living surface, fire hearth, bedrock milling stations, mortuary remains, or rock art panels exist as parts of prehistoric sites. Prehistoric sites can be manifested as only a scatter of surface material, or can include a subsurface component or midden deposit. Most frequently, such sites contain both surface and subsurface elements. Historic archaeological sites can be subsurface remains that contain buried foundations, wells, cisterns, privies, etc., or surface remains such as historic walkways, roads, or structural remnants. Archaeological resources can be identified and evaluated for significance according to each site's cultural importance, integrity, and ability to yield information to stated research questions.

Underwater archaeological resources are defined as submerged sites having some cultural affiliation. These can take the form of submerged prehistoric sites or isolated prehistoric artifacts; or can be submerged historic shipwrecks, or pieces of ship components, such as cannons or guns.

B - Architectural Resources

Architectural resources are standing buildings, dams, canals, bridges, and other structures of historic or aesthetic significance. Architectural resources generally must be more than 50 years old to be considered for protection under existing cultural laws. However, more recent structures, such as Cold War military buildings, may warrant protection if they manifest the potential to gain significance in the future. Buildings, structures, and other facilities can be of historic significance, depending on their time frame, degree of integrity, and their possible association with known historical events or persons.

C - Traditional Cultural Resources

Traditional cultural resources are resources associated with cultural practices and beliefs of a living community that are rooted in its history and are important in maintaining the continuing cultural identity of the community. Traditional cultural resources may include archaeological sites; locations of historic events; sacred areas; sources of raw materials used to produce tools and sacred objects; and traditional hunting or gathering areas. The community may consider these resources essential for the persistence of their traditional culture.

3.9.1.2 Regional Setting

Southern California's offshore islands within the Sea Range include San Nicolas, Anacapa, Santa Cruz, Santa Rosa, and San Miguel. These islands and the nearby mainland show archaeological evidence of some of the most politically complex hunter-gatherers in the world. Beginning at least 15,000 years ago, Native Americans hunted, fished, and gathered shellfish on the islands. They also participated in an elaborate trading network between islands and the mainland through the use of canoes.

Spanish explorers arrived in the 1600s with a devastating effect on mainland native groups. Decimated by disease, the remaining groups were relocated to villages next to Catholic missions. Island groups were most affected by seal and other hunting in the early 19th century. On San Nicolas Island, all native inhabitants were moved to the mainland by the mid-1800s. Ranching and fishing in the late 19th and 20th centuries were the major subsistence activities on the islands. Remains of Anglo and Chinese occupations can be found in abalone gathering camps, fishing camps, or ranch houses and outbuildings.

Military activities in the Sea Range began during World War II and increased dramatically during the Cold War. Point Mugu and its related testing range facilities were critical to the research and development efforts required to test surface-to-surface, surface-to-air, and air-to-surface missiles. Several structures at Point Mugu associated with early missile development and testing have been determined eligible for the National Register of Historic Places (National Register).

3.9.1.3 Region of Influence

The region of influence (ROI) for cultural resources encompasses the Sea Range and associated facilities at NAS Point Mugu and San Nicolas Island. For purposes of the cultural resources analysis, the region has been divided into the Sea Range proper, Point Mugu, and San Nicolas Island. The Sea Range includes all offshore areas under the Special Use Airspace, a total of 36,000 square miles (93,200 km^2); cultural resource issues are primarily related to potential effects to underwater archaeological resources. The Point Mugu area consists of the main base and the nearshore area to the extent that alternatives addressed in this EIS/OEIS may affect archaeological, architectural, and historic resources. The areas of analysis for San Nicolas Island consist of the island proper and the immediate nearshore areas. Resources of concern for San Nicolas Island include archaeological, architectural, and historic resources. Since the alternatives analyzed in this EIS/OEIS (including the No Action Alternative) would not affect onshore cultural resources at San Miguel, Santa Rosa, Santa Cruz, Anacapa, or Santa Barbara islands, they are not specifically addressed; however, they are included in discussions pertaining to the Sea Range to the extent that underwater resources in proximity to these islands might be affected.

3.9.1.4 Research Methodology

Under federal laws and regulations, only significant cultural resources warrant consideration with regard to adverse impacts resulting from federal activities. Significant archaeological and architectural resources include those that are eligible or are recommended as eligible for inclusion in the National Register. The significance of cultural resources is evaluated according to the National Register eligibility criteria (36 C.F.R. 60.4), in consultation with the State Historic Preservation Officer (SHPO). According to these criteria, "significance" is present in districts, sites, buildings, structures, and objects that:

(a) are associated with events that have made a significant contribution to the broad patterns of history; or
(b) are associated with the lives of persons significant in the past; or

(c) embody the distinctive characteristics of a type, period, or method of construction, represent the work of a master, possess high artistic value or represent a significant and distinguishable entity whose components may lack individual distinction; or
(d) have yielded, or may be likely to yield, information important in prehistory or history.

There are no legally established criteria for assessing the importance of a traditional cultural resource. These criteria must be established primarily through consultation with Native Americans. When applicable, consultation with other affected groups provides the means to establish the importance of their traditional resources. They may also be derived from 36 C.F.R. 60.4 and from the Advisory Council on Historic Preservation guidelines.

The methodology for determining the presence of significant cultural resources within the ROI was based on a combination of existing data and special research studies. Extensive data searches on known cultural resources within the Point Mugu Sea Range, NAS Point Mugu, San Nicolas Island, and other Channel Islands provided information on the number, types, locations, and significance of archaeological and architectural resources within the ROI. Specific databases on known underwater cultural resources were combined with bathymetric information and data on ocean currents and sea level changes to model areas with the potential to contain submerged cultural resources. Ongoing discussions with Native American groups and a detailed ethnohistoric study to identify direct lineal descendants of prehistoric populations provided information on Native American issues and traditional cultural resources.

3.9.2 Point Mugu Sea Range

3.9.2.1 Background

Existing information on submerged resources is based on review of the *Channel Islands National Park and Channel Islands National Marine Sanctuary: Submerged Cultural Resources Assessment* (Morris and Lima 1996). Their study indicates that more than 100 shipwrecks are recorded within the northern portion of the Sea Range. Another existing database provided by the Environmental Project Office indicates that as many as 500 shipwrecks have been recorded throughout the Sea Range, although precise locational and descriptive information is lacking. Within the outer portion of the Sea Range, major data gaps exist regarding the presence of submerged cultural resources; virtually nothing is known of this area.

3.9.2.2 Underwater Resources

Archaeological resources within the Sea Range are limited to shipwrecks and an occasional isolated artifact that was lost from Native American watercraft during a prehistoric or historic voyage.

<u>A - Prehistoric Archaeological Resources</u>

No prehistoric archaeological resources are recorded within the Sea Range. Amateur deep sea dives have reported the sitings of isolated artifacts, such as stone bowls or mortars; however, none has been officially recorded within this area. Since prehistoric Native Americans frequently sailed the waters between the offshore islands and the mainland, it is likely that a number of isolated artifacts may exist on the sea floor.

B - Historic Archaeological Resources

No historic resources, other than submerged shipwrecks and one plane, are known to exist in the Sea Range. Over 500 sunken vessels have been reported within the coastal waters of southern California. Precise locations are infrequent, with vague descriptive narratives of the area in which the ship was last known, or thought to have sunk, being provided. Generally, weather conditions (e.g., high wind, dense fog), geographical features (e.g., submerged rocks or reefs), and human error are all factors that may influence vessel failures. Morris and Lima (1996) have compiled a database of known shipwrecks and their locations in the Sea Range. The underwater resources dating prior to 1947 are considered important for the purposes of this study and are summarized in Table 3.9-1. Note that in many cases, although a shipwreck is known to have occurred, no wreckage has been located.

The listed shipwrecks include fishing boats, barges, yachts, cargo carriers, passenger ships, freighters, and target ships. Reasons for their demise include mechanical failure, fire, collision, grounding, or capsizing. The most common reasons for shipwrecks were either running aground on natural hazards such as prominent rocks or colliding in harbors during stormy weather. A predictive model based on the locations of lost ships and ships found within the Sea Range constructed for the EIS/OEIS suggests that shipwrecks are most likely to be found less than 0.5 NM (0.9 km) from shore in relatively shallow water (less than 33 feet [10 m] in depth). Few ships are lost more than 10 NM (19 km) from shore and, if lost, are unlikely to be found given the depth to the ocean floor.

The other cultural resource found submerged is the Grumman Avenger, a government plane that was possibly ditched off Santa Cruz Island due to mechanical problems. All of the submerged resources are protected by the State of California Penal Code (Sec. 622.5), the Archaeological Resources Protection Act (ARPA) of 1979 (16 U.S.C. § 470aa et seq.); and National Park Regulations (36 C.F.R. 2.1), and, if located within the sanctuary boundaries, the CINMS regulations (15 C.F.R. 935.7).

The largest number of shipwrecks found within the Sea Range are near Santa Rosa Island. These shipwrecks have occurred in the vicinity of Talcott Shoal, Sandy Point, Bee Rock, East Point, and Becher's Bay. Two shipwrecks are currently known to be located in Becher's Bay (the site currently used for simulated mine drops): the *Ella G* and the *Blue Fin*. While wreckage from the *Ella G* has been located, nothing has been found of the *Blue Fin*. Portions of Becher's Bay between the pier and Carrington Point were surveyed by the National Park Service in 1985 using a side-scan sonar and magnetometer (Morris and Lima 1996). Although the results of the survey were negative, remains of a wooden frame ship, probably the *Ella G*, were discovered on the beach near the pier in 1992. The frame had been covered in sand and was temporarily exposed during winter storms. It is likely that other submerged and buried remains are located in Becher's Bay along with the remains of the *Ella G*.

3.9.3 Point Mugu

3.9.3.1 Background

The Environmental Project Office provided existing cultural resources information for NAS Point Mugu. Previous cultural resource investigations conducted for the NAS Point Mugu mainland property include: six inventories and National Register evaluations; three historical overviews; and two cultural resource management studies (Table 3.9-2).

Table 3.9-1. Ships and Aircraft Built Prior to 1947 Lost within the Sea Range

SAN NICOLAS ISLAND			
Ship Name	**Official Number**	**Year**	**Wreckage Found**
John Begg		1825	
La Gironde		1902	
Intruder		1905	
Coney Island		1926	
Nora II		1937	
SS Steel Chemist		1949	
LCI		1951	
Standard No. I		1951	
Dixie Lee		1960	
CVE-91		1962	X
Margie A		1970	
Agerholm		1974	
Savage		1979	
Baussell		1982	
Vance		1982	
Higbee		1986	
LSD (Kabildo)		1986	X
Deperm		1987	
YFU-5		Unknown	X
Unknown	4413	Unknown	X
ANACAPA ISLAND			
Ship Name	**Official Number**	**Year**	**Wreckage Found**
Windfield Scott		1853	X
Pearl		1891	
Dawn		1901	
Lotus	141723	1921	
Beulah		1933	
Nancy B		1946	
Bar-Bee		Unknown	
SANTA ROSA ISLAND			
Ship Name	**Official Number**	**Year**	**Wreckage Found**
Yankee Blade		1854	X
Convoy		1884	
Goldenhorn		1892	X
Crown of England		1894	X
Magic		1899	
Ella G[1]		1908	X
Dora Bluhm		1910	
Aggi		1915	X
Jane L Stanford		1929	X
Blue Fin[2]		1944	

[1] Found at Becher's Bay
[2] Lost at Becher's Bay

Table 3.9-1. Ships and Aircraft Built Prior to 1947 Lost within the Sea Range (continued)

SANTA CRUZ ISLAND			
Ship Name	**Official Number**	**Year**	**Wreckage Found**
San Buenaventura		1858	
Chappo	127191	1897	
Helene	96325	1898	
Bell		1901	
Francine	120988	1901	
Sea Lion		1906	
Irene		1908	
Nellie	130865	1912	
International I	167316	1918	
Unity	218553	1922	
Eagle		1923	
OK		1923	
Wampas (aka Grey Ghost)		1926	
Maryland	214495	1927	
Kinkajou		1930s	
Swan	230938	1932	
Imperial	212356	1936	
Yukon	219965	1938	
City of Sausalito	235380	1941	
Lion	215807	1924	
Grumman Avenger (plane)		1940s	
Billcona		1952	
Golden Gate		1952	
Corsair		1953	
Ruth E.		1955	
Santa Cruz		1960	
Vineth		1961	
Cinnamon Bear		1966	
Joan		1974	
Glady I			
SAN MIGUEL ISLAND			
Ship Name	**Official Number**	**Year**	**Wreckage Found**
Leader		1876	X
G.W. Prescott	85329	1879	
N.B.		1879	
Isabella		1885	
Surprise		1888	
Liberty		1895	
Santa Rosa		1895	
Kate & Anna		1902	
J. M. Colman		1905	X
Comet		1911	X
Cuba		1923	X
Watson A West		1923	X
W.T. Co. No. 3		1935	
SANTA BARBARA ISLAND			
Ship Name	**Official Number**	**Year**	**Wreckage Found**
Dante Alighieri II	236704	1938	X

Source: Morris and Lima 1996.

Table 3.9-2. Summary of Recent NAS Point Mugu Cultural Resource Studies

Reference	Type of Study	Associated Site
Prehistoric Resources		
Schwartz 1992	Inventory and National Register Evaluation	CA-VEN-187/256
Martz et al. 1995	Paleoenvironmental and Cultural Ecology Study (Cultural Resource Management Study)	CA-VEN-11* CA-VEN-26* CA-VEN-110*
ACOE 1995	Curation Assessment (Cultural Resource Management Study)	NAS Point Mugu
Historic Resources		
Swanson 1984	Historical Overview	Spanish occupation through WW II
Mikesell 1994	Inventory and National Register Evaluation	Building 5-2
Mikesell 1995a	Inventory and National Register Evaluation	Building 2-8 Building 6-1 Building 75
Mikesell 1995b	Inventory and National Register Evaluation	Building 5-3 Building 7010 Building 7011 Building 7012 Building 7013
Mikesell 1996	Inventory and National Register Evaluation	Building 55
Schaefer 1996	Inventory and National Register Evaluation	CA-VEN-1239
Newland & Van Wormer 1996	Historical Overview	WW II era
JRP 1997	Inventory and National Register Evaluation	Buildings 865-878
Wee & Byrd 1997	Historical Overview	Cold War era
JRP 1998	Inventory and National Register Evaluation	All structures

*Onshore sites located adjacent to NAS Point Mugu.

3.9.3.2 Archaeological Resources

As part of the archaeological resources assessment of NAS Point Mugu, two inventories and National Register evaluations were conducted (Schwartz 1992; Schaefer 1996). In addition, a cultural resource management study was conducted to synthesize existing ethnographic, historic, and environmental data to produce a cultural ecology of Mugu Lagoon (Martz et al. 1995).

A - Prehistoric Archaeological Resources

Site CA-VEN-187/256 is a prehistoric site recorded on the east end of Runway 27. A 1968 backhoe excavation revealed the presence of human remains; however, no official investigation was conducted and no report was produced. A 1992 surface survey of the area found no evidence of the site (Schwartz 1992). Today the site CA-VEN-187/256 is capped with a fill deposit; however, the presence of human burials from the 1968 backhoe excavation suggests the possibility of a buried deposit. Testing in 1997 (NAWS Point Mugu 1998g) confirmed that the site is primarily buried. A formal determination of eligibility of VEN-187/256 has not been completed at this time.

The presence of two known villages (*Mu'wu* [CA-VEN-11] and *Simo'mo* [CA-VEN-24 and -26]), a cemetery, and a midden site (CA-VEN-110) along Calleguas Creek, adjacent to NAS Point Mugu but outside of Navy lands, suggest that Mugu Lagoon supported a large prehistoric complex (Martz et al. 1995).

B - Historic Archaeological Resources

Historic site CA-VEN-1239 is an early 20th century fishing compound. The site is located on the sand spit on the southern edge of Mugu Lagoon and was investigated as part of an inventory and a National Register evaluation for a seawall repair project (Schaefer 1996). Data recovery investigations were conducted to mitigate impacts to a level of no adverse effects in compliance with Section 106 of the National Historic Preservation Act (NHPA), as amended (§ 106, 16 U.S.C. 470 et seq.). Final results of Schaefer's investigation are still pending.

C - Underwater Resources

Submerged lands off Point Mugu include the area that extends to the mean high-tide line. Records do not indicate the presence of any underwater cultural resources within the immediate subsurface tidal zone off Point Mugu.

3.9.3.3 Architectural Resources

Six inventories and National Register evaluation projects and three historical overviews were conducted for NAS Point Mugu. These studies resulted in the evaluation of all World War II- and Cold War-era buildings (Mikesell 1994, 1995a,b, and 1996; JRP 1997 and 1998), and historical overviews of the Spanish occupation through the World War II-era (Swanson 1984; Newland and Van Wormer 1996) and the Cold War era (Wee and Byrd 1997).

The inventories and evaluations were for Building 5-2 (Mikesell 1994); Buildings 2-8, 6-1, and 75 (Mikesell 1995a); Buildings 5-3, 7010, 7011, 7012, and 7013 (Mikesell 1995b); and Building 55 (Mikesell 1996). Only Building 55 was determined eligible for inclusion in the National Register. The building relates to the Cold War context of Navy guided missile testing and evaluation, and is an exceptionally significant example of launching structure design (Mikesell 1996). Recent inventories of Cold War structures have identified six additional facilities that meet the criteria for National Register eligibility: Bravo Launch Complex (formerly known as the Baker Launch Complex) (Buildings 727, 728, and 729), ground support (Buildings 354 and 354A), Buildings 97 and 98, Buildings 375 and 390, and headquarters for testing (Building 36).

3.9.3.4 Traditional Resources and Native American Issues

Native American concerns regarding Point Mugu are currently being addressed through the ethnohistoric study being conducted by Dr. John Johnson of the Santa Barbara Museum of Natural History. This ongoing investigation has identified some direct lineal descendants from the *Mu'wu* village site. In compliance with the Native American Graves Protection and Repatriation Act (NAGPRA) and EO 13084 (*Consultation and Coordination with Indian Tribal Governments*), and as part of the NAS Point Mugu Historic and Archaeological Resources Protection (HARP) Plan, NAS Point Mugu will hold consultations with recognized tribes and/or direct lineal descendants as appropriate. Future consultation regarding Native American issues could include both the identified direct lineal descendants and members of the federally recognized Santa Ynez Band of Mission Indians. Additional coordination can be made with the Oak Brook Park Interpretive Center.

3.9.4 San Nicolas Island

3.9.4.1 Background

The Environmental Project Office supplied information on San Nicolas Island's cultural resources. Previous research conducted on San Nicolas Island's cultural resources include inventories, evaluations, data recovery or mitigation programs, management studies, and research-oriented investigations. Over 530 prehistoric archaeological sites and 48 historic sites have been recorded on the island (Reinman and Lauter 1984; Schwartz and Rossbach 1993; Schwartz 1995).

Archaeological investigations on San Nicolas Island began approximately 100 years ago and have continued to the present. Early collectors include Paul Schumacher, Leon de Cessac, and Stephen Bowers who were responsible for the removal of countless San Nicolas Island specimens for museum displays during the late 1870s through the early 1900s. The first scientific exploration of the island occurred during the 1930s when Malcom Rogers recorded more than 30 sites and conducted several test excavations in a project sponsored by the San Diego Museum of Man (Schwartz 1993). During the 1950s, the University of California, Los Angeles (UCLA) initiated a program in which scientific methods of research were applied to the archaeology of San Nicolas Island. The Environmental Project Office has continued to explore the scientific research objectives and has supported numerous systematic studies of the island resulting in the development of a comprehensive research design. Recent investigations have included three inventories, four National Register evaluations, eight prehistoric research investigations, three historic research investigations, and one cultural resource management study (Table 3.9-3). Based on this research, San Nicolas Island is in the process of being nominated as a Historic District to the National Register due to its numerous prehistoric archaeological sites of intense research value and significant historic interest.

3.9.4.2 Archaeological Resources

Cultural resource sites on San Nicolas Island were of great importance to the now extinct Native American group known as the *Nicoleño* (Kroeber 1925). Most prehistoric sites discovered on the island are large stabilized dune sites in which the debris and artifacts exemplify the early inhabitants' reliance on marine resources. Referred to as "shell middens," these prehistoric sites contain an abundance of fish, marine mammal, and shellfish remains and the tools and utilitarian objects that were used to obtain and prepare the marine resources. Over 530 prehistoric sites, dating from 7,000 years ago, have been recorded for San Nicolas Island. The majority are concentrated within the island's coastal zone, where these marine resources were easily obtained (Schwartz and Martz 1992).

Several of the more well known cultural resource sites on San Nicolas Island include whale-bone houses, carved rock art (petroglyphs) and rock art paintings (pictographs) in the Cave of the Whales, and a prehistoric water-collection site in which the natural spring area was channeled into a catch basin by the prehistoric inhabitants. Also of renown is the story of the "Lone Woman" of San Nicolas Island, that describes how a single surviving woman was found on the island 18 years after all other natives had been removed to the mainland.

Table 3.9-3. Summary of Recent San Nicolas Island Cultural Resource Studies

Reference	Type of Study	Associated Site
Prehistoric Resource Studies		
Reinman & Lauter 1984	Inventory and National Register Eligibility	All San Nicolas Island sites
Schwartz 1991	Research-Oriented Investigation	CA-SNI-11 CA-SNI-14 CA-SNI-15 CA-SNI-16 CA-SNI-18 CA-SNI-38 CA-SNI-40 CA-SNI-51 CA-SNI-51 CA-SNI-56 CA-SNI-79
Howard & Raab 1993	Research-Oriented Investigation	Shell beads from San Nicolas Island
Mitchell 1993	Research-Oriented Investigation	CA-SNI-351
Rogers 1993	Research-Oriented Investigation	1930s San Nicolas Island excavations
Schwartz 1993a	Research-Oriented Investigation	1930 Rogers excavation
Schwartz 1993b	Inventory	26 Chinese abalone processing sites
Schwartz 1993c	Research-Oriented Investigation	Historic overview of San Nicolas Island
Schwartz & Martz 1993	Research-Oriented Investigation	CA-SNI-38 CA-SNI-161 CA-SNI-168 CA-SNI-351
Vellanoweth 1993	Research-Oriented Investigation	CA-SNI-161
Rosenthal & Padon 1994	National Register Eligibility; Archaeological Testing	CA-SNI-18
Schwartz 1994	Research-Oriented Investigation	Historic occupation of San Nicolas Island
Alschul & Grenda 1995	Research-Oriented Investigation	Research design overview
Rosenthal & Padon 1995	National Register Eligibility; Archaeological Testing	CA-SNI-168
Thomas 1995	Research-Oriented Investigation	Paleobotanical research
USACE, St. Louis District 1995	Curation Needs Assessment (Cultural Resource Management Study)	NAS Point Mugu and San Nicolas Island
Historic Resource Studies		
Swanson 1994	Research-Oriented Investigation	Sheep ranching at San Nicolas Island
Mikesell 1995	Inventory and National Register Eligibility	Building 74
Lima 1995	Research-Oriented Investigation	Navigation aids at San Nicolas Island
JRP 1997	Inventory	World War II Historic Context of San Nicolas Island
Swanson 1997	Research-Oriented Investigation	Fishing on San Nicolas Island
Wee & Byrd 1997	Inventory	Cold War Context of NAS Point Mugu and San Nicolas Island
JRP (in preparation)	Evaluation	World War II and Cold War structures

A number of cultural resources investigations have been conducted on San Nicolas Island, although most of these have been research-oriented studies (see Table 3.9-3). These studies have included a complete inventory of prehistoric sites; an inventory of Chinese abalone sites; testing of prehistoric sites; analysis of shell beads; paleobotanical research into plant processing; analysis of human burials; a curation assessment of existing collections; historic context descriptions of fishing, ranching, and military activities; and architectural inventories.

A - Prehistoric Archaeological Resources

Survey and testing investigations on San Nicolas Island include a survey of the entire island (Reinman and Lauter 1984) and eligibility testing at a number of sites (see Table 3.9-3). However, previous prehistoric archaeological investigations conducted on San Nicolas Island have focused on only a small portion of the more than 530 sites on the island. Sites considered eligible for inclusion on the National Register include CA-SNI 11, CA-SNI-16, CA-SNI-18, CA-SNI-38, CA-SNI-40, CA-SNI-51, CA-SNI-56, CA-SNI-79, CA-SNI-160, CA-SNI-168, CA-SNI-169, CA-SNI-351, and CA-SNI-144. The National Register status of the numerous undescribed sites on San Nicolas Island is unknown at present; however, the entire island is in the process of being nominated as the San Nicolas Island Historic District. Once a National Register eligibility evaluation is completed, all sites within the Island Historic District would be afforded protection and preservation subject to the NHPA.

B - Historic Archaeological Resources

From the mid-1850s through 1943, San Nicolas Island became an important fishing and ranching center. Evidence of early sheep ranching, fishing camps, and abalone collecting stations is present in areas scattered throughout the island. A recent investigation provides an overview of historic sites on San Nicolas Island and includes descriptions of the early (late 1880s) sheep ranching activities and discusses possible site locations (Schwartz and Rossback 1993). Evidence relating to past sheep ranching activities exists on the terraces above NAVFAC Beach where remnants of wooden structures, a root cellar, and portions of old fence lines can be found.

A preliminary survey of Chinese abalone collecting sites has identified approximately 26 sites at several locations on the northwest and southern coastline of the island (Schwartz 1995). Some of these sites retain evidence of circular rock-walled structures, isolated hearths with rectangular stone alignments, and other areas paved with sandstone slabs speculated to have been used in conjunction with early Chinese abalone processing camps. Several instances of Chinese ceramics and vessels have been reported from San Nicolas Island giving credence to the theory of Chinese abalone exploitation activities on the island. To date, evaluation of these sites for inclusion in the National Register has not been undertaken. Evidence of early Euro-American fishing camps exist on the island along the northwestern and southeastern tips (Schwartz 1993). An historic overview of the San Nicolas Island fishing industry (Swanson 1997) from the 1500s through the mid-20th century (recently completed) will provide the historic context to evaluate fishing sites on the island.

C - Underwater Resources

Underwater prehistoric sites and/or isolated objects may be located in the waters around San Nicolas Island, but none is recorded officially. It is known from ethnographic literature that prehistoric peoples navigated the channel and traveled between the mainland and the Channel Islands, including San Nicolas Island (Hudson et al. 1977). Treacherous waters and changing weather conditions most likely resulted in disaster for some of these prehistoric voyages, thus, items aboard their plank canoes may have been lost to the ocean currents. Precise locations of these isolated artifacts from failed canoe trips are unknown because no systematic underwater survey has been undertaken to date. Occasionally, isolated prehistoric artifacts, including stone mortars and bowls, are reported by divers, but these events are relatively rare. Sea levels have risen substantially during the past 18,000 years and it has been postulated that site locations beyond the existing shoreline may now be covered with water (Bloom 1983). An investigation is currently in progress to study this hypothesis by assuming a settlement similar to that known for the island would be found in submerged areas surrounding the island. The preliminary results of this study suggest that the areas most likely to contain submerged archaeological sites are within 1,640 feet (500 m) of the rocky shore habitat and near a water source. Given the shoreline at 8,500 years ago, these resources would most likely occur on the western end of the island at less than 1 NM (1.9 km) from the present shore. The predictive model, although based on the best information to date, still must be tested through a sample survey program.

Underwater historic resources related to shipwrecks are known to occur in a number of areas within the waters surrounding San Nicolas Island (see Table 3.9-1). Twenty shipwrecks are known to have been lost or sunk off the coast of San Nicolas Island. A predictive model based on the locations of lost ships and ships found within the Sea Range constructed for this EIS/OEIS suggests that ships are most likely to be found less than 0.5 NM (0.9 km) from shore in relatively shallow water (less than 33 feet [10 m]) in depth. Shipwrecks are most likely to occur at harbors and hazards on the western and eastern ends of San Nicolas Island.

3.9.4.3 Architectural Resources

San Nicolas Island contains a number of buildings and structures related to the various types of military activities that previously took place on the island. Recent investigations have inventoried those facilities and made preliminary eligibility determinations based on National Register criteria. Building 74 was evaluated and is considered to be ineligible for listing on the National Register (Mikesell 1995). Investigations into the historic context of World War II-era and Cold War-era facilities on San Nicolas Island (JRP 1997; Wee and Byrd 1997) and examinations of these structures have recommended that one facility be considered eligible, the Permanent Radar Tower (Building 138).

3.9.4.4 Traditional Resources and Native American Issues

Although numerous cultural items have been collected from San Nicolas Island, no cultural affiliation can be assigned with certainty. No federally recognized Native American tribes or groups have been identified, and there is not clear information as to who the prehistoric inhabitants of the island were. In previous studies, they have been described as *Gabrielino*; however, an ethnolinguistic study (Munro 1994) on the few recorded words spoken by the Lone Women of San Nicolas Island suggests that the *Nicoleño* language may be older than *Gabrielino* and the island may have been settled prior to the establishment of *Gabrielino* speakers on the coast. An on-going ethnohistoric study by Dr. John Johnson of the Santa Barbara Natural History Museum has failed to locate any living descendants from the island. The Environmental Project Office has recently attempted to involve local Native Americans in San Nicolas Island cultural resource work by inviting members to take part in projects and in consultation relating to the development of the San Nicolas Island HARP Plan. In addition, NAGPRA studies are in progress for San Nicolas Island archaeological collections. Upon completion, the final version of the NAGPRA inventory will be submitted to the National Park Service per NAGPRA regulations. All remains discussed in this inventory are classified as “culturally unaffiliated.”

3.10 LAND USE

3.10.1 Introduction

3.10.1.1 Definition of Resource

Land use classifications typically fall into two major categories: naturally occurring land cover and human-modified land use. Natural land cover includes areas of unaltered vegetation, rangeland, and other open or undeveloped areas. Human-modified land use classifications include residential, commercial, industrial, transportation, communications and utilities, agricultural, institutional, recreational, and other developed use areas. Land use is regulated by management plans, policies, regulations, and ordinances (i.e., zoning) that determine the type and extent of land use allowable in specific areas (both under natural land cover and human modified) and that also protect specially designated or environmentally sensitive areas. Examples of land use in an ocean environment include offshore activities such as shipping, military uses, commercial and recreational fishing, tourism, and other recreational activities. Types of offshore activities suitable for given areas are often addressed in local coastal management programs which have been established to comply with the Coastal Zone Management Act (CZMA) of 1972, as amended (16 C.F.R. § 1451 et seq.).

3.10.1.2 Regional Setting

The Point Mugu Sea Range has many unique marine and terrestrial features suitable to a wide variety of land uses. Military use of the Sea Range (e.g., weapons testing and evaluation) takes advantage of the Sea Range's rare combination of physical features: curvature of the SCB, high elevations along the mainland coast (Laguna Peak) and offshore (San Nicolas Island and northern Channel Islands) for radar and telemetry use, and the remote location of San Nicolas Island to support Navy activities relatively far away from areas that are heavily used by the general public. The Sea Range also has features important to commercial land use: productive fishing grounds for commercial fishing and sport fishing enterprises and a central location serving as an important transportation link for ocean and aircraft traffic between southern California and areas to the north and west of California. Finally, the Sea Range has many important elements beneficial to recreational land use: relatively mild climate and water temperatures for year-round recreational boating, marine mammal migration routes conducive to sight-seeing excursions, and proximity of the Channel Islands for recreational enjoyment. In general, most recreational and commercial activities occur within relatively close proximity of shorelines (either near the mainland or the islands). Navy activities occur in the open ocean areas as well as at support locations such as NAS Point Mugu and San Nicolas Island.

3.10.1.3 Region of Influence

The following discussion focuses on land use policies and zoning regulations established by regulating authorities, including the National Park Service (NPS), National Oceanic and Atmospheric Administration (NOAA), Department of the Navy, Ventura County, and City of Oxnard. For the purposes of this EIS/OEIS, the land use region of influence (ROI) includes: the Sea Range; the boundaries of NAS Point Mugu, Ventura County, and neighboring areas; and San Nicolas, San Miguel, Santa Rosa, and Santa Cruz islands.

3.10.2 Point Mugu Sea Range

3.10.2.1 Overview

Located in the Pacific Ocean approximately 50 miles (80 km) northwest of Los Angeles, the Point Mugu Sea Range is a heavily instrumented military operations and testing area operated by the Navy. The Sea Range is used for controlled air-, surface-, and subsurface-launched missile test operations; aircraft tests; and fleet exercises involving aircraft, surface ships, submarines, and various targets. Navy-owned San Nicolas Island plays an important role in supporting the NAWCWPNS mission.

3.10.2.2 Military Activities

A - Airspace Use

Areas of concentrated and regular military training tend to be located away from heavily used offshore areas to ensure public safety. Areas most frequently used for aircraft operations and missile activities are Range Areas 4A/B and 5A/B (refer to Figures 3.0-19 and 3.0-20, respectively). These range areas are part of the Outer Sea Range; they are located west (i.e., seaward) of the imaginary line between San Nicolas and San Miguel islands. (This line is approximately 45 NM [83 km] southwest of NAS Point Mugu.) A more detailed discussion of military airspace use is presented in Section 3.11, Traffic (refer to Section 3.11.2.1-B).

B - Ocean Use

The Sea Range is also used by Navy vessels for ocean-related activities. Common types of vessels on the Sea Range include range support boats, larger ships (cruisers, destroyers, and aircraft carriers), and surface targets. A more detailed discussion of military vessel activity is presented in Section 3.11, Traffic (refer to Section 3.11.2.1-A).

3.10.2.3 Commercial Activities

Non-military activities can occur in all areas within the Sea Range. When Navy activities require exclusive use of an area, NAWCWPNS issues Notices to Airmen (NOTAMs) and Notices to Mariners (NOTMARs) 24 hours in advance requesting non-participants to remain clear of the area. Despite these procedures, non-participants occasionally enter areas of operations. In these cases, NP-3D aircraft or Navy vessels contact these vessels directly on the radio to ensure that areas are clear prior to commencing planned operations. A more detailed discussion of safety procedures on the Sea Range is presented in Section 3.14, Public Safety.

A - Shipping

Maritime traffic routes are typically established by the U.S. Coast Guard (USCG). The major purpose of these routes (often referred to as *shipping lanes*) is to allow access to and from major ports for large commercial marine vessels while allowing an adequate separation scheme for other types of offshore activities. A detailed source of information for commercial ship traffic volumes is the Navy-maintained Historical Temporal Shipping (HITS) database as updated in 1992 and 1993 (U.S. Navy 1993). The HITS data provide ship densities tabulated by geographic location and time of year. The shipping densities represent the average number of ships per 1,000 NM^2 (3,430 km^2) centered at a specific sampling point. The vessel categories included are supertankers, merchant vessels, tankers, and large tankers. The fishing vessel traffic, a minor component, was not considered in this analysis. Although some high-traffic areas (e.g., the area between Point Mugu and Anacapa Island) are not included in the database, the geographic study area includes most of the Sea Range.

A major shipping lane transits the Santa Barbara Channel and passes through a portion of the Sea Range east of the channel (Figure 3.10-1). This route is the most heavily traveled traffic lane used by commercial cargo vessels in the waters off southern California. Between three and eight transits per day require range safety consideration (NAWCWPNS Point Mugu 1996m). The Traffic Separation Scheme (TSS) established by the USCG is aligned just north of, and roughly parallel with, the northern Channel Islands. The TSS is used by commercial vessels traveling between northern Pacific (e.g., Seattle, San Francisco, and Vancouver) and southern California ports, as well as by traffic destined for remote ports such as Panama Canal or Asia. The majority of oil tankers passing through the area voluntarily travel 50 NM (93 km) offshore (USCG 1997). However, those tankers heading south to the Port of Los Angeles use a route which lies further landward. The USCG issues a NOTMAR which notifies passing vessels of the presence of military activities in the area. A more detailed description of commercial shipping is presented in Section 3.11, Traffic (refer to Section 3.11.2.1-B).

B - Commercial Fisheries

Commercial fishing, diving, and trapping occur at various locations off the coast of southern California, including portions of the Sea Range and the Channel Islands, which constitutes an extremely productive commercial fishing area. The nearshore waters along the coast from Ventura to Santa Barbara and the waters just off the Channel Islands contain giant kelp beds which provide habitats for numerous species. The majority of fish are caught within these areas. Fishery seasons are established and regulated by the CDFG. A detailed description of fish species is presented in Section 3.6, Fish and Sea Turtles; the economic elements of commercial fishing are discussed in Section 3.12, Socioeconomics.

The commercial harvest of kelp and other marine vegetation near the coastline is becoming a more established industry in southern California. Live fish trapping (e.g., rockfish, sheephead, and sea bass) occurs primarily in the shallower waters near the coastlines of the Channel Islands. Hook and line fisheries are not allowed within the state waters of California (3 NM [5.6 km]) offshore; the main species caught in hook and line fisheries is rockfish. Lobsters are fished in coastal waters since they are typically most abundant in rocky areas with kelp in depths of 100 feet (30 m) or less. The waters off the majority of the Channel Islands are conducive to this habitat since they generally have an offshore shelf which extends gradually into deeper waters. Commercial drift gill netting for pelagic shark and swordfish occurs in the open waters throughout portions of the Sea Range and Channel Islands. This fishery, however, is only a small portion of the total industry in southern California.

Specific fisheries in the nearshore and offshore waters of San Nicolas Island are discussed in greater detail later in this section (see Section 3.10.4.2).

C - Oil and Gas Production

Federal leasing of offshore lands for oil and gas production began in 1963, following 10 years of state leasing of offshore areas. Numerous oil platforms and exploratory drilling rigs are located within the Santa Barbara Channel between Oxnard and Gaviota, both in state waters (out to 3 NM [5.6 km]) and federal waters (beyond 3 NM [5.6 km]). Several of these rigs and platforms (including associated onshore facilities) are in the process of being decommissioned.

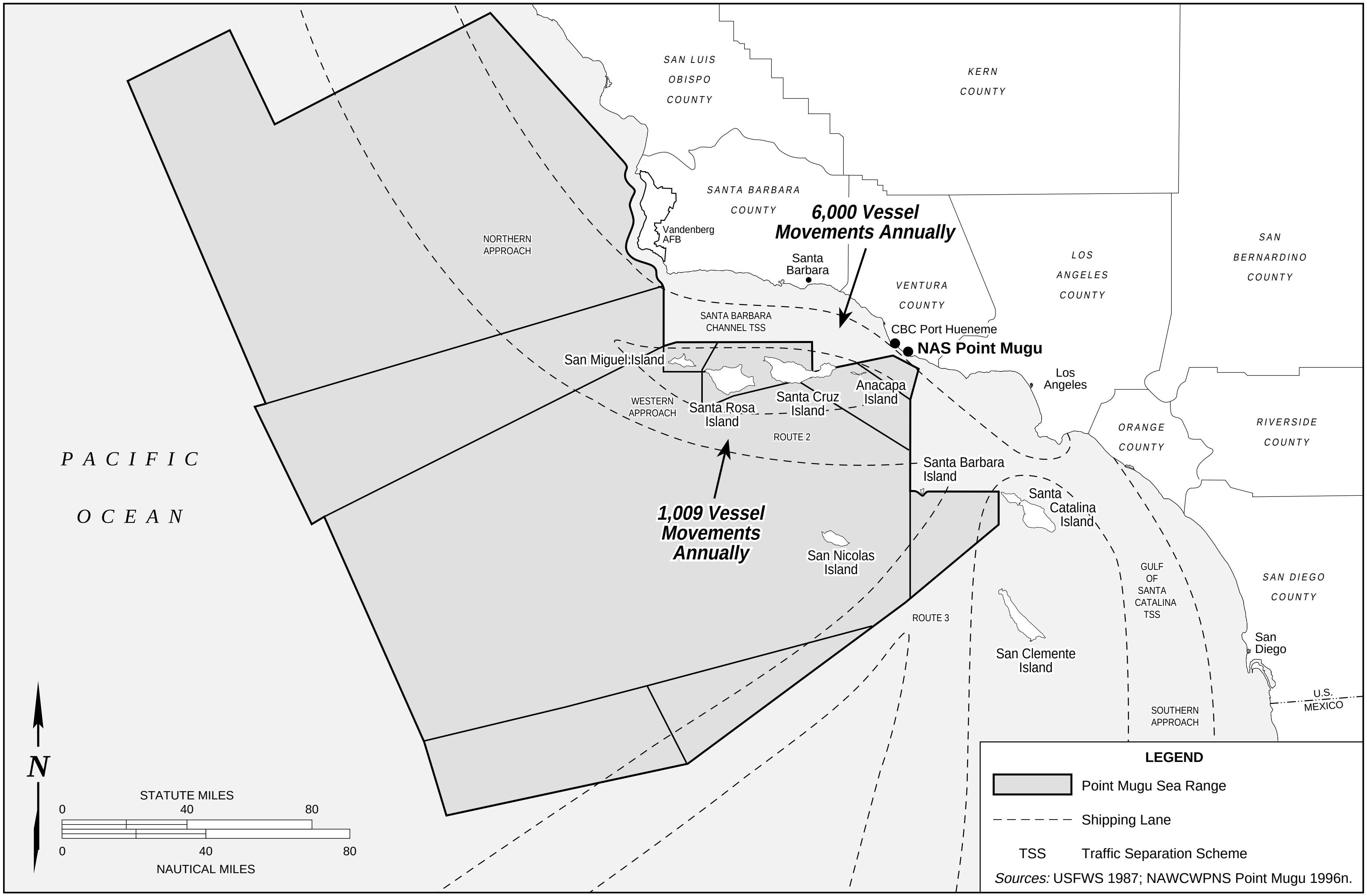


Figure 3.10-1
Annual Shipping Traffic within the Point Mugu Sea Range

3.10.2.4 Recreational Activities

Recreational activities occur primarily in nearshore areas of the Sea Range, particularly along the mainland and around the Channel Islands. Examples of common offshore recreational activities include sport fishing, sailing, boating, and swimming. In addition, the coastal and offshore marine environments are ideal locations for tourism. Tourist-related activities include sightseeing, whale watching, sport fishing, pleasure boating, and diving.

Recreational fishing involves hook-and-line fishing from piers and docks, jetties and breakwaters, beaches and banks, private or rental boats, and commercial passenger fishing vessels. Recreational fishing also includes activities such as spear and net fishing. Recreational fisheries in southern California access both nearshore and offshore areas, targeting both bottom fish and mid-water fish species.

Southern California is a leading recreational fishing area along the west coast. Weather and sea conditions allow for year-round fishing activity. The coastlines around the Channel Islands are popular sport fishing areas; although the majority of kelp beds are within 1 NM (2 km) of shore, some fishing areas extend as far as 5 NM (9 km) from shore and include lingcod grounds to the west of San Miguel Island, broadbill swordfish and marlin in waters south of Santa Cruz Island, and kelp beds off the coast of San Nicolas Island. Commercial passenger fishing vessels frequently offer 1-day sport fishing excursions either from the Ventura or Santa Barbara harbor. Types of fish landed on commercial passenger fishing vessels include kelp bass, mackerel, sheephead, halfmoon, and whitefish.

Recreational activities in the Sea Range other than rod and reel fishing include scuba diving for spiny lobster, scallop, and abalone and spear fishing for rockfish, sheephead, and swordfish. These activities also occur primarily in shallow waters near the coastline.

Offshore recreational activities are generally allowed off all the islands, including San Nicolas Island, during periods of limited military activity. Restrictions are enacted to clear the appropriate range areas of non-participants before military operations are conducted.

3.10.2.5 Channel Islands National Park and National Marine Sanctuary

<u>A - Boundaries</u>

The four islands comprising the northern chain of the Channel Islands together with Santa Barbara Island form the 250,000 acre (101,180 ha) CINP. Park boundaries extend 1 NM (1.9 km) beyond the coast of each island (including rocks and islets). The NPS has management responsibility for Anacapa, Santa Barbara, Santa Rosa, and San Miguel islands, as well as management responsibility for a portion of Santa Cruz Island. However, over 30 other local, state, and federal agencies also have jurisdiction for lands, resources, or activities which impact the park. Several of the principal agencies include the Navy and local, state, and Native American agencies (NPS 1991). NOAA has jurisdiction over the CINMS which was established in 1980 to protect significant marine resources off the Channel Islands. The CINMS extends from the high water mark to 6 NM (11.1 km) offshore of Anacapa, Santa Cruz, Santa Rosa, San Miguel, and Santa Barbara islands.

<u>B - Management</u>

In order to provide an orderly plan of management, the islands within the CINP are zoned into separate management areas. Zoning classifications are based on NPS policies and guidelines, as well as the intent of the park, to ensure that areas are managed based on the inherent nature of their resources and on their best use. Offshore areas of the CINP are classified into a Special Use Zone, which is briefly described below.

The Special Use Zone includes lands and waters within the park boundary not owned or managed by NPS (i.e., sites managed by NPS but reserved by the USCG for navigational aids). Portions of the waters and submerged lands from the mean high-tide line to 1 NM off the islands have been designated by the State of California as ecological reserves. Two areas around Anacapa Island and one area around Santa Cruz Island are designated ecological reserves. Within these areas, recreational and commercial fish takes are not allowed. Owned by California but lying within the park boundary, submerged lands and marine resources are under the jurisdiction of the state. The State Lands Commission has primary responsibility for managing this area, although various other agencies, such as the CDFG, have responsibility for specific resources. The waters surrounding the islands have been given the designation of Areas of Special Biological Significance in recognition of the high quality of the marine ecosystems and to ensure their protection. Further, the entire water area within the park boundary is also included within the CINMS. The sanctuary's regulations, which primarily address development and related activities, are enforced by the NPS.

Recreational activities include diving, snorkeling, sailing, and wildlife observation, particularly of marine mammals. An increasing number of visitors kayak in park waters, school groups use the resources of the park extensively, and numerous visitors hike the islands. Heaviest visitation is during the summer; however, winter visitation may also be high on the water because of whale-watching programs (NPS 1991).

The waters of the CINMS are heavily trafficked. An aerial survey of the sanctuary initiated by the NPS in 1981-1982 revealed that 78 percent of observed boats were within the boundaries of the CINP (NPS 1991). Less than one-third of the vessels in the sanctuary were engaged in commercial fishing or diving; almost two-thirds were recreational boats; and the remaining minimal percentage of vessels were freighters, tankers, Navy vessels, tugs, barges, kelp harvesters, tour boats, or patrol boats. The survey also revealed that nearly half of the observed boating activity occurred in waters off Santa Cruz Island.

3.10.3 Point Mugu

3.10.3.1 Overview

<u>A - Coastal Zone Management</u>

The California Coastal Commission (CCC) maintains jurisdiction over the coastal zone, which runs through NAS Point Mugu and the City of Port Hueneme (from the mean high-tide line to 3,000 feet [914 m] inland) and extends out to 3 NM (5.6 km) offshore. Coastal states are provided the authority to evaluate projects conducted, funded, or permitted by the federal government through the federal CZMA of 1972, as amended (16 C.F.R. § 1451 et seq.). Under the CZMA and California Coastal Act (CCA), any federal project or activity affecting the coastal zone must be consistent to the maximum extent practicable with the provisions of federally approved state coastal plans. The CCC enforces the regulations and guidelines of the CCA. In addition, Ventura County may review and comment in an advisory capacity to the CCC on federal activities that may affect the coastal zone, including changes in use of Mugu Lagoon (Ventura County 1994). The U.S. Army Corps of Engineers (USACE) is responsible for protection and development of water resources including navigation, flood control, energy production, water supply, and recreation. Therefore, the two major drainages to Point Mugu

(Calleguas Creek and Revolon Slough) are under USACE jurisdiction. In addition, USACE has jurisdiction of Mugu Lagoon and adjacent wetlands.

B - Air Installation Compatible Use Zones (AICUZ) Program

The DoD has established the AICUZ program to address noise, safety, and land use issues. The purpose of the AICUZ program is to prevent incompatible development in high noise exposure areas, to minimize public exposure to potential health and safety hazards associated with aircraft operations, and to protect the operational capability of the air installation. The AICUZ program establishes guidelines for noise levels and accident potential zones (APZs) and provides recommendations for land use planning and policies that affect military installations and surrounding communities.

The AICUZ program identifies land uses that would be compatible with certain noise levels, accident potential, and flight clearance requirements associated with military airfield operations. Community noise equivalent levels (CNELs), shown as noise contour lines on AICUZ maps (refer to Figure 3.3-2), help define land uses that are compatible with certain noise levels. Specific AICUZ issues at NAS Point Mugu are discussed later in this section. Additional considerations associated with AICUZ program noise contours are discussed in Section 3.3, Noise, and Section 3.14, Public Safety.

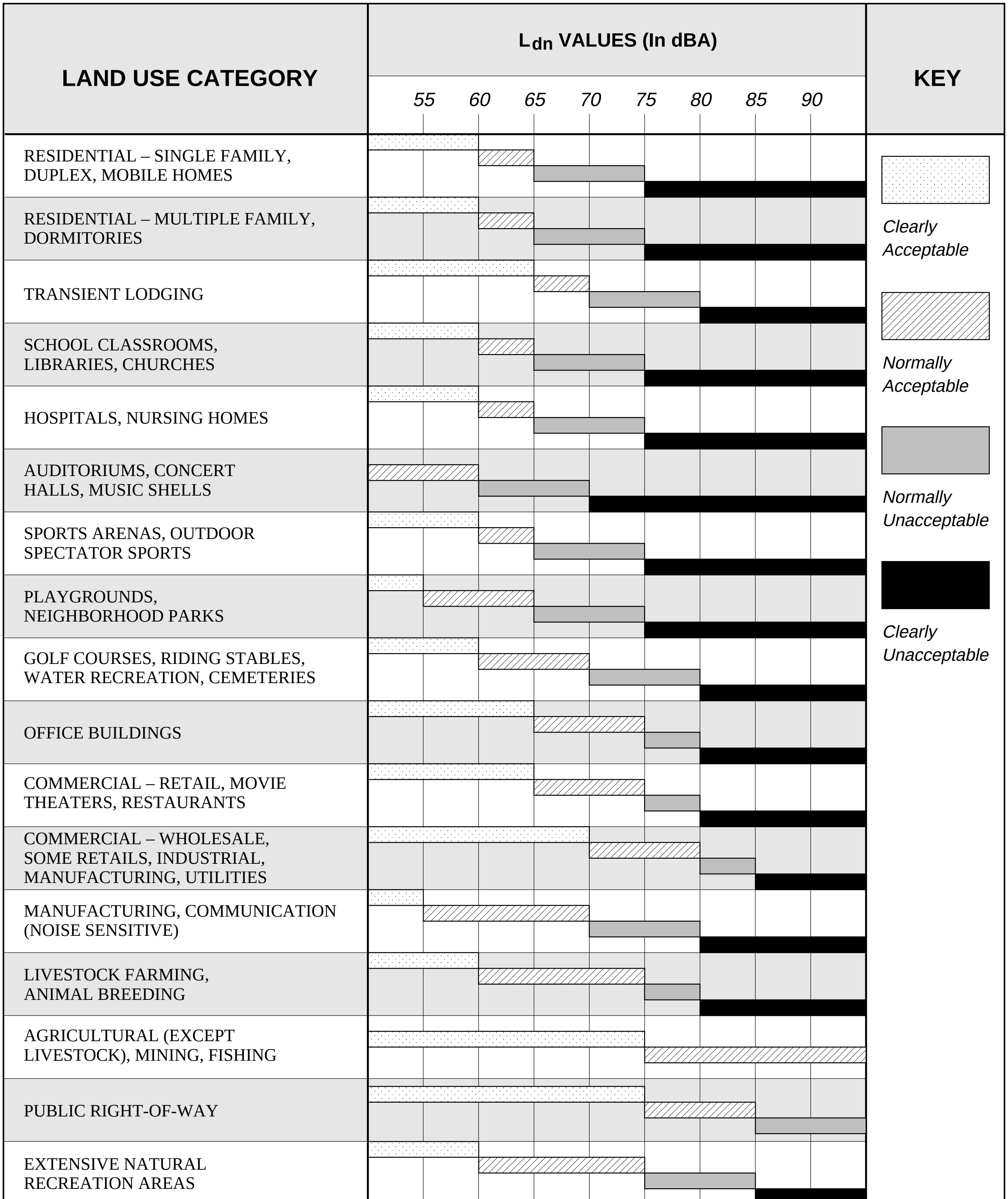
The U.S. Department of Housing and Urban Development (HUD) uses land use guidelines established by the Federal Interagency Committee on Noise (FICON) to determine acceptable levels of noise exposure for various land use categories (Figure 3.10-2). Land use activities most sensitive to ambient noise are residential, public services, commercial, and cultural and recreation. Residential land use is unacceptable in areas experiencing noise levels at or above 75 dB and is discouraged in areas exposed to noise levels between 65 and 75 dB (refer to Section 3.3, Noise, and Appendix D, Overview of Airborne and Underwater Acoustics).

Another land use compatibility issue associated with airfield operations is the proximity of structures to *imaginary surfaces*. An *imaginary surface* is the slope or angle at which an aircraft departs or arrives from an airfield. Imaginary surfaces are another way to describe clearances for air navigation. Federal Aviation Regulations specify a series of height restrictions based on imaginary surfaces surrounding an airport to prevent conflicts with aircraft approach and departure paths.

3.10.3.2 Regional Location and Land Use

A - Regional Location

NAS Point Mugu is located on the coast in Ventura County. Situated within an unincorporated area, the base is located near the cities of Camarillo, Oxnard, Port Hueneme, and Ventura. Predominant land use activities occurring in the area currently consist of row-crop agricultural production to the north and west and recreation (e.g., fishing, surfing, swimming, hiking, and camping) to the south and west in the Santa Barbara Channel and Santa Monica Mountains National Recreation Area in the east (Figure 3.10-3). Ventura County contains nine incorporated cities (San Buenaventura [Ventura], Santa Paula, Port Hueneme, Thousand Oaks, Simi Valley, Moorpark, Ojai, Fillmore, and Oxnard) which maintain their own planning policies; growth in the remaining unincorporated county areas is guided by Ventura County policies.



Source: U.S. Department of Housing and Urban Development 1991.

Figure 3.10-2
Recommended Land Use for L_{dn}-Based Noise Values

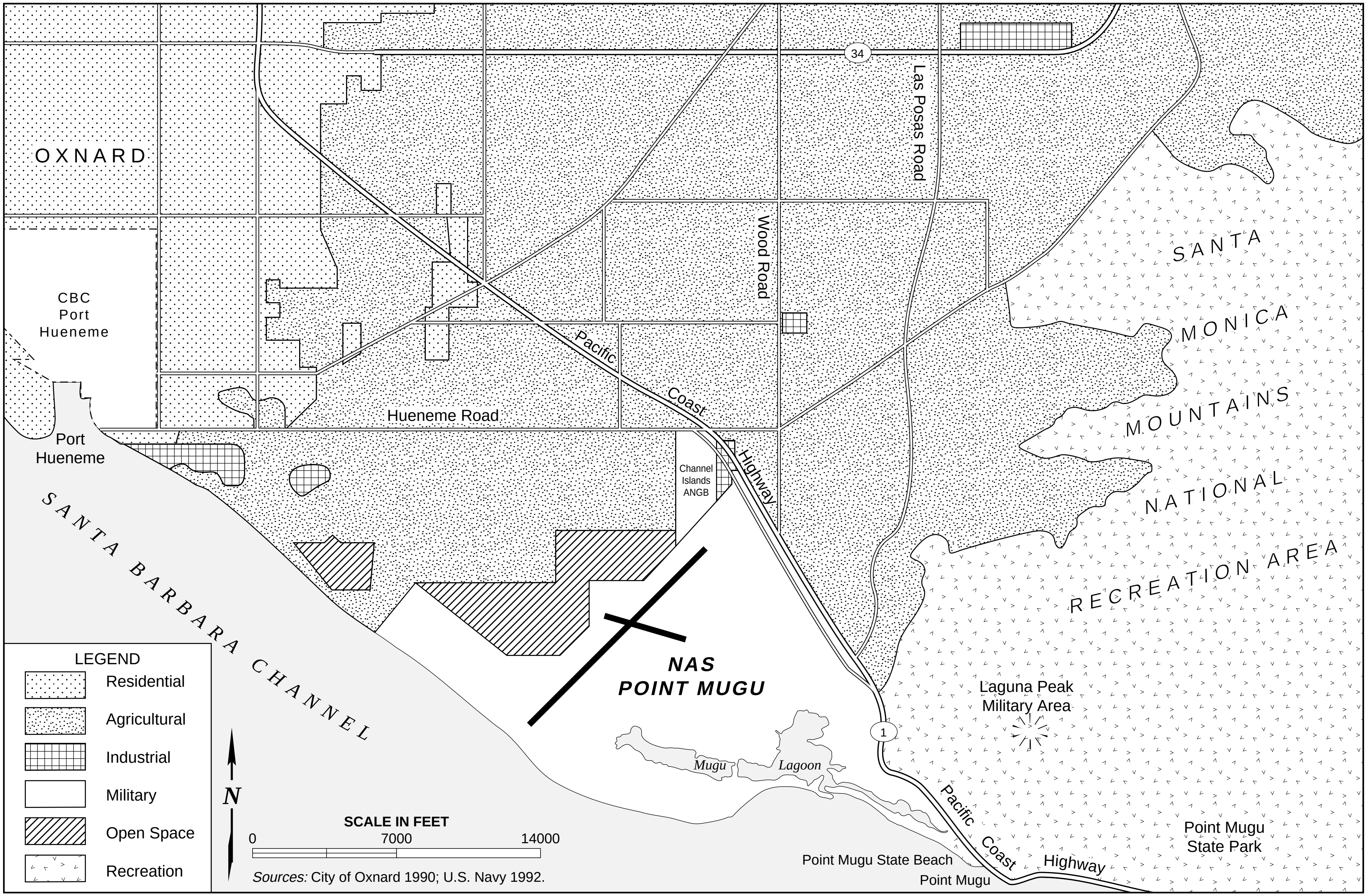


Figure 3.10-3
Existing Land Use Designations in the Vicinity of NAS Point Mugu

B - Local Land Use

General

The communities located nearest to NAS Point Mugu include Oxnard, approximately 6 miles (10 km) to the northwest, and Camarillo, 8 miles (13 km) to the northeast; the sphere of influence (SOI) for Oxnard abuts the western border of NAS Point Mugu. The SOI is defined as the "probable ultimate city boundary" and is required by County Government Code Section 56425. The majority of the area adjacent to the base is unincorporated and under the jurisdiction of Ventura County. The land east of the main base includes a portion of the Santa Monica Mountains National Recreation Area and is managed by the NPS. Point Mugu State Park and Beach are also located east of the main base.

In general, areas to the east, northeast, and north of Point Mugu are zoned for agricultural use. Land use in these areas also includes rural residential development and industrial facilities associated with agricultural operations. Agricultural preserve contracts and greenbelt agreements have been established with Ventura County to prevent urban expansion in this portion of the county (Ventura County 1994). The Ormond Beach area located west of the base is zoned for industrial use and includes open space and industrial land use. The area directly west of the main base, encompassing approximately 800 acres (324 ha), includes the Ventura County Game Reserve and the Point Mugu Game Reserve, two private clubs which support duck hunting. Large expanses of area to the east and northeast are designated as recreational and open space in the Santa Monica Mountains National Recreation Area and Point Mugu State Park. This area, contained within the Santa Monica Mountains, was classified as a special overlay zone due to its significant environmentally sensitive habitat areas (Ventura County 1994). Eastern Mugu Lagoon is incorporated as part of the Santa Monica Mountains National Recreation Area. The nearest major concentrations of residential and commercial land use are located approximately 2 miles (3 km) to the north.

Channel Islands ANGB

Channel Islands Air National Guard Base (ANGB) comprises 206 acres (83 ha) on the northwest portion of NAS Point Mugu. It can be generalized into the following land use categories: aircraft operations, maintenance, support (security and supply functions), administrative headquarters, and open space.

City of Oxnard

The City of Oxnard and its SOI comprises 19,360 acres (7,835 ha), approximately 61 percent of which are developed (City of Oxnard 1989). The SOI extends to the Santa Clara River to the north, Walnut Avenue/Beardsley Wash to the east, the Pacific Ocean to the west, and NAS Point Mugu and Channel Islands ANGB to the south. Land use policy in the city is structured to preserve and maintain the city's three primary resource areas: beaches and coastline, inland resource areas, and agricultural areas. Most of the city's undeveloped land is dedicated to agricultural production.

Regional Land Use Incompatibilities

No offbase structures currently penetrate imaginary surfaces (see discussion in Section 3.10.3.3-B). The cities of Oxnard, Port Hueneme, Camarillo, and Ventura, as well as the Oxnard and Camarillo airports, are located below the outer horizontal surface (U.S. Navy 1992). However, as a result of noise- and safety-related issues, approximately 163 acres (66 ha) surrounding the NAS Point Mugu airfield complex have been identified by the AICUZ program as developed with incompatible land use (Figure 3.10-4).

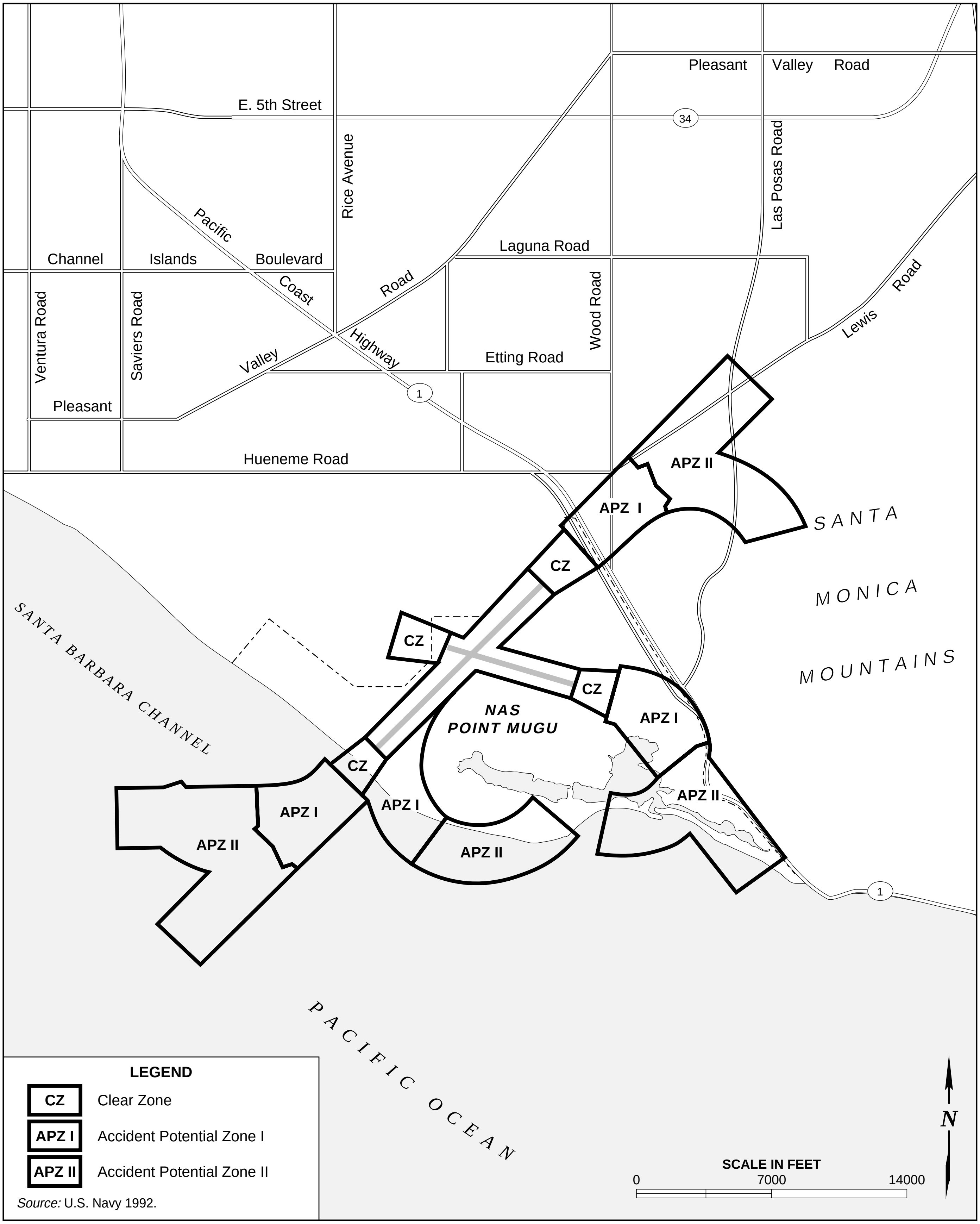


Figure 3.10-4
Accident Potential Zones at NAS Point Mugu

The majority of incompatible land use occurs within APZs and areas that the base does not own in their entirety. In addition to existing issues, certain planned commercial and industrial development east and north of the base was determined to be potentially incompatible (U.S. Navy 1992). Specifically, the following incompatibilities were identified:

- Nine acres (4 ha) of rural residential units within the 75 dB contour of the base and 49 acres (20 ha) of residences are located within the 65-75 CNEL noise contour (U.S. Navy 1992). These residences have not been sound attenuated and are therefore considered incompatible with airfield operations.
- The Clear Zone (CZ) at the north end of the Navy's primary runway includes 64 acres (26 ha) of the Ventura County Game Reserve. Since a wildlife preserve is not considered to be open space or agricultural land, this area is considered incompatible with airfield operations.
- A mobile home park is located on 3.8 acres (1.5 ha) within APZ I, west of the Navy's airfield complex. This area, which is located between Channel Islands ANGB and NAS Point Mugu, is zoned for industrial use. In general, residences are not permitted within this zone.

Future Development

Agricultural preserve contracts, coastal zone management issues, and floodplain regulations associated with Ventura County zoning are limits for proposed future development in the vicinity of NAS Point Mugu. Floodplains along Calleguas Creek and steep slopes of the Santa Monica Mountains present additional constraints. As a result, these lands are expected to remain within their present land use designations. Residential and commercial development are expected to occur in other portions of Ventura County, primarily in the northern coastal area and along major roads (U.S. Navy 1992).

3.10.3.3 Onbase Land Use

A - General Land Use

Many onbase and offbase land use issues have been addressed in the *Master Plan* (Western Division 1986). Figure 3.10-5 shows existing land use at NAS Point Mugu. NAS Point Mugu comprises approximately 4,490 acres (1,817 ha) of which approximately 1,990 acres (805 ha) have been developed; the remainder remains largely in its natural state. Land use at NAS Point Mugu is dominated by natural and operational constraints that require preservation of open space.

Included in the undeveloped area is over 1,500 acres (607 ha) of designated wetlands, 200 acres (81 ha) of beach dunes, and 270 acres (109 ha) of grasslands. In addition, a large portion of the base is located within the coastal zone, which has boundaries from the mean high-tide line to 3,000 feet (914 m) inland. Although federal lands are excluded from enforcement by the CCC or Ventura County (Ventura County 1994), much of the open land at NAS Point Mugu is environmentally constrained (i.e., development or activities are limited by the presence of sensitive environmental resources). These areas include the Mugu Lagoon and portions of the Calleguas Creek floodplain (see Figure 3.10-5). Development is also limited by the existence of airfield safety clearance zones.

Onbase land use has been grouped into ten categories (U.S. Navy 1992): Aircraft Operations, Aircraft Maintenance, Base Support, Test and Evaluation (T&E), Administration, Community Support, Housing, Training, Ordnance, and Open Space (see Figure 3.10-5). Approximately 890 acres (360 ha) are used for administration, operations, and training; 240 acres (97 ha) are used for military housing and recreation. Laguna Peak is located in the Santa Monica Mountains adjacent to the eastern corner of NAS Point

Figure 3.10-5
Onbase Land Use at NAS Point Mugu

Mugu and borders Point Mugu State Park. NAWCWPNS Point Mugu owns the 44-acre (18-ha) area atop Laguna Peak, at an elevation of 1,457 feet (444 m), and has developed instrumentation and communications facilities there. The four main buildings contain range communications transmission and reception equipment, ultra high frequency (UHF) command control/destruct, target control transmitters, a microwave relay system, a surface surveillance radar, and two telemetry antenna systems.

B - AICUZ Program

As described earlier (see Section 3.10.3.1-B), recommendations regarding land use compatibility in the immediate vicinity of NAS Point Mugu are established by the NAS Point Mugu AICUZ Program (U.S. Navy 1992). The following is a list of AICUZ incompatibilities identified on and in the vicinity of NAS Point Mugu:

- A 4-acre (2-ha) portion of the Capehart 2 Housing Complex in the northern portion of NAS Point Mugu is within the 75 CNEL noise contour. In addition, various housing, administration facilities, and personnel support facilities are within the 65 CNEL noise contour. Because relocating these facilities would be impractical, the NAS Point Mugu AICUZ recommends insulating the buildings to attenuate noise impacts (U.S. Navy 1992).
- There are also three existing land use incompatibilities with APZs at NAS Point Mugu. A 3-acre (1-ha) portion of the family housing area extends within APZ I associated with Runway 27. The gate and sentry house for Gate 3 also are within Runway 27's APZ I. Finally, a recreational lodge is within Runway 27's APZ II. Onbase buildings along both sides of Runway 09/27 penetrate the imaginary surfaces, and operate under airfield safety waivers (Western Division 1986). NAS Point Mugu currently holds six waivers for onbase obstructions that are necessary for safe navigation. The foothills of the Santa Monica Mountains penetrate the imaginary surfaces to the northeast of the station, thereby creating flight hazards and prohibiting straight-in approaches to Runway 27 and straight-out departures from Runway 09.

C - Aircraft Support Facilities

Aircraft operations and test, evaluation, and training constitute a major land use of the base. This category consists of airfield runways, taxiways, parking aprons, and associated buffer space. Runway 03/21 and the associated buffer space comprise the northwestern boundary of the base and Runway 09/27 runs east-west through the center of the base (see Figure 3.10-5). Most T&E facilities are located in the central portion of the site. Training is confined to separate areas along the coast.

Aircraft maintenance facilities are found mainly in the vicinity of aircraft operations. The storage of ordnance at NAS Point Mugu is primarily confined to an area along the coast in the far western portion of the base, although one area is adjacent to Runway 03/21 (see Figure 3.10-5). Ordnance storage and handling is discussed in detail in Section 3.14, Public Safety.

D - Community Services

Open space areas constitute a large portion of NAS Point Mugu. Much of the land used for community services is environmentally or operationally constrained and occurs in the eastern portion of the base. Community service land use includes police and fire facilities, post office, gate and sentry buildings, general mess and commissary buildings, childcare, chapel, and recreation facilities. Most of these uses are found in the northern portion of the base (see Figure 3.10-5). Housing facilities at NAS Point Mugu include both bachelor and family housing. The majority of housing facilities is located in the northeast portion of the base. Base support and administration are the remaining land uses identified at NAS Point Mugu. These land uses make up a relatively small proportion of land and are dispersed throughout the developed portions of the base.

E - Recreation

Recreational facilities at NAS Point Mugu are located primarily on Mugu Road. These facilities include a library, baseball fields, gym/workout center, BMX bike track, skateboard park, picnic pavilion, swimming pool, theater, community center, park, auto hobby shop, bowling center, golf course, and four restaurants. In addition, a beach area and recreational vehicle park are located at the coast near Mugu Lagoon. Recreational facilities onbase are open to DoD employees, base contractors, and active duty, retired, or reserve personnel.

F - Public Access

NAS Point Mugu is designated a classified, or secure, base; therefore, public admittance is generally not allowed. Members of the public are allowed onbase during certain occasions (e.g., air shows and bird-watching tours) and for community relations tours. The base is open to DoD employees, base contractors, and active duty, retired, or reserve personnel. For safety purposes, onshore and offshore areas are cleared during target and missile launch activities from the Building 55 Launch Complex (refer to Section 3.14.3.4).

G - Coastal Zone Management Issues

In general, the inland boundary of the coastal zone extends approximately 3,000 feet (914 m) from the mean high-tide line. This boundary can vary due to significant marine habitat areas, recreation areas, or urban areas. The coastal zone boundary extends more than 3,000 feet (914 m) inland on NAS Point Mugu for the purpose of protecting the unique wildlife habitat of Mugu Lagoon (Ventura County 1994). However, NAS Point Mugu is a federal property, and as such, is an enclave within the coastal zone not subject to CCC permit authority. Rather, federal activities occurring at NAS Point Mugu that may affect coastal zone resources are evaluated for consistency with state coastal management programs to the maximum extent practicable.

3.10.4 San Nicolas Island

3.10.4.1 Military Uses

Located approximately 57 NM (105 km) southwest of Point Mugu, San Nicolas Island is owned and operated by the Navy as a major element of the Sea Range. Although San Nicolas Island is part of Ventura County, all development on the island is associated with the military and associated land use classification is either considered military-support or open space. The island has one minor population center, Nicktown, which is located on the north side of the island. No permanent residences are established on the island; however, approximately 200 people live as part-time residents at Nicktown.

Instrumentation at the island includes four metric radars, three small and three large telemetry antennas with a receive/transmit station, a frequency monitoring station, a Multilateral Operations Control System (MOCS) with two Ground Interrogation Stations and three Ground Reference Stations, photo-optical tracking instrumentation, range communications capabilities, microwave transmission facilities, missile launching stands and bunkers, three surveillance radars, meteorological measurement systems, target control facilities, and a marine environment test site.

The San Nicolas Island Outlying Landing Field (OLF) consists of a single 10,000-foot (3,050 m) long, 200-foot (61-m) wide concrete and asphalt runway aligned northwest to southeast. It is located on the mesa in the southeastern portion of the island. Adjoining the airfield are a control tower, hangars, ground control approach capabilities, and two fire stations: one at the airport and one near the main military complex. Additional facilities include extensive range, support, and fuel storage facilities; machine/repair shops and storage buildings; and ordnance and launching facilities.

There are 156 buildings located on San Nicolas Island with facilities to transport, house, and support personnel and related materials. Infrastructure includes water wells, a desalination plant, water distribution and sewage systems, and a power plant and power distribution system (NAWCWPNS Point Mugu 1994). The island has a total of 47 miles (7.6 km) of roads, of which 21.6 miles (34.8 km) are paved. As mentioned previously, the only residential area on San Nicolas Island is Nicktown, located in the center of the north side of the island. A total of 7 barracks are available, containing 255 rooms with a capacity for 417 people. Additional facilities include a dining facility, a Naval Exchange, a four-lane bowling alley, gymnasium, hobby shop, and racquetball/tennis court.

Large items are barged to the island at Daytona Beach from the Navy's deep-water harbor at Port Hueneme, California. The barge landing area enables sea transport of material and equipment to and from the island. Barge landings at Daytona Beach occur about once every 2 weeks, on average.

3.10.4.2 Other Uses

A - Commercial Fishing

Common Nearshore Fisheries

Most types of inshore fisheries common in southern California can occur in the nearshore waters of San Nicolas Island (Ventura County Commercial Fisherman's Association 1997). Occasional fisheries occurring near the island include drift sea bass fishing, live fish trapping, hook and line bottom fishing (rock cod), hook-and-line trolling (halibut and sea bass), open water trolling (albacore and swordfish), squid purse seining, and crab trapping. However, primary nearshore fisheries at the island are urchins and lobster (abalone fisheries are currently closed). These fisheries occur in less than 120 feet (37 m) of water around the island; fall and winter are the heaviest seasons for these fisheries (see Section 3.12, Socioeconomics, for specific fishing periods).

Commercial Catch Statistics

For the purposes of this analysis, catch data for the waters surrounding San Nicolas Island (M3), San Miguel Island (W-289N), and Santa Cruz Island (W-412, 3E, and Anacapa) were assessed for quantity and type of species. The most recent years available for catch data are 1994 and 1995; these years were used to represent average totals. It should be noted, however, that fisheries can vary widely each year in terms of species and number in a given area.

Table 3.10-1 summarizes average annual commercial fish and invertebrate catch totals near the Channel Islands for the years of 1994 and 1995. In the waters surrounding San Nicolas Island, Pacific sardine was the primary fishery in the region, followed by Pacific bonito, Pacific mackerel, and jack mackerel. Other productive fisheries included California sheephead, red rockfish, and other rockfish. These are primarily

Table 3.10-1. Average Annual Commercial Catch Totals near the Channel Islands (with Range Area)

Catch Type	Average Landings for 1994 and 1995 (pounds)				
	San Nicolas Island M3	Santa Cruz Island (South) 3E	Santa Cruz Island (North) W-412	Santa Cruz Island (East) Anacapa	San Miguel Island W-289N
Fish	312,173	980,276	224,762	115,485	87,429
Invertebrates*	2,106,536	22,868,926	9,090,641	926,994	2,714,029
TOTAL	**2,418,709**	**23,849,202**	**9,315,403**	**1,042,479**	**2,801,458**

*Average annual catch 1994/1995 only – 80 percent of catch reported by origin.
Source: CDFG 1996a.

offshore fisheries. In the waters surrounding San Nicolas Island, red sea urchin was the primary invertebrate catch, followed by squid and California spiny lobster. Purple sea urchin and spot prawns were other productive fisheries.

Clearance Procedures at San Nicolas Island

As described earlier in Section 3.10.2.3, NAWCWPNS issues NOTAMs and NOTMARs 24 hours in advance of Navy activities that require exclusive use of an area. In addition, a special phone number has been set up by NAWCPWNS Point Mugu to allow commercial fishermen to be informed in advance of military activities at San Nicolas Island (Ventura County Commercial Fisherman's Association 1997). Despite these procedures, non-participants (e.g., commercial fishing vessels) occasionally are present in offshore areas of the island prior to scheduled operations. In these cases, a helicopter or Navy vessel contacts non-participants directly by radio to ensure that the area is clear prior to commencing a scheduled operation. In some cases, only one of the three areas (A, B, and C) surrounding the island must be clear. However, there are certain situations that require two or all three areas to be clear during a scheduled operation. The number of closures per year can fluctuate substantially. There are occasional periods of several months or more with no closures, while several closures can sometimes occur in a 2 to 3 week period (Ventura County Commercial Fisherman's Association 1997).

B - Public Access

San Nicolas Island is primarily used by the Navy but is also used by other government agency research divisions and government contractors. However, since the island is the site of weapons testing and highly sensitive radar equipment, unauthorized public access onshore is prohibited. Civilian access to the island is closely monitored and granted for approved military-related and research purposes only. The island is principally accessible by air for personnel and most types of equipment and supplies.

C - Coastal Zone Management Issues

The CZMA and CCA protect land within the coastal zone by limiting development within the zone. As discussed earlier in Section 3.10.3.1-A, the CCC enforces the regulations and guidelines of the CCA, which includes policy guidelines on public access and recreation, marine resources, land resources, and development of coastal lands. Although federal lands such as San Nicolas Island are technically excluded from state coastal zones, federal agencies strive to be as consistent as practicable with federally approved state coastal zone management plans.

3.10.5 Other Channel Islands

Sea Range facilities are located on San Miguel, Santa Rosa, and Santa Cruz islands (refer to Section 3.0.1.3). These sites consist of instrumentation and ancillary facilities used to support Sea Range operations. None of the facilities are permanently manned. Under CZMA and CCA, any federal project or activity affecting the coastal zone must be consistent to the maximum extent practicable with the provisions of federally approved state coastal plans.

3.11 TRAFFIC

3.11.1 Introduction

3.11.1.1 Definition of Resource

Traffic issues refer to transportation and circulation of vehicles within an organized framework. This discussion addresses air and marine traffic as well as ground transportation systems.

A - Air Traffic

Air traffic refers to movements of aircraft through airspace. Airspace is designated to accommodate certain types of uses, including federal airways, restricted use airspace, warning areas, and control area extensions (CAEs) (refer to Figure 1-2). Airspace designations throughout the United States are controlled by the Federal Aviation Administration (FAA) and are applicable to all aircraft. (No changes in the FAA airspace designations are proposed as part of this action.) Regulations governing visual flight are called visual flight rules (VFR). Instrument routes are flown using instrument flight rules (IFR), which enable the pilot to fly without visual reference to the ground.

Federal airways are corridors for civilian air traffic. These civilian airways are shown with a “V” or a “J” and a number designation; “V” denotes airways up to 18,000 feet MSL, while “J” denotes jet routes which are at altitudes over 18,000 feet MSL.

Restricted use airspace is used for military flight training and, for safety reasons, is not usually accessed by civilian or commercial aircraft.

Warning areas are designated areas for military activities in international airspace and are exclusively located over coastal waters of the United States and its territories. Although military flight operations and activities may be of a hazardous nature, international agreements do not provide for prohibition of flight in international airspace. Therefore, there is no restriction of flight by non-participating aircraft.

A CAE is a corridor through a warning area that can be opened or closed at the request of a user in coordination with the FAA.

B - Ocean Traffic

Ocean traffic involves the transit of military, commercial, and private vessels on the ocean surface. Offshore traffic flow and control is imposed on large vessels (large cargo and container ships or tankers) by the use of directional shipping lanes. Flow controls are also implemented to ensure that harbors and ports-of-entry remain as uncongested as possible. There is less control on ocean traffic involving recreational boating, sport fishing, commercial fishing, and activity by Navy and USCG vessels. In most cases, the factors which govern shipping or boating traffic include the following: adequate depth of water, weather conditions (primarily affects recreational boating), availability of fish of recreational or commercial value, and water temperature (higher water temperatures will increase boat traffic for skiers, jet skis, and diving activities).

C - Ground Traffic

Ground transportation refers to the movement of vehicles through a road or highway network. Roadway operating or pavement conditions and the adequacy of the existing and future roadway system to accommodate vehicular movements are typically described in terms of the volume-to-capacity (V/C) ratio, which is a comparison of the average daily traffic (ADT) volume to roadway capacity. The V/C ratio corresponds to a Level of Service (LOS) rating (Table 3.11-1) which ranges from free-flowing traffic conditions (LOS A) for a V/C of usually less than 30 percent, to forced flow, congested conditions (LOS F) for a V/C of usually 100 percent or greater (i.e., roadways operating at or beyond design capacity).

Table 3.11-1. Level of Service Definitions

Level of Service (LOS)	Volume-to-Capacity (V/C)
A	≤ 30.0%
B	30.1 - 50.0%
C	50.1 - 75.0%
D	75.1 - 90.0%
E	90.1 - 100%
F	> 100%

Source: Caltrans 1994.

3.11.1.2 Regional Setting

A large amount of ocean traffic (consisting of both large and small vessels) occurs through the Point Mugu Sea Range. The Sea Range boundaries encompass major sea lanes and approaches for ships to ports in southern California – approximately 7,000 vessel movements through the Sea Range have been estimated for a 1-year period (NAWCWPNS Point Mugu 1996n). These shipping routes cross the Sea Range through the Santa Barbara Channel (between the mainland coast and the northern Channel Islands) and through an area south of the Channel Islands. These shipping channels are major marine transit areas for vessels traveling to and from areas northward along the coast or westward toward Hawaii and Asia. The areas around the northern Channel Islands provide extensive opportunities for recreational fishing and boating. Due to the distance from the mainland, the area around San Nicolas Island is primarily used by Naval vessels, commercial fishing boats, and sport fishing boats.

Routes for aircraft with IFR clearances run north and south along the coast and do not enter the Sea Range. There are corridors for aircraft to cross the Sea Range while under FAA control. These are regionally significant corridors because they allow air traffic to approach or leave the Los Angeles area enroute to Hawaii or other transpacific destinations.

Major roadways in the vicinity of NAS Point Mugu include the Pacific Coast Highway (California State Route 1), which forms the northeastern boundary of the base, and the Ventura Freeway (U.S. Highway 101), which is located 6 miles (10 km) north of the base and is a major regional north-south route in the California highway system.

3.11.1.3 Region of Influence

The region of influence (ROI) for traffic includes the Point Mugu Sea Range, NAS Point Mugu, and San Nicolas Island. San Miguel, Santa Rosa, and Santa Cruz islands are not addressed in this section because the alternatives analyzed in this EIS/OEIS (including the No Action Alternative) would not affect traffic at these locations.

3.11.2 Point Mugu Sea Range

3.11.2.1 Ocean Traffic

A - Military

The number and types of Navy vessels on the Sea Range depend on mission essential activities such as the T&E of weapon systems or training exercises. The types of Navy vessels on the Sea Range are highly variable and range from small work boats used for nearshore work to major Navy combatants such as aircraft carriers. The baseline level of Navy vessel "events" (one trip into the Sea Range for an assigned mission) on the Sea Range was obtained from NAWCWPNS reports (Table 3.11-2). Operations are conducted in large subdivisions of the total Sea Range, and blocks of range times are allocated for these operations.

Vessel activity can be divided into three categories: project ships, project boats, and support boats. Project ships are larger Navy combatant vessels such as destroyers, cruisers, or any large Navy ships directly involved in events. They may operate anywhere on the Sea Range depending on mission needs, although most ship operations occur within 60 NM (110 km) of San Nicolas Island in Range Areas 3A, 3D, 4A, 4B, 5A, 5B, M3, and M5. Most project ships operating on the Sea Range originate off-range (e.g., San Diego). Project boats are smaller vessels directly involved in test or training activities. While they may also operate throughout the Sea Range, project boat operations occur mainly within the range areas receiving the most use, including Range Areas 4A, 4B, 5A, 5B, 6A, 6B, 3A, 3D, and M5. Support boats are the smallest vessels; they have limited range and usually operate close to shore near Point Mugu and San Nicolas Island in Range Areas 3A, 3B, 3D, W1, W2, and M3.

The activity level of ships or boats is characterized by a ship or boat event. As shown in Table 3.11-2 for the baseline year, there were 495 project ship events, 79 project boat events, and 225 support boat events on the Sea Range. To put the Navy vessel operations level in perspective, the table also includes an estimate of annual commercial shipping activity in 1995.

B - Civilian

Civilian vessels fall into two general categories: commercial and recreational. Estimates for the number of large commercial shipping vessels that transit the Sea Range are based on a 1996 study prepared by the NAWCWPNS Test Operations Division. The only study on the number of commercial fishing vessels on the Sea Range is dated (Pacific Missile Test Center 1976) and does not accurately characterize current conditions. The USCG has indicated that no definitive study exists on recreational boating traffic on the Sea Range; only anecdotal estimates are available.

Commercial

Commercial vessels enter and cross the Sea Range on a routine basis. A wide variety of commercial vessels transit the Sea Range, including container carriers, vehicle carriers, bulk ore ships, oil tankers, roll on/roll off ships, and general cargo ships. The size of these ships can range from very large oil tankers that are over 1,000 feet (300 m) in length to the smaller general cargo ships whose length can be under 300 feet (90 m). For safety purposes, large vessel traffic on and through the Sea Range is tracked and controlled by the USCG. The USCG also provides traffic advisories to vessels transiting the Sea Range.

Table 3.11-2. Baseline Navy and Commercial Vessel Events on the Sea Range

Vessel Type	Number of Events[1]
Project Ships	495
Project Boats	79
Support Boats	225
Total Navy	**799**
Commercial Shipping Estimate 1995	**>7,000**[2]

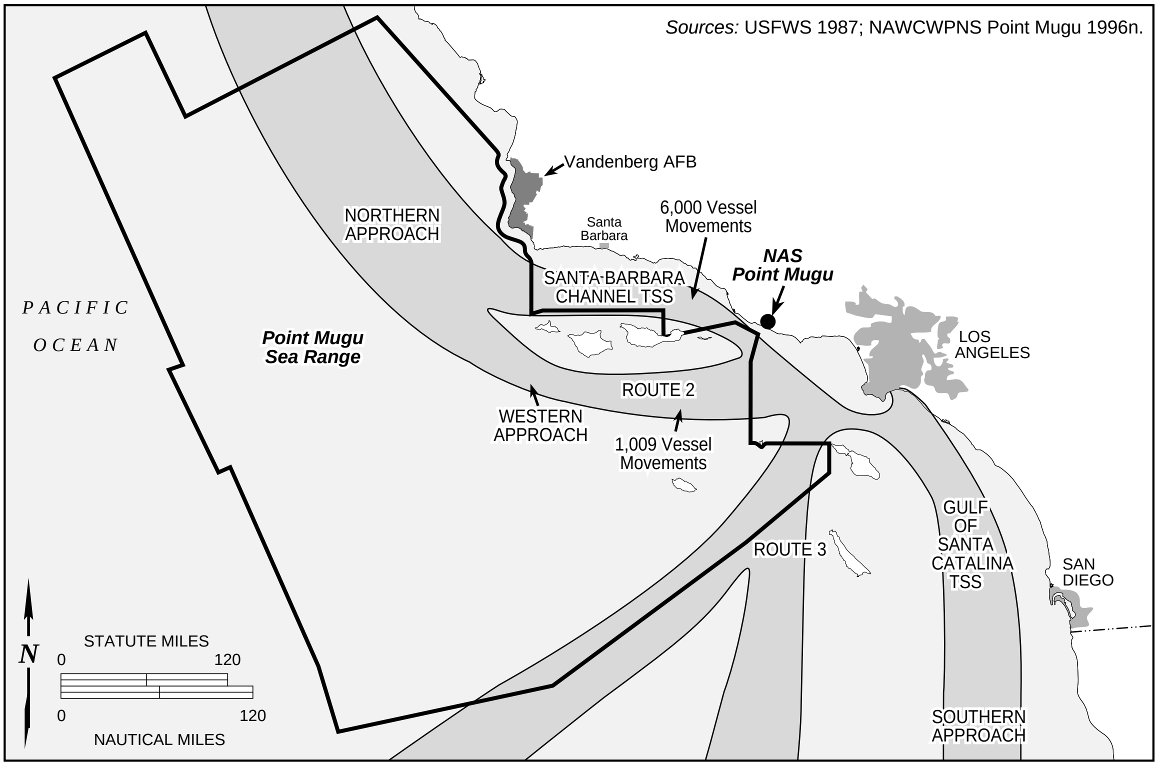
[1] "Event" is defined as one trip into the Sea Range for an assigned mission.
[2] Data collected over a nine month period in 1995 and extrapolated to a one-year period.
Source: NAWCWPNS Point Mugu 1996k,n.

There are two primary routes into and across the Sea Range (Figure 3.11-1). One is the Santa Barbara Channel route (or Northern Approach), a two-way shipping lane which generally parallels the coast and runs between the mainland and the Channel Islands. The other is the Western Approach about 25 NM (46 km) south of the Channel Islands. This route was established for safety reasons for supertankers entering and leaving the area. The length of the Santa Barbara Channel route is approximately 180 NM (330 km) and the Western Approach is over 270 NM (500 km) long. Traveling at 15 knots (28 km/hr), a ship can cross the Sea Range via the Northern Approach and Western Approach in about 12 and 18 hours, respectively.

The *Ship Traffic Study, Southern California Operations Area, Status Report* (NAWCWPNS Point Mugu 1996n) provides data on ship traffic on and near the Sea Range. The period covered was 1 January through 30 September 1995. About 3,583 vessel movements occurred to and from the ports of Los Angeles and Long Beach. These records have been further disaggregated to include 1,985 vessels entering the Sea Range from the north and west enroute to the ports of Los Angeles and Long Beach. There were 2,220 vessel departures from the same ports to the north and west. There were also 306 vessels observed on the Sea Range by Range NP-3D aircraft, individuals in the Range Surveillance Center, or through official Naval message traffic. Statistical extrapolation of these numbers allows these data to be annualized. The annual traffic estimate through the Santa Barbara Channel Traffic Separation Scheme (TSS) is 6,000 vessel movements; the annual estimate for the Western Approach is 1,009 vessel movements.

Recreational

Boating and fishing are year-round activities on the water near Point Mugu and on the Sea Range. Recreational boats include powered boats and sailboats. There is no source for official counts of recreational boats on the Sea Range. Estimates can be made based on a count of vessel movement at the nearest harbor frequented by recreational boaters. Channel Islands Harbor is 1 mile north of Port Hueneme and has facilities for launching small boats and slips for mooring them. The Harbor Patrol keeps a count of daily vessel operations at the harbor. For 1997, the total boat operations count was 92,485, an average of 253 per day. This figure represents the number of boats launching at the harbor and transient vessels entering the harbor. However, not all boats launched or transient at this harbor enter the Sea Range. The Channel Islands Harbor Patrol estimates that on the weekends, the number of recreational boats that are on the Sea Range in the vicinity of the Channel Islands could be 500 or more. During weekdays or periods of marginal weather, the number of recreational boats would be substantially less. Most of the recreational boating in the region is concentrated between the coast and the Channel Islands, outside Sea Range boundaries.



TSS = Traffic Separation Scheme

Figure 3.11-1
Major Shipping Lanes on the Sea Range and Estimate of Annual Shipping Traffic Volumes

3.11.2.2 Air Traffic

A - Military

There are eight Warning Areas which comprise the majority of the airspace over the Sea Range (refer to Figure 1-2): W-289, W-289N, W-290, W-412, W-532, W-537, W-60, and W-61. All or part of these areas are in international airspace. These Warning Areas are active on an intermittent basis and are activated in coordination with the FAA. The flying public is informed of their activation by NOTAMs issued by the FAA. The location and activation status of these Warning Areas can have an effect on civil aviation on routes between Hawaii and the west coast of the U.S.

The overseas air route structure crosses the Sea Range via CAEs. There are four CAEs which cross the Sea Range and one CAE on the range's southern boundary (refer to Figure 1-2):

- 1155 (through W-532)
- 1176 (through W-537)
- 1316 & 1318 (through W-289)
- 1177 (just to the south of the Sea Range and north of San Clemente Island).

CAEs 1316 and 1318 are closed daily during daylight hours and occasionally on weekends. CAE 1176 is closed for missile launches from Vandenberg AFB. CAE 1155 is also closed daily for other operations from the north, other than from Point Mugu. CAE 1177 is the most important of the five CAEs and is rarely closed. The FAA does not record the numbers of IFR flights through the Sea Range on the CAEs. However, general estimates of traffic through the Sea Range on all the CAEs is about 20 arrivals and departures daily. This is only IFR traffic and does not include aircraft flying VFR.

Memoranda of Agreement exist between NAWCWPNS and the FAA which address the usage of the Warning Areas and stipulate the conditions under which the CAEs can be closed to civil traffic. Under most circumstances at least one CAE must remain available for use by general aviation and commercial air carriers. NAWCWPNS has established procedures to minimize the disruption of other air traffic due to operations on the range.

Military aircraft routinely operate in international airspace over the Sea Range. These aircraft take off from the airfield at NAS Point Mugu or from other locations. In addition, during major exercises on the Sea Range, aircraft will take off from an aircraft carrier and subsequently land aboard the ship. Aircraft which take off from NAS Point Mugu have IFR flight clearance from the FAA Air Traffic Control (ATC) Service through the military tower at NAS Point Mugu. During flight on the Sea Range, no IFR clearance from the FAA is required since most of the area is in international airspace and flight is accomplished using VFR with a see-and-avoid concept. Although aircraft operate in every range area, the following range areas near San Nicolas Island have the heaviest usage: 3A, 3D, 4A, 4B, 5A, 5B, M3, and M5. For the baseline year, 3,934 sorties were flown on the Sea Range (a *sortie* is the complete flight of a single aircraft; for a description of operational terms, refer to Chapter 10, Glossary and Index). Military aircraft activities are explained in more detail in Section 3.0, Current Activities.

<u>B - Civilian</u>

Aircraft operating on IFR clearances under control of the Los Angeles Air Route Traffic Control Center (ARTCC) normally fly on formal airway route structures. In the vicinity of NAS Point Mugu, these airways run along the coastline and to the east. Figure 3.11-2 shows the high-altitude airway route structure in the vicinity of NAS Point Mugu. Special airways, CAEs, cross the Sea Range to the west and can be opened or closed by the FAA at the request of the Navy in order to facilitate activities on the Sea Range. The airways running north and south are among the most heavily used in the area but do not conflict with activities on the Sea Range since they are located over land or along the coast.

Since most of the Sea Range is over international waters, aircraft operate under VFR or without clearance from ATC. Flight under these conditions is conducted under a see-and-avoid concept and flown clear of clouds or other limited-visibility conditions such as rain or fog.

3.11.3 Point Mugu

3.11.3.1 Air Traffic

NAS Point Mugu is located within airspace controlled by the Los Angeles ARTCC. The Los Angeles ARTCC has delegated control of aircraft into and out of the NAS Point Mugu airfield to NAS Point Mugu Air Traffic Services, which operates the Radar ATC facility and the control tower at the airfield. Thus, NAS Point Mugu has responsibility for the control of all civilian and military aircraft operating on IFR clearances within its designated airspace.

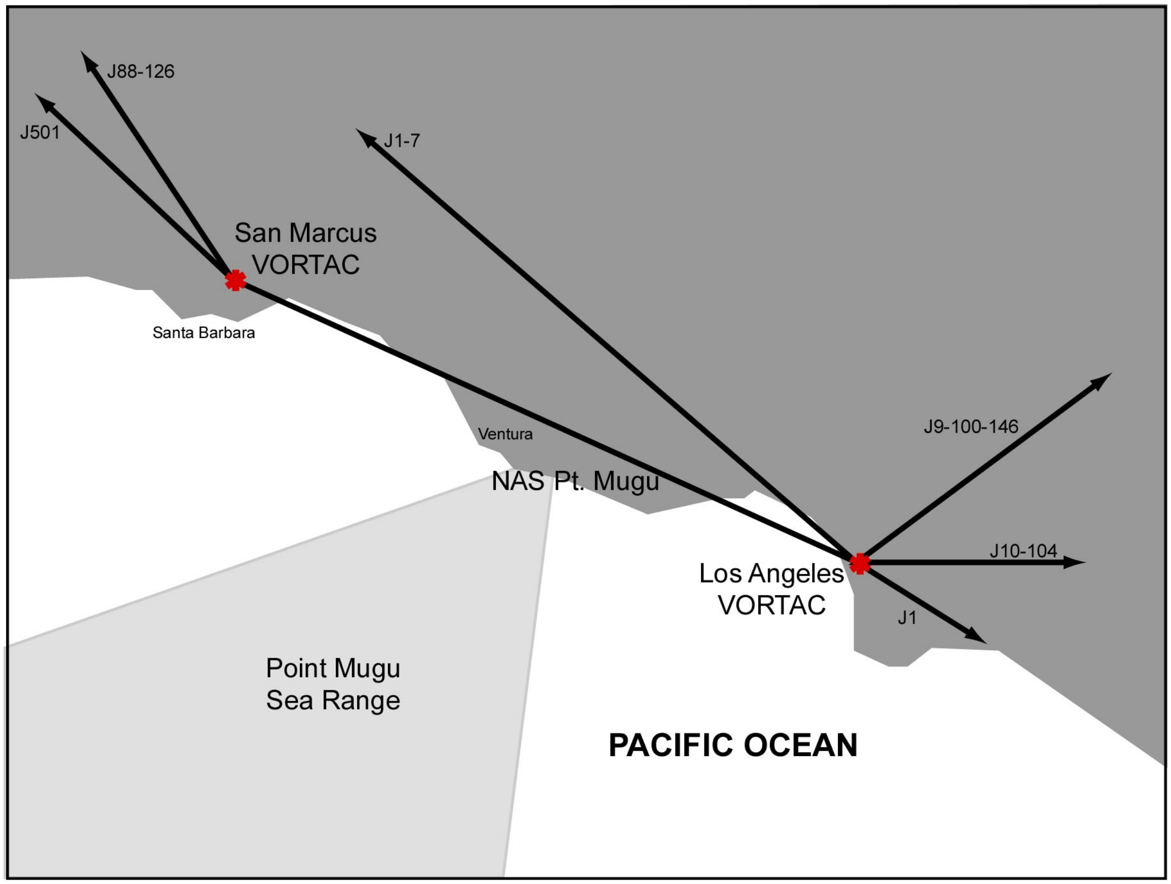


Figure 3.11-2
High-Altitude Airway Route Structure in the Vicinity of NAS Point Mugu

A - Military

An aircraft operation is defined as an aircraft event at the airfield that involves a takeoff (or an intent for flight), a landing, a low approach to the airfield, or a touch-and-go landing. Thus, a single sortie from the airfield with one takeoff and one landing would be considered two aircraft operations. The NAS Point Mugu airfield supports an annual total of approximately 45,933 aircraft operations (refer to Table 3.0-1; this reflects baseline year totals plus the recent addition of E-2 aircraft). There were 5,300 civilian aircraft operations from the airfield at NAS Point Mugu in FY95. The number of military operations at the airfield for FY95 (19,866) is much greater than the number of sorties flown on the Sea Range for a comparable period in FY95 (3,934) because one sortie can consist of several aircraft operations. (Note: Not all sorties flown on the Sea Range originate from NAS Point Mugu; many can originate from the Navy's airfield at NAWS China Lake, California, or from other military airfields.)

B - Civilian

There are two civilian airfields near the NAS Point Mugu airfield: Oxnard Airport, 7 miles (11 km) to the northwest, and Camarillo Airport, 6 miles (10 km) to the north. Oxnard Airport traffic includes both scheduled air carrier and general aviation traffic, while the Camarillo Airport (formerly Oxnard AFB) is solely a general aviation airfield. In 1996, Camarillo Airport reported 172,905 aircraft operations, and Oxnard Airport had 110,145 aircraft operations.

Factors influencing air traffic flow in the Point Mugu area are described below.

- VFR operations at Oxnard Airport, Camarillo Airport, and NAS Point Mugu operate independently.
- VFR traffic flow along the coastline is heavy but does not present a conflict with NAS Point Mugu air traffic operations because of altitude separation.
- Traffic on federal airways is at high altitudes and does not conflict with NAS Point Mugu.
- Camarillo Airport further congests the area's air traffic flow; however, as a VFR facility with strict adherence to a properly designed local pattern, it does not generate any major conflicts with either NAS Point Mugu or Oxnard Airport VFR traffic flow.
- IFR operations at the airports conflict under certain conditions and result in either a one-for-one sharing of the airspace or circuitous routing procedures. Specific conflicts include instrument approaches to NAS Point Mugu Runway 21, Oxnard Airport Runway 25, and Camarillo Airport Runway 26; and instrument departures from NAS Point Mugu Runway 03, Oxnard Airport Runway 07, and Camarillo Airport Runway 08.

3.11.3.2 Ground Traffic

A - Offbase

Primary Roadways

NAS Point Mugu is served by an extensive road system to allow access to and from base facilities. Figure 3.11-3 shows the local roads in the vicinity of NAS Point Mugu and their estimated ADT volumes. The Pacific Coast Highway (California State Route 1) forms the northeastern boundary of the base. The Ventura Freeway (U.S. Highway 101) is approximately 6 miles (10 km) north of the base and is a major north-south route in the California highway system. Both the Ventura Freeway and the Pacific Coast Highway allow access to the Los Angeles area. Major roads which run from the Ventura Freeway south toward NAS Point Mugu are Rice Avenue, Wood Road, Las Posas Road, and Lewis Road. Direct access to the base is from a frontage road along the Pacific Coast Highway primarily at Gates 2 and 3.

Table 3.11-3 shows V/C ratios and LOSs for major offbase street segments immediately adjacent to NAS Point Mugu. Table 3.11-4 shows LOSs for unsignalized intersection operations outside of NAS Point Mugu. These tables show that traffic movements are currently at LOS C or better.

Circulation Patterns

Since the elimination of bus service to the area in 1996, NAS Point Mugu is not served by any public transit. Access to the base is therefore primarily by personal vehicle (some carpooling does occur). Traffic in the vicinity of the base runs southeast and northwest on the Pacific Coast Highway.

North-south roads near the base, Las Posas Road and Wood Road, are the main access routes from the north (Camarillo area) to the base entrances. All offbase roadways and most offbase intersections serving NAS Point Mugu operate at LOS A or B on a daily basis (see Tables 3.11-3 and 3.11-4).

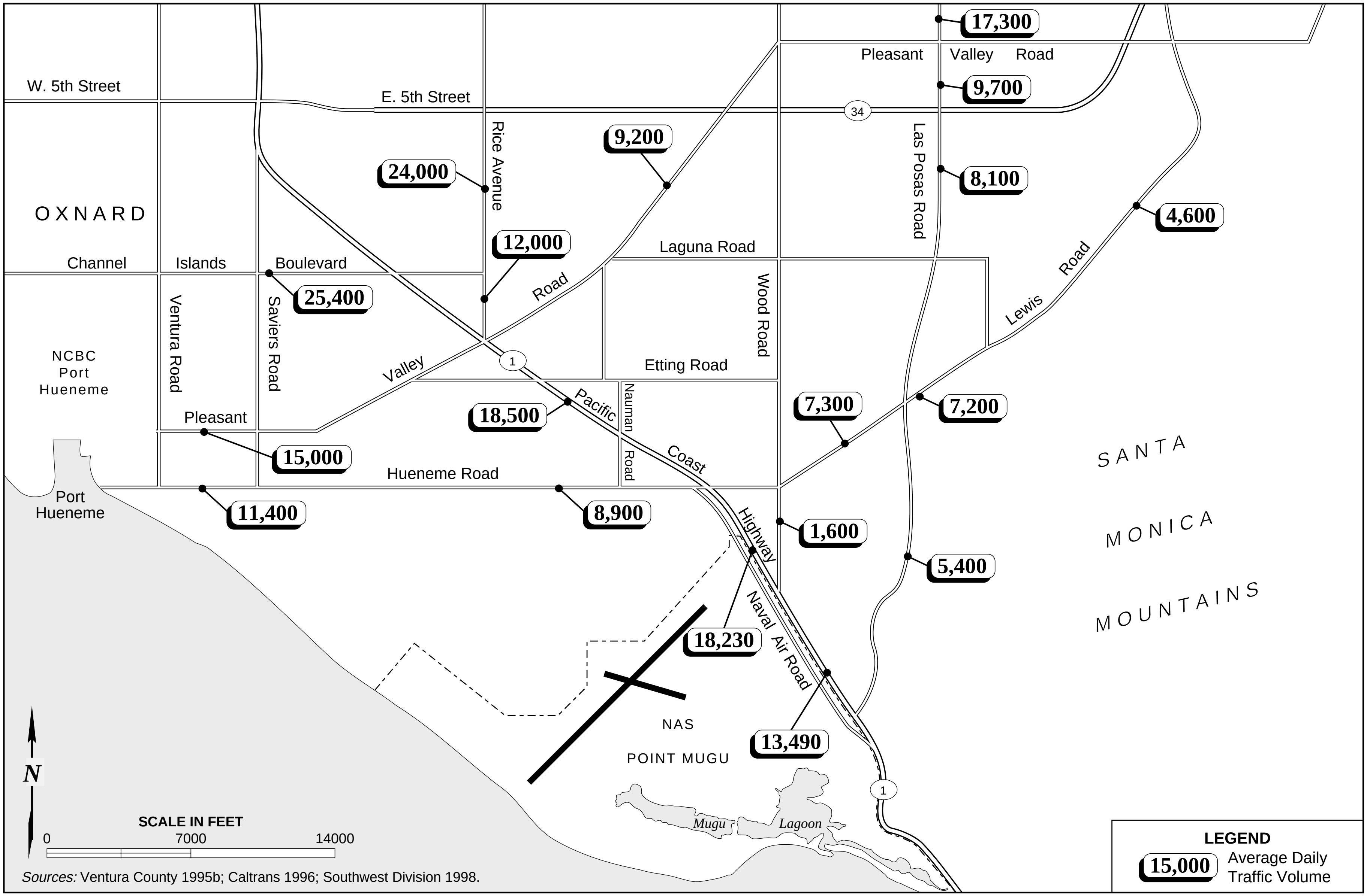


Figure 3.11-3
Major Roadways and Existing Average Daily Traffic Volumes in the Vicinity of NAS Point Mugu

Table 3.11-3. Projected Offbase Daily Street Segment Operations

Street Segment	Capacity*	1999 Volume	1999 V/C	1999 LOS
Pacific Coast Highway				
north of Wood Road	43,000	18,230	42%	B
south of Wood Road	43,000	13,490	31%	B
Frontage Road				
south of Wood Road	31,000	13,900	45%	B
south of Main Road	14,000	2,220	16%	A
Wood Road				
south of Hueneme Road	14,000	1,780	13%	A
Las Posas Road				
east of Pacific Coast Highway	14,000	6,090	44%	B

Notes: *Capacities and V/C ratio thresholds based on Caltrans Standards (see Section 3.11.1.1-C).
Source: Linscott, Law and Greenspan 1997.

Table 3.11-4. Projected Offbase Unsignalized Intersection Operations

Intersection	Movement		Peak Hour	1999 Delay (seconds)	1999 LOS
Navalair Road/Pacific Coast Highway SB ramp	NB	T	AM	4.6	A
	SB	R		2.6	A
	SB	L/T		4.5	A
	WB	L		2.3	A
	NB	T	PM	6.3	B
		R		2.6	A
	SB	L/T		5.2	B
	WB	L		2.3	A
Navalair Road/Wood Road	WB	L/R	AM	5.0	A
	SB	L		2.5	A
	WB	L/R	PM	11.0	C
	SB	L		5.4	B
North Mugu Road/Frontage Road*	-	-	AM	11.3	C
	-	-	PM	17.7	C
Main Road/Frontage Road*	-	-	AM	1.4	A
	-	-	PM	1.9	A
Las Posas Road/Pacific Coast Highway SB Ramp	NB	L/R	AM	5.1	B
	NB	L/R	PM	8.5	B

Notes: *Denotes all-way stop sign controlled intersections.
L = Left-turn   WB = Westbound
R = Right-turn   NB = Northbound
T = Through movement   SB = Southbound
Source: Linscott, Law and Greenspan 1997.

B - Onbase

Roadways and Gates

The base has four entrances: Gates 1, 2, 3, and 5 (Figure 3.11-4). The majority of traffic accesses the base via the Pacific Coast Highway from the north (52 percent) and Las Posas Road (36 percent), which runs north from the base to the City of Camarillo (Southwest Division 1998). Of the remaining traffic, 8 percent access the base via Wood Road, and 4 percent access via Pacific Coast Highway from the south. Gates 2 and 3 accommodate about 50 and 45 percent, respectively, of NAS Point Mugu entry and exit traffic. Gate 5 is at the far western edge of the base and provides access from Arnold Road to Perimeter Road and is open by special request only. ADT volumes at major roads and gates are shown in Figure 3.11-4.

Circulation Patterns

NAS Point Mugu has over 50 miles (80 km) of paved roads. Primary roadways on the base include North Mugu Road, Main Road, Laguna Road, 11th Street, 13th Street, and Beach Road (see Figure 3.11-4). The existing roads are adequate to accommodate current and projected traffic loads at the base.

The majority of major arterial streets have four lanes and traffic flow conditions are generally good (LOS B or better). The primary access road to the area across Mugu Lagoon is Laguna Road. Laguna Road intersects Beach Road which provides access to Gate 5 and Perimeter Road on the west end of Runway 21/03. Access to the industrial areas east of Runway 21/03 is via 11th Street and 13th Street. The only current circulation conflict occurs at the intersection of North Mugu Road and the Pacific Coast Highway frontage road. This intersection (without a traffic signal) is estimated to operate at LOS C during evening rush hour traffic when large numbers of vehicles are leaving the base (estimate based on traffic levels expected through 1999) (Linscott, Law, and Greenspan 1997). All other intersections on the base operate at LOS B or better.

Parking

The *Master Plan* (Western Division 1986) reports that sufficient parking is available onbase for employees except in a few areas. Since the publication of the *Master Plan*, the facility has had a reduction in employees, and no significant shortages in parking are presently known to exist.

3.11.4 San Nicolas Island

3.11.4.1 Air Traffic

The San Nicolas Island airfield is owned, operated, and maintained by the Navy. It consists of a single runway (30/12) on the southeast portion of the island. It is an instrument-capable airfield with a 10,000-foot (3,050-m) long runway that can accommodate the largest military transport aircraft. The runway is equipped with two bi-directional arresting gears for use with tail hook equipped aircraft (for simulated aircraft carrier landings). The San Nicolas Island airfield serves as the primary staging area for remote controlled flights conducted by QF-4 aircraft. The only authorized air traffic into the airfield are those approved by NAS Point Mugu and generally include aircraft involved in T&E activities, training on the Sea Range, and scheduled contract passenger flights which bring duty personnel, researchers, or other permitted visitors to the island. On an average busy day, there are approximately seven arrivals and seven departures at the San Nicolas Island airfield (refer to Section 3.3, Noise).

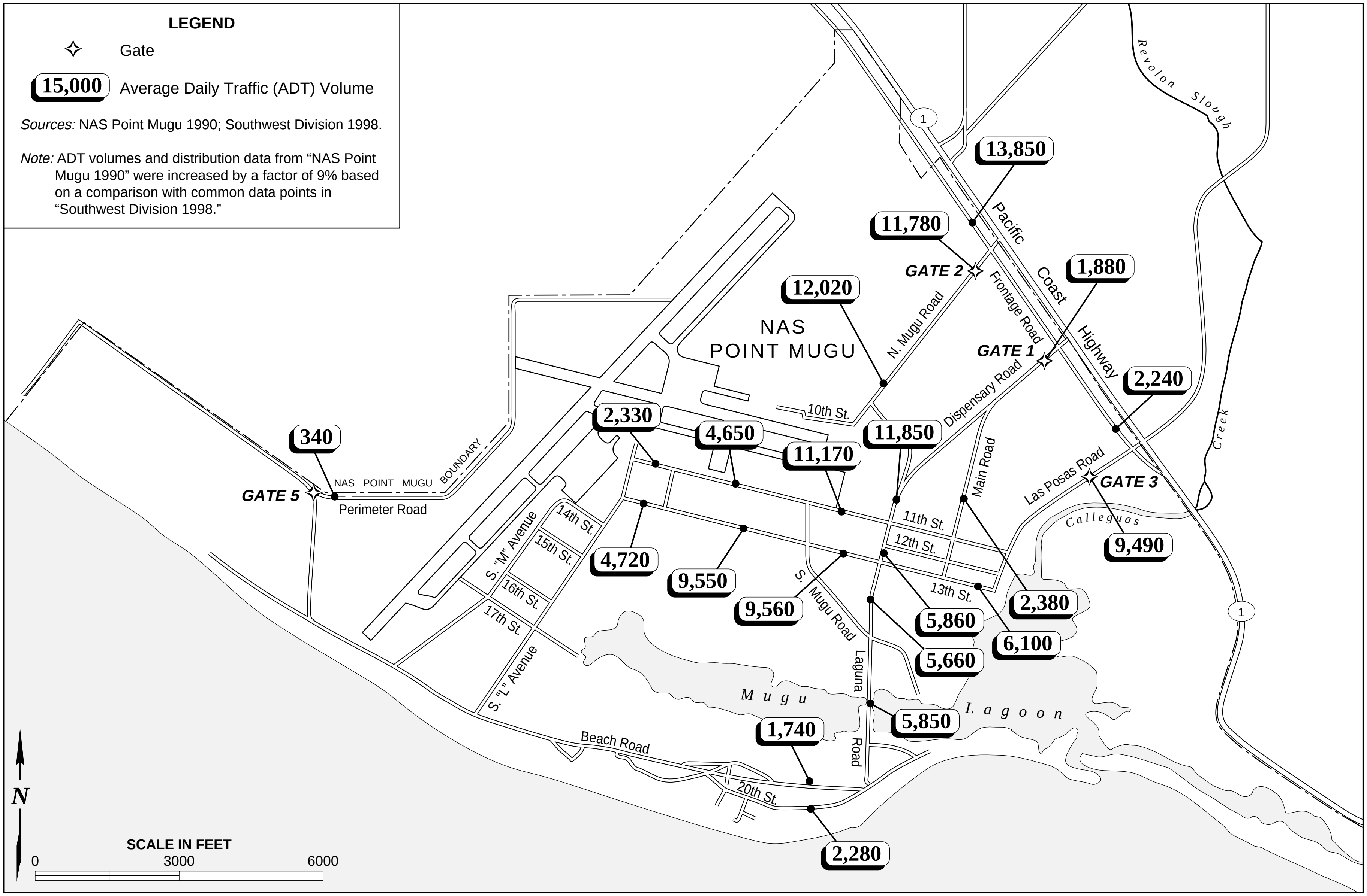


Figure 3.11-4
Average Daily Traffic Volumes at NAS Point Mugu

3.11.4.2 Ground Traffic

A - Roadways

There are approximately 22 miles (35 km) of paved roads on San Nicolas Island. The roads generally run southeast to northwest along the long axis of the island. Monroe Drive, Beach Road, Jackson Highway, Shannon Road, Tufts Road, and Skyline Drive are the primary named roadways (refer to Figure 3.0-2).

B - Circulation Patterns

The circulation of traffic on the island centers around three general areas: 1) the Community Support Complex which contains the housing area, 2) the airfield, and 3) the T&E infrastructure on the western half of the island. A secondary traffic focus is the Beach Road access to the Barge Landing area on the southeast coast of the island.

All vehicles on the island are government-owned or -controlled, with approximately 30 present at any one time. Traffic conflicts only occur when convoys transport ordnance or other hazardous materials. Non-participating vehicles are precluded from operating along roads taken by these convoys while enroute.

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3.12 SOCIOECONOMICS

3.12.1 Introduction

3.12.1.1 Definition of Resource

Socioeconomics comprise the basic attributes and resources associated with the human environment, particularly population and economic activity. Economic activity typically encompasses employment, personal income, and industrial growth. Impacts on these fundamental socioeconomic components influence other issues such as housing availability and provision of public services.

Socioeconomic data herein are presented at the county, state, and national level to analyze baseline socioeconomic conditions in the context of state, regional, and national trends. Data have been collected from previously published documents issued by federal, state, and local agencies (e.g., county financial reports); from state and national databases (e.g., U.S. Bureau of Economic Analysis' *Regional Economic Information System* [1996]); and from interviews with representatives from relevant agencies (e.g., Ventura County).

<u>A - Executive Order 12898</u>

In 1994, EO 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations* (EO 12898, 59 Federal Register 7629 [section 1-101]), was issued to focus attention of federal agencies on human health and environmental conditions in minority and low-income communities and to ensure that disproportionately high and adverse human health or environmental effects on these communities are identified and addressed. In order to provide a thorough environmental justice evaluation, this presentation focuses on the distribution of race and poverty status in areas potentially affected by implementation of proposed actions.

Data used for the environmental justice analysis were collected primarily from the *1990 Census of Population and Housing* (U.S. Bureau of the Census 1993); although these data are now 10 years old, they represent the most complete, detailed, and accurate statistics available addressing population distribution and income.

<u>B - Executive Order 13045</u>

EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks (*EO 13045, 62 Federal Register 1985), states that each federal agency:

> "shall make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children" and
>
> "shall ensure its policies, programs, activities and standards address disproportionate risks to children that result from environmental health risks or safety risks."

This EO, commonly referred to as "Environmental Justice for Children," focuses primarily on the noise environment around schools. This is further supported by recent studies that show that school children who are routinely subjected to a noisy environment perform below average, particularly in reading comprehension. To ensure that federal activities do not disproportionately affect children, particular attention to public school risks must be identified. Specifically, this analysis will address the potential for previously unaffected schools to be affected by noise (greater than 65 CNEL) resulting from Navy

Sea Range operations. The DoD is currently formulating polices which will address schools which may already be within 65 CNEL noise contours.

3.12.1.2 Regional Setting

In the context of statewide socioeconomic activity, industries active in the region of influence (ROI) (see detailed description below) comprise a substantial contributor to the social and economic well-being of California. For example, fishing districts affected by ongoing Naval operations on the Sea Range account for almost half of the revenue generated by commercial fishing operations statewide (U.S. Bureau of the Census 1997). Other economic activities somewhat unique to the ROI — including sport fishing and commercial shipping — also comprise significant contributors to statewide economic benefit. Less unique but equally important, Ventura County agricultural employment is critical not only at the county level but also in the viability of statewide agricultural industry.

3.12.1.3 Region of Influence

The ROI for socioeconomics is defined as the area in which the principal effects arising from implementation of the proposed action or an identified alternative are likely to occur. The proposed action and alternatives would directly affect areas already dedicated to military use in Ventura County (including NAS Point Mugu and San Nicolas Island), and open water locations off the Los Angeles, Ventura, Santa Barbara, and San Luis Obispo county coastlines. Current uses of potentially affected areas include military facilities, national park activities, commercial fishing, commercial marine transport, sport fishing, tourism, and recreation.

Implementation of the proposed action or alternatives would not result in significant land use changes in affected areas; only the intensity and type of T&E activities performed would change. Therefore, the ROI for direct impacts from the proposed action and alternatives would be limited to Ventura County, San Nicolas Island, and users of the open water areas in the Sea Range. Within Ventura County, special attention is given to communities near NAS Point Mugu (e.g., Oxnard and Camarillo).

3.12.2 Point Mugu Sea Range

For the purposes of the socioeconomics discussion, this section addressees both the open ocean area of the Sea Range, San Nicolas Island, and ocean areas around relevant Channel Islands.

3.12.2.1 Economic Activity

A - Military Activity

Military activities are conducted throughout the Point Mugu Sea Range. Naval restricted surface areas are located at Navy-owned San Nicolas Island out to 3 NM (5.6 km) (CCC 1993). These areas are used on an "as-required" basis only, and public access is restricted only at those times when military exercises are being conducted.

B - Civilian Activity

Commercial Shipping

Commercial shipping in the Point Mugu Sea Range is dominated by cargo transports, oil tankers, and barges. The Sea Range is used by commercial vessels traveling between northern Pacific ports (e.g., Vancouver, Seattle, and San Francisco) and those situated in southern California. The Sea Range is also transited by vessels to and from the Panama Canal, Indonesia, or other western ports. According to the USCG, oil tankers using the channel voluntarily travel 50 NM (93 km) offshore to reduce the potential for conflict with nearshore water craft, sport fishing activities, and subsurface obstructions (USCG 1997).

Commercial Fishing

Economic activity associated with commercial fishing is compiled by the CDFG through required reporting procedures. Catch totals by species are reported by commercial fleets within each district (for a detailed description on commercial fish species, refer to Section 3.6, Fish and Sea Turtles). Totals and associated revenues for ports within the Santa Barbara area (which includes ports and landings from Los Angeles to Avila Beach) are recorded by the CDFG. In 1995 the ports of Hueneme and Ventura landed the largest total poundage of commercial fish species in the Santa Barbara area with approximately 93 million pounds (42 million kg) for Hueneme and 19 million pounds (9 million kg) for Ventura. With regard to total value, the most lucrative ports in the region were Hueneme ($13.9 million) and, due primarily to large-scale urchin harvesting, Santa Barbara ($10.2 million). A summary of reported poundage and values for 1995 is presented in Table 3.12-1. A list of commercially fished species and their respective seasons is presented in Table 3.12-2.

Table 3.12-1. Regional Commercial Fishing Poundage and Value (1995)

Port	Pounds	Value
Hueneme	92,969,700	$13,858,400
Santa Barbara	6,942,280	$10,228,100
Oxnard	5,618,940	$6,574,200
Morro Bay	6,253,090	$6,526,390
Ventura	18,608,800	$5,864,640
Avila	3,534,140	$2,943,220
Other[1]	9,400	$28,759
San Simeon	118,144	$20,138
Gaviota	29,719	$14,500
Total	**134,084,213**	**$46,058,347**

[1] This category comprises landings too small to be considered *ports* but required to report daily catches.
Source: CDFG 1996a.

Sport Fishing

Southern California is the leading recreational fishing area along the Pacific coast of the U.S.; the area encompassed by the Sea Range is fished year-round due to favorable prevailing weather and sea conditions. Modes of recreational fishing include shore and pier activities, as well as private and charter boats.

Inner waters from Santa Barbara to Point Conception are lined with kelp beds and reefs that provide recreational fishing opportunities to catch kelp bass, yellowtail, bonito, rockfish, barracuda, and others. Popular Channel Islands sport fishing areas are concentrated around the offshore kelp beds and open ocean south of Anacapa and Santa Cruz islands (CCC 1993). Total fish catches of recreational passenger fishing boats in California are recorded by the CDFG (Table 3.12-3).

Table 3.12-2. Commercially Fished Species within the Sea Range

Species	Open Season
king salmon (Chinook)	Regulated by federal government
silver salmon (coho)	Regulated by federal government
California halibut	June 16 - March 14
surf perch	July 16 - April 30
abalone[1]	September 1 - December 31; March 1 - July 31
spiny lobster	1st Wednesday of October -1st Wednesday after 15th of March
clams	September 1 - March 31
dungeness crab	November 15 - June 30
shrimp (trawling)	April 1 - October 31
white sea bass	June 16 - March 14
ridge back prawn (trawling)	October 1 - May 31
spot prawn (trapping)	April 1 - January 15
sea urchin	seasons vary [2]

[1] As of May 1997, the CDFG has placed a temporary closure on all commercial abalone harvesting.
[2] Sea urchin seasons are:

- November 1 - March 31: 7 days per week
- April and October: Monday-Thursday
- May and September: Monday-Thursday (closed 2nd week)
- June and August: Monday-Wednesday (closed 2nd week)
- July: closed north of San Luis Obispo/Monterey County line but open Monday-Thursday except 2nd week south of county line.

Source: CDFG 1996c.

Other Recreational Activities/Tourism

The Channel Islands are also used by the public for recreational purposes other than sport fishing (e.g., boating, diving, and whale watching). These activities originate from harbors, coves, and marinas along the mainland coast. Whale watching is popular in the region primarily from March through May (during the annual gray whale northward migration); bird watching and marine mammal observation are popular year-round. Recreational diving at shipwrecks and natural areas around the Channel Islands is also popular (CCC 1993).

3.12.2.2 Environmental Justice

No permanent population centers exist within areas encompassed by the Sea Range.

3.12.3 Point Mugu

NAS Point Mugu is located in an unincorporated area of southern Ventura County, 3 miles (5 km) southeast of the City of Oxnard and 7 miles (11 km) south of the City of Camarillo. The installation itself is located within two divisions (Oxnard and Camarillo) established by the U.S. Bureau of the Census for statistical analysis. Within the Oxnard division, analytical areas are further subdivided into Oxnard City, Channel Islands Beach Census Designated Place (CDP), El Rio CDP, and Port Hueneme City; the remainder of the Oxnard division, which includes NAS Point Mugu, is not contained within any official subdivisional classification. Within the Camarillo division, subdivisional areas are Camarillo City and nonpopulated portions of Thousand Oaks City.

Table 3.12-3. Number of Fish Caught by California Recreational Passenger Fishing Fleets (1990 and 1991)

Species	1990 Totals	1991 Totals
rockfish	311,992	339,025
bass (various)	165,375	165,225
mackerel (Pacific and jack)	40,844	57,999
whitefish	19,288	26,435
California barracuda	16,429	25,109
halfmoon	4,853	17,269
sheephead	7,344	12,201
sculpin	9,030	9,771
ling cod	4,844	7,644
flatfish	1,948	1,780
cabezon	1,374	1,134
California halibut	842	811
others	476	650
salmon	3	404
white sea bass	1,248	302
Pacific bonito	10,377	251
sanddab	17	205
white croaker	278	140
opaleye	23	89
sole	15	50
sablefish	183	20
yellowtail	1,000	16
jacksmelt	80	10
tuna	0	7
Total Fish	**597,863**	**666,547**
Total Anglers	**67,698**	**73,988**
Total Boats	**31**	**29**

Source: CCC 1993.

For this analysis, the portion of the Oxnard division not contained within any city or CDP subdivision is examined in detail since it excludes urban statistics not characteristic of NAS Point Mugu and includes areas where facilities associated with the installation are located. The entire Camarillo division is examined because it encompasses portions of the base proper and offbase facilities controlled by the Navy (namely military family housing [MFH] in Camarillo).

3.12.3.1 Population

<u>A - The 1990 Census</u>

Based on the *1990 Census of Population and Housing*, Ventura County had a population of 669,016 people, about 2.2 percent of the statewide total; all population in the county is classified as *urban* (U.S. Bureau of the Census 1993). Ventura County boundaries coincide with those for the Oxnard-Ventura Primary Metropolitan Statistical Area (PMSA). Together with Los Angeles, Orange, Riverside, and San Bernardino counties, to the east and southeast, the PMSA forms part of the Los Angeles-Anaheim-Riverside Consolidated Metropolitan Statistical Area (CMSA), the second greatest metropolitan area in the nation, which reported a 1990 population of 14.5 million people. The Santa Barbara-Lompoc-Santa

Maria PMSA, with a 1990 population of 370,000 people, is located to the west (California Department of Finance 1993).

B - Population Distribution

In 1990, Ventura County's average household size was 3.07 persons, as compared to a statewide average of 2.86. The majority of the county's population has historically been concentrated in its southern half, beginning with agricultural development on the coastal plain associated with the Santa Clara River delta and followed by industrial and residential expansion. Through established transportation and communication networks, this area maintains closer interaction with population centers in neighboring Los Angeles and Santa Barbara counties than with the sparse population in the remainder of Ventura County.

Table 3.12-4 shows population breakdowns of all cities in Ventura County. More than 87 percent of Ventura County's population lives in incorporated cities; the largest cities are Oxnard (1990 population of 142,560 and 1996 estimate of 153,300), Thousand Oaks (1990 population of 104,381 and 1996 estimate of 112,000), and Simi Valley (1990 population of 100,218 and 1996 estimate of 103,200). About 53 percent of the county's population lives in the cities of Camarillo, Oxnard, Port Hueneme, and San Buenaventura (Ventura). The census' Oxnard division (containing most of the City of Oxnard and several CDPs) contained about 177,000 people in 1990; of that total, 142,200 (or 80.3 percent) lived in the City of Oxnard, while the division remainder lived in unincorporated areas. The Camarillo division reported a 1990 population of about 54,000 people, with 52,300 (or 96.8 percent) living within Camarillo city limits.

Table 3.12-4. Ventura County Population by City for 1990 and Population Estimates for 1991-1996

City	1990	est. 1991	est. 1992	est. 1993	est. 1994	est. 1995	est. 1996
Camarillo	52,297	53,600	55,100	55,600	56,000	57,500	58,200
Oxnard	142,560	143,600	146,200	148,000	150,600	152,100	153,300
Port Hueneme	20,322	20,250	19,900	20,250	21,700	21,450	22,250
San Buenaventura	92,557	93,100	93,900	95,100	96,200	99,100	100,300
Incorporated	582,496	587,300	594,600	602,300	610,800	617,400	624,600
Unincorporated	86,520	88,000	89,100	90,600	91,400	91,700	91,500
County Total	**669,016**	**675,300**	**683,700**	**692,900**	**702,200**	**709,100**	**716,100**

Source: California Department of Finance 1993.

C - Population Trends

By 1996, population in the Los Angeles-Anaheim-Riverside CMSA is estimated to have grown to 15.7 million people (an 8.3-percent increase since 1990) and the Santa Barbara-Lompoc-Santa Maria PMSA had grown to an estimated 394,000 people (a 6.5-percent increase since 1990). Since 1990, Ventura County's population is estimated to have increased by 7.0 percent, to about 716,100 people. Of this 47,084-person increase, about 22.8 percent (10,740 people) reside in Oxnard, 16.4 percent reside in San Buenaventura, and 16.1 percent reside in Thousand Oaks. The remainder of this increase is distributed throughout the county (California Department of Finance 1993). The Ventura County population will increase by an estimated 2,548 upon full completion of the E-2 realignment at NAS Point Mugu (Southwest Division 1998). This consists of the 996 personnel and associated family members.

Urban development and related population growth in the area bordering NAS Point Mugu has remained fairly constant during the last 6 years; however, areas closer to the cities of Oxnard and Camarillo have experienced rapid growth. As indicated above, the greatest population increases in the county during the past 6 years have been within Oxnard city limits; population growth within the City of Camarillo has been approximately 11.3 percent, significantly greater than the county average of 7 percent. Much of the growth in Camarillo has occurred along the U.S. Highway 101 corridor which serves as the principal link (i.e., the only limited-access freeway) between the cities of San Buenaventura and Oxnard to the west and Thousand Oaks and Los Angeles to the east. Residential and commercial development is quickly replacing agricultural land use in Camarillo. This trend is in response to demand for quality affordable housing not met within an ever-growing commute distance from nearby business centers and industrial areas (i.e., San Buenaventura and, more significantly, Los Angeles).

The University of California, Santa Barbara (UCSB) Economic Forecast Project's (1996) long-term population forecast estimates that Ventura County's population will grow to 778,860 by 2000 and 827,078 by 2004 (it should be noted that this organization projected a 1996 population of 732,992 as compared to a 716,000 estimate prepared by the California Department of Finance). The Forecast Project anticipates that the county's population will grow on the order of 1.4 to 1.6 percent per year, the order of growth experienced during the early 1990s but substantially less than population growth seen during the 1980s.

3.12.3.2 Housing

A - Regional Housing

In 1990, housing supply in Ventura County totaled 228,478 units; of the 1990 total housing supply, 217,298 units (or 95.1 percent) were occupied. Of that total, 65.5 percent (142,262 units) were owner-occupied; median value of these units was $245,300. Median rent of the 75,036 occupied rental units in the county was $695 per month. In 1990, about 65.7 percent of occupied housing units were single-family, detached units; multiple-family attached units comprising 3-9 units accounted for 9.2 percent; and about 5.6 percent were mobile homes or trailers. County vacancy rates in 1990 were 2.0 percent for owner-occupied units and 5.2 percent for rental units. Approximately 3,389 units in the county were vacant and either held for seasonal, recreational, or occasional use; for migrant workers; or otherwise vacant, including boarded up.

The City of Oxnard had 41,247 total housing units in 1990, about 18 percent of the county total; 39,302 of these units were occupied. Of this total, 21,119 (53.7 percent) were owner-occupied and 18,183 (44.1 percent) were rental units. The median value of the city's 39,302 owner-occupied housing units was $204,600. Median rent in the city was $634 per month.

B - Military Housing

Housing for military and civilian personnel working at NAS Point Mugu is available at onbase and offbase locations. Onbase family housing is located between Frontage Road and 6th Street and is accessed from Gate 1 and Gate 2. In addition to family housing units, onbase housing includes 612 bachelor-enlisted quarters and 34 bachelor-officer quarters. Offbase housing is located between Las Posas Road and F Avenue in Camarillo (NAWS Point Mugu 1997f). Summaries of offbase and onbase housing areas are provided in Table 3.12-5.

Table 3.12-5. NAS Point Mugu Onbase and Offbase Housing Summary

Housing Unit Type	Onbase Number	Offbase Number	Total
Officer housing units:			
2-bedroom	0	0	0
3-bedroom	36	0	36
4-bedroom	32	11	43
Enlisted housing units:			
2-bedroom	80	24	104
3-bedroom	393	234	627
4-bedroom	127	42	169
Total Units	**668**	**311**	**979**
Vacancy Rate	25%		

Source: NAWS Point Mugu 1997f.

3.12.3.3 Employment and Economic Activity

A - Employment

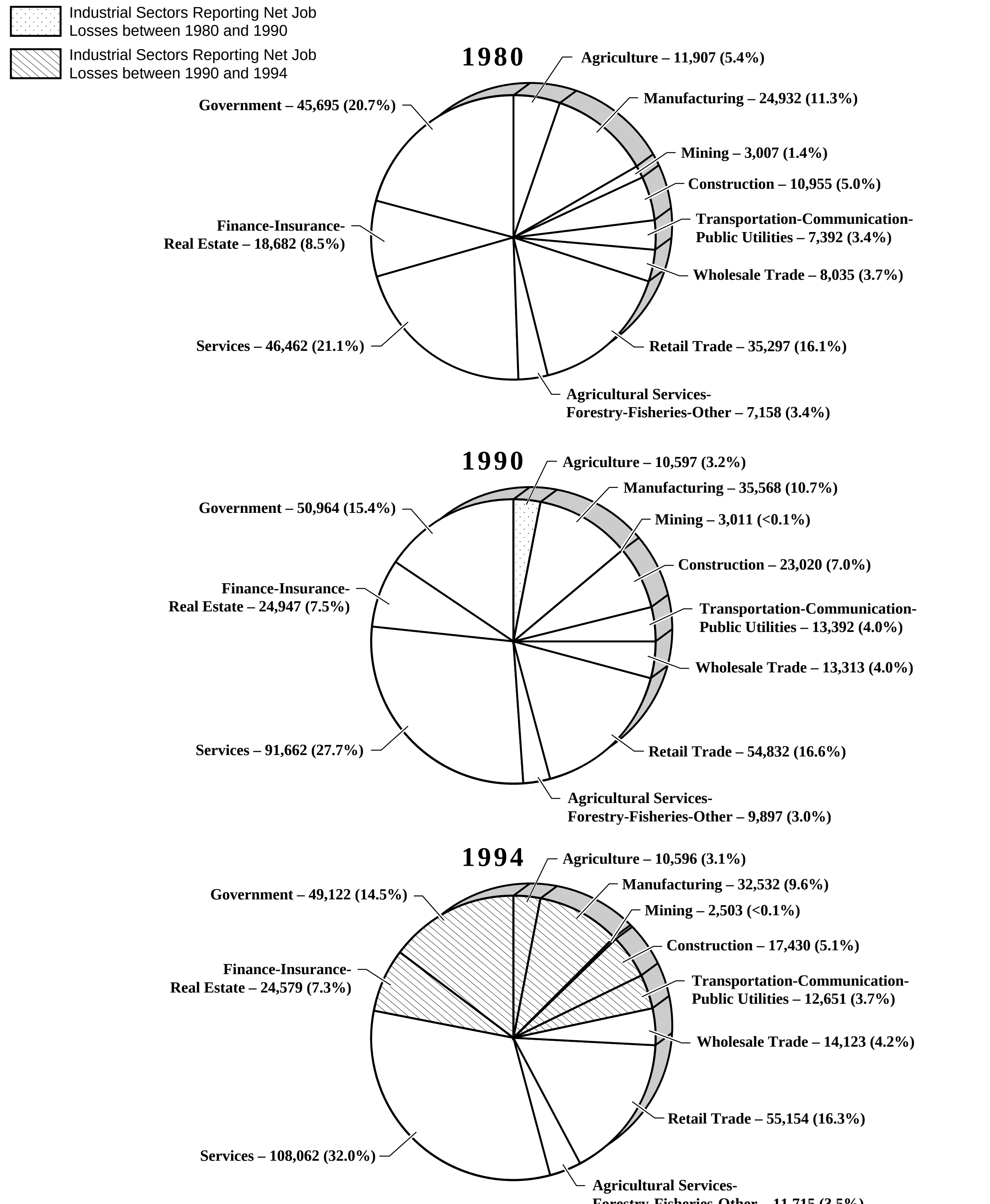
As with population, Ventura County employment levels have grown substantially over the past 15 years, experiencing a cumulative increase of 118,703 jobs (53.5 percent overall growth) between 1980 and 1994. During that period, the county's growth—by comparison with national employment growth—was substantial (the U.S. experienced 27.0 percent overall job growth between 1980 and 1994).

The labor force in Ventura County increased from 366,769 people in 1990 to 384,414 people in 1994—an increase of 5 percent. During the same period, the number of unemployed persons in the county also grew substantially, from 20,573 to 30,281 (47.2 percent). Consequently, despite decreasing from a peak of 8.8 percent in 1992, unemployment levels in 1994 (7.9 percent) were higher than in 1990 (5.6 percent).

B - Job Composition

The primary industrial sectors providing the greatest numbers of jobs in Ventura County in 1994 were services (108,062 jobs), retail trade (55,154 jobs), and government (49,122 jobs). Other significant employment sectors include manufacturing (32,532 jobs) and construction (17,430 jobs). Figure 3.12-1 presents the distribution of jobs by employment sector in Ventura County for 1980, 1990, and 1994. In 1980, services (21.0 percent of all jobs), government (20.1 percent), and retail trade (15.9 percent) were the largest employment sectors of the county economy, together accounting for 57 percent of all jobs in Ventura County (U.S. Bureau of Economic Analysis 1996). In 1994, these three employment sectors still comprised the largest employment areas in the county, although employment in the retail trade sector had surpassed employment levels in the government sector.

Employment growth slowed in the early 1990s as a result of recessionary pressures (county employment grew by 118,703 jobs—53.5 percent—between 1980 and 1990, but by only 7,266—2.2 percent—between 1990 and 1994). An indicator of this trend is the number of employment sectors experiencing net job losses between 1980 and 1990 (none); 1980 and 1994 (two—farming and mining—which lost a combined 1,815 jobs); and 1990 and 1994 (seven—farming, manufacturing, mining, construction, government, transportation/utilities, and fire, insurance, and real estate—losing a combined 12,086 jobs).



Source: U.S. Bureau of Economic Analysis 1996.

Figure 3.12-1
Jobs by Industial Sector
Ventura County, 1980, 1990, and 1994

Employment in the government sector comprises state and local government, federal military, and federal civilian jobs. Despite the fact that government employment in Ventura County decreased by 1,842 jobs between 1990 and 1994, it experienced a net increase of 3,427 jobs (7.5 percent) between 1980 and 1994. In 1994, NAWS Point Mugu accounted for 8,167 (16.6 percent) of the 49,122 wage and salary government jobs in the county (as of 1996, NAS Point Mugu accounted for 9,163 government jobs [NAWS Point Mugu 1996c]).

C - Earnings

Ventura County's economy expanded from the period of 1980 through 1994. Total earnings for the county in 1994 were approximately $9.6 billion. The greatest earnings were reported for the services sector ($2.8 billion), government ($1.7 billion), and manufacturing ($1.2 billion). Included within the government sector is the federal military employment category, which reported 1994 earnings in Ventura County of $175 million (U.S. Bureau of Economic Analysis 1996).

Per capita income in Ventura County for 1994 averaged $17,861, 7.4 percent more then the per capita income for the State of California ($16,624) and 23.9 percent above the U.S. average ($14,420). The greatest annual earnings per job were reported in the mining sector ($51,273), followed by transportation-public utilities ($40,707), manufacturing ($38,102), wholesale trade ($35,985), and government ($34,627). Federal military per capita earnings averaged $29,064 in 1994 (Figure 3.12-2).

D - Personnel Located at NAS Point Mugu

NAS Point Mugu accounts for approximately 6.2 percent of Ventura County employment; military and civilian personnel assigned to the base total about 9,163 (NAWS Point Mugu 1996c). A breakdown of personnel (including non-tenant employees) is provided in Table 3.12-6.

Table 3.12-6. Personnel by Type at NAS Point Mugu

Personnel Type	Number
Assigned military	2,491
Reserve forces	545
Civil service	3,563
Contractor employees	2,564
TOTAL	**9,163**

Source: NAWS Point Mugu 1996c.

NAS Point Mugu Finances

The Navy at Point Mugu has a combined annual payroll of $273.2 million (NAWS Point Mugu 1996c; Southwest Division 1998). In addition, the base contribution to the local economy (i.e., in local area expenditures) totals about $200 million (Table 3.12-7).

3.12.3.4 Public Services

The following discussion focuses on police departments and fire departments that provide services for NAS Point Mugu, the surrounding area, and the Camarillo family housing area.

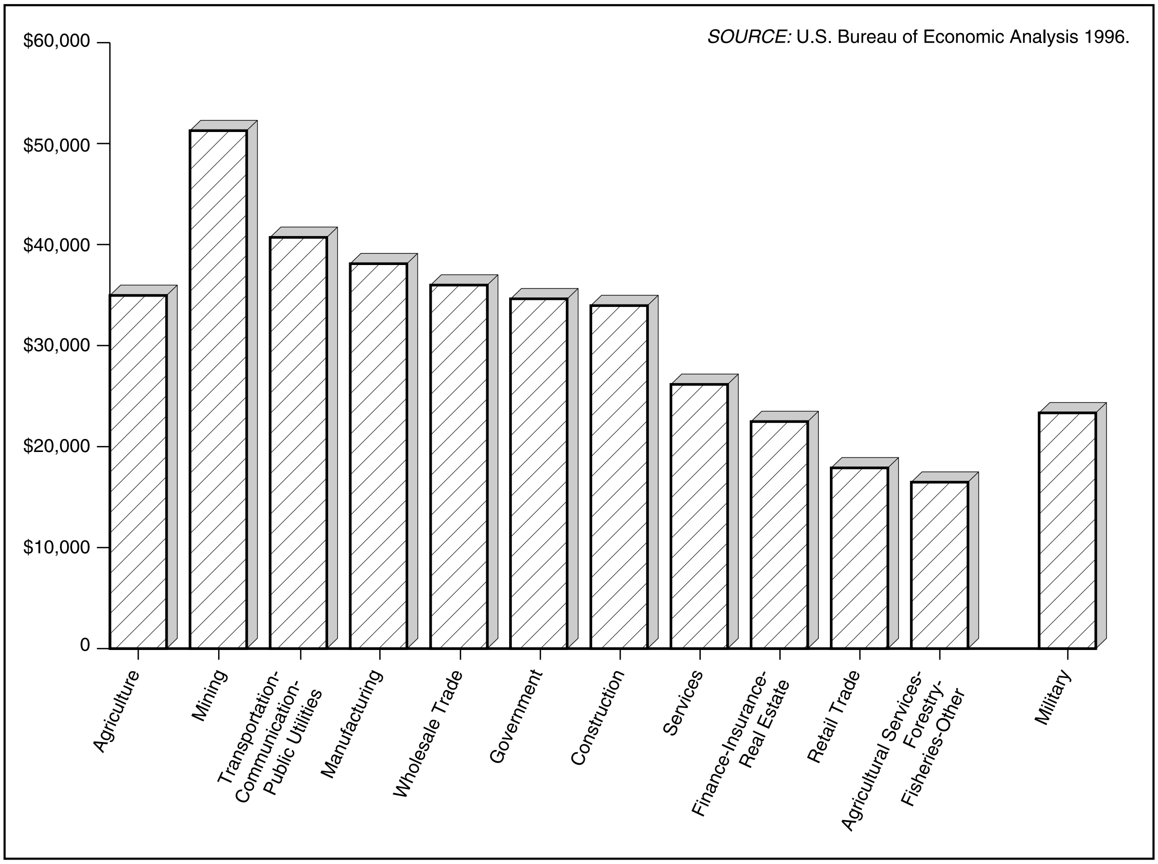


Figure 3.12-2
Average Annual Earnings per Industrial Sector, Ventura County, 1994

Table 3.12-7. Payroll and Expenditures of NAS Point Mugu

Expenditure	Amount
Payroll	
FY96 annual military payroll	$25,651,277
FY96 annual civilian payroll	$209,156,104
Annual E-2 payroll	$38,382,000
Total	**$273,189,381**
Purchases	
FY96 local area purchases	$3,407,395
FY96 local area contracts over $25,000	$134,433,638
FY96 bank card purchases under $25,000	$5,224,356
E-2 business volume	$56,850,000
Total	**$199,915,389**
Total Contribution to Local Economy	**$473,104,770**

Source: NAWS Point Mugu 1996c; Southwest Division 1998.

A - Police Protection

Regional law enforcement and police protection is provided primarily by the Ventura County Sheriff's Department, with 742 sworn officers; the county sheriff's service area includes the cities of Camarillo, Fillmore, Thousand Oaks, and Moorpark, and unincorporated areas throughout the county. The Ventura County Sheriff's Department operates under a mutual aid agreement with NAS Point Mugu.

B - Fire Protection

The Ventura County Fire Department currently operates 34 fire stations with a staff of 453 personnel. Five bureaus have been established within the department, including emergency services, community services, communications, training and technical services, human resources, and fiscal/administrative services. The Ventura County Fire Department has a mutual aid agreement with fire protection personnel at NAS Point Mugu.

3.12.3.5 Utilities

Because the availability of utilities (e.g., potable water, electricity, and natural gas) and the adequacy of their distribution systems are directly related to and affected by changes in regional socioeconomic patterns, they are important to consider when analyzing potential socioeconomic impacts associated with proposed actions.

A - Potable Water

The primary source of potable water at NAS Point Mugu is the United Water Conservation District in Port Hueneme, which sells its water to the base; this source is supplemented by onbase wells that tap local aquifers. The distribution plant at the base is equipped with softening and chlorinating capabilities and two surge-protection tanks with capacities of 50,000 and 200,000 gallons (190,000 and 760,000 liters). The potable water distribution system supplies the entirety of NAS Point Mugu, including the tenant Channel Islands ANGB facilities and Laguna Peak facilities. The existing system has a capacity of 5.8 million gallons per day (gpd) (22.0 million liters per day [Lpd]). Average demand is about 1.6 million gpd (6.1 million Lpd) (Southwest Division 1998). Therefore, potable water supply is not a constraining issue with regard to maintenance and operations activities at NAS Point Mugu.

B - Wastewater Treatment and Disposal

Wastewater generated at NAS Point Mugu is transported to the base's primary treatment facility (Imhof tank) via a system comprising 26 pump and lift stations. After initial treatment at the Imhof tank onbase, effluent is pumped to the City of Oxnard's sewage treatment plant for final treatment and discharge. The capacity of the onbase system as currently configured is 4 million gpd (15.2 million Lpd). Normal, steady-state load is about 480,000 gpd (1,820,000 Lpd), which is about 12 percent of total capacity (Southwest Division 1998). Therefore, issues associated with wastewater treatment and disposal do not comprise constraints to operations at NAS Point Mugu.

C - Solid Waste

Solid waste from NAS Point Mugu and surrounding communities is collected by a private contractor and is taken to an offbase transfer station before being delivered to a landfill. Solid waste from the base is taken to a transfer station in Oxnard and then transported to the Toland Road Landfill, about 15 miles (24 km) from the base. This is a 161-acre (65-ha) municipal waste facility operated by the Ventura Regional

Sanitation District and serves the communities of Fillmore, Santa Paula, and Piru. It is expected that the landfill will operate for another 30 years at the present waste generation rate, with an estimated remaining capacity of 30 million cubic yards (4 million cubic meters [m^3]) (Ventura County 1994). Solid waste generation at NAS Point Mugu is about 18 tons (16 metric tons) per day.

D - Electricity

The Edison Company provides NAS Point Mugu with electricity via a system with a 44,000 kilowatt (kW) capacity. Three onbase switching systems with production capacities of 16.5 kV each distribute electricity throughout the base through an established distribution system comprising substations each operating at 3,750 kV. Normal, steady-state demand for electricity at NAS Point Mugu amounts to 8,000 kW (18.2 percent of total capacity); recent demand, typically during summer months, has peaked at 13,000 kW (30.0 percent). The Edison Company has indicated that it would be capable of providing NAS Point Mugu with an additional 4.5 million kW with no infrastructure-related cost being passed on to the Navy. Therefore, current systems and readily available future expansion meet and exceed existing and reasonable foreseeable demand for electricity at NAS Point Mugu.

E - Natural Gas

Southern California Gas Company provides NAS Point Mugu with natural gas that is used primarily at onbase housing units. Natural gas enters the base via an 8-inch (20-cm) main supply line and is distributed to the housing areas by 4-inch (10-cm) lines. The existing system has a capacity of 6,240,000 cubic feet per day (cfd) (177,000 m^3 per day); normal, steady-state demand is about 139,040 cfd (3,940 m^3 per day) (2.2 percent of capacity). Recent peak demand has not exceeded 624,000 cfd (17,770 m^3 per day), or 10 percent of capacity. In the event that the base's natural gas supply is interrupted, a back-up supply of 240,000 gallons (912,000 liters) of propane is available. Therefore, the quantity and availability of natural gas is not a constraining issue at NAS Point Mugu.

3.12.3.6 Environmental Justice

As summarized in Tables 3.12-8, and 3.12-9, the areas immediately surrounding NAS Point Mugu are currently characterized by an ethnically diverse population. However, projections indicate that as population grows over the next 50 years, there will be a dramatic shift at both state and county levels; by 2040, the Hispanic population is anticipated to comprise about 49.7 percent of the state's population and 52.9 percent of the population in Ventura County. As depicted in Table 3.12-10 (poverty status of families) and Figure 3.12-3 (poverty status of individuals), comparatively few households in the county have incomes below the poverty line.

Table 3.12-8. Projected Population by Ethnic Group (in thousands), State of California (2000-2040)

	1990	2000	2010	2020	2030	2040
White	17,199	18,462	19,368	20,062	20,522	20,555
Black	2,116	2,471	2,784	3,118	3,440	3,757
Hispanic	7,740	11,513	15,401	20,077	25,503	31,506
Other	2,921	3,998	4,855	5,720	6,635	7,525
Total	**29,976**	**36,444**	**42,408**	**48,977**	**56,100**	**63,343**

Source: California Department of Finance 1993.

Table 3.12-9. Projected Population by Ethnic Group, Ventura County (2000-2040)

	1990	2000	2010	2020	2030	2040
White	443,000	471,600	491,800	506,700	510,600	502,400
Black	14,700	17,300	20,200	23,100	25,800	28,500
Hispanic	177,600	246,800	335,400	441,100	562,500	697,200
Other	36,300	39,000	58,200	69,600	80,600	91,000
Total	**671,600**	**773,700**	**782,700**	**905,600**	**1,040,500**	**1,319,100**

Source: California Department of Finance 1993.

Table 3.12-10. Income and Poverty Status (1990)

Income Status	U.S.	California	Ventura County	Oxnard City	Camarillo City	Ventura City
Total Households (HHs)	91,993,582	10,399,700	217,723	39,133	1,842	35,546
Median HH Income	$30,056	$35,798	$45,612	$37,174	$48,219	$40,307
Per Capita Income	$14,420	$16,624	$17,861	$12,096	$19,930	$19,091
Total Families	65,049,428	7,218,877	166,925	31,214	14,157	24,032
Total below poverty	6,487,515	670,685	8,292	3,000	355	1,113
Percent below poverty	10.0	9.3	5.0	9.6	2.5	4.6

Source: U.S. Bureau of the Census 1993.

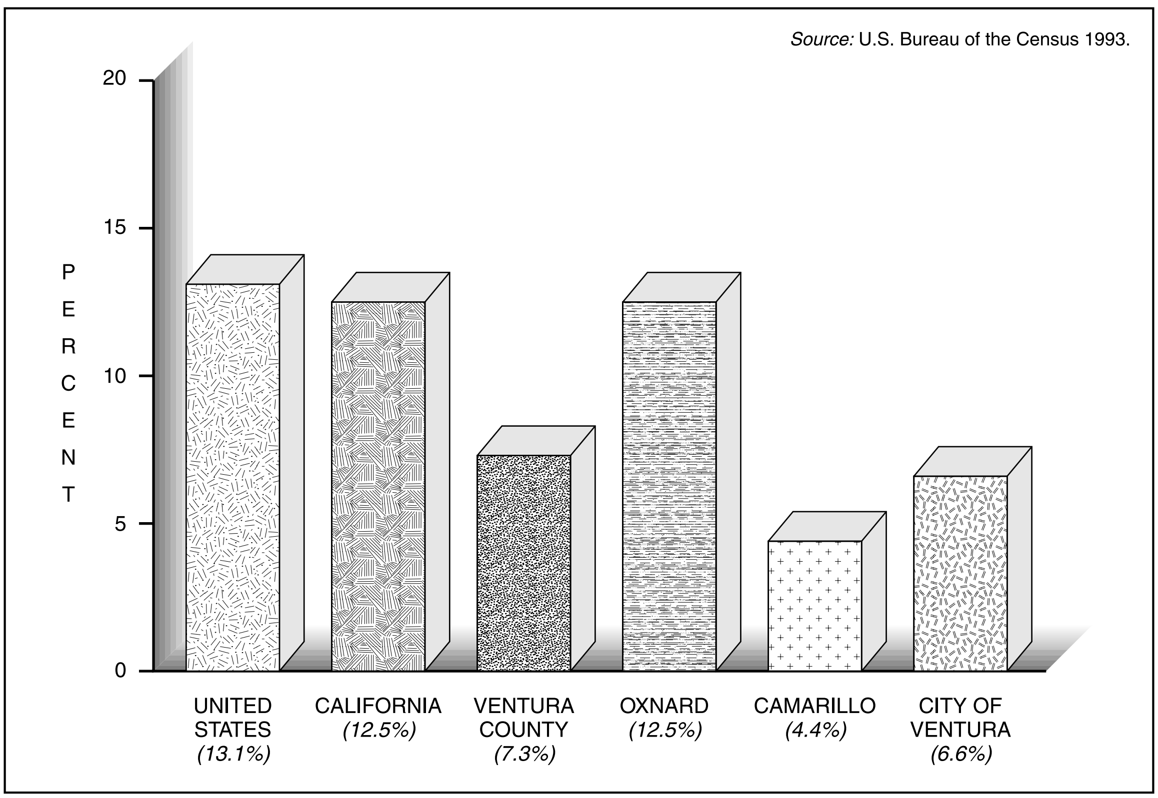


Figure 3.12-3
Poverty Status of Individuals (by Region)

3.13 HAZARDOUS MATERIALS, HAZARDOUS WASTES, AND NON-HAZARDOUS WASTES

3.13.1 Introduction

3.13.1.1 Definition of Resource

Hazardous materials addressed in this EIS/OEIS are chemical substances that pose a substantial hazard to human health or the environment. The definition of "hazardous materials" includes extremely hazardous substances, hazardous chemicals, hazardous substances, and toxic chemicals. In general, these materials pose hazards because of their quantity, concentration, physical, chemical, or infectious characteristics. Hazardous materials are often used in high technology missiles, munitions, and targets because they are strong, lightweight, reliable, long-lasting, or low cost. When missiles, munitions, and targets are used for their intended purpose, component hazardous materials are considered hazardous constituents.

A hazardous waste may be a solid, liquid, semi-solid, or contained gaseous material that alone or in combination may: 1) cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible illness; or 2) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed. Hazardous wastes are controlled by the Resource Conservation and Recovery Act (RCRA; 42 U.S.C. § 6901 et seq.).

This section provides a review of the affected environment for hazardous constituents that enter the environment from missiles, aerial targets, surface targets, ships and boats, and other ordnance used in the Sea Range and hazardous wastes at NAS Point Mugu and San Nicolas Island. Since hazardous constituents comprise only a portion of materials entering the Sea Range, this section also addresses the amounts and types of non-hazardous materials used in the Sea Range.

3.13.1.2 Regional Setting

Hazardous materials and wastes are a regional issue in the SCB. Hazardous constituents from missiles, bombs, ships, aircraft, and targets have the potential to affect the water quality of this area and to be transported over a lengthy portion of the southern California coastline and islands. Hazardous wastes generated at NAS Point Mugu or San Nicolas Island have the potential to threaten human health in their vicinity.

3.13.1.3 Region of Influence

The region of influence (ROI) for hazardous materials, hazardous wastes, and non-hazardous wastes is the 36,000 square mile (93,200 km^2) Point Mugu Sea Range, NAS Point Mugu, and San Nicolas, San Miguel, Santa Rosa, and Santa Cruz islands.

3.13.2 Point Mugu Sea Range

3.13.2.1 Hazardous Materials Transport

To the extent possible, maintenance of weapon systems is performed at NAS Point Mugu instead of on San Nicolas Island to avoid the transport of hazardous materials on the Sea Range. However, fuel and gasoline must be transported from Point Mugu to San Nicolas Island by barge. The largest volume of hazardous material transported over the Sea Range is in the form of aviation jet fuel and unleaded gasoline. In the baseline year, San Nicolas Island received 490,785 gallons (1.87 million liters) of jet fuel and 53,000 gallons (201,400 liters) of unleaded fuel.

3.13.2.2 Hazardous Constituents Disposition in the Sea Range

A - Missiles

Missiles fired on the Sea Range contain hazardous constituents as normal parts of their functional components. In general, the largest single hazardous constituent type is solid propellant, but there are numerous hazardous constituents used in igniters, explosive bolts, batteries, and warheads. Most of the missiles fired on the Sea Range carry inert warheads with no hazardous constituents. Approximately 5 percent of the missiles carry live warheads. Table 3.13-1 shows typical missiles fired on the Sea Range and their hazardous constituents.

B - Aerial Targets

Aerial targets are used on the Sea Range for testing and training purposes. Most air targets contain jet fuel, oils, hydraulic fluid, batteries, and explosive cartridges as part of their operating systems. Following a test or training operation, targets are generally flown (using remote controls) to pre-determined recovery points on the Sea Range (either 10 NM [19 km] south of Anacapa Island or 6 NM [11 km] north of San Nicolas Island). Fuel is shut off by an electronic signal, the engine stops, and the target begins to descend. A parachute is activated and the target descends to ocean surface where it is retrieved by range personnel using helicopters or range support boats. However, some targets are physically hit by missiles, and these targets fall into the Sea Range. Table 3.13-2 shows hazardous constituents associated with airborne targets used on the Sea Range.

C - Surface Targets

Surface targets are used on the Sea Range during missile and bombing exercises. Surface targets are stripped of unnecessary hazardous constituents and other augmentation and made environmentally clean; therefore, only minimal amounts of hazardous constituents are on board. Table 3.13-3 shows hazardous constituents associated with surface targets.

D - Ships and Boats

Test and training operations involve numerous combatant ships, target retrieval aviation rescue boats, and other support craft. These vessels are manned and do not intentionally expend any hazardous constituents into the water. However, small amounts of diesel fuel and engine oil may leak and be deposited on the Sea Range.

E - Other Ordnance

Other ordnance includes bombs, mine shapes, gunnery rounds, flares, and chaff used regularly on the Sea Range. Table 3.13-4 summarizes the types and amounts of ordnance used on the Sea Range and expended into the ocean in the baseline year. Most of this ordnance is inert (nonexplosive) and consists of non-hazardous constituents. Inert ordnance includes steel shapes or replicas containing concrete, vermiculite (a clay), or other non-hazardous constituents similar in appearance, size, and weight to explosive ordnance used in wartime.

Table 3.13-1. Hazardous Constituents in Typical Missiles Fired on the Sea Range, Baseline Year

Type	Description	Hazardous Constituents	# Missiles
AIM-7 Sparrow	Fired by F-14, F/A-18, F-15, and F-16 aircraft. Medium range (approximately 30 miles [48 km]), maneuverable, radar-guided missile with annular blast fragmented warhead.	Depending on the model, the propulsion system contains up to 99 lbs (45 kg) of solid propellant. Approximately 17 lbs (7.7 kg) of explosives in warhead.	82
AIM-9 Sidewinder	Fired by F-14, F/A-18, F-15, and F-16 aircraft. Short range (approximately 13 miles [21 km]), infrared heat-seeking missile with blast fragmentation warhead.	Depending on the model, the prolusion system contains up to 44 lbs (20 kg) of solid double-base propellant. The warhead contains approximately 10 lbs (4.5 kg) of PBX-N high-explosive components.	46
SM-1 and SM-2 Standard Missile	Fired from Navy surface ships. Long range (approximately 100+ miles [160+ km]), passive/semi-active radar guided anti-air missile, with a proximity fuse, high-explosive warhead.	The propulsion system contains 1,550 lbs (703 kg) of aluminum and ammonia propellant grain in the booster and 386 lbs (175 kg) of arcite propellant grain in the sustainer. The warhead contains between 75.2 lbs (34.1 kg) and 80 lbs (36.3 kg) depending on the missile version. Potassium hydroxide battery.	56
AIM-54 Phoenix	Fired by F-14 aircraft. Long range (approximately 65 miles [105 km]), semi-active and active radar homing missile with a proximity fused high-explosive warhead.	The propulsion system contains 366 lbs (166 kg) of solid propellant. The warhead contains 71 lbs (32 kg) of PBXN-106 explosive. Potassium hydroxide battery.	30
AGM-84 Harpoon	Fired from F/A-18, A-6, P-3, and B-52 aircraft. Long range (approximately 65+ miles [105+ km]), low-level flight, anti-ship, active radar guided missile with a penetration high-explosive warhead.	The propulsion system is a J402-CA-404 turbojet burning up to 128 lbs (58 kg) of JP-10 jet fuel. Warhead contains 215 lbs (98 kg) of Destex explosive components. Potassium hydroxide battery.	12
AIM-120 AMRAAM	Fired by F-14, F/A-18, F-15, and F-16 aircraft. Medium range (approximately 30 miles [48 km]), all weather beyond-visual range, semi-active and active radar homing missile with blast fragmented high-explosive warhead.	The propulsion system contains 101 lbs (46 kg) of solid propellant. The warhead contains 15 lbs (6.8 kg) of PBX (AF)-108 explosive. Lithium chloride batteries.	10

Source: 60 Series weapons publications.

Flares consist of powdered or pelleted magnesium imbedded in a matrix. They are incendiary and burn at high temperatures. There are two types: small flares are ejected from aircraft to act as decoys for enemy missiles, and larger ones are deployed under parachutes to provide illumination in support of other operations. Chaff is a thin polymer with a metallic (aluminum) coating used to decoy enemy radars.

Table 3.13-2. Hazardous Constituents in Air Targets on the Sea Range, Baseline Year

Type	Description	Hazardous Constituents	# Not Recovered
BQM-74	Surface- or air-launched target propelled by a JP-8 powered turbojet engine. Recovered in 57% of its launches in the baseline year.	Oils, hydraulic fluids, a nicad battery, and 16 gal (48 kg) of JP-8 fuel.	60
AQM-37	Supersonic, air-launched target (launched from a QF-4). An expendable target and is not recovered.	Hypergolic fuel of inhibited red fuming nitric acid as an oxidizer and mixed amine as a fuel. In addition, nitrogen is used to pressure fuels out of the tank and into the booster and sustainer chambers. The AQM-37 contains oils, hydraulic fluids, and a nicad battery.	29
QF-4	A twin engine, supersonic jet aircraft capable of speeds of Mach 2.1. Capable of being flown by remote control or with a pilot in the aircraft.	2,077 gal (6,117 kg) internal JP-8 fuel, various oils, and hydraulic fluids (3.8 lbs [1.7 kg] of thorium-232 in the 96 lbs [43.6 kg] of magnesium thorium in three gear boxes located in each engine).	3
BQM-34	Surface or air-launched target propelled by a JP-8 powered turbojet engine. Recovered in most tests.	Oils, hydraulic fluid, a lead-acid battery, and 111 gal (326 kg) JP-8 fuel.	3
MQM-8	Supersonic, surface-launched target that uses an initial solid propellant booster which burns for 2.7 seconds for initial launch. The main ramjet engine is powered by JP-10 fuel. An expendable target and is not recovered.	2,800 lb (1,270 kg) solid propellant, 140 gal (796 kg) JP-10 fuel oils, and hydraulic fluids. Also contains 129 lbs (58.5 kg) of magnesium thorium.	9
QUH-1	A single-engine, twin-rotor helicopter powered by JP-8 fuel. Recovered in the majority of tests.	227 gal (668 kg) JP-8 fuel, oil, and hydraulic fluid.	0
Tow Targets	The tow targets are not powered and do not contain hazardous constituents/materials. The tow aircraft uses a Ramair powered tow reel using the same fuel as the aircraft. The tow reels are reusable and return to base with the aircraft.	None	0
MA-31	A converted air-to-ground, supersonic missile now used as an expendable target. It is not recovered.	Carries up to 121 lbs (55 kg) of JP-8 fuel to power the ramjet engine.	None used in the baseline year.

Source: NAWCWPNS Point Mugu 1996o.

Table 3.13-3. Hazardous Constituents in Surface Targets on the Sea Range, Baseline Year

Target	Description	Hazardous Constituents	# Not Recovered
Mobile Ship Target (MST)	A 50-foot (15-m) steel hulk that has been stripped of excess hazardous constituents. Operates under its own power using diesel engines with only the necessary fuel on board to perform the test requirements. The MST can be hit by missiles and remain afloat.	Diesel fuel, engine oil, and batteries	None
SEPTAR (QST-33 and QST-35)	An 18-foot (5-m) (QST-33) or 60-foot (18-m) (QST-35) fiberglass boat that is loaded with floatation foam to prevent sinking. Operates under its own power with gasoline engines and a 12-volt battery for starting. Both targets are augmented with specialized equipment to prevent being struck by a missile, and no SEPTARs have been sunk.	Gasoline, engine oil, and batteries	None
Improved Surface Test Target (ISTT)	A towed, polygon shaped, fiberglass target. It is often the target of gunnery practice.	None	The ISTT is a non-hazardous, low-cost target and is usually sunk during tests at a rate of two to three per year.
Floating at Sea Target (FAST)	A towed, polygon shaped, fiberglass target.	None	Similar to the ISTT; approximately two targets are expended per year.
Williams Sled	A 28-foot (8-m) steel and aluminum towed target similar to a catamaran.	None	Generally used for gunnery practice with approximately two to three expended per year.
Trimaran	A 16-foot (5-m) fiberglass trimaran towed target.	None	Approximately two to three are expended per year.

Source: NAWCWPNS Point Mugu 1996o.

Table 3.13-4. Other Ordnance Expended on the Sea Range, Baseline Year

Category	Ordnance Type	# Expended in Sea Range
Flares	MJU-8, LUU-2	262
General Purpose Bombs - Inert	MK-82, MK-76, GBU	405
Practice Bombs - Inert	BDU-45, BDU-48, Other	180
Mine Shapes - Inert	MK-36, MK-52, MK-55, Others	49
Aircraft gunnery rounds	20 mm	7,310
Naval gunfire rounds	7.62 mm, 20 mm, 76 mm, 5-inch/54-caliber	2,688
Chaff	N/A	114

Source: NAWCWPNS Point Mugu 1997a.

3.13.2.3 Shipboard Hazardous Materials Management

Environmental compliance policies and procedures applicable to shipboard operations on the Sea Range are defined in OPNAVINST 5090.1B (1998), Chapter 19. These instructions reinforce the Clean Water Act's prohibition against discharge of harmful quantities of hazardous substances into or upon U.S. waters out to 200 NM. Navy ships are required to conduct operations at sea in such a manner as to minimize or eliminate any adverse impacts on the marine environment. This includes stringent hazardous waste discharge, storage, dumping, and pollution prevention requirements. Refer to Table 3.4-1 for a description of discharge restrictions for Navy vessels at sea.

3.13.3 Point Mugu

3.13.3.1 Hazardous Materials Management

NAS Point Mugu has a *Hazardous Waste Management Plan* (October 1997) that provides guidance and direction for the use, storage, and compliance activities for hazardous materials and wastes at the base. The plan contains major sections on the following areas:

- Specific responsibilities for functional areas;
- A summary of applicable federal/state laws and regulations and DoD policies;
- Requirements for hazardous waste generators;
- Storage, transportation, disposal requirements;
- Personnel training requirements;
- Reporting and record keeping;
- Contingency and Emergency Plans;
- Emergency Planning and Community Right-to-Know Act (EPCRA);
- Explosive ordnance derived wastes; and
- Hazardous wastes inventories and site specific maps.

The Hazardous Waste Management Plan is a comprehensive compilation of procedures and requirements that are mandated by law, directive, or regulation. The plan has a compliance orientation to ensure safe and efficient control, use, transport, and disposal of hazardous waste.

<u>A - Hazardous Materials Storage</u>

The majority of hazardous materials used at NAS Point Mugu are stored by the Environmental Materials Management Division (EMMD) in the Hazardous Material Minimization Center (HAZMINCEN). Individual shops are also authorized to store hazardous materials in small quantities. Generally, shops are limited to storing one week's worth of hazardous materials for tasks that are performed on a routine basis. There are approximately 40 storage lockers on NAS Point Mugu.

Fuel products comprise the greatest amount of hazardous materials on the base. The most hazardous fuel is the hypergolic fuel used in the AQM-37 target. Other types of hazardous materials are stored at NAS Point Mugu in varying quantities throughout the year. Table 3.13-5 presents a summary of the types and amounts of fuel stored onbase.

Table 3.13-5. Fuel Type and Quantity Stored at NAS Point Mugu

Fuel Type	Supply (gallons)
JP-8 (jet fuel)	800,000 to 1,100,000
Unleaded Gasoline	up to 50,000
Aviation Gasoline	up to 52,000
Diesel	up to 24,000

Source: NAS Point Mugu 1998b.

B - Ordnance Transportation

Ordnance, including the solid rocket motor boosters and safe arming devices, arrive at Gate 3. Base security notifies the Receiving Office in the Supply Department. All ground shipments of ordnance are escorted by security personnel over predetermined routes. Shipments of ordnance to San Nicolas Island are via aircraft with security providing escort during the ground phase of the delivery. For a discussion of the transportation of ordnance through civilian areas see Section 3.14, Public Safety.

3.13.3.2 Hazardous Waste Management

The *Hazardous Waste Annual Report* indicates that NAS Point Mugu produced approximately 826,000 pounds (375,000 kg) of hazardous waste in 1996. With the addition of the four E-2 squadrons as a result of realignment from NAS Miramar, this amount is expected to increase to 835,573 pounds (379,245 kg) annually (Southwest Division 1998). These wastes consist primarily of contaminated jet fuel, waste rags, paint, solvent, spill residues and absorbent materials, corrosion prevention compound in aerosol cans, ethylene glycol, batteries, antifreeze, hydraulic fluid, photo processing waste materials, waste cleaning compounds, and debris materials.

Hazardous wastes are generated at most of the industrial shops at NAS Point Mugu. There are approximately 41 satellite accumulation areas and three “less-than-90-day” accumulation areas at the base. Hazardous waste is collected at the satellite accumulation areas by the EMMD and transported back to the EMMD “less-than-90-day” accumulation area. The EMMD vehicle is equipped with a spill containment system and an emergency spill kit. The Environmental Project Office hazardous waste contractor collects the hazardous waste from the EMMD and transports it to the Environmental Project Office “less-than-90-day” accumulation area. All hazardous waste is removed from the waste yard and off base by a Defense Reutilization and Marketing Office (DRMO) contractor to an approved treatment, storage, and disposal (TSD) facility.

Waste fuels, oils, and hydraulic fluids are temporarily stored in fuel tanks at the fuel farm. A contractor periodically drains the contents from the tanks and recycles the fluids.

3.13.3.3 Installation Restoration Program

The DoD has established the Installation Restoration Program (IRP) as a means to identify, investigate, and remediate or control hazardous waste sites located at military installations. The IRP is intended to be a tool for the identification and clean-up of any contaminant releases that could endanger public health, welfare, or the environment. There are three phases in the IRP process: Phase I, the Site Inspection Phase, includes the identification of potential hazardous waste sites through interviews, record searches, and minimal sampling; Phase II, the Remedial Investigation/Feasibility Study Phase, includes exhaustive sampling and remediation design planning; and Phase III, the Remedial Design/Remedial Action Phase, within which the site is remediated or secured.

There are 15 active IRP sites which have been identified at NAS Point Mugu. Other sites have been identified in the past but have been closed after remediation or are in long-term monitoring status. Table 3.13-6 presents a summary of the 15 active IRP sites at NAS Point Mugu; Figure 3.13-1 shows the locations of these IRP sites.

Table 3.13-6. Active IRP Sites at NAS Point Mugu

No.	Site	Description	Status
1	Lagoon Landfill	A 35-acre site operated from 1952 to 1975.	Feasibility study being performed.
2	Old Shops Area	General Public Works vehicle maintenance area.	Remedial investigation ongoing.
4	Public Works Storage Yard	Electrical transformer maintenance area and hazardous material storage area.	Removal action complete. Awaiting official site closure.
5	Old Area 6 Shops	An all purpose shop area including: machine shop, plating shop, chemical laboratory, sandblasting, and photography shop.	Pilot test being performed during feasibility study.
6	Building 311 Yard	A disposal location for plating shop wastes.	Remedial investigation ongoing.
7	Electrical Substation 688	An electrical substation where a small PCB spill occurred.	Site investigation complete.
8	Runway Landfill	A 4-acre site where disposal of demolition debris occurred.	Remedial investigation ongoing.
9	Main Base Fire Training Area	Former fire fighting training area which used an unlined pit to burn jet fuel.	Remedial investigation ongoing.
10	California Edison Transformer	A pole-mounted, PCB-containing transformer involved in a fire caused a release of transformer fluid.	Remedial action complete. Awaiting official site closure.
11	Lagoon and Drainage Ditches	This site was used for disposal of battery waste, waste oil, fuel, detergents, hydrazine, metals, and acids. It also receives rain runoff from Sites 1,2,4,5,8, and 9.	Remedial investigation complete.
20	Missile Testing Area (Saltwater Well)	The site is a closed saltwater well into which mercury was released from an unknown source.	Site investigation ongoing.
24	Former Ground Support Equipment Area	Formerly known as UST Sites 23 and 55. A former OWS where oil and solvents were disposed of.	Remedial investigation ongoing.
None	UST Site #21	A former 500-gallon UST removed in 1989. Solvents and petroleum products present.	Site investigation ongoing.
None	UST Site #24	A former OWS removed in 1989. Solvents and petroleum products present.	Site investigation ongoing.
None	UST Site #6	A UST where used oil and waste solvents were stored.	Remedial investigation ongoing.

OWS - oil/water separator
PCB - polychlorinated biphenyl
UST - underground storage tank
Source: NAWS Point Mugu 1998c.

IRP Sites at NAS Point Mugu

Projection: Universal Transverse Mercator, Zone 11
North American Datum of 1927
Scale shown is 1:40,000
Source: Western Division 1993b.

pmirp.aml

Figure 3.13-1

3.13.3.4 Storage Tanks and Oil/Water Separators

Both underground storage tanks (USTs) and aboveground storage tanks (ASTs) are used to store hazardous substances and petroleum products throughout the base. Many USTs have been taken out of service and removed from the ground. There are 18 USTs and 115 ASTs on the main base, San Nicolas Island, and Santa Cruz Island. All 18 USTs and 83 of the ASTs are located at NAS Point Mugu. Sixty-six UST facilities have had releases; 49 of the facilities have been closed. Cleanup has been completed at one site with its closure pending. One site is undergoing cleanup, and six have been transferred to the IRP. The remaining nine sites have been assessed and are awaiting closure (NAWS Point Mugu 1997i).

JP-8 is transported to NAS Point Mugu by bulk fuel transport trucks from the Defense Fuel Supply Point in San Pedro, California. The fuel is stored at the fuel farm in three ASTs with a capacity of 334,500 gallons (1,271,100 liters) each and three ASTs with a capacity of 121,800 gallons (462,840 liters) each, providing a total capacity of 1,368,900 gallons (5,201,820 liters) (NAWS Point Mugu 1997j). Current throughput is approximately 1,285,300 gallons (4,865,300 liters) per month, including fuel used in support of the four E-2 squadrons (NAWS Point Mugu 1997i; Southwest Division 1998). The fuel storage tanks are presently being upgraded to meet environmental requirements, and modern control systems (e.g., high level alarms) are being installed.

Aircraft fueling occurs on the aircraft parking apron and in the ammunition loading revetment. The fuel is transported from the fuel storage facility by designated trucks identified as airplane side refueling vehicles. There are three refueling vehicles and one fueler/defueler presently in operation.

An Oil and Hazardous Substance Spill Prevention, Control, and Countermeasure Plan (SPCC) plan is implemented for the base (NAWS Point Mugu 1995b). Spill response equipment is stored at each fuel storage area, and the Fire Department responds to any spills over 5 gallons (19 liters) on pavement and any spills to soil or water.

There are 17 active oil/water separators located in the operations area of the base that receive jet fuel and oily wastewater from the wash racks and other activities (NAWS Point Mugu 1997i). The wastewater from the oil/water separators is discharged to the NAS wastewater treatment plant for pretreatment prior to its discharge to the public water treatment facility.

3.13.4 San Nicolas Island

3.13.4.1 Hazardous Materials

Hazardous materials used on San Nicolas Island are ordered through the NAS Point Mugu EMMD and shipped to the island via barge or aircraft. Seven storage lockers are located on the island. The largest quantity of hazardous materials stored is in the form of fuel. About 680,000 gallons (2.6 million liters) of jet fuel are shipped to the island by tanker barge per year. Unleaded gasoline is also shipped for use by ground vehicles. About 1,000 gallons (3,800 liters) of unleaded gasoline per week are shipped by freight barge. A total of 53,000 gallons (201,400 liters) of unleaded gasoline was used on the island in the baseline year.

Various hazardous materials, oils, and hydraulic fuels are used to support aircraft, target, and vehicle maintenance that is performed on the island. Hazardous materials are used in a similar manner as at NAS Point Mugu. Only the minimum amount of a hazardous material is obtained for a task in order to prevent disposing excess material as hazardous waste.

3.13.4.2 San Nicolas Island Hazardous Waste Management

There are eight satellite hazardous waste storage areas on San Nicolas Island. Hazardous wastes are stored at these satellite accumulation areas prior to being transported to the less-than-90-day accumulation area on the island. From the less-than-90-day accumulation area, the waste is shipped via freight barge to Port Hueneme. In the baseline year, there were 65,689 pounds (29,813 kg) of hazardous wastes shipped from San Nicolas Island. After arrival at Port Hueneme, the waste is transported by a DRMO contractor to an approved TSD facility.

3.13.4.3 Installation Restoration Program

There are two active IRP sites located on San Nicolas Island. Other sites have been identified in the past but have been closed after remediation or are in long-term monitoring status. Table 3.13-7 summarizes the active IRP sites on San Nicolas Island; Figure 3.13-2 shows their location.

Table 3.13-7. IRP Sites on San Nicolas Island

No.	Name	Description	Status
18	West End Range	Presence of unexploded ordnance.	Preliminary assessment completed.
26	Building 182	Release of caustic materials.	Site investigation completed.

Source: NAWS Point Mugu 1998c.

3.13.4.4 Underground Storage Tanks

There are several UST remediation projects taking place on San Nicolas Island. None of the leaking USTs have contaminated drinking water sources, and contamination does not extend beyond the island boundaries.

3.13.5 Other Channel Islands

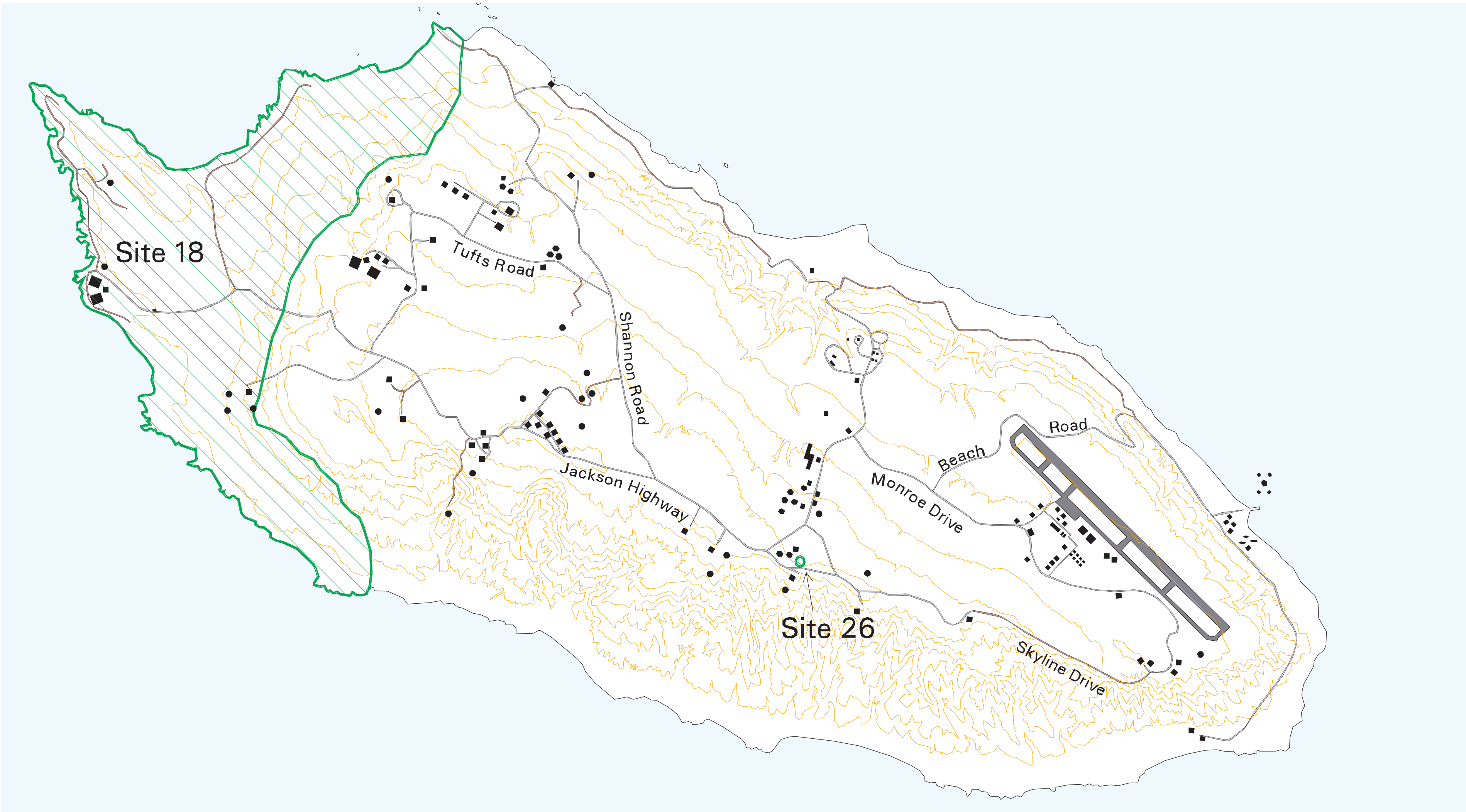
Sea Range facilities are located on San Miguel, Santa Rosa, and Santa Cruz islands (refer to Section 3.0.1.3). Hazardous materials used on these islands are ordered through the NAS Point Mugu EMMD and shipped to the islands via boat, barge, or aircraft. The largest quantity of hazardous materials stored is in the form of fuel on Santa Cruz Island. A photovoltaic power generation system recently was installed on the island to reduce annual fuel consumption. In FY98, approximately 1,626 gallons (6,155 liters) of gasoline and 21,141 gallons (80,027 liters) of JP-8 were shipped to Santa Cruz Island by barge.

Various hazardous materials are used to support maintenance of facilities on these islands. Only the minimum amount of hazardous material is obtained for a task in order to prevent disposing excess material as hazardous waste.

3.13.6 Pollution Prevention

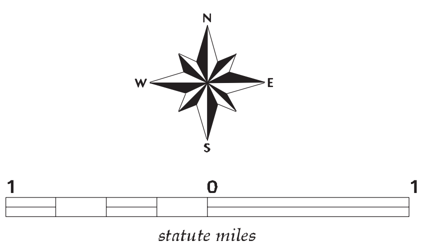
The Navy has an active Pollution Prevention Program which applies to all aspects of its activities. It is Navy policy to conduct its facility management and acquisition programs to reduce to the maximum extent possible the quantity of toxic chemicals entering the environment. Pollution prevention is not

IRP Sites at San Nicolas Island



Legend

- Airfield
- Structures
- IRP Sites
- Roads
- 100′ Contour Lines



Projection: Universal Transverse Mercator, Zone 11
North American Datum of 1927
Scale shown is 1:60,000
Source: Western Division 1993a.

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Figure 3.13-2

pollution control but a comprehensive set of practices which result in less volume of wastes to be treated or transferred to the environment. The fundamental tenet of the Navy's Pollution Prevention Program is the reduction of hazardous materials and wastes at their source. This results in less hazardous wastes for all waste streams. Examples of the types of practices or techniques used in pollution prevention programs include many of the following:

- Raw material input substitution
- Product reformulation
- Process redesign or modification
- Improved operation and maintenance
- Aggressive recycling programs

Since many of the activities which occur at NAS Point Mugu are Research and Development in the weapons systems acquisition process, these activities must be compliant with the overall DoD guidance on pollution prevention during weapons acquisition. DoD Instruction 5000.2-R mandates specific weapons acquisition policies and procedures. Pollution prevention requirements are covered by this regulation and are directive in nature to the military services. The regulation's major pollution prevention requirements are:

> In designing, manufacturing, testing, operation, maintaining, and disposing of systems, all forms of pollution shall be prevented or reduced at the source whenever feasible. Pollution that cannot be prevented shall be recycled. Pollution that cannot be prevented or recycled shall be treated in an environmentally safe manner. Disposal or other releases to the environment shall be employed only as the last resort.

NAS Point Mugu has an active Pollution Prevention Program to reduce the amount of hazardous and solid wastes generated on base. The guidance for the program is the December 1995 Pollution Prevention Plan.

3.13.7 Recycling

Recycling is the reuse or reclamation of previously used materials which would become wastes and require disposal if not recycled. An aggressive recycling program is an important part of the NAS Point Mugu Pollution Prevention Program. Table 3.13-8 shows some of the pollution prevention recycling statistics for NAS Point Mugu.

Table 3.13-8. Recycling Statistics for NAS Point Mugu, Baseline Year

Waste	Weight (lbs)	Revenue (dollars)	Landfill Reduction (tons)
Aluminum	2,084	$ 2,002.30	1.042
Batteries	23,270	612.05	11.635
Books	20,166	210.36	10.083
Cardboard	254,520	28,288.10	127.260
Christmas trees	14,040	0	7.020
Colored paper	7,526	497.58	3.763
Computer paper	64,514	9,403.19	32.257
Glass	66,638	2,264.45	33.319
Newspaper	199,690	4,153.65	99.845
Oil	337,800	4,776.17	N/A
Plastics	10,859	1,051.80	5.430
Scrap metal	403,870	24,209.55	201.935
Toner cartridges	1,654	3,576.00	0.827
White ledger	59,769	4,106.02	29.884
Wood	N/A	102.50	N/A
Totals	**1,466,400**	**$85,253.72**	**564.300**

Source: NAWS Point Mugu 1996d.

3.14 PUBLIC SAFETY

3.14.1 Introduction

3.14.1.1 Definition of Resource

Public health and safety issues include potential hazards inherent in flight operations, missile firings, operation of Navy vessels, and target operations. This resource also addresses issues of public proximity and access; effects of electromagnetic radiation (EMR) on the public; potential ordnance hazards; and potential fuel hazards. The safety policy of NAWCWPNS Point Mugu is to observe every reasonable precaution in the planning and execution of all operations which occur on the Sea Range to prevent injury to people and damage to property.

3.14.1.2 Regional Setting

The Point Mugu Sea Range is fundamentally a missile range, although other activities occur in addition to that basic mission. The primary priority when planning and conducting missile test and training activities is safety, both for military personnel and for the general public. The majority of tests are conducted in outer parts of the Sea Range, usually away from areas heavily used by commercial and recreational users (refer to Figures 3.0-19 and 3.0-20). NAWCWPNS implements advance NOTAMs and NOTMARs as well as range safety clearance prior to conducting any tests that might be hazardous to non-participants. In more than 50 years of Navy operations on the Sea Range, no safety incidents involving the general public have occurred.

3.14.1.3 Region of Influence

The region of influence (ROI) for public safety includes the Point Mugu Sea Range, NAS Point Mugu, and San Nicolas Island. San Miguel, Santa Rosa, and Santa Cruz islands are not addressed in this section because the alternatives analyzed in this EIS/OEIS (including the No Action Alternative) would not affect public safety at these locations.

3.14.2 Point Mugu Sea Range

3.14.2.1 Range Safety

The Sea Range safety policy, procedures, and guidance are covered in NAWCWPNS Instruction 5100.2 dated 9 July 1993. This document defines range safety requirements, criteria, the safety planning process, and operational procedures. Although the Commander of NAWCWPNS has the ultimate responsibility for range safety, the authority for execution of these safety programs is delegated to the Sea Range Safety Officer in the Range Safety Office. A more detailed description of safety procedures on the Sea Range is presented in Section 3.0.2.1.

3.14.2.2 Public Access and Proximity

Public access and proximity to the Sea Range is a principal safety consideration since most of the Sea Range is in non-Territorial Waters and open to the public. The airspace over the NAS Point Mugu airfield, beach, and to 3 NM (5.6 km) offshore is a Restricted Area, and non-participating aircraft are precluded from entering this area. Another Restricted Area encompasses airspace over San Nicolas

Island to prevent access of unauthorized aircraft. These are the only areas of the Sea Range where NAWCWPNS has the authority to control access of individuals, aircraft, and ships.

NAWCWPNS Point Mugu has an extensive surveillance system to implement real-time safety clearance procedures prior to initiation of an operation on the range. This system includes the use of land-, sea-, and air-based radar in addition to aircraft surveillance of the range which is necessary to ensure that the public remains clear of designated operational areas where they could be subjected to hazardous conditions. The range uses specially modified P-3 aircraft, the NP-3D, that provides extended Sea Range surveillance. A review of past Range Safety Office records show that accidents involving the public on the Sea Range have never occurred.

When the Sea Range is used for military testing and training operations, the Navy notifies commercial, civilian, and other military aviation through a NOTAM which provides appropriate information to the FAA and its ATC agencies to route traffic around these Warning Areas and Restricted Areas when they are active. (Warning Areas are located over non-Territorial Waters of the U.S.; Restricted Areas are located over land or Territorial Waters.) Although a NOTAM does not preclude uncontrolled air traffic from entering a Warning Area even when the area is active, DoD Directive 4540.1, *Use of Airspace by U.S. Military Aircraft and Firings Over the High Seas*, provides guidance for operating within Warning Areas: non-participating aircraft are identified by radar, and contact with these aircraft is made by radio; if aircraft remain in a clearance area, even after being requested to leave, the Sea Range will delay, cancel, or move a test to a clear area.

Similar procedures exist for notification of the commercial shipping and recreational boating communities of potentially hazardous activities on the Sea Range. These notifications are made through NOTMAR and daily VHF-FM Marine Radio (Channel 16) broadcasts. The Sea Range has established procedures to ensure that non-participating surface vessels are not exposed to undue risk. The surveillance aircraft survey designated clearance areas to ensure that surface vessels are not present. Any vessels, if present, are warned that they are in an area of an impending hazardous activity and are requested to leave the area. Contact with vessels is made by marine band FM radio; however, loud speakers can be used if the boat is not radio-equipped. Since most of these areas are in Territorial Waters, the Navy requests that ships leave the clearance areas. If vessels remain in the clearance area, the Sea Range will delay, cancel, or move the test to a clear area. A test will not normally be initiated if a non-participating vessel is present in the clearance area.

3.14.2.3 Safety Procedures

Safety analyses and planning are integral parts of operations prior to the execution of any event on the Sea Range. The safety documentation begins with the preparation of either a Range Safety Approval or a Range Safety Operational Plan (RSOP). These are similar planning documents, except that an RSOP applies to missiles requiring a flight termination system (FTS) controlled by a Missile Flight Safety Officer (MFSO). At a minimum these documents are required to include:

1. the location of the launch site and conditions under which the launch will be made;
2. a description of the missile air safety hazard pattern, ground safety hazard pattern, surface safety hazard pattern, and impact areas;
3. a description of regions to be surveyed and cleared of aircraft and surface vessels;
4. a description of the ground safety hazard pattern which must be cleared of personnel;
5. a list of all essential personnel approved to be in the safety hazard pattern;
6. a list of any waivers of safety criteria, special instructions, or stipulations; and
7. a list of specific requirements or guidelines for range safety briefings for the operation.

In addition, the RSOP requires a description of the operational procedures and equipment by which the MFSO will monitor missile performance and exercise FTS control over the missile.

During the safety planning process, the extent of each safety hazard pattern is established. A safety hazard pattern is the surface area that could be endangered by a missile if it does not follow its prescribed flight path. Safety hazard patterns are highly variable in size and are dependent on the altitude of launch, total missile energy available (time of flight), and turning ability. A clearance area is an area larger than the safety hazard pattern which is kept clear of non-participants for safety purposes. Impact areas are much smaller and fall within the defined safety hazard pattern of a missile. The impact area (or debris pattern) is the predetermined maximum area where a missile or its components could strike the surface. Since most missiles fired on the Sea Range do not carry live warheads, most impact areas are relatively small. Computer models are used to determine the size and location of the impact area into which debris may fall. These predictions are calculated based on altitude, speed, mass of debris pieces, angle of impact, and winds. Impact areas for missiles used on the Sea Range are generally oval in shape and can be up to 10 NM (19 km) long and 7 NM (13 km) wide.

3.14.3 Point Mugu

3.14.3.1 Electromagnetic Radiation

The Navy uses equipment such as communications devices, radar, electronic jammers, and other special testing equipment which produce EMR. EMR is created as a result of the flow of electricity within a system, producing an electromagnetic field. Instruments that produce an electromagnetic field have the potential to produce hazardous levels of EMR. EMR is expressed in milliwatts per square centimeter (mW/cm^2). The safety threshold for EMR depends on the frequency of the source of EMR. The lower the frequency of the EMR source, the lower the acceptable power density threshold before an endangerment to human health occurs. Likewise, the higher the frequency of the EMR source, the higher the acceptable power density threshold before health effects occur. An EMR hazard exists when transmitting equipment generates electromagnetic fields that induce currents or voltages great enough to trigger electro-explosive devices in ordnance, cause harmful effects to people or wildlife, or create sparks which ignite flammable substances in the area. These hazards are reduced or eliminated by establishing minimum distances from EMR sources for people, ordnance, and fuels.

The onbase hazards of electromagnetic radiation to personnel (HERP), ordnance (HERO), and fuel (HERF) have been determined using information supplied by the NAS Point Mugu Weapons Department. Figure 3.14-1 shows HERO and HERP arcs at NAS Point Mugu. HERF constraints are considered to be negligible and are not depicted. Although the HERO arcs are large enough to extend beyond base boundaries, these arcs only affect ordnance on base, and strict EMR control procedures are used when HERO-susceptible ordnance is transported or present in the open.

3.14.3.2 Explosive Safety Quantity Distance Arcs

Explosive Safety Quantity Distance (ESQD) arcs are defined by Naval Sea Systems Command (NAVSEA) Operating Procedure (OP) 5(1) (NAVSEA 1995) and are used to establish the minimum safe distance between ordnance storage facilities (often referred to as magazines) and inhabitable buildings. The type and amount of ordnance material which can be stored in a magazine is determined by the Department of Defense Explosive Safety Board (DDESB). To ensure safety, personnel movements are restricted in areas surrounding a magazine or group of magazines.

HERO and HERP Arcs at NAS Point Mugu

Legend

- NAS Point Mugu
- Surface Water
- Roads
- Airfield
- Structures
- Hazards of Electromagnetic Radiation to Ordnance (HERO) Arcs
- Hazards of Electromagnetic Radiation to Personnel (HERP) Arcs

N W E S

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statute miles

Projection: Universal Transverse Mercator, Zone 11
North American Datum of 1927
Scale shown is 1:60,000
Source: Western Division 1986.

pmhero.aml

Figure 3.14-1

Figure 3.14-2 shows ESQD arcs at NAS Point Mugu associated with ordnance storage facilities, most of which are in the western portion of the base. A small ordnance magazine complex is located at the south end of South I Avenue. Two other ordnance magazines, Structures 344 and 347, are located on the north side of 11th Street, west of South Mugu Road. Structure 344 is a small arms/pyrotechnic magazine for the NAS Intermediate Maintenance Activity Avionics Armament Division. Structure 347 is a VX-9 ready magazine.

3.14.3.3 Accident Potential Zones

APZs are developed based on a review of historical accident and operations data and the application of military accident potentials guidelines. APZs are not used to predict aircraft accidents, rather they are used to indicate where accidents tend to occur most often. OPNAVINST 11010.36A identifies three types of APZs: the clear zone, APZ-I, and APZ-II. The clear zone, the area with the highest probability for accidents, includes the runway environment and extended areas off each runway end. It lies immediately beyond the end of the runway and outward along the extended runway centerline for a distance of 3,000 feet (914 m). Its fan-shaped pattern ranges from 1,500 feet (457 m) to 2,284 feet (696 m) at its widest point (refer to Figure 3.10-4).

The AICUZ program, which identifies clear zones and APZs, was last updated for NAS Point Mugu in September 1992 (U.S. Navy 1992). APZs have been developed for all runways, except Runway 09. Runway 09 handles about 3 percent of all operations at NAS Point Mugu, and no single flight track has over 5,000 operations per year. The most common use for Runway 09 is for rotary wing pattern flight tracks and the number of these operations is not enough to generate an APZ. No aircraft accidents have occurred on or near Runway 09.

3.14.3.4 Public Access and Proximity

Except for special events, public access to NAS Point Mugu is controlled for security reasons and to safeguard against potential hazards associated with military operations on the base. Potential hazards include EMR, ordnance storage and loading, aircraft operations, and missile and target launches. A security fence surrounds NAS Point Mugu, and all foot and vehicular traffic enter the base through four guarded gates (Gate 5 is operated by special request only). The base is surrounded by an agricultural buffer zone to the northeast and northwest, thus reducing the population density in the areas immediately outside base boundaries. The primary launch location for airborne targets and for surface-to-surface missiles at NAS Point Mugu is at the Building 55 Launch Complex. During launch events, access to the immediate vicinity and offshore areas beneath the launch azimuth is strictly controlled to prevent injury to personnel or damage to property. Figure 3.14-3 shows the safety hazard pattern for target launches from Building 55.

3.14.3.5 Bird-Aircraft Strike Hazard

Bird-aircraft strike hazard (BASH) is defined as the threat of aircraft collision with birds during flight operations. It is a safety concern at all airfields due to the frequency of aircraft operations and the possibility of encountering birds at virtually all altitudes. Most birds fly close to ground level, and more than 95 percent of all reported bird-strikes occur below 3,000 feet (914 m) above ground level (AGL). At most military bases, about half of reported bird-strikes occur in the immediate vicinity of the airfield, and another 25 percent occur during low-altitude local training exercises.

ESQD Arcs at NAS Point Mugu

Legend

- NAS Point Mugu
- Surface Water
- Roads
- Airfield
- Structures
- Explosive Safety Quantity Distance (ESQD) Arcs

N
W E
S

1 0 1
statute miles

Projection: Universal Transverse Mercator, Zone 11
North American Datum of 1927
Scale shown is 1:45,000
Source: Western Division 1986.

Figure **3.14-2**

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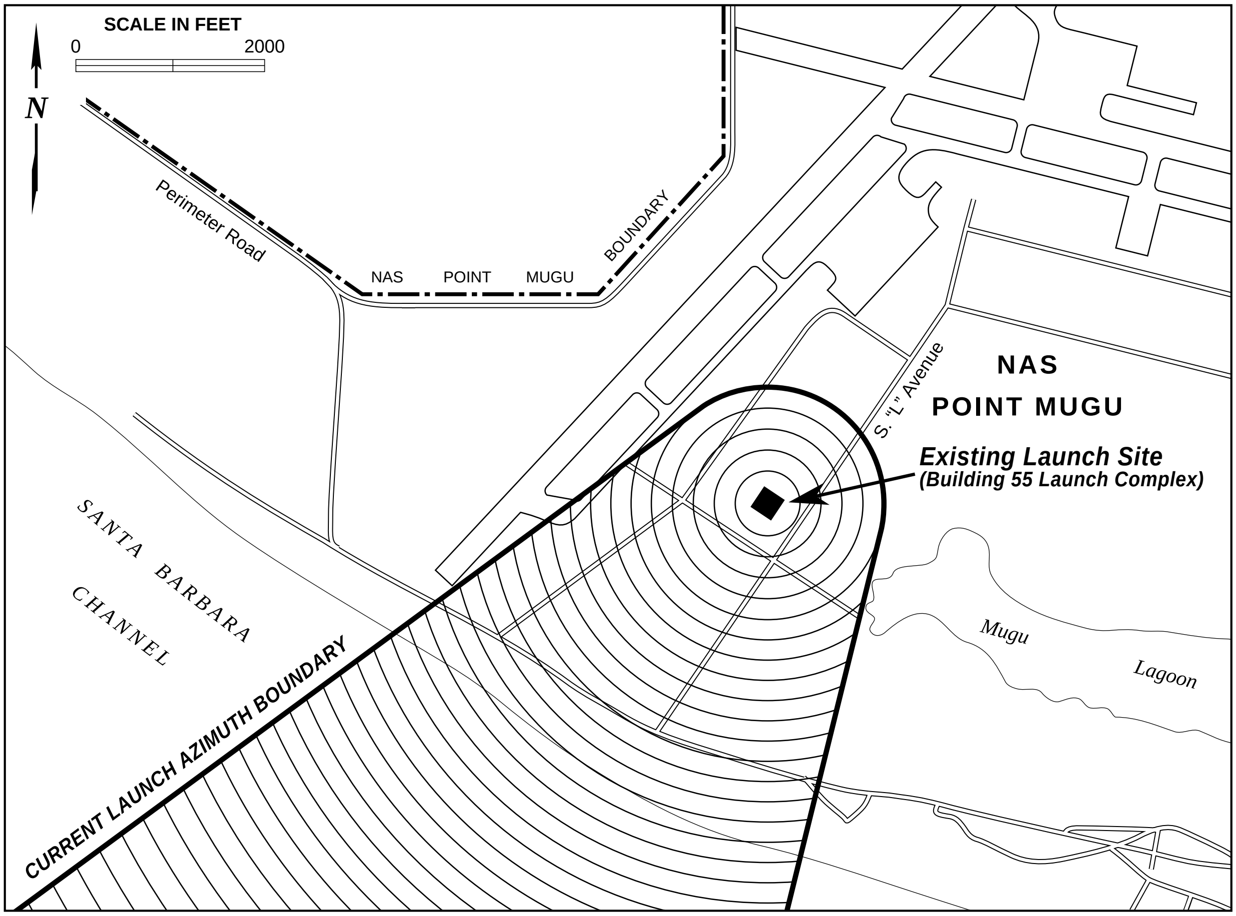


Source: NAWCWPNS Point Mugu 1996m.

Figure 3.14-3
Target Launch Warning
Zones at NAS Point Mugu

Waterfowl present the greatest BASH potential due to their congregational flight patterns and because when migrating they can be encountered at altitudes of up to 20,000 feet (6,096 m) AGL. Raptors also present a substantial hazard due to their size and soaring flight patterns. In general, the threat of bird-aircraft strikes increases during March and April and from August through November due to migratory activity (U.S. Navy 1992).

In terms of airfield operations and related safety procedures, ATC and the Environmental Project Office have primary responsibility for implementation of accident-preventative measures. Among the programs the Navy has developed and implemented is their BASH Plan, most recently updated in April 1990. NAS Point Mugu's BASH Plan has the stated purpose "to reduce the bird-strike hazard to aircraft aboard NAWS Point Mugu by creating an integrated bird control and bird hazard abatement program…" It is tailored to address seasonal fluctuations in bird concentrations in the vicinity of the airfield complex. Some portions of the plan are implemented on a continuous basis while others are enacted only during periods of heightened bird activity.

A critical function of the NAS Point Mugu BASH Plan is the establishment and maintenance of a Bird Hazard Working Group (BHWG) responsible for collecting, compiling, and reviewing bird-strike data; identifying and recommending hazard-reducing activities; recommending operational changes when appropriate; preparing informational programs for aircrews; and serving as the point of contact regarding off-base BASH issues. The BHWG meets quarterly in conjunction with the Area Aviation Safety Office and submits all recommendations to the Commanding Officer for approval; implementation follows a standard chain of command.

Numerous wetlands and other habitats conducive to bird congregation (e.g., seasonal and migratory birds) and nesting (e.g., resident birds) are located at Point Mugu. The Santa Barbara Channel and Pacific Ocean serve as migratory corridors and foraging areas for several species of waterfowl (e.g., gulls, geese, and pelicans). In addition, two duck hunting clubs are located immediately west of the base and present potential hazards as they contain marshes and ponds designed for the specific purpose of attracting waterfowl to the area.

Historically, bird-strikes have not represented a significant safety hazard for aircraft at the NAS Point Mugu airfield. Bird strike data indicate that anywhere from 10 to 60 birds have been struck within any given year. The majority of reported bird strikes occurred with propeller-driven planes. Given the recent increase in aircraft activity associated with the E-2 aircraft squadron realignment to NAS Point Mugu (Southwest Division 1998), existing bird strike potential could be as much as 30 percent higher than this (or about 10 to 80 incidents per year). However, none of the reported bird-aircraft collisions resulted in major damage to aircraft or injury to personnel.

3.14.3.6 Transportation of Munitions and Dangerous Articles

Transport of non-fused munitions on public roadways is controlled and regulated by the U.S. Department of Transportation. The State of California applies federal guidelines (49 C.F.R.) for regulating transportation of explosives or other dangerous articles within its jurisdiction. Munitions and other dangerous articles may be transported on public highways if proper safety criteria are applied in accordance with federal guidelines.

3.14.4 San Nicolas Island

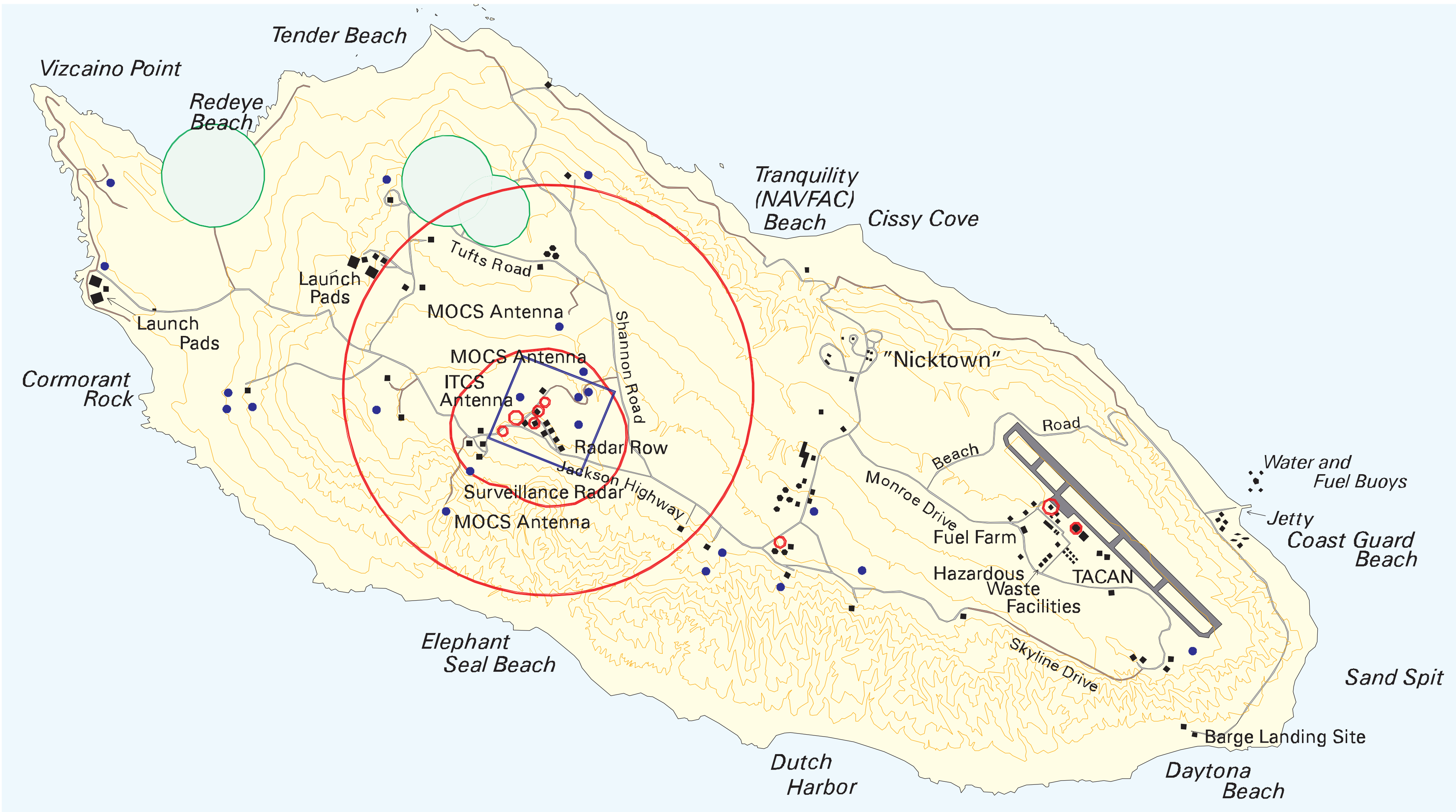
3.14.4.1 Electromagnetic Radiation

The Navy operates a variety of equipment and facilities at San Nicolas Island which generate EMR. These EMR sources include radar, communication facilities, and power utility lines. The potential hazards associated with the operation of this equipment are similar to those discussed for NAS Point Mugu in Section 3.14.3. Figure 3.14-4 shows the HERO and HERP arcs for San Nicolas Island. As with NAS Point Mugu, the HERF danger is negligible and not depicted.

3.14.4.2 Explosive Safety Quantity Distance Arcs

Various munitions and targets are stored and maintained at San Nicolas Island that are susceptible to the effects of EMR. These include missile warheads, rocket motors, high explosives, and other types of ordnance which are used in the testing or training activities occurring on the Sea Range. Munitions arrive on the island either by surface ship or by air transport. ESQD arcs for the safety of personnel and equipment have been established around the munitions storage and assembly areas (see Figure 3.14-4).

HERO, HERP, and ESQD Arcs at San Nicolas Island



Legend

- Airfield
- Structures
- Instrumentation
- Hazards of Electromagnetic Radiation to Ordnance (HERO) Arcs
- Hazards of Electromagnetic Radiation to Personnel (HERP) Arcs
- Explosive Safety Quantity Distance (ESQD) Arcs

Projection: Universal Transverse Mercator, Zone 11
North American Datum of 1927
Scale shown is 1:60,000
Source: Western Division 1986.

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Figure
3.14-4

3.14.4.3 Accident Potential Zones

Because of San Nicolas Island's remote location in relation to civilian communities, the airfield does not require an AICUZ study. Therefore, APZs have not been identified.

3.14.4.4 Public Access and Proximity

San Nicolas Island is owned and operated by the Navy and access is strictly controlled. Access is granted for military-related activities and for pre-approved, non-military users, primarily for scientific purposes. A scheduled contract aircraft shuttle operates between NAS Point Mugu and San Nicolas Island to bring personnel to the island.

Three surface restricted areas are located around San Nicolas Island: Alpha, Bravo, and Charlie (Figure 3.14-5). In addition, NAWCWPNS has established two airspace Restricted Areas over San Nicolas Island that extend 3 NM (5.6 km) around the island. The two areas are divided by an imaginary line from the north side to the south side of the island where the Bravo boundaries intersect the shorelines; they extend from the surface to 100,000 feet (30,500 m). Figure 3.14-5 also shows warning zones associated with missile and target launches from the west end of San Nicolas Island. Naval security personnel secure on-land restricted access zones prior to and during launch activities at the west end of the island to prevent unauthorized personnel and non-participants from entering the area. Roads into Warning Zone 2 are blocked during launches, and personnel in Warning Zone 2 are required to be in protected block houses or shelters during launches. No personnel are allowed in Warning Zone 1 during missile or target launches or during missile impacts at the Standoff Land Attack Missile (SLAM) target. In addition, clearance areas are cleared of all non-participating fishing or recreational boats prior to launch activities (see Section 3.14.2.2).

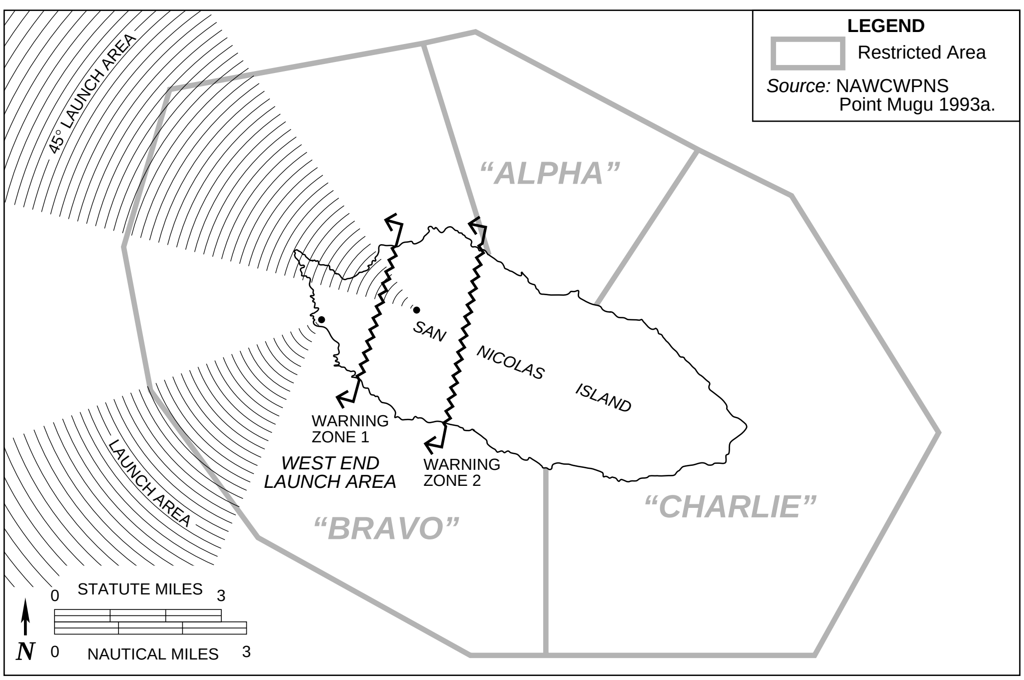

Figure 3.14-5
Warning Zones for Missile and Target Launches at San Nicolas Island

CHAPTER 4
ENVIRONMENTAL CONSEQUENCES

This joint Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) has been prepared in compliance with National Environmental Policy Act (NEPA) and Executive Order 12114, Environmental Effects Abroad of Major Federal Actions (Executive Order [EO] 12114). As described in Chapter 1, while NEPA and EO 12114 represent two distinct, independent processes, the Navy has conducted the analysis under these two processes concurrently because the proposed action includes operations that occur both within and outside U.S. Territorial Waters. To identify each instance within this chapter in which the analysis is conducted pursuant to NEPA or in which it is conducted pursuant to EO 12114, italics have been used for differentiation; impact discussions under the purview of NEPA are presented in regular text, while discussions pursuant to EO 12114 are presented in italics.

4.0 INTRODUCTION

This chapter describes the potential environmental consequences associated with the No Action Alternative, the Minimum Components Alternative, and the Preferred Alternative for the Naval Air Warfare Center Weapons Division (NAWCWPNS) Point Mugu (the alternatives addressed within this EIS/OEIS are described in Chapter 2). The Council on Environmental Quality (CEQ) Regulations (40 Code of Federal Regulations [C.F.R.] §§ 1500-1508) Implementing the Procedural Provisions of the National Environmental Policy Act (NEPA) of 1969 (42 United States Code [U.S.C.] § 4321 et seq.) state that the environmental consequences discussion shall include an estimate of direct and indirect effects and their significance (40 C.F.R. 1502.16). Direct effects are caused by the action and occur at the same time and place (40 C.F.R. 1508.8). Indirect effects are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 C.F.R. 1508.8). This chapter provides an analysis of environmental impacts (direct and indirect) and associated mitigation measures (the same resource areas addressed in Chapter 3 are considered in this chapter). Cumulative impacts (40 C.F.R. 1508.7) are addressed in Chapter 5. Other NEPA considerations, including possible conflicts between the proposed action and the objectives of federal, regional, state, and local land use plans, policies and controls; energy requirements and conservation potential of the proposed action and alternatives; irreversible or irretrievable commitment of resources; and relationship between short-term environmental impacts and long-term productivity, are provided in Chapter 6.

Per CEQ regulations, the significance of impacts must be considered in terms of context and intensity (40 C.F.R. 1508.27). "Context" is related to the uniqueness of a resource and means that the significance of an action must be analyzed in several contexts such as society as a whole, the affected region, affected interests, and the locality. Significance varies depending on the setting of the proposed action. "Intensity" refers to the severity of the impact (i.e., the magnitude of the impact on the environment). The CEQ regulations and Navy guidelines, OPNAVINST 5090.1B (Office of the Chief of Naval Operations 1998), provide considerations for evaluating intensity, including geographical extent of the action; long-term impact of the action (including precedent-setting actions); risk potential of an action; sites having existing or possible historic, architectural, or archaeological interest; and potential impact on endangered animal or plant species.

For each resource area examined in this EIS/OEIS, factors used to assess the potential for significant impacts are described. The determination of significance is based on considerations of context and intensity as described above. Potential environmental effects are identified as either significant or less than significant. Where appropriate, mitigation measures are identified to reduce significant impacts to an acceptable level. Mitigation measures (40 C.F.R. 1508.20) include avoiding the impact altogether by not taking a certain action or parts of an action; minimizing impacts by limiting the degree or magnitude of the action and its implementation; rectifying the impact by repairing, rehabilitating, or restoring the affected environment; reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; or compensating for the impact by replacing or providing substituting resources or environments.

Material relevant to an EIS may be incorporated by reference in accordance with CEQ regulations (40 C.F.R. 1502.21) and with the intent of reducing the document's size. The following are incorporated by reference due to their relevance to the actions addressed in this EIS/OEIS:

- NAWCWPNS Point Mugu. 1995. *AIM-9X Environmental Assessment for Demonstration Evaluation Testing at Point Mugu*. NAVAIR, Sidewinder Project Office; cooperating agency—U.S. Air Force. 10 July. China Lake, CA. This Environmental Assessment (EA) examines the potential environmental impacts of the Navy's proposal to conduct seeker capability demonstration and evaluation testing at NAS Point Mugu. This analysis is relevant to the air-to-air operations addressed within this EIS/OEIS.

- NAWCWPNS Point Mugu. 1998a. *Environmental Assessment, Nonwarhead Standoff Land Attack Missile (SLAM) and Future Model SLAM Firings*. Prepared for Program Executive Officer (PMA-258), Cruise Missile and Unmanned Vehicle Office [PEO(CU)]. 9 July. Point Mugu, CA. This EA evaluates the potential environmental impacts of conducting firings of nonwarhead SLAM and future model SLAM missiles over the Point Mugu Sea Range against a land target located on the western end of San Nicolas Island. This analysis is relevant to the air-to-surface operations addressed within this EIS/OEIS.

- NAWCWPNS Point Mugu. 1998e. *Marine Mammal Technical Report*. Prepared in support of the Point Mugu Sea Range EIS/OEIS by LGL, Limited. The Technical Report contains a detailed account of the marine mammals occurring on the Point Mugu Sea Range and expands on the summary contained in Section 3.7 of this EIS/OEIS. The Technical Report also includes a more comprehensive review of the relevant literature and issues, as well as more detailed descriptions of the analysis on which the impact predictions are based, as summarized in Section 4.7 of this EIS/OEIS.

- NAWCWPNS Point Mugu. 1998h. *Environmental Assessment for Tomahawk Flight Test Operations on the West Coast of the United States*. June. San Diego, CA. This EA analyzes the potential environmental impacts associated with the continued testing of the Tomahawk Land Attack Missile on the West Coast of the United States using military test facilities in California, Nevada, and Utah. These missiles are usually launched from a ship or submarine within Sea Ranges off the coast of southern California or occasionally from a ground launch site on San Nicolas Island. The Navy is proposing to conduct between 6 and 12 flight tests annually until 2017. This analysis is relevant to the surface-to-surface and subsurface-to-surface operations addressed within this EIS/OEIS.

- Northern Division. 1996. *Final Environmental Impact Statement, Disposal of US Navy Shipboard Solid Waste.* Naval Facilities Engineering Command. August. Lester, PA. This EIS assesses the potential environmental impacts of at-sea disposal of U.S. Navy shipboard solid waste from surface ships. The assessment is part of the Navy's effort to develop a plan for compliance with Regulation 5 of Annex V of the International Convention for the Prevention of Pollution from Ships (MARPOL). Solid waste consists of biodegradable wastes (food, paper, and cardboard), nonbiodegradable wastes (glass, ferrous and nonferrous metals), and plastics. The Preferred Alternative is the Compliance Plan, in which the Navy would install solid waste pulpers and metal/glass shredders on frigates and larger ships (200) or store solid waste on small ships (55) in odor-barrier bags until returning to shore or for transfer to another ship. The following alternatives were also analyzed: No Action Alternative (install plastics waste processors on 200 ships and implement store and retrograde procedures on remaining ships); Store and Retrograde Alternative (retain all processed plastics and solid waste until a retrograde opportunity becomes available); Process and Discharge Alternative (process nonplastic wastes and retain plastic wastes onboard); and On-Board Destruction Alternative (food waste would be pulped and disposed of overboard or incinerated, and plastic waste would be processed and retrograded). Impacts of the Preferred Alternative on biological environment, shoreside resources, and air quality would not be significant; implementation of the Compliance Plan would benefit the world's oceanic environment. This analysis is relevant to the Navy vessel activities within the Sea Range that are addressed within this EIS/OEIS.

- U.S. Air Force. 1997a. *Final Environmental Impact Statement for the Program Definition and Risk Reduction Airborne Laser Phase*. Prepared by the U.S. Department of the Air Force in cooperation with the U.S. Department of the Army and U.S. Department of the Navy. April. Kirtland AFB, NM. This EIS evaluates potential environmental impacts associated with conducting airborne laser activities at locations that include the Western Range (including the Point Mugu Sea Range). The USAF preferred alternative selects the Western Range as an Expanded-Area Test Range where the airborne laser system would track and destroy either a single or multiple theater ballistic missile(s) during boost phase. This analysis is relevant to the proposed boost phase intercept tests addressed within this EIS/OEIS.

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4.1 GEOLOGY AND SOILS

4.1.1 Approach to Analysis

Potential geology and soils impacts are limited to elements of current and proposed activities that could affect onshore and ocean bottom sediments. Aircraft operations and associated activities (e.g., missile use, target use, and other ordnance activities) are not expected to have significant effects on geology and soils. However, the analysis evaluates activities that have any potential for adverse effects, such as the ongoing SLAM program as well as target launch operations at Point Mugu and San Nicolas Island. Potential soil and sediment contamination issues are addressed for the following scenarios: jet-assisted takeoff (JATO) bottles (Mugu Lagoon for current activities, nearshore marine environment of Point Mugu for proposed activities), missile and target debris on ocean bottom sediments, and contaminant deposition on soils during target and missile launches from Point Mugu and San Nicolas Island.

Impacts on geology and soils can be direct or indirect. Direct impacts result from physical soil disturbance, while indirect impacts include leaching of contaminants from debris into ocean bottom sediments, or deposition of contaminants onto soils from target launch combustion products. Factors considered in determining whether an impact would be significant include the potential for substantial change in soil stability characteristics (e.g., disturbance to sand dunes by target launch exhaust or increased erosion due to construction activities) and the potential for contaminants to substantially degrade soil and ocean bottom sediment quality. The U.S. Environmental Protection Agency (USEPA) has established Preliminary Remediation Goals (PRGs) as guidelines for soil quality (USEPA 1998). PRGs are chemical concentrations that correspond to fixed levels of risk (e.g., a one-in-one million [10^{-6}] cancer risk or a noncarcinogenic hazard quotient). These guidelines apply to human health risk; since ecological risk criteria for soil quality are not available, the most stringent PRGs are considered in the assessment of potential geology and soils impacts.

Toxicity to marine organisms is the key issue associated with sediment quality. Therefore, effects of contaminants on Mugu Lagoon and ocean sediments are addressed in Section 4.5, Marine Biology. A summary matrix of geology and soils impacts is presented in Table 4.1-1.

4.1.2 No Action Alternative - Current Operations

4.1.2.1 Air-to-Air Operations

A - Target Launches at Point Mugu

Physical Effects

Terrestrial effects associated with current air-to-air operations are limited to the surface launch locations at San Nicolas Island and Point Mugu. The Building 55 Launch Complex is routinely used for target and missile launches at Point Mugu (refer to Figure 2-3a). JATO bottles are used on drone targets to provide the initial thrust necessary during target launches. The bottles (typically one larger bottle for larger drones and two smaller bottles for smaller drones) fall off soon after the launch and typically land 700 to 1,400 feet (210 to 420 m) south of Building 55 into Mugu Lagoon. JATO bottles are being retrieved; a removal program has been finalized in conjunction with the Biological Opinion (refer to Section 4.8, Terrestrial Biology). Existing concrete launch pads prevent any direct disturbance to soils at this location. About 75 percent of the jettisoned JATO bottles fall in the water of Mugu Lagoon, and the remainder falls on dry land. The bottles range from 2.5 to 4.3 feet (0.8 to 1.3 m) in length and weigh

Table 4.1-1. Geology and Soils Impact Summary Matrix

Alternative	Impact Conclusions NEPA (On Land→ Territorial Waters)	EO 12114 *(Non-Territorial Waters)*	Mitigation Measures
NO ACTION ALTERNATIVE	Ten-year accumulation of target launch combustion products in soils, in mg per kg of soil (Mugu/San Nicolas Island): Al (11.3/26.0), Pb (0.2/ 0.5), Cu (0.05/0.1). These levels are substantially below federal soil quality guidelines and are less than 4% and 6% of respective background soil concentrations. Physical soil disturbance from JATO bottles falling on dry soil at Point Mugu and San Nicolas Island constitutes only 0.1 and 0.03% of the respective impact areas. Less than significant impact.	*No effects on sediment stability; changes to ocean bottom sediment quality are well below federal standards. Less than significant impact.*	None.
MINIMUM COMPONENTS ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Ten-year accumulation of target launch combustion products in soils, in mg/kg (Mugu/San Nicolas Island): Al (12.0/34.6), Pb (0.2/ 0.7), Cu (0.06/0.2). These levels are substantially below federal soil quality guidelines and are less than 4% and 8% of respective background soil concentrations. Physical soil disturbance from JATO bottles falling on dry soil at Point Mugu and San Nicolas Island would constitute only 0.1 and 0.04% of the respective impact areas. Less than significant impact.	*No effects on sediment stability; changes to ocean bottom sediment quality would be well below federal standards. Less than significant impact.*	None.
PREFERRED ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Ten-year accumulation of target launch combustion products in soils, in mg/kg (Mugu/San Nicolas Island): Al (12.0/47.9), Pb (0.2/ 0.9), Cu (0.06/0.2). These levels are substantially below federal soil quality guidelines and are less than 4% and 10% of respective background soil concentrations. Physical soil disturbance from JATO bottles falling on dry soil at Point Mugu and San Nicolas Island would constitute only 0.1 and 0.04% of the respective impact areas. Less than significant impact.	*No effects on sediment stability; changes to ocean bottom sediment quality would be well below federal standards. Less than significant impact.*	None.

from 34 to 125 pounds (15 to 57 kg) empty. The cross section diameter can range from 5 to 11 inches (13 to 28 cm). Although the water softens the impact, it is relatively shallow, so sediment disturbance does occur temporarily before settling back to the bottom. The resulting soil disturbance for JATO bottles falling on land is typically an area up to 6.6 feet (2 m) by 1.6 feet (0.5 m); the divots are relatively shallow – less than 1 foot (0.3 m) – based on observations of JATO bottles sitting on dry soil following target launches. Such divots are not noticeably different than normal topographic variations in soil. Even for the 15 to 20 bottles per year that fall on land, such soil disturbances are negligible – amounting to about 211 square feet (20 m^2) over a 1-year period. This represents about 0.1 percent of the dry soil area within the JATO bottle impact area. Therefore, physical effects of JATO bottles on sediments in Mugu Lagoon and soils surrounding the lagoon are less than significant.

Contaminant Effects – Deposition of Launch Combustion Products

Single Launch. Solid rocket propellant is used in drone target JATO bottles and in missiles launched from Point Mugu and San Nicolas Island. When ignited during launch activities, these propellants emit a variety of combustion products into the air. Some residual amounts of these combustion products (such as aluminum oxide [Al_2O_3], lead, copper, and hydrochloric acid [HCl]) can be deposited on the surface around the launch location. Most of the metals are suspended in the air and dispersed over areas larger than the launch complexes. A previous analysis of surface-launched missiles (which typically use much larger quantities of solid propellant than drone targets) indicates that the amount of Al_2O_3 on the ground does not significantly change soil chemistry around launch sites (U.S. Army 1994). HCl is even less likely than metals to deposit on the ground. This product is in gaseous form and generally remains suspended in air. In the presence of water vapor from the propellant exhaust, it potentially deposits on the ground in calm conditions. Rain within 2 hours of a launch could cause additional amounts HCl to be deposited in small quantities.

Calculations were recently made to estimate the potential deposition amounts for current launch operations for drone targets and missile targets (Ogden 1998). The results of these calculations are shown in Table 4.1-2. Drone targets are the only targets currently launched at Point Mugu. Based on observational data (NAWCWPNS Point Mugu 1998c), the assumption was made that about one-third of the propellant burns in the first 330 vertical feet (100 vertical m) of flight and that the approximate deposition area is a plume about 720 feet (220 m) in diameter. The resulting deposition area on level ground and with no wind is estimated to be about 407,000 square feet (38,000 m^2). [Note: about half of the area surrounding Building 55 is paved surface.]

As shown in Table 4.1-2, about 4.9 pounds (2.2 kg) of Al_2O_3, 0.093 pounds (0.042 kg) of lead, and 0.024 pounds (0.011 kg) of copper potentially deposit on the ground during a single target launch. These amounts represent average densities of 0.002, 0.000003, and 0.000001 ounces per square foot (0.058, 0.001, and 0.0003 g/m^2), respectively. These small amounts of deposition materials for a single launch are negligible and do not adversely affect soil chemistry.

Multiple Launches. Regular target launch activity results in small quantities of deposition products accumulating over time. Long-term calculations for HCl were not performed since it does not have the same propensity to bioaccumulate in soil as do metals. Based on current operations tempo projected over 1-year and 10-year periods, calculations were made to estimate the quantity of metals that could accumulate in the top 4 inches (0.1 m) of soil. The following factors were used in these calculations:

Table 4.1-2. Soil Deposition of Rocket Propellant Contaminants for a Single Aerial Target or Missile Launch

	Drone Targets[1]		Missiles[2]	
	Small	Large	Small	Large
Assumptions				
Propellant Type	solid	solid	solid	solid
% burned near surface (100 m altitude)	33%	33%	10%	10%
Deposition area (no wind)				
Plume diameter	220 m	220 m	440 m	440 m
Surface area (level ground)	38,000 m^2	38,000 m^2	152,000 m^2	152,000 m^2
Physical Disturbance Area (JATO Bottles)	2 m x 0.5 m (0.3 m deep)	2 m x 0.5 m (0.3 m deep)	NA	NA
Combustion products deposited on ground – in mass (mass per area)				
Aluminum oxide (Al_2O_3)[3]	0.65 kg (0.017 g/m^2)	2.2 kg (0.058 g/m^2)	9.4 kg (0.06 g/m^2)	17.7 kg (0.12 g/m^2)
Hydrochloric acid (HCl)	0.051 kg (0.001 g/m^2)	0.17 kg (0.005 g/m^2)	0.74 kg (0.005 g/m^2)	1.4 kg (0.009 g/m^2)
Lead	0.013 kg (0.0003 g/m^2)	0.042 kg (0.001 g/m^2)	0.18 kg (0.001 g/m^2)	0.34 kg (0.002 g/m^2)
Copper	0.003 kg (0.0001 g/m^2)	0.011 kg (0.0003 g/m^2)	0.048 kg (0.0003 g/m^2)	0.090 kg (0.0006 g/m^2)

[1] Used in air-to-air, surface-to-air, and FLEETEX operations.
[2] Used in surface-to-air and FLEETEX operations.
[3] Aluminum constitutes approximately 53% of Al_2O_3 by mass.
Source: Ogden 1998; NAWCWPNS Point Mugu 1998c.

1) *Number of launches* at each location by target type (based on information in Appendix B);
2) *Combustion product* per launch based on Table 4.1-2;
3) Approximate *Soil Density* (dry weight) of 100 pounds per cubic foot (1,600 kg/m^3);
4) *Soil Volume* based on affected surface areas in Table 4.1-2 to a depth of 4 inches (0.1 m); and
5) *Soil Mass* (calculated by multiplying the *Soil Volume* by the *Soil Density*).

Minor corrections were also made to reflect the dissipation of metals over time due to natural processes such as wind, erosion, and leaching. The corrections were 10 percent over 1 year and 20 percent over 10 years. The result of the calculation for each target is a measure of the constituent's mass (in mg) per one kg of dry soil. The results were added together for all targets to estimate the total deposition of various constituents over the 1-year and 10-year periods. The elements described above were incorporated into a basic formula as shown below:

Equation 4.1-1

$$\text{Deposited Metals} = \frac{(\text{\# Launches}) \times (\text{Combustion Product per Launch}) \times (\text{kg} \rightarrow \text{mg Conversion})}{\text{Soil Mass}}$$

The results of these calculations and comparisons with appropriate PRGs for each constituent are shown in Table 4.1-3. The No Action Alternative totals for each target and missile type were added together for

Table 4.1-3. Long-Term Target and Missile Launch Combustion Product Deposition at Point Mugu and San Nicolas Island[1]

Combustion Product	Point Mugu					San Nicolas Island			
	USEPA PRGs	Existing Soil Background Levels	1 Year	10 Years	10-Year % of Background Levels	Soil Background Levels	1 Year	10 Years	10-Year % of Background Levels
No Action Alternative									
Aluminum (Al)	75,000	8,953	1.4	11.3	0.1%	11,809	3.3	26.0	0.2%
Lead (Pb)	400	6.44	0.03	0.2	3.4%	9.36	0.06	0.5	5.3%
Copper (Cu)	2,800	13.6	0.01	0.05	0.4%	11.7	0.02	0.1	1.1%
Minimum Components Alternative[2]									
Aluminum (Al)	75,000	8,953	1.5	12.0	0.1%	11,809	4.3	34.6	0.3%
Lead (Pb)	400	6.44	0.03	0.2	3.6%	9.36	0.08	0.7	7.1%
Copper (Cu)	2,800	13.6	0.01	0.06	0.5%	11.7	0.02	0.2	1.5%
Preferred Alternative[2]									
Aluminum (Al)	75,000	8,953	1.5	12.0	0.1%	11,809	6.0	47.9	0.4%
Lead (Pb)	400	6.44	0.03	0.2	3.6%	9.36	0.12	0.9	9.8%
Copper (Cu)	2,800	13.6	0.01	0.06	0.5%	11.7	0.03	0.2	2.1%

[1] Units are mg/kg (i.e., mg of constituent per kg of soil - dry weight).
[2] Includes current operations.

PRG - Preliminary Remediation Goals

Source: Ogden 1998; USEPA 1998; EFAWEST 1997; Western Division 1993a.

1-year and 10-year periods. These levels were also compared against average background levels of aluminum, lead, and copper in soil at Point Mugu to provide context for comparison purposes (Engineering Field Activity West [EFAWEST] 1997). As shown in the table, the estimated accumulation amounts of aluminum, lead, and copper estimated from combustion product deposition over a 10-year period at current operational levels are about 10.5, 0.2, and 0.05 mg/kg, respectively. These amounts are minor (about 0.1, 3.1, and 0.4, percent respectively) in comparison to background soil concentrations. These amounts are also well below the respective PRGs (see Table 4.1-3).

The calculations tend to overestimate the deposition of combustion products since they are based on the assumption of calm conditions (no wind), with the resulting combustion products settling straight down to the ground. These conditions are rare (particularly at San Nicolas Island) except for early morning launches. Average wind speeds are 14 knots (26 km per hour) at San Nicolas Island and 10 knots (19 km per hour) at Point Mugu. These average wind speeds are likely to entrain some of the solid combustion products in the air long enough to be transported outside the area in the immediate vicinity of the launch locations. HCl is even less likely than Al_2O_3 to deposit on the ground. This product is in gaseous form and generally remains suspended in air. In the presence of water vapor from the propellant exhaust, it potentially deposits on the ground in calm conditions. Rain within 2 hours of a launch could cause additional amounts HCl to be deposited in small quantities. Given the low average annual rainfall amounts – 6.55 inches (16.6 cm) at San Nicolas Island and 13.5 inches (34.3 cm) at Point Mugu – this is not a common occurrence. Also, NAWCWPNS safety policies keep launches from occurring when clouds are too low. This operational restriction further minimizes the potential for rainfall immediately after a launch. In the case that some HCl is deposited on the ground, soils associated with marine terraces in the area of the launch complexes at San Nicolas Island are relatively alkaline (i.e., able to offset acidic substances) and are able to buffer these small amounts of HCl (U.S. Army 1994). Therefore, accumulation of target launch combustion products from current operations have a less than significant impact on soil chemistry.

The combustion product deposition amounts shown in Table 4.1-3 were calculated based on all Point Mugu launches under the No Action Alternative. Air-to-air testing, however, comprises only a portion of all drone target launches. Therefore, accumulation of target launch combustion products associated with air-to-air operations over the long term has a less than significant impact on soil chemistry at Point Mugu.

<u>B - Target Launches at San Nicolas Island</u>

Physical Effects

Various targets are currently launched from the Alpha Launch Complex on the west end of San Nicolas Island (refer to Figure 3.0-9). The existing concrete pad prevents any direct soils impacts at the launch site. Ground disturbance from use of the mobile launcher does not occur (U.S. Army 1994). For missile target launches, fires occasionally occur downslope from the Vandal launch pad. The Fire Department historically attempted to actively extinguish all fires on San Nicolas Island. However, a “let it burn” policy has been adopted at the recommendation of the Environmental Project Office. It was found that the disturbance created by firefighting equipment was more damaging to the environment than the fires. The fires typically affect only a small area; vegetation is not reduced enough to cause soil erosion or slope instability.

The drone targets launched from the Alpha Launch Complex have JATO bottles that are jettisoned over land before reaching the shore. These JATO bottles could potentially have a larger physical disturbance area than that mentioned above for Point Mugu because the bottles fall on a sloped area and likely skip across the surface. However, it is assumed for this analysis that the size of the divot would be the same—typically an area up to 6.6 feet (2 m) by 1.6 feet (0.5 m). The divots are relatively shallow—less than 1 foot (0.3 m)—based on observations of JATO bottles sitting on dry soil following certain target launches. Such divots are not noticeably different than normal topographic variations in soil. Even for the 20 bottles per year that fall on land at San Nicolas Island, such soil disturbances are negligible—amounting to about 211 square feet (20 m^2) over a 1-year period. This represents about 0.03 percent of the surface area within the JATO bottle impact area. Therefore impacts of physical disturbance on soils at San Nicolas Island are less than significant.

Contaminant Effects – Deposition of Launch Combustion Products

Single Launch. Calculations were recently made to estimate the potential deposition amounts for current launch operations (Ogden 1998). The assumptions were the same as those used for Point Mugu (see discussion above) except that, for larger missile targets launched at San Nicolas Island (some of which are in support of air-to-air tests), it was assumed that only 10 percent of the propellant burns in the first 330 vertical feet (100 vertical m) of flight and that the approximate deposition area is a plume about 1,440 feet (440 m) in diameter. As shown in Table 4.1-2, about 39.0 pounds (17.7 kg) of Al_2O_3, 0.75 pounds (0.34 kg) of lead, and 0.20 pounds (0.090 kg) of copper potentially deposit on the ground during a single missile target launch. These amounts represent average densities of 0.0004, 0.000007, and 0.000002 ounces per square foot (0.12, 0.002, and 0.0006 g/m^2), respectively. These amounts are well below the respective PRGs (see Table 4.1-3). These small amounts of deposition materials for a single launch are negligible and do not adversely affect soil chemistry.

Multiple Launches. Regular target launch activity results in small quantities of deposition products accumulating over time. Based on current operations tempo projected over 1-year and 10-year periods, calculations were made to estimate the quantity of metals that could accumulate in the top 4 inches (0.1 m) of soil. The No Action Alternative totals for each target and missile type were added together for 1-year and 10-year periods. These levels were also compared against average background levels of aluminum, lead, and copper in soil at San Nicolas Island to provide context for comparison purposes (Western Division 1993a). As shown in the table, the estimated accumulation amounts of aluminum, lead, and copper estimated from combustion product deposition over a 10-year period at current operational levels are about 26.0, 0.5, and 0.1 mg/kg. These amounts are minor (about 0.2, 5.3, and 1.1 percent, respectively) in comparison to background soil concentrations. These amounts are also well below the respective PRGs (see Table 4.1-3). The combustion product deposition amounts shown in Table 4.1-3 were calculated based on all San Nicolas Island launches under the No Action Alternative. Air-to-air testing, however, comprises only a portion of all target launches. Therefore, accumulation of target launch combustion products at San Nicolas Island associated with air-to-air operations over the long term has a less than significant impact on soil chemistry.

C - Debris

Debris from the intercepted targets during air-to-air operations lands in the ocean and settles to the bottom. Air-to-air intercepts occur primarily in non-Territorial Waters, typically in Range Areas 5A and 5B. The size of debris from a missile/target intercept is dependent on a variety of factors. In general, small pieces can be 1 pound (0.45 kg) or less, while large pieces can be as big as the missile or target themselves if the intercept is a near miss. The debris pieces from airborne targets are spread over a relatively large area in the open ocean (the surface area of Range Areas 5A and 5B combined is 2,646 NM^2 [9,077 km^2]). Even larger pieces, however, do not affect sediment stability on the ocean bottom and cause only minimal disturbance relative to natural ocean processes (e.g., sedimentation, currents). Water depths beneath these range areas vary from 1,640 to 13,120 feet (500 to 4,000 m) and include *primarily sandy bottoms; larger debris pieces settle on the bottom and are covered with sediment over time. The average density of hazardous constituents entering the Sea Range annually for all current operations (including air-to-air) is 0.53 pounds/NM² (0.07 kg/km²) (refer to Tables 4.13-2 and 4.13-6 in Section 4.13, Hazardous Materials, Hazardous Wastes, and Non-Hazardous Wastes). Some hazardous constituent residue remains on some of the debris pieces when they settle onto ocean bottom sediments. However, resultant water quality and sediment concentrations are below federal guidelines for marine water quality and sediment quality (refer to Section 4.4, Water Quality, and Section 4.5, Marine Biology, respectively). Therefore, impacts on ocean bottom sediment quality in non-Territorial Waters are less than significant.*

4.1.2.2 Air-to-Surface Operations

Inert mine shapes are dropped northeast of Santa Rosa Island in Becher's Bay (refer to Figure 3.0-14). Of the estimated 49 mine shapes dropped annually, 13 are part of air-to-surface testing and 18 are part of each of the two FLEETEXs. About 40 percent of inert mine shapes are recovered by divers after each operation. Neither the deployment nor retrieval of inert mine shapes permanently disturbs ocean bottom sediments in Becher's Bay. Any temporary disturbance is likely minimized by ocean bottom currents over time. The mine shapes do not contain any hazardous constituents and do not affect sediment quality. Therefore, impacts of air-to-surface operations (including inert mine drop operations) on ocean bottom sediments are less than significant.

SLAM test and training events occur at the west end of San Nicolas Island in a designated area. An EA for this program (U.S. Navy 1997c) concluded that these activities caused soil disturbance at the point of impact, the location of which can vary by up to 1,000 feet (300 m). Sand is also displaced by cranes and trucks each time the targets are reconfigured. This setup procedure, however, occurs only once every 3 years. Missile depressions from impact are typically about 10 feet (3 m) by 20 feet (6 m) by 5 feet (2 m) deep. The quality of the soil present is not adversely affected. In addition, most depressions are quickly filled due to the nature of sand and the frequent winds. Therefore, impacts of SLAM activities on geology and soils are less than significant.

Potential effects of air-to-surface operations are limited to ocean bottom sediment disturbance; no terrestrial soil disturbance occurs. Surface targets are sunk primarily in Range Areas 4B, 5B, and 3D. Pieces of the surface target can potentially be larger than the debris for aerial targets. Even these larger pieces, however, do not affect sediment stability on the ocean bottom. Some hazardous constituents residue remains on some of the debris pieces when they settle onto ocean bottom sediments (refer to Table 4.1-2). However, surface targets are cleaned of hazardous constituents prior to being used in testing and training scenarios. Resultant water quality and sediment concentrations are below federal guidelines for marine water quality and sediment quality (refer to Section 4.4, Water Quality, and Section 4.5, Marine Biology, respectively). Therefore, impacts on ocean bottom sediment quality are less than significant.

4.1.2.3 Surface-to-Air Operations

Terrestrial effects associated with surface-to-air operations are limited to the surface launch locations at San Nicolas Island and Point Mugu. These terrestrial effects are the same as those discussed earlier for air-to-air operations (see Section 4.1.2.1). Therefore, impacts of surface-to-air operations on geology and soils at San Nicolas Island and Point Mugu are less than significant. Potential debris effects associated with surface-to-air operations are similar to those described above for air-to-air operations (see Section 4.1.2.1); impacts on ocean bottom sediments are less than significant.

4.1.2.4 Surface-to-Surface Operations

Potential effects associated with surface-to-surface operations are the same as those described above for air-to-surface operations (see Section 4.1.2.2), although less hazardous materials are expended each year for surface-to-surface operations. Impacts on ocean bottom sediments in non-Territorial Waters are less than significant.

4.1.2.5 Subsurface-to-Surface Operations

Potential effects associated with subsurface-to-surface operations are the same as those described above for air-to-surface operations (see Section 4.1.2.2); impacts on ocean bottom sediments in non-Territorial Waters are less than significant.

4.1.2.6 Ancillary Operations Systems

Chaff and flares are the only ancillary operations systems that could potentially affect geology and soils. Use of these items in training occurs over water and does not affect geology and soils onshore. Chaff use is restricted to at least 10 NM (19 km) from shore on the Sea Range. Recorded annual use of chaff and flares on the Sea Range is minimal, about 101 pounds (46 kg) and 11 pounds (5 kg), respectively (refer to Table 4.13-2). These materials are spread over large areas over a 1-year period and have no impact on soil stability and minimal impact on sediment quality. Impacts of chaff and flare use on ocean bottom sediments are less than significant.

For the reasons described above for Territorial Waters, impacts of chaff and flare use on ocean bottom sediments in non-Territorial Waters are less than significant.

4.1.2.7 Current Fleet Exercise Training

Terrestrial effects associated with current FLEETEX training (twice per year) are limited to the surface launch locations at San Nicolas Island and Point Mugu. These terrestrial effects are the same as those discussed earlier for air-to-air operations (see Section 4.1.2.1). Therefore, impacts on geology and soils at San Nicolas Island and Point Mugu associated with current FLEETEX training are less than significant.

Ocean bottom sediment effects from intercept debris associated with current FLEETEX training are the same as those described for air-to-air operations (see Section 4.1.2.1). The difference is that each FLEETEX consists of multiple target/missile intercepts over a 2-3 day period, whereas each individual test described in Section 4.1.2.1 consists of a single target/missile intercept which occurs several times throughout the year. Despite these differences in timing, effects on ocean bottom sediments are similar since the FLEETEX intercepts typically occur at various locations over the Sea Range (rather than condensed in one area). Therefore, impacts on ocean bottom sediments in non-Territorial Waters associated with current FLEETEX training are less than significant.

4.1.2.8 Littoral Warfare Training

Littoral warfare training on the Sea Range consists of U.S. Marine Corps small-scale amphibious warfare training (twice per year) and Navy special warfare training (twice per year). The areas of the range required to perform these training events are the currently used nearshore and beach areas of San Nicolas Island. Beach areas and nearshore terrestrial environments are disturbed from foot traffic of personnel (typically between 10 to 30 people). Small-scale amphibious warfare training involves larger numbers of ground personnel but impacts are still limited to temporary disturbance from foot traffic. Low-altitude helicopter activity occurs primarily over the water or over approved areas such as the San Nicolas Island airfield. Nearshore sediments are stirred up from small landing craft turbulence. However, these soil and sediment disturbances are minimal and are similar to natural turbidity which occurs year-round in the nearshore environment. Further, the frequency of these training events is only four times per year. The Environmental Project Office has not identified significant impacts on geology and soils at San Nicolas Island resulting from such activities. Therefore, impacts of current littoral warfare training on geology and soils and on ocean bottom sediments are less than significant.

4.1.3 Minimum Components Alternative

This alternative includes impacts identified for the No Action Alternative since the testing, training, and facility modernization activities included in this alternative are proposed in addition to current operations. The approximate amounts of long-term target and missile launch combustion product deposition associated with the Minimum Components Alternative are summarized in Table 4.1-3.

4.1.3.1 Theater Missile Defense Element – Nearshore Intercept

Terrestrial effects associated with nearshore intercept testing and training would not occur because the target would be air-launched, and the missile would either be air-launched or surface launched (from a Navy vessel). As proposed, no debris from the nearshore intercept would fall onshore at San Nicolas Island. Therefore, impacts of nearshore intercept testing and training on geology and soils at San Nicolas Island would not occur.

A total of 780 cubic feet (22 m^3) of debris would result each year from all four proposed theater missile defense (TMD) testing and training programs. About 75 percent of this total would occur during nearshore intercept events. Debris from the nearshore intercept would land in the ocean and settle to the bottom in the nearshore waters of San Nicolas Island. The majority of the debris would be located in a 15 NM^2 (51 km^2) area off the west end of the island or in an equal-sized area off the southeast end of the island (refer to Figure 4.5-1). These patterns would be located in the Area of Special Biological Significance (ASBS) surrounding San Nicolas Island (refer to Figure 3.4-4). Some hazardous constituent residue (such as battery constituents or residual fuel) could remain on some of the debris pieces when they settle onto ocean bottom sediments. However, resultant water quality and sediment concentrations would be below federal guidelines for marine water quality and sediment quality (refer to Tables 4.4-3, 4.4-4, and 4.5-2). Therefore, impacts on ocean bottom sediment quality would be less than significant.

4.1.3.2 Training Element – Additional FLEETEX

The effects of an additional FLEETEX would be similar to those described earlier for the FLEETEXs currently conducted two times per year (see Section 4.1.2.7). Additional aerial targets would be launched from Point Mugu and San Nicolas Island to support the additional FLEETEX. With the additional FLEETEX, a total of about 21 JATO bottles per year would fall on land at Point Mugu, and about 26 JATO bottles would fall on land at San Nicolas Island. Such soil disturbances would be negligible – amounting to about 222 and 275 square feet (21 and 26 m^2), respectively, over a 1-year period. These totals represent about 0.1 and 0.04 percent of the respective dry JATO bottle impact areas at Point Mugu and San Nicolas Island. Therefore impacts of physical disturbance on soils would be less than significant.

When combined with regular target launch activity associated with current operations, the additional targets would result in greater quantities of combustion product deposition on soils accumulating over time at Point Mugu and San Nicolas Island (see Table 4.1-3). As shown in the table, the estimated accumulation amounts of aluminum, lead, and copper would be well below PRGs established by the USEPA for these metals. These amounts are also minor (about 0.1, 3.3, and 1.4, percent, respectively, at Point Mugu and 0.3, 7.1, and 0.5 percent, respectively, at San Nicolas Island) in comparison to background soil concentrations. Since the additional FLEETEX would comprise only a portion of these small amounts, long-term accumulation of target launch combustion products at Point Mugu and San Nicolas Island would have a less than significant impact on soil chemistry.

Some hazardous constituents residue could remain on some of the debris pieces when they settle onto ocean bottom sediments. However, resultant water quality and sediment concentrations would be below federal guidelines for marine water quality and sediment quality (refer to Section 4.4, Water Quality and Section 4.5, Marine Biology, respectively). Therefore, impacts on ocean bottom sediment quality in non-Territorial Waters would be less than significant.

4.1.3.3 Facility Modernization Element – Multiple-Purpose Instrumentation Sites

Five multiple-purpose instrumentation sites would be constructed at San Nicolas Island with an approximate disturbance area of 15,000 SF (1,400 m^2) each. These facilities would be constructed in previously undisturbed areas. Four of the multiple-purpose instrumentation sites would be located along the southern edge of the mesa where the terrain slopes steeply down toward the coast. However, the sites would be designed such that their construction would not affect slope stability in these areas, and standard construction practices would be implemented to control erosion. Therefore, impacts on geology and soils would be less than significant.

4.1.4 Preferred Alternative

This alternative includes impacts identified for the No Action Alternative since the testing, training, and facility modernization activities included in this alternative are proposed in addition to current operations. The approximate amounts of long-term target and missile launch combustion product deposition associated with the Preferred Alternative are summarized in Table 4.1-3.

4.1.4.1 Theater Missile Defense Element

A - Boost Phase Intercept

Terrestrial effects associated with boost phase intercept testing and training would be limited to the surface launch locations at San Nicolas Island. The target missile would be launched from the Alpha Launch Complex on the west end of San Nicolas Island. This could occur from the existing rail launcher at the Vandal launch pad, from a mobile launcher positioned just south of this location, or from the proposed 50K launcher. Terrestrial effects would be similar to those discussed previously for air-to-air operations (see Section 4.1.2.1). Therefore, impacts of boost phase intercept testing and training on geology and soils at San Nicolas Island would be less than significant.

Over a 1-year period, a total of 780 cubic feet (22 m^3) of debris for all proposed TMD programs would land in the ocean and settle to the bottom. Debris areas for each program vary considerably (effects of nearshore intercept events were discussed earlier [see Section 4.1.3.1]):

- boost phase intercept (Range Areas 4A and 5C) – 2,420 NM^2 (8,330 km^2)
- upper tier (Range Areas 5A, 6A, 6B, and W-537) – 6,910 NM^2 (23,700 km^2)

- lower tier (Range Areas 5A, 5B, and 6A) – 3,880 NM^2 (13,310 km^2)

Based on the assumption that the entire volume would fall within the smallest debris area, the affected area could be as small as 2,420 NM^2 (8,330 km^2). Also, it is likely that, within the area of potential effect, debris could be concentrated more heavily in some areas than others. This could be a factor of where the debris falls into the ocean, surface and bottom currents, and ocean bottom topography. Consequently, certain areas can be assumed to have about 10 times more than the average debris density. In this case, the estimated concentration of TMD debris on the sea floor over a 10-year period would be about 32 cubic feet per NM^2 (0.26 m^3/km^2). Over a 0.3-NM^2 (1-km^2) area, this long-term, high-average density equates roughly to the size of a box 25 inches (64 cm) on a side. This small amount of debris would not have substantial physical effects on ocean bottom sediments.

Some hazardous constituents residue could remain on some of the debris pieces when they settle onto ocean bottom sediments. However, resultant water quality and sediment concentrations would not exceed federal guidelines for marine water quality and sediment quality (refer to Section 4.4, Water Quality and Section 4.5, Marine Biology, respectively). Therefore, impacts on ocean bottom sediment quality would be less than significant.

Potential impacts on ocean bottom sediments in non-Territorial Waters would be the same as described above and would be less than significant.

B - Upper Tier

Terrestrial effects associated with upper tier events would be limited to the surface launch locations at San Nicolas Island. Potential effects would be the same as those described for boost phase intercept events. Therefore, impacts of upper tier testing and training on geology and soils at San Nicolas Island would be less than significant.

Debris effects from upper tier events were included in the analysis of boost phase intercept impacts. Impacts on ocean bottom sediment quality in non-Territorial Waters would be less than significant.

C - Lower Tier

Terrestrial effects associated with lower tier events would be limited to the surface launch locations at San Nicolas Island. Potential effects would be the same as those described for boost phase intercept events. Therefore, impacts of lower tier testing and training on geology and soils at San Nicolas Island would be less than significant.

Debris effects from lower tier events were included in the analysis of boost phase intercept impacts. Impacts on ocean bottom sediment quality in non-Territorial Waters would be less than significant.

D - Nearshore Intercept

Effects of nearshore intercept events were discussed earlier (see Section 4.1.3.1). Impacts on geology and soils would not occur, and impacts of nearshore intercept testing and training on ocean bottom sediments would be less than significant.

4.1.4.2 Training Element – Fleet Exercise and Special Warfare Training

A - Fleet Exercise Training

Effects of one additional FLEETEX were discussed earlier (see Section 4.1.3.2). Impacts of the additional FLEETEX on geology and soils and on ocean bottom sediments would be less than significant.

B - Special Warfare Training

In addition to the ongoing amphibious operations by the U.S. Marine Corps at their current level of activity, the proposed action would incorporate a twofold increase of special warfare training activity by SEALs (increasing from 2 to 4 times per year). The effects of additional special warfare training activity are similar to those described earlier for littoral operations (see Section 4.1.2.8). Although the amount of training activity on land at San Nicolas Island would increase, the disturbance would not adversely affect soil stability or increase erosion potential. In addition, no hazardous constituents would be deposited on the soil. Therefore, impacts of increased special warfare training on geology and soils would be less than significant.

4.1.4.3 Facility Modernization Element – Point Mugu and San Nicolas Island

A - NAS Point Mugu Modernizations

Beach Launch Capability

Two previously used launch pads at NAS Point Mugu would be used for missile launches that currently occur in front of Building 55. The concrete pads would prevent any disturbance to soils behind the pads at launch. Exhaust from the missile would not affect sand dunes in front of the pads. Missiles from mobile launchers are typically positioned at angles of about 30°, so much of the exhaust is directed horizontally. After it leaves the launch pad, the missile would be high enough over the surface that the vertical component of the exhaust would not affect the sand dunes in front of the proposed beach launch locations. Therefore, operational impacts of the proposed beach launch capability on geology and soils at Point Mugu would be less than significant.

Some of the missile launches could include the use of solid propellant boosters. Exhaust from the boosters would not affect sand dunes in front of the pads. Boosters on missiles are typically positioned at angles ranging from 25° to 45°, so much of the exhaust is directly horizontally. After it leaves the launch pad, the missile would be high enough over the surface that the vertical component of the exhaust would not affect the sand dunes in front of the proposed beach launch locations. Jettisoned boosters would fall into the marine environment approximately 0.25 to 0.50 mile (0.40 to 0.80 km) offshore. Relative to natural wave and current action in this environment, soils and sediments would not be substantially disturbed. Because the solid propellant is expended during the launch, propellant residue in the boosters after a launch is minimal (NAWS Point Mugu 1998g). Impacts on marine sediments (sandy bottom) would be less than significant due to minimal propellant residue in the expended boosters and due to the dilution by strong ocean currents in this area. Therefore, operational impacts of the proposed beach launch capability on geology and soils and nearshore sandy bottom at Pont Mugu would be less than significant.

B - San Nicolas Island Modernizations

Increased Launch Capabilities

A launch site would be added near the Alpha Launch Complex, which is used for many of the current target launches. A 1,200 SF (110 m^2) concrete pad would be constructed on soils classified as dune sand deposits. Ground disturbance would occur outside this pad but would not adversely affect the stability of nearby slopes. The site is presently used for occasional mobile launch activities without any sign of adverse effects on soils (either from the positioning of the mobile launcher itself or from the exhaust during the missile launch). In addition, a vertical launch system would be placed at one of the pads of the Building 807 Launch Complex on the southwest coast of the island. The 30-foot (9-m) tall vertical launcher would be placed on an existing pad and would not require additional ground disturbance. This location is currently used to launch targets and missiles. In addition, these proposed launch facilities could be used in support of current and/or proposed testing and training activities. Combustion product deposition effects for current and proposed target launches at San Nicolas Island are summarized in Table 4.1-3. Therefore, impacts of increased launch capabilities on geology and soils would be less than significant.

Support Facilities

Support facilities at San Nicolas Island include a new range support building with a disturbance area of 12,000 SF (1,100 m^2) and five multiple-purpose instrumentation sites with an approximate disturbance area of 15,000 SF (1,400 m^2) each. The range support building would be located on the central part of the island on soils classified as marine terrace deposits. Four of the five multiple-purpose instrumentation sites would be located on the west end of the mesa on soils classified as dune sand deposits. The fifth would be located along the southern edge of the mesa on consolidated tertiary sediments where the terrain slopes steeply down toward the coast. All of these proposed facilities would be constructed in previously undisturbed areas; however, the facilities would be designed such that their construction would not affect slope stability, and standard construction practices would be implemented to control erosion. Therefore, impacts of proposed support facilities on geology and soils would be less than significant.

4.2 AIR QUALITY

4.2.1 Approach to Analysis

The evaluation of potential air quality impacts includes two separate analyses for the reasons identified below:

1) NEPA Air Quality Analysis. To assess the impact of air pollutant emissions from proposed Sea Range operations for those effects occurring within U.S. Territory. The NEPA analysis includes a Clean Air Act (CAA) General Conformity Analysis in order to make an applicability determination pursuant to the General Conformity Rule (40 C.F.R. § 93[B]). The NEPA analysis also includes an evaluation of potential exposures to toxic air pollutant emissions.
2) EO 12114 Air Quality Analysis. To assess the impact of air pollutant emissions from proposed Sea Range operations for those effects occurring outside U.S. Territory.

The NEPA analysis involves estimating emissions generated from the proposed activities and assessing potential impacts on air quality. Since NEPA applies to those areas located within U.S. Territory, the NEPA emissions analysis includes those air quality impacts occurring within U.S. Territory (refer to Figure 1-3). Extensive modeling efforts conducted by NAWCWPNS Point Mugu demonstrate that a majority of the emissions occurring shoreward of San Nicolas Island and the northern Channel Islands will, under certain wind conditions, be transported back to nonattainment areas onshore (NAWCWPNS Point Mugu 1997e). In recognition of the potential for emissions transport from offshore to onshore regions, the area of effect for the air quality NEPA analysis was enlarged to include all emissions landward of San Nicolas Island (i.e., inclusive of Range Areas 3B/W2, 3D, and 3A; refer to Figure 1-3).

Since the region of influence (ROI) for air quality encompasses more than one air district (refer to Figure 3.2-2), and recent studies indicate that offshore emissions can be transported to different regions onshore (NAWCWPNS Point Mugu 1997e), it was necessary to estimate the relative proportion of offshore emissions that could be transported to the various onshore air districts. Based on an analysis of annual mean surface wind vectors in the ROI, all emissions generated from the proposed action below 3,000 feet (914 m) and within U.S. Territory could potentially end up onshore. NAS Point Mugu airfield emissions, as well as those emissions generated within 3 NM (5.6 km) of shore, are included in the conformity applicability analysis (see Section 4.2.6) and may impact the Ventura County air basin. These emissions are excluded from the emissions transport analysis. Assuming that the remaining U.S. Territory emissions are distributed uniformly and that aircraft emissions generated aloft move with the surface wind, it was determined that approximately 34 percent of emissions would be transported to the South Coast, 43 percent to San Diego, and the remainder (23 percent) to Mexico (refer to Appendix C for additional information). These percentages were used to estimate the amount of emissions that could be transported to these onshore areas. Since emissions are affected by numerous variables such as mixing, photochemical reactions, and wind variability, the amount of emissions that would be transported onshore in any one area and on any given day could differ from the above estimates. However, when examined on a yearly basis, the above apportionment and approach is considered representative. It is assumed that aircraft emissions in the lowest 3,000 feet (914 m) are transported with the surface wind. Since winds aloft may differ from this assumption, the estimates calculated for this EIS/OEIS tend to overestimate rather than underestimate emissions.

The CAA Conformity Applicability Analysis is presented in Section 4.2.6 and includes an analysis of emissions subject to the General Conformity Rule. For the purpose of evaluating the proposed action for the Point Mugu Sea Range, emissions were estimated to assess whether the proposed action is exempt from the provisions of the General Conformity Rule and the requirements to conduct a conformity determination. Because the proposed action is not specifically exempted under the provisions of the General Conformity Rule, it was necessary to compare the proposed project's emissions increases with appropriate *de minimis* levels (refer to Appendix C for additional information).

The air toxics analysis is presented in Section 4.2.5 and involves comparing the emissions to health-based guidance levels for those toxic emissions not specifically regulated on a state or national level. This includes hazardous air pollutants not covered under the ambient air quality standards. Potential hazardous air pollutant sources are associated with missile and target operations and include rocket motor exhaust and unspent missile fuel vapors.

Since EO 12114 applies to those areas located outside U.S. Territory, the EO-compliant emissions analysis includes those air quality impacts occurring outside U.S. Territory (refer to Figure 1-3). The EO-compliant analysis involves estimating emissions generated from the proposed activities and assessing potential impacts on air quality outside U.S. Territory. CAA General Conformity does not apply since the CAA is not applicable to actions outside the U.S.

The most complete emissions data available for NAS Point Mugu were recently developed as part of the EIS process for the proposed realignment of four E-2 squadrons (Southwest Division 1998). Since the four E-2 squadrons are now located at NAS Point Mugu, the emission estimates calculated for the E-2 FEIS represent the best available data to use in this EIS/OEIS. These emission estimates were presented in Section 3.2 and represent the No Action Alternative (i.e., current operations). An itemized list of emission sources and an explanation of the approach used to prepare emissions estimates for the No Action Alternative (baseline), the Minimum Components Alternative, and the Preferred Alternative are included in Appendix C. Appendix C also contains a Record of Non-Applicability and supporting material. A summary matrix of air quality impacts is presented in Table 4.2-1.

4.2.2 No Action Alternative - Current Operations

The No Action Alternative involves maintaining operations at current levels. The current levels of emissions are presented in Section 3.2, which describes baseline operations at existing levels for the Sea Range, NAS Point Mugu, San Nicolas Island, and other Channel Islands operations. The methodology used for calculating emissions estimates is provided in Appendix C.

Under the No Action Alternative, there would be no increase in operations from current activities. The emissions levels would remain constant for those emission sources that are not affected by other federal, state, or local requirements to reduce air emissions. Emissions associated with motor vehicles may decrease due to the implementation of federal and California CAA requirements to reduce tailpipe emissions. Table 4.2-2 presents a summary of the air emissions within U.S. Territory projected for the No Action Alternative (current operations). Since there would be no increase in current emissions within U.S. Territory under the No Action Alternative, impacts would be less than significant.

Table 4.2-3 presents a summary of the air emissions outside U.S. Territory projected for the No Action Alternative (current operations). Since there would be no increase in current emissions outside U.S. Territory under the No Action Alternative, impacts would be less than significant.

Table 4.2-1. Air Quality Impact Summary Matrix

Alternative	Impact Conclusions		Mitigation Measures
	NEPA (On Land→ Territorial Waters)	**EO 12114** (Non-Territorial Waters)	
NO ACTION ALTERNATIVE	No increases in current emissions; no change to baseline. Less than significant impacts.	*No increases in current emissions; no change to baseline. Less than significant impacts.*	None.
MINIMUM COMPONENTS ALTERNATIVE	Net emissions change below *de minimis* levels; a General Conformity Determination not required. Net emissions change would not significantly affect regional air quality; less than significant impact.	*Net emissions change would not significantly affect air quality; less than significant impact.*	None.
PREFERRED ALTERNATIVE	Net emissions change below *de minimis* levels; a General Conformity Determination not required. Net emissions change would not significantly affect regional air quality; less than significant impact.	*Net emissions change would not significantly affect air quality; less than significant impact.*	None.

Table 4.2-2. Summary of Annual Air Emissions Within U.S. Territory of No Action Alternative

Emission Source	Emissions (tons/year)				
	CO	**NO_x**	**ROG/HC**	**SO_x**	**PM_{10}**
No Action Alternative (Current Operations)					
Point Mugu Sea Range	192.38	77.17	13.16	19.53	5.95
NAS Point Mugu	672.89	170.45	118.09	13.26	123.33
San Nicolas Island	33.92	151.75	11.45	5.17	11.65
Santa Cruz Island	0.30	0.45	0.07	0.19	0.16
Total	**899.49**	**399.82**	**142.77**	**38.15**	**141.09**

Table 4.2-3. Summary of Annual Air Emissions Outside U.S. Territory of No Action Alternative

Emission Source	*Emissions (tons/year)*				
	CO	***NO_x***	***ROG/HC***	***SO_x***	***PM_{10}***
No Action Alternative (Current Operations)					
Point Mugu Sea Range	*120.73*	*190.58*	*11.35*	*149.01*	*37.09*
NAS Point Mugu	*0*	*0*	*0*	*0*	*0*
San Nicolas Island	*0*	*0*	*0*	*0*	*0*
Santa Cruz Island	*0*	*0*	*0*	*0*	*0*
Total	***120.73***	***190.58***	***11.35***	***149.01***	***37.09***

4.2.3 Minimum Components Alternative

The Minimum Components Alternative represents the minimum level of action required to meet the purpose and need of the proposed action. Under this alternative, only one component of each proposed action element would be implemented. In addition to current testing and training activities, the Sea Range would accommodate up to eight nearshore intercept events and one FLEETEX per year. The only facility modernization component that would be implemented is the construction of five multiple-purpose instrumentation sites on San Nicolas Island. These activities would result in a potential increase in air emissions. The following sections provide descriptions of the air emission sources associated with the Minimum Components Alternative.

4.2.3.1 Theater Missile Defense Element – Nearshore Intercept

Emission sources associated with nearshore intercept activities include aircraft, marine vessels, and missiles and targets.

4.2.3.2 Training Element – Additional FLEETEX

Emission sources associated with one additional FLEETEX per year include aircraft, marine vessels, missiles, targets, and other ordnance.

4.2.3.3 Facility Modernization Element – Multiple-Purpose Instrumentation Sites

Emissions associated with the proposed five multiple-purpose instrumentation sites on San Nicolas Island include construction emissions during the modernization and additional emissions arising from increased use of the new facilities following completion of the modernization. The emissions associated with constructing the additional instrumentation sites would be temporary and not significant. Emissions associated with the operation of the five multiple-purpose instrumentation sites would be minor and not significant.

4.2.3.4 Potential Air Quality Impacts

A summary of annual air emissions within U.S. Territory associated with the proposed TMD and training elements of the Minimum Components Alternative is presented in Table 4.2-4. These estimates include the additional emissions generated at the NAS Point Mugu airfield. Implementation of the Minimum Components Alternative would result in an increase in all criteria pollutants. Based on the estimated percentage of total emissions that could be distributed to onshore areas (refer to discussion in Section 4.2.1 and Appendix C), the annual maximum increases of criteria pollutants that could be transported to onshore regions are shown in Table 4.2-5.

To assess the potential for significant air quality impacts resulting from these emissions, the stationary new source review emission limits were used for comparison purposes. While the major new source thresholds are not directly applicable to emissions generated offshore, they were identified as indicators for establishing the potential for significant air quality impacts under NEPA. This approach is very conservative given that much of the area included within the NEPA analysis is considered in attainment (refer to Section 3.2) and the emission sources under consideration are mobile (e.g., aircraft, vessels, etc.) and typically would not be subject to the stationary new source thresholds. However, they were selected for this analysis as conservative thresholds that would indicate the potential for significant effects. The

Table 4.2-4. Summary of Estimated Annual Emissions within U.S. Territory Associated with the Minimum Components Alternative

Emission Source	Emissions (tons/year) CO	NO_x	ROG/HC	SO_x	PM_{10}
Nearshore Intercept					
Aircraft	0.68	0.61	0.24	0.03	0.19
Marine Vessels	2.66	8.07	0.73	3.02	0.46
Missiles/Targets	1.84	0.01	0.07	0.00	1.56
Subtotal	5.18	8.69	1.04	3.05	2.21
Additional FLEETEX					
Aircraft	0.31	0.31	0.07	0.02	0.08
Marine Vessels	4.12	6.83	0.88	1.72	0.38
Missiles/Targets	14.78	1.75	0.54	0.10	0.39
Subtotal	19.21	8.89	1.49	1.84	0.85
Total	**24.39**	**17.58**	**2.53**	**4.89**	**3.06**

Table 4.2-5. Summary of Estimated Annual Emissions within U.S. Territory Associated with the Minimum Components Alternative that could Potentially Affect Air Districts Onshore

Location of Emissions and Potentially Affected Areas Onshore	Emissions (tons/year) CO	NO_x	ROG/HC	SO_x	PM_{10}
Total Emissions within U.S. Territory	24.39	17.58	2.53	4.89	3.06
Total Emissions within 3 NM	<0.92>	<0.79>	<0.32>	<0.12>	<0.17>
Total Emissions Available for Transport[1]	23.47	16.79	2.21	4.77	2.89
Transported Emissions[2]					
Air Districts					
South Coast	7.98	5.71	0.75	1.62	0.98
San Diego	10.09	7.22	0.95	2.05	1.24
Other Areas					
Mexico	5.40	3.86	0.51	1.10	0.67
Total	**23.47**	**16.79**	**2.21**	**4.77**	**2.89**

[1] Excludes emissions assigned to the Ventura County APCD (these emissions are included in the Conformity Applicability Determination).
[2] Emissions estimates are based on the assumption that all emissions are transported onshore.

stationary new source thresholds for the areas that could be affected by an increase in offshore emissions are shown in Table 4.2-6. As shown in Table 4.2-5, all emissions are below the associated thresholds for the respective areas. The following points are also relevant to this assessment:

- The transport model (refer to Appendix C) assumes that all emissions are distributed uniformly.
- The transport model assumes that all emissions are transported onshore.
- The transport model assumes that aircraft emissions generated aloft move with surface wind (since winds aloft may differ from this assumption, the estimates calculated for this EIS/OEIS tend to overestimate rather than underestimate emissions).

Table 4.2-6. New Source Review Emission Limits for Major Sources

Air Basin	CO	NO_x	ROG/HC	SO_x	PM_{10}
	Major Source Thresholds Emissions (tons/year)				
South Coast	100	10	10	70	70
San Diego	100	50	50	100	100

Given the above, it is clear that the emissions estimated to reach onshore air districts are probably higher than what actually would occur. Since the total emissions estimated to affect onshore areas are overestimates, and because these emissions are below the conservative stationary new source thresholds, air quality impacts resulting from implementation of the Minimum Components Alternative would be less than significant.

A summary of annual air emissions outside U.S. Territory associated with the proposed TMD and training elements of the Minimum Components Alternative is presented in Table 4.2-7. Since the offshore region seaward of San Nicolas Island and the northern Channel Islands can be considered in attainment, for purposes of this EIS/OEIS, the attainment area threshold for Prevention of Significant Deterioration (PSD) of 250 tons per year for criteria pollutants was used for comparison purposes to assess the potential significance of air quality impacts under the EO. While CAA requirements are implemented by state agencies and apply to areas extending 3 NM (5.6 km) from shore, the federal thresholds were used in the absence of any other established criteria for emissions in offshore regions. CAA standards provide a conservative basis for evaluating potential EO 12114 air quality impacts.

For the Minimum Components Alternative (see Table 4.2-7), emissions estimated to occur outside U.S. Territory are below the PSD limit of 250 tons per year for criteria pollutants. Emissions associated with the Minimum Components Alternative would therefore have less than significant impacts on air quality.

Table 4.2-7. Summary of Estimated Annual Emissions outside U.S. Territory Associated with the Minimum Components Alternative

Emission Source	*CO*	*NO_x*	*ROG/HC*	*SO_x*	*PM_{10}*
	Emissions (tons/year)				
Nearshore Intercept					
Aircraft	*0.01*	*0.04*	*0.00*	*0.00*	*0.01*
Marine Vessels	*14.94*	*36.32*	*1.33*	*19.85*	*1.89*
Missiles/Targets	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Subtotal	*14.95*	*36.36*	*1.33*	*19.85*	*1.90*
Additional FLEETEX					
Aircraft	*1.65*	*0.36*	*0.63*	*0.02*	*0.29*
Marine Vessels	*7.55*	*21.44*	*0.88*	*11.79*	*1.44*
Missiles/Targets	*5.96*	*4.22*	*0.35*	*0.24*	*1.82*
Subtotal	*15.16*	*26.02*	*1.86*	*12.05*	*3.55*
Total	***30.11***	***62.38***	***3.19***	***31.90***	***5.45***

4.2.4 Preferred Alternative

The Navy proposes to accommodate new types of testing, accommodate an increase in current training operations, and modernize Sea Range facilities. These activities would result in increased activities above the baseline activity levels, and thus would result in potential increases in air emissions. The following sections provide descriptions of the air emission sources associated with each of the proposed action elements.

4.2.4.1 Theater Missile Defense Element

TMD may involve four or more distinct types of testing and training activities on the Point Mugu Sea Range. These activities include the following:

- Boost Phase Intercept
- Upper Tier
- Lower Tier
- Nearshore Intercept

The Navy proposes to accommodate up to three boost phase intercept events per year, up to three upper tier events per year, up to three lower tier events per year, and up to eight nearshore intercept events per year. Emission sources during TMD activities include aircraft, marine vessels, and use of missiles and targets.

4.2.4.2 Training Element – Fleet Exercise and Special Warfare Training

<u>A - Fleet Exercise Training</u>

Emission sources associated with one additional FLEETEX per year include aircraft, marine vessels, missiles, targets, and other ordnance.

<u>B - Special Warfare Training</u>

The proposed action incorporates the accommodation of a twofold increase of special warfare training activity, increasing from two to four times per year. Emission sources associated with two additional special warfare training activities per year include aircraft and marine vessels.

4.2.4.3 Facility Modernization Element – Point Mugu and San Nicolas Island

<u>A - Point Mugu Modernizations</u>

Proposed facility modernizations to NAS Point Mugu include the use of two previously used launch pads (pads B and C) to serve as the new missile launch location at NAS Point Mugu. Use of either of the new launch locations would not affect the number or types of missiles launched from NAS Point Mugu. No construction would be required. Therefore, there would be no additional air emissions generated from the use of these pads.

B - San Nicolas Island Modernizations

Range Support Building/Multiple-Purpose Instrumentation Sites

Emissions associated with the construction of a Range Support Building and five multiple-purpose instrumentation sites at San Nicolas Island comprise construction emissions during the modernization and additional emissions arising from increased use of the new facilities following completion of the modernization. Emissions associated with constructing the facilities would be temporary and not significant. These modernization proposals would not require additional staff on the island. Emissions associated with the operation of the Range Support Building and five multiple-purpose instrumentation sites would be minor and not significant.

Increased Launch Capabilities

The Navy proposes to add a launch site near the Alpha Launch Complex, which is currently used for many of the target launches from San Nicolas Island. The 50K launcher would be used approximately three times per year to launch targets and missiles weighing up to 50,000 pounds (23,000 kg). A vertical launch system is proposed for one of the pads on the west end of the island. The vertical launch system would be used approximately three times per year. Emissions associated with six additional launches per year from San Nicolas Island would be minor and not significant.

4.2.4.4 Potential Air Quality Impacts

Table 4.2-8 presents a summary of air emissions within U.S. Territory associated with the proposed TMD and training elements of the proposed action. These estimates include the additional emissions generated at the NAS Point Mugu airfield. Detailed estimates are provided in Appendix C. As discussed in Section 4.2.3.4, the stationary new source thresholds were identified as appropriate for use in assessing whether air quality impacts would be potentially significant under NEPA. This approach is very conservative given that much of the area included within the NEPA analysis is considered in attainment (refer to Section 3.2) and that the emission sources under consideration are mobile (e.g., aircraft, vessels, etc.) and typically would not be subject to the stationary new source thresholds.

Based on the estimated percentage of total emissions that could be distributed to onshore areas (refer to discussion in Section 4.2.1 and Appendix C), the annual maximum increases of criteria pollutants that could be transported to onshore regions are shown in Table 4.2-9. As shown in this table, emissions would be below the associated stationary new source thresholds for each respective air district (see Table 4.2-6).

As described previously in Section 4.2.3.4, the actual amount of emissions transported to the onshore regions likely would be much lower. Since comparing potential emission increases to the stationary new source thresholds is a very conservative approach given that much of the area included within the NEPA analysis is considered in attainment (refer to Section 3.2) and typically would not be subject to these limits, and that the emissions potentially transferred to onshore regions have been overestimated, air quality impacts resulting from implementation of the Preferred Alternative would be less than significant.

Table 4.2-8. Estimated Annual Air Emissions within U.S. Territory Associated with the Proposed Action

	Emissions (tons/year)				
Emission Source	**CO**	**NO_x**	**ROG/HC**	**SO_x**	**PM_{10}**
THEATER MISSILE DEFENSE ELEMENT					
Boost Phase Intercept					
Aircraft	0.60	0.46	0.18	0.02	0.13
Marine Vessels	0.51	1.86	0.24	0.47	0.11
Missiles/Targets	0.00	1.53	0.00	0.00	0.00
Subtotal	1.11	3.85	0.42	0.49	0.24
Upper Tier					
Aircraft	0.04	0.32	0.01	0.01	0.08
Marine Vessels	0.61	2.23	0.28	0.57	0.14
Missiles/Targets	0.00	1.02	0.00	0.00	0.00
Subtotal	0.65	3.57	0.29	0.58	0.22
Lower Tier					
Aircraft	0.06	0.42	0.02	0.02	0.10
Marine Vessels	0.61	2.23	0.28	0.57	0.14
Missiles/Targets	0.23	0.51	0.01	0.00	0.19
Subtotal	0.90	3.16	0.31	0.59	0.43
Nearshore Intercept					
Aircraft	0.68	0.61	0.24	0.03	0.19
Marine Vessels	2.66	8.07	0.73	3.02	0.46
Missiles/Targets	1.84	0.01	0.07	0.00	1.56
Subtotal	5.18	8.69	1.04	3.05	2.21
TRAINING ELEMENT					
Additional FLEETEX					
Aircraft	0.31	0.31	0.07	0.02	0.08
Marine Vessels	4.12	6.83	0.88	1.72	0.38
Missiles/Targets	14.78	1.75	0.54	0.10	0.39
Subtotal	19.21	8.89	1.49	1.84	0.85
Additional Special Warfare Training					
Aircraft	0.14	0.08	0.03	0.00	0.02
Marine Vessels	0.58	2.11	0.27	0.54	0.13
Missiles/Targets	0.00	0.00	0.00	0.00	0.00
Subtotal	0.72	2.19	0.30	0.54	0.15
TOTAL – PROPOSED ACTION					
Aircraft	1.83	2.20	0.55	0.10	0.60
Marine Vessels	9.08	23.32	2.68	6.88	1.35
Missiles/Targets	16.85	4.82	0.62	0.10	2.14
GRAND TOTAL	**27.76**	**30.34**	**3.85**	**7.08**	**4.09**

Table 4.2-9. Summary of Estimated Annual Emissions within U.S. Territory Associated with the Preferred Alternative that could Potentially Affect Air Districts Onshore

Location of Emissions and Potentially Affected Areas Onshore	Emissions (tons/year)				
	CO	NO_x	ROG/HC	SO_x	PM_{10}
Total Emissions within U.S. Territory	27.76	30.34	3.85	7.08	4.09
Total Emissions within 3 NM	<1.86>	<1.77>	<0.60>	<0.27>	<0.35>
Total Emissions Available for Transport[1]	25.90	28.57	3.25	6.81	3.74
Transported Emissions[2]					
Air Districts					
South Coast	8.81	9.71	1.11	2.32	1.27
San Diego	11.14	12.29	1.40	2.93	1.61
Other Areas					
Mexico	5.95	6.57	0.74	1.56	0.86
Total	**25.90**	**28.57**	**3.25**	**6.81**	**3.74**

[1] Excludes emissions assigned to the Ventura County APCD (these emissions are included in the Conformity Applicability Determination).
[2] Emissions estimates are based on the assumption that all emissions are transported onshore.

Table 4.2-10 presents a summary of air emissions outside U.S. Territory associated with the proposed TMD and training elements of the proposed action. In terms of the EO 12114 analysis, as discussed in Section 4.2.3, since the offshore region seaward of San Nicolas Island and the northern Channel Islands can clearly be considered in attainment, for purposes of this EIS/OEIS, the attainment area threshold for new source review, the Prevention of Significant Deterioration (PSD) limit of 250 tons per year for criteria pollutants was selected as an appropriate indicator for use in assessing the significance of potential air quality impacts. While CAA requirements are implemented by state agencies and apply to areas extending 3 NM (5.6 km) from shore, the federal thresholds are used in the absence of any other established criteria for emissions in offshore regions. CAA standards provide a conservative basis for evaluating potential EO 12114 air quality impacts.

For the Preferred Alternative (see Table 4.2-10), emissions estimated to occur outside U.S. Territory are well below the PSD limit of 250 tons per year for criteria pollutants. Emissions associated with the Preferred Alternative would therefore have less than significant impacts on air quality.

4.2.5 Hazardous Air Pollutants

To conduct a screening evaluation of potential exposure to toxic air pollutant emissions, those substances listed in Appendix A-1 of the AB2588 Emission Inventory Criteria and Guidelines Regulation were estimated. This list identifies substances for which noncancer health effects are to be evaluated as a result of acute exposures. For noncancer health effects, an acceptable exposure level (AEL) is used for calculating hazard indices, which provide a comparison of the predicted concentrations of toxic air pollutants with the AEL. Peak 1-hour emissions are used in evaluating acute health risks. The predicted concentration of all combustion products was calculated based on the amount of product dispersed into a volume of air (refer to Section 4.1.2.1). These calculations are conservative because they do not account for dilution due to wind mixing or other dissipation factors. Even with these conservative assumptions, Table 4.2-11 shows that concentrations of the toxic air pollutants are below the acceptable exposure levels. Rather than using 1-hour criteria for lead, California EPA (Cal/EPA) suggests that a 30-day averaging time be used to estimate a hazard index for lead exposure (Cal/EPA 1993). As noted in Table 4.2-11, the lead hazard index (1.5 $\mu g/m^3$) applies to subchronic exposure and, therefore, is not applicable

Table 4.2-10. Estimated Annual Air Emissions outside U.S. Territory Associated with the Proposed Action

Emission Source	Emissions (tons/year)				
	CO	NO_x	ROG/HC	SO_x	PM_{10}
THEATER MISSILE DEFENSE ELEMENT					
Boost Phase Intercept					
Aircraft	0.00	0.04	0.00	0.00	0.01
Marine Vessels	0.20	0.74	0.09	0.19	0.05
Missiles/Targets	0.00	0.00	0.00	0.00	0.00
Subtotal	0.20	0.78	0.09	0.19	0.06
Upper Tier					
Aircraft	0.00	0.04	0.00	0.00	0.01
Marine Vessels	8.10	19.62	0.70	10.78	1.02
Missiles/Targets	1.56	0.51	0.06	0.00	1.31
Subtotal	9.66	20.17	0.76	10.78	2.34
Lower Tier					
Aircraft	0.00	0.04	0.00	0.00	0.01
Marine Vessels	8.10	19.62	0.70	10.78	1.02
Missiles/Targets	0.46	1.02	0.02	0.00	0.39
Subtotal	8.56	20.68	0.72	10.78	1.42
Nearshore Intercept					
Aircraft	0.01	0.04	0.00	0.00	0.01
Marine Vessels	14.94	36.32	1.33	19.85	1.89
Missiles/Targets	0.00	0.00	0.00	0.00	0.00
Subtotal	14.95	36.36	1.33	19.85	1.90
TRAINING ELEMENT					
Additional FLEETEX					
Aircraft	1.65	0.36	0.63	0.02	0.29
Marine Vessels	7.55	21.44	0.88	11.79	1.44
Missiles/Targets	5.96	4.22	0.35	0.24	1.82
Subtotal	15.16	26.02	1.86	12.05	3.55
Additional Special Warfare Training					
Aircraft	0.01	0.01	0.00	0.00	0.00
Marine Vessels	0.16	0.59	0.08	0.15	0.04
Missiles/Targets	0.00	0.00	0.00	0.00	0.00
Subtotal	0.17	0.60	0.08	0.15	0.04
TOTAL – PROPOSED ACTION					
Aircraft	1.67	0.53	0.63	0.02	0.33
Marine Vessels	39.05	98.33	3.78	53.54	5.46
Missiles/Targets	7.98	5.75	0.43	0.24	3.52
GRAND TOTAL	***48.70***	***104.61***	***4.84***	***53.80***	***9.31***

Table 4.2-11. Exhaust Products of Typical Targets and Missiles Launched from NAS Point Mugu and San Nicolas Island (kg)*

Combustion Product	Combustion Percentage	Peak 1-Hour Acute AEL (µg/m³)	Small Drone Target Amount (kg)	Small Drone Target Volumetric Concentration (µg/m³)**	Large Drone Target Amount (kg)	Large Drone Target Volumetric Concentration (µg/m³)**	Small Missile Amount (kg)	Small Missile Volumetric Concentration (µg/m³)**	Medium Missile Amount (kg)	Medium Missile Volumetric Concentration (µg/m³)**	Large Missile Amount (kg)	Large Missile Volumetric Concentration (µg/m³)**
*Proportion below mixing height**			*33%*		*33%*		*10%*		*10%*		*10%*	
Al_2O_3	28.07%	--	1.2966	*233*	4.4085	*791*	1.8259	*41*	18.7758	*421*	35.3625	*793*
CO	21.08%	23,000	0.9738	*175*	3.3108	*594*	1.3712	*31*	14.1004	*316*	26.5569	*596*
HCl	22.27%	3,000	1.0288	*185*	3.4979	*628*	1.4487	*32*	14.8974	*334*	28.0578	*629*
N_2	8.66%	--	0.3999	*72*	1.3597	*244*	0.5632	*13*	5.7911	*130*	10.9069	*245*
H_2O	12.33%	--	0.5694	*102*	1.9361	*347*	0.8018	*18*	8.2456	*185*	15.5299	*348*
H_2	1.86%	--	0.0859	*15*	0.2919	*52*	0.1209	*3*	1.2432	*28*	2.3415	*53*
CO_2	4.57%	--	0.2113	*38*	0.7185	*129*	0.2976	*7*	3.0602	*69*	5.7637	*129*
Other	1.18%	--	0.0543	*10*	0.1846	*33*	0.0765	*2*	0.7863	*18*	1.4809	*33*
Total	100.00%	--	4.6200	*829*	15.7080	*2,819*	6.5057	*146*	66.9000	*1,501*	126.0000	*2,826*
Lead	0.54%	***	0.0249	*4*	0.0848	*15*	0.0351	*1*	0.3613	*8*	0.6804	*15*
Copper	0.14%	10	0.0066	*1*	0.0224	*4*	0.0093	*0*	0.0953	*2*	0.1796	*4*

* Mixing heights can vary but are typically about 3,000 feet (910 m). Depending on the target or missile type, only a certain proportion of all combustion products would occur below this height. The general assumptions for proportions of combustion products occurring below this mixing height are included in the top row of this table.

** Volumetric calculations are based on the following assumptions (refer to Section 4.1.2.1):

- No wind
- Spherical plume
- Plume diameter (drone targets) = 220 m
- Plume diameter (missile targets) = 440 m

Criteria Source: AB2588 Emission Inventory Criteria and Guidelines Regulation.
AEL = acceptable exposure levels.

*** Level standard of 1.5 µg/m³ is based on exposure averaged over 30 day period; therefore, the hazard index would be subchronic exposure and is not applicable in this comparison.
Source: Cal/EPA, Evaluation of Acute Exposure to Lead. Office of Environmental Health Hazard Assessment. Letter dated May 7, 1993.

in this comparison. However, target/missile launches occur an average of about once per week at NAS Point Mugu and once every three weeks at San Nicolas Island. Therefore, the instantaneous lead concentration of 15 $\mu g/m^3$ would fall well below the subchronic exposure level when averaged over a period of 30 days (especially when considering effects of wind mixing or other dissipation factors). Consequently, air toxic impacts associated with current and proposed target/missile launches at NAS Point Mugu and San Nicolas Island would be less than significant.

4.2.6 Clean Air Act Conformity Applicability

Under the provisions of 40 C.F.R. Parts 51 and 93, federal actions are required to conform with the State Implementation Plan (SIP) for those areas that are categorized as nonattainment or maintenance areas for any criteria pollutant. The proposed action includes activities in Ventura County, which is classified as a *severe nonattainment area* for ozone. Because of its location in a nonattainment area, the proposed action at the Point Mugu Sea Range must be evaluated to determine whether the provisions of the General Conformity Rule are applicable to the action, and to demonstrate that the proposed action is in conformity with the applicable SIP (Appendix C contains a more detailed explanation of conformity). Table 4.2-12 shows the *de minimis* levels for nonattainment pollutants in Ventura County.

Table 4.2-12. *de minimis* Levels for Determination of Applicability of General Conformity Rule

	***de minimis* Levels, tons/year**				
Air Basin	**ROG/HC**	**NO_x**	**NO_2**	**CO**	**PM_{10}**
Ventura County	25	25	-	-	-

If emissions of criteria pollutants associated with the proposed action are below the *de minimis* levels and if the emissions are not regionally significant (i.e., not greater than 10 percent of the air basin's emissions budget), the proposed action is exempt from the requirements of a full conformity determination under the General Conformity Rule.

Emissions associated with the proposed action include emissions from the following source categories:

- Aircraft Operations;
- Marine Vessel Operations; and
- Missile/Target Operations.

Because all missile and target operations associated with the proposed action would be above 3,000 feet (914 m) or beyond 3 NM (5.6 km) from shore, emissions from this source category were not included within the conformity applicability analysis. A discussion of the methodology used to estimate emissions pertinent to the conformity applicability analysis, including detailed emission estimates, is provided in Appendix C. The activities occurring in Ventura County have been evaluated in this conformity applicability analysis to assess their status and requirements relative to the General Conformity Rule. The analysis is presented in the section below.

4.2.6.1 Actions Occurring in Ventura County

The Ventura County Air Pollution Control District (VCAPCD) is the agency responsible for the attainment and maintenance of air quality standards in the Ventura County Air Basin. According to representatives of the VCAPCD, the VCAPCD has adopted the provisions of the federal General Conformity Rule by reference.

Activities associated with the proposed action occurring in the Ventura County Air Basin include increased aircraft sorties originating at NAS Point Mugu, support operations from NAS Point Mugu, and range support marine vessels traveling to and from the Sea Range from Port Hueneme, which is also located in Ventura County. Other activities would occur on San Nicolas Island. While San Nicolas Island is considered part of the Ventura County Air Basin, its attainment status is different from the mainland Ventura County. San Nicolas Island is currently classified as "unclassified/attainment" for air quality standards by the USEPA. The provisions of the General Conformity Rule therefore do not apply to activities occurring on San Nicolas Island in support of the proposed action. Table 4.2-13 presents a summary of the emission sources, and NO_x and ROG/HC emissions associated with the sources, that would occur below 3,000 AGL (914 m) and within 3 NM (5.6 km) of the shoreline.

Table 4.2-13. Emission Sources Associated with the Proposed Action

Source	Emissions, tons/year NO_x	Emissions, tons/year ROG/HC
Aircraft	0.86	0.48
Marine Vessels	0.91	0.12
Totals	1.77	0.60
de minimis levels	25	25
Above *de minimis*?	**No**	**No**

The proposed action's emissions are below both the *de minimis* levels and below 10 percent of the emissions budget for NO_x and ROG/HCs in the Ventura County SIP. Therefore, the General Conformity Rule is not applicable to the proposed action.

4.2.6.2 Conclusions

According to the analysis presented above, the General Conformity Rule is not applicable to the proposed action. A Record of Non-Applicability and supporting material is included in Appendix C.

4.3 NOISE

4.3.1 Approach to Analysis

Projected noise levels for the Point Mugu Sea Range were calculated using the Department of Defense (DoD) noise modeling program MR_NMAP which applies the L_{dnmr} metric (refer to Appendix D). Changes in noise levels associated with increased usage of the range were assessed with respect to noise levels resulting from aircraft operations conducted in the most commonly used range areas. By comparing projected noise levels to current levels, the degree of change was identified and the significance of any projected change is discussed with respect to current noise levels and the likelihood that any change would be perceptible.

The DoD-developed Air Installation Compatible Use Zone (AICUZ) program provides threshold noise levels for various land use types found near military airfields. The AICUZ program is a tool used for making decisions on land development, encroachment issues, land purchase issues, and general air traffic operations. AICUZ program findings are considered in determining whether an alternative would have a significant land use impact relative to noise exposure.

The factors considered in determining the significance of noise effects on other receptors of concern (i.e., marine mammals, birds, and fish) are discussed within other sections of this chapter. Potential noise impacts on fish (to the extent that noise introduced to the sea can affect catchability) are discussed in Section 4.6; marine mammals are discussed in Section 4.7; and birds are discussed in Section 4.8. Since the primary issue of concern with regard to underwater noise is the potential for marine mammal impacts, changes to the underwater noise environment resulting from Sea Range operations are addressed in Section 4.7, Marine Mammals, and referenced as necessary in the discussion of potential impacts on fish and sea turtles (Section 4.6). Due to the importance of these issues with respect to wildlife, noise generated from missile and target launches and overflights are addressed quantitatively in Section 4.7, and referenced as appropriate in this and other sections.

4.3.1.1 Point Mugu Sea Range

Current activities are addressed in the impact analysis under the No Action Alternative. The majority of this assessment has already been included in the description of existing airborne noise conditions (refer to Section 3.3). These results depict the collective baseline noise contribution of all activities on the Sea Range. The following impact analysis (Section 4.3.2) divides these total operations into the appropriate operations for each scenario (e.g., air-to-air, air-to-surface, etc.). Assumptions are made on the percentages of aircraft, missile, and target operations apportioned to each scenario. Single event levels are presented as necessary in order to form the basis for analyzing potential noise-related effects on biological species.

Compared to aircraft activity modeled to generate baseline noise levels, proposed Sea Range aircraft activity corresponds to an increase of slightly more than 3 percent. Proposed sorties would use the same altitude structure as described under existing test and training scenarios. Most proposed sorties would be conducted in Range Areas 4A, 4B, and 5A, although the majority would require transit through other range areas. Noise-generating events modeled in any single range area do not result in perceptible changes to the overall noise environment. Proposed activities would result in increases in noise levels; however, the increases would be only fractions of 1 dB. As shown in Table 4.3-1, when number-rounding conventions are applied, reported noise levels would be identical to those reported for baseline conditions.

Table 4.3-1. Projected Average Subsonic Sound Levels (L_{dnmr}) under the Proposed Action by Range Area[1]

Range Area	Baseline (L_{dnmr})	Increase (L_{dnmr})	Projected (L_{dnmr})
3A (W-289)	52.8	<0.1	52.8
3B (W-289)	54.5	<0.1	54.5
3D (W-289)	52.2	<0.1	52.2
3E (W-289)	58.5	<0.1	58.5
3F (W-289)	58.6	<0.1	58.6
4A (W-289)	60.6	<0.1	60.6
4B (W-289)	63.3	<0.1	63.3
5A (W-289)	60.3	<0.1	60.3
5B (W-289)	60.1	<0.1	60.1
5C (W-532)	57.4	<0.1	57.4
5D (W-532)	55.5	<0.1	55.5
6A (W-289)	56.6	<0.1	56.6
6B (W-289)	56.6	<0.1	56.6
6C (W-532)	58.4	<0.1	58.4
6D (W-532)	55.3	<0.1	55.3
7A (W-289)	48.2	<0.1	48.2
7B (W-289)	48.5	<0.1	48.5
7C (W-532)	59.1	<0.1	59.1
7D (W-532)	52.6	<0.1	52.6
8A (W-532)	56.1	<0.1	56.1
M1 (W-532)	57.1	<0.1	57.1
M2 (W-532)	58.0	<0.1	58.0
M5 (W-289)	60.9	<0.1	60.9
W-289 W-412	57.0	<0.1	57.0
W-289N	61.5	<0.1	61.5
W-290	52.6	<0.1	52.6
W-537	49.1	<0.1	49.1
W-60	58.8	<0.1	58.8
W-61	48.0	<0.1	48.0

[1] Based on assumptions presented in Section 3.3.

A more meaningful impact would be demonstrable if the proposed sorties (130 per year) are assumed to take place in only one of the primary range areas (4A, 4B, or 5A). This approach would yield the highest noise levels for any range area, and would further support the position that an increase of 130 sorties per year over the entire range would be negligible with respect to overall noise levels. For the purpose of conducting a conservative analysis, this approach was used to assess potential noise impacts of the Preferred Alternative since this alternative includes the greatest increase in flight activity (see Section 4.3.4).

Noise level calculation algorithms take into account total noise input to each specific area. However, most range areas include Territorial and non-Territorial Waters. Since aircraft in an assigned area can operate at a variety of altitudes and along many different flight paths, calculated noise levels would be identical for Territorial and non-Territorial Waters. Aircraft operate in the range areas with respect to range boundaries, not the Territorial Waters limit. Noise levels could be calculated for each portion of a designated range area by encoding artificial boundaries into the noise model to delineate the Territorial Waters limit, basically creating two range areas from one. However, this was not done because the result of that action would be no change in modeled overall noise level since the total noise input per square mile (or square kilometer) would not change.

Many of the range areas are approved for supersonic flight; however, no data are available that describe the exact location of supersonic activities within the approved areas. Supersonic aircraft activity in the Sea Range is generally restricted to altitudes greater than 30,000 feet (9,140 m) above mean sea level or in areas at least 30 NM (56 km) from shore. These restrictions prevent most sonic booms from reaching the ground. Under certain atmospheric conditions, a sonic boom produced at such a high altitude could reach the ground; however, the boom would be of low intensity due to atmospheric effects. Tests requiring low-altitude supersonic aircraft flight are conducted well away from developed areas to further prevent sonic boom exposure. Given the lack of data detailing exactly where supersonic events have occurred historically, Chapter 3 (Section 3.3) addresses supersonic activity with respect to the overpressures and sound levels that would be experienced by an observer if a given aircraft were to produce a sonic boom under idealized conditions. The increase in sorties under the proposed action would likely mean a small increase in supersonic events as well. The significance of those events are described in the context that these types of events already occur throughout most of the range areas, any increase in the number of those events would be minimal, and the intensity of any sonic booms would not be altered by proposed activities since the types of aircraft, ordnance, and targets would be similar to baseline conditions. An increase in supersonic flights is not likely to affect areas within Territorial Waters off Point Mugu or the northern Channel Islands since the Navy already imposes restrictions to prevent aircraft sonic booms from reaching developed areas.

Supersonic ordnance are periodically used during various test scenarios. Sonic booms resulting from supersonic ordnance flight would be less intense than those generated by supersonic aircraft for given atmospheric, altitude, and speed conditions. Supersonic ordnance flights tend to be of shorter duration than supersonic aircraft flights, thus affecting smaller areas. Proposed supersonic ordnance use initiated near San Nicolas Island would typically be directed away from the island. Sonic booms produced by supersonic ordnance would be projected away from both the island and mainland areas. Furthermore, total supersonic ordnance noise is made up of both an engine component and a sonic boom component. For the types of ordnance proposed for use in the Sea Range, engine noise can exceed the sonic boom noise, either of which is audible for only brief periods.

4.3.1.2 Point Mugu

Increases in aircraft activity would have negligible effects on noise contours developed for NAS Point Mugu. When averaged over the year, an increase of 130 sorties amounts to an increase of less than one flight per day. When compared to the "average busy day," a deviation of one flight per day compared to the 31 flights modeled would represent a statistically meaningless change. Notable increases in the NAS Point Mugu noise contours would occur only if main arrival and departure paths were altered or if flight operations were to increase overall by more than 10 to 20 percent; neither is proposed. Furthermore, some of the proposed sorties would be initiated from aircraft carriers and other offstation sites instead of from the NAS Point Mugu airfield.

4.3.1.3 San Nicolas Island

Following a similar rationale for San Nicolas Island as for NAS Point Mugu, the occasional use of the San Nicolas Island airfield by aircraft supporting additional operations would result in no notable changes in noise contours. Unless standard arrival and departure routes would be modified or total airfield activity increased by at least 10 to 20 percent, noise contours for San Nicolas Island would remain effectively the same as under baseline conditions. Even though 130 new sorties are proposed, only a fraction would use the San Nicolas Island airfield.

A summary of noise impacts on the airborne environment is presented in Table 4.3-2.

Table 4.3-2. Noise Impact Summary Matrix

Alternative	Impact Conclusions: NEPA (On Land→ Territorial Waters)	Impact Conclusions: EO 12114 (Non-Territorial Waters)	Mitigation Measures
NO ACTION ALTERNATIVE	No change to noise contours at the NAS Point Mugu or San Nicolas Island airfields. Less than significant impact. No change from current Sea Range airborne noise levels (63.3 L_{dnmr}). Less than significant impact.	*No change from current Sea Range airborne noise levels (63.3 L_{dnmr}). Less than significant impact.*	None.
MINIMUM COMPONENTS ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	No change to noise contours at the NAS Point Mugu or San Nicolas Island airfields. Less than significant impact. No change from current Sea Range airborne noise levels (63.3 L_{dnmr}). Less than significant impact.	*No change from current Sea Range airborne noise levels (63.3 L_{dnmr}). Less than significant impact.*	None.
PREFERRED ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	No change to noise contours at the NAS Point Mugu or San Nicolas Island airfields. Less than significant impact. A <1 L_{dnmr} increase from current Sea Range airborne noise levels. Less than significant impact.	*A <1 L_{dnmr} increase from current Sea Range airborne noise levels. Less than significant impact.*	None.

4.3.2 No Action Alternative - Current Operations

Selection of the No Action Alternative would result in no change to overall noise levels resulting from airborne noise sources. Subsonic and supersonic events are conducted in accordance with existing regulations and restrictions. Noise levels for the NAS Point Mugu airfield, San Nicolas Island, other islands within the range, and all range areas would not change from those presented in Section 3.3. The effects of these noise levels on wildlife are addressed in Sections 4.6 (Fish and Sea Turtles), 4.7 (Marine Mammals), and 4.8 (Terrestrial Biology). The effects of these noise levels on human populations are addressed in Section 4.10 (Land Use).

For the reasons described above, the No Action Alternative would also result in no change to overall noise levels in non-Territorial Waters.

4.3.3 Minimum Components Alternative

This alternative includes impacts identified for the No Action Alternative since the testing, training, and facility modernization activities included in this alternative are proposed in addition to current operations.

4.3.3.1 Theater Missile Defense Element - Nearshore Intercept

Proposed nearshore intercept events would involve subsonic and supersonic missile flight and subsonic aircraft and target flight. For events involving air-launched targets, the target, launch aircraft, and missile are subsonic. The target launch aircraft is propeller-driven and operates at 15,000 feet (4,570 m) MSL. Fighter aircraft loiter at 20,000 feet (6,100 m) MSL and descend only during a portion of the exercise to fire a missile at the target. Supersonic missile events would occur during ship-launched missile scenarios. Proposed supersonic ordnance use initiated near San Nicolas Island would typically be directed away from the island. Thus, any sonic booms produced by supersonic ordnance would be projected away from both the island and mainland areas. Given that a total of only eight nearshore intercept exercises are proposed each year and that not all involve ship-launched missile exercises, impacts from potential sonic booms would be limited. Further, sonic booms produced by supersonic missiles would propagate upwards along the missile flight path and would not be focused on surface-based receptors. Missile and target intercept would occur at an altitude of about 1,000 feet (300 m) MSL. Ambient noise levels would be exceeded for a few seconds during each missile launch. Since the noise from a launch would be infrequent, of short duration, and of the same intensity as existing launch activity, proposed nearshore intercept testing and training events would have less than significant impacts on the airborne noise environment.

4.3.3.2 Training Element - Additional FLEETEX

The additional FLEETEX would involve a wide variety of aircraft, missile, and target activity. Aircraft activity would be conducted in both subsonic and supersonic conditions. Subsonic flights would predominate. Few missions require supersonic flight, and all such flights would be controlled and planned in accordance with current procedures. Fighter aircraft conducting air superiority exercises may be supersonic during very brief periods while positioning for strategic maneuvers. However, since supersonic flight requires increased fuel consumption, the duration of supersonic events is typically brief. Further, most supersonic events occur at altitudes in excess of 30,000 feet (9,140 m) MSL or in areas at least 30 NM (56 km) from shore, generating sonic booms which, depending on weather and on aircraft maneuver, may not reach the surface. Sonic booms that reach the surface would be similar in intensity and duration to those generated from existing range activity. Given the limited number of proposed supersonic activities and likelihood that few sonic booms from these events would reach the ground, no perceptible increase in long-term noise levels would occur as a result of sonic booms.

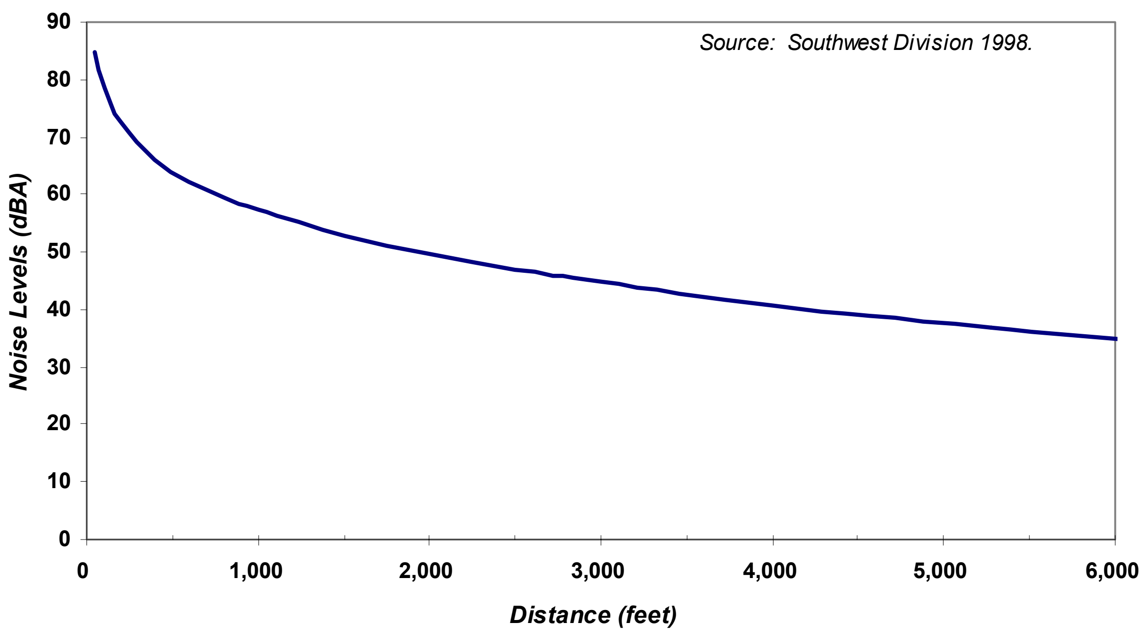
Continuous air surveillance is conducted during FLEETEXs, primarily by propeller-driven aircraft. These aircraft operate subsonically at altitudes ranging from 4,000 to 30,000 feet (1,220 to 9,140 m)

MSL. While mission support by these aircraft generally involves lengthy sorties, the fact that the aircraft are relatively quiet (commonly at least 10 dB less than fighter aircraft) and operate at generally high altitudes, perceptible long-term noise increases would not occur.

As described above, subsonic flights associated with an additional FLEETEX would not result in perceptible long-term noise increases in the Sea Range. Although in non-Territorial Waters supersonic flights can occur below 30,000 feet (9,140 m), populated areas are not likely to be affected since such flights would typically be in areas greater than 30 NM (56 km) from shore. The effects of supersonic events on wildlife are addressed in Sections 4.6 (Fish and Sea Turtles), 4.7 (Marine Mammals), and 4.8 (Terrestrial Biology).

4.3.3.3 Facility Modernization Element - Multiple-Purpose Instrumentation Sites

Facility modernization efforts would result in limited noise increases in areas immediately adjacent to proposed construction activities. Noise generated during construction would be orders of magnitude less than noise generated by routine activities on the island. Typical construction noise sources include trucks, heavy equipment, and air- and electric-powered tools. Figure 4.3-1 shows typical averaged noise levels at varying distances from common types of construction activities. The 65 CNEL noise contours are frequently used to help determine compatibility of noise sources with local land use. As shown in the figure, average noise decreases below these levels at distances greater than 400 feet (120 m) from the construction site. There are no sensitive human noise receptors within this proximity to the proposed construction locations at San Nicolas Island. Also, instantaneous construction noise levels generally do not exceed 90 dB, the limit for continuous 8-hour exposure under Occupational Safety and Health Administration guidelines. Noise generated during facility modernization would be temporary, lasting only as long the construction period, and long-term noise impacts would not occur.



Notes: Noise calculations incorporate both distance attenuation and atmospheric absorption effects. Noise estimates assume variable equipment use concentrated in a limited area over a 10-hour workday with no nighttime construction activity.

Figure 4.3-1
Typical CNELs Associated with Construction Activity (in dBA)

Selection of the Minimum Components Alternative would result in an imperceptible increase in overall average noise levels resulting from airborne noise sources. Overall noise levels would increase by fractions of a decibel (a noise level change of 3 dB is difficult to detect). Subsonic and supersonic events would continue to be conducted in accordance with existing regulations and restrictions. Projected increases in average long-term noise levels for the NAS Point Mugu airfield, San Nicolas Island, and all range areas would be less than significant.

For the reasons described above, the Minimum Components Alternative would result in less than significant noise impacts in non-Territorial Waters.

4.3.4 Preferred Alternative

This alternative includes impacts identified for the No Action Alternative since the testing, training, and facility modernization activities included in this alternative are proposed in addition to current operations.

Increased aircraft and missile activity would result in increases in overall noise levels at any location where either type of proposed activity would occur. Characterizing these increases requires consideration of existing conditions, noise measurement techniques, and levels of precision required to present a meaningful analysis. With respect to noise modeling for airborne sources, the most notable aspects of proposed range activity are: 1) when considered on an annual, monthly, or daily basis, additional noise resulting from proposed activities represents small fractions of noise levels modeled for existing conditions; and 2) modeled noise levels are exacerbated by the addition of nighttime and startle penalties (L_{dnmr}).

Noise level increases are determined by modeling proposed activity in affected areas and comparing proposed noise levels with those calculated under existing conditions for the same area. Since the proposed increases in activity by airborne noise sources are so small, overall noise levels increase by only fractions of a decibel measured in L_{dnmr} (see Table 4.3-1). For the purposes of assessing the potential for noise impacts, an analysis can be presented by describing a case where the maximum noise impact could occur. Given that a majority of proposed activities would take place in Range Areas 4A, 4B, and 5A, an analysis yielding the highest estimated noise levels can be accomplished by assuming that all of the proposed activity takes place in only one of these areas. Range Area 4B is the smallest of these three areas and would be subject to the maximum estimated noise levels under this scenario.

Maximum noise levels measured in L_{dnmr} were determined by modeling all 130 proposed aircraft sorties in Range Area 4B. Aircraft most commonly found on the range were assumed to spend a total of 120 minutes each at a variety of altitudes. The altitudes assigned to each aircraft depended on each aircraft's role in range activities. For example, surveillance aircraft tend to fly predominantly at lower altitudes, while fighter-type aircraft generally fly at high altitudes. The resulting noise level under this scenario would be 64.2 L_{dnmr}, an insignificant increase from the 63.3 L_{dnmr} determined for existing conditions. Since this minor increase is notably larger than would be anticipated given the vast distribution of aircraft activity throughout the entire range, it is reasonable to conclude that the increase in subsonic airborne noise in all range areas would be less than significant.

Limited supersonic aircraft events would occur during the additional FLEETEX. Noise issues associated with the additional FLEETEX are the same as those discussed earlier in Section 4.3.3.2. Supersonic missile flight also could occur for proposed TMD tests and training events. However, since the potentially supersonic portions of missile flight would occur during ascent, the potential impacts of a sonic boom are low since the boom would be propagated along the upward flight path. As a result, it is unlikely that a boom generated in this scenario would reach the surface.

Further assessment of the proposed activities is presented below. Emphasis is placed on the lack of noise sources capable of significantly increasing overall noise levels in any range area given the proposed levels of activity.

4.3.4.1 Theater Missile Defense Element

Proposed TMD testing and training events include four distinct programs, all of which require aircraft, target, and missile flight activity. With the exception of nearshore intercept events, proposed flight activities are conducted at relatively high altitudes, resulting in no long-term perceptible changes in noise levels. Proposed nearshore intercept events require subsonic and supersonic flight activity, neither of which would result in long-term increases in overall noise levels despite the lower flight altitudes.

<u>A - Boost Phase Intercept</u>

Boost phase intercept systems are designed to intercept tactical or theater ballistic missiles in ascent or boost phases of flight. To ensure an observer sufficient coverage of large areas, aircraft activity supporting proposed boost phase intercept testing and training would be conducted at high altitudes. A modified Boeing 747 and accompanying fighter-type aircraft would perform test and evaluation exercises at altitudes exceeding 35,000 feet (10,670 m) MSL. Potential increases in overall noise levels would result from range safety and surveillance aircraft patrolling the areas. Overflights by surveillance aircraft would continue to be conducted in the same manner as under baseline conditions. The surveillance overflights are typically performed between 4,000 and 8,000 feet (1,220 to 2,400 m) MSL or higher. Overall noise levels in Range Areas 4A, 5C, and M2 would remain unchanged from those described in Section 3.3.

As described above, overall noise levels in non-Territorial Waters would not change from baseline levels.

<u>B - Upper Tier</u>

Overall noise levels would increase under this scenario; however, any modeled increase would be effectively imperceptible. The primary contributor to a noise increase would be the surveillance aircraft conducting range safety survey and evaluation flights. The aircraft launch platform would operate at approximately 20,000 feet (6,100 m) MSL during an exercise and would provide negligible contributions to the noise environment. Both the surveillance and target launch aircraft are propeller driven and are relatively quiet when compared to jet-engine powered aircraft.

As described above, the increase in overall noise levels in non-Territorial Waters would not be perceptible.

<u>C - Lower Tier</u>

Overall noise levels would increase under this scenario; however, any modeled increase would be effectively imperceptible. The primary contributor to a noise increase would be the surveillance aircraft conducting range safety survey and evaluation flights. Proposed lower tier testing and training events incorporate use of subsonic aircraft launch platforms and supersonic targets. Targets are launched from either land-based locations or from the target launch aircraft flying at approximately 20,000 feet (6,100 m) MSL. Target intercepts would occur between 100,000 and 300,000 feet (30,500 and 91,400 m) MSL. Increased noise would occur at land-based launch locations; the noise levels associated with missile launch would be identical to those described under existing conditions. Since the noise from a launch would be infrequent, of short duration, and of the same intensity as existing launch activity, proposed lower tier testing and training would result in less than significant impacts on the airborne noise environment.

As described above, the increase in overall noise levels in non-Territorial Waters would not be perceptible.

D - Nearshore Intercept

As discussed in Section 4.3.3.1, the effects of proposed nearshore intercept events on the airborne noise environment would be less than significant.

E - Collective Impacts of Theater Missile Defense Element

Increased subsonic and supersonic activities in the Sea Range would have a less than significant impact when analyzed either incrementally or collectively. Proposed activities do not vary substantially from existing activities in any range area. Subsonic events modeled in any single range area would not result in perceptible changes to the overall noise environment. An increase of 3 dB represents a doubling of sound energy in a given area. While a change in noise levels for proposed activities can be shown mathematically, the change would be demonstrable only with respect to fractions of decibels, and there would be no perceptible change to baseline conditions.

As described above, overall noise levels in non-Territorial Waters from TMD activities would not substantially change from baseline conditions.

4.3.4.2 Training Element - Fleet Exercise and Special Warfare Training

A - Fleet Exercise Training

The effects of an additional FLEETEX on the airborne noise environment are the same as those discussed in Section 4.3.3.2.

B - Special Warfare Training

Four helicopter sorties would be used to transport exercise participants to and from littoral warfare areas. These types of sorties are brief and conducted at low altitude. No supersonic events would occur. Since helicopter activity is common in the areas used for littoral warfare, introduction of four sorties per year would result in less than significant impacts on the airborne noise environment.

C - Collective Impacts of Training Element

Increased subsonic and supersonic activities in the Sea Range resulting from increased training would have no significant impact when analyzed either incrementally or collectively. Proposed activities would not vary substantially from existing activities in any range area. Noise-generating events modeled in any single range area do not result in perceptible changes to the overall noise environment. Proposed activities would result in increases in noise levels; however, the increases would be only fractions of 1 dB. When number rounding conventions are applied, reported noise levels would be virtually identical to those reported for baseline conditions.

As described above, overall noise levels in non-Territorial Waters from increased training activities would not substantially change from baseline conditions and impacts would be less than significant.

4.3.4.3 Facility Modernization Element - Point Mugu and San Nicolas Island

Some or all surface-to-surface missile launches at NAS Point Mugu currently conducted just south of Building 55 could potentially occur at Pad B or Pad C near the beach (refer to Figure 2-3a). Noise levels from these launches are roughly equivalent to those measured for large aerial target launches (NAWCWPNS Point Mugu 1998c). This area already experiences noise from airfield operations and from missile and target launches currently conducted at the Building 55 Launch Complex. Therefore, impacts on the airborne noise environment would be less than significant.

Some missile launches at San Nicolas Island would be conducted with the proposed vertical launch system (at the Building 807 Launch Complex) and at the proposed 50K launcher site (at the Alpha Launch Complex) – refer to Figure 2-3b. These areas already experience noise from missile and target launches currently conducted at the two launch complexes on the island. Therefore, impacts on the airborne noise environment would be less than significant.

Facility modernization components at San Nicolas Island would result in limited noise increases in areas immediately adjacent to proposed construction activities. Noise generated during construction would be insignificant compared to the noise generated by routine operations at San Nicolas Island. The 65 CNEL noise contours are frequently used to help determine compatibility of noise sources with local land use. Average noise decreases below these levels at distances greater than 400 feet (120 m) from the construction site (see Figure 4.3-1). There are no sensitive human noise receptors within this proximity to the proposed construction locations at San Nicolas Island. Also, instantaneous construction noise levels generally do not exceed 90 dB, the limit for continuous 8-hour exposure under Occupational Safety and Health Administration guidelines. Additionally, noise generated during facility modernization would be temporary, lasting only as long as the construction period. Therefore, impacts on the airborne noise environment would be less than significant.

Associated effects of missile/target launch noise on wildlife at these locations are addressed separately in Section 4.7, Marine Mammals, and Section 4.8, Terrestrial Biology.

4.4 WATER QUALITY

4.4.1 Approach to Analysis

4.4.1.1 Regulatory Setting

Water quality criteria established under the authority of federal and state law were considered to help determine the significance of water quality impacts from current and proposed activities (e.g., weapons testing, ship activities, etc.) on the Point Mugu Sea Range and at Point Mugu and San Nicolas Island. Table 4.4-1 provides a summary of water quality impacts.

A - Federal Regulations

Several federal statutes play important roles in protecting ocean and coastal waters. The Clean Water Act (CWA) (33 U.S.C. § 1251 et seq.) was enacted by Congress to restore and maintain the chemical, physical, and biological integrity of U.S. waters. The CWA prohibits the discharge of oil or hazardous substances in Territorial Waters (i.e., to 12 NM [22 km]) in quantities harmful to public health or welfare or to the environment. The cleanup of oil and hazardous substance spills is addressed under the National Contingency Plan (NCP). The Marine Protection, Research, and Sanctuaries Act (MPRSA, also known as the "Ocean Dumping Act") (33 U.S.C. § 1401 et seq.) regulates the transport of materials for the purpose of dumping in ocean waters.

As required by the CWA, the USEPA has established the National Ambient Water Quality Criteria (NAWQC) (USEPA 1996), which establish numerical maximum concentration levels for contaminants in discharges to surface waters for the protection of both ecological and human health. The criteria, which apply to Territorial Waters, are not rules, and they do not have regulatory effect; however, they can be used to develop regulatory requirements based on concentrations that will have an adverse impact on the qualities necessary for existing beneficial uses of U.S. waters. Table 4.4-2 shows the NAWQC for contaminants commonly present in hazardous constituents expended in the Sea Range.

B - State Regulations

The Porter-Cologne Water Quality Control Act (California Water Code §§ 13000-13999.10) directs local Regional Water Quality Control Boards (RWQCBs) to establish beneficial uses for water bodies in California and controls water quality to ensure that these beneficial uses are not degraded. Under the authority of California law, the State Water Resources Control Board (SWRCB) has promulgated the Water Quality Control Plan for Ocean Waters of California (*Ocean Plan*) (SWRCB and Cal/EPA 1997), which contains numerical criteria for the protection of beneficial uses. Because these criteria do not specifically address the constituents pertinent to the water quality analysis in this EIS/OEIS (as discussed below in Section 4.4.1.2-B), they do not provide an adequate basis on which to determine the significance of impacts on ocean water quality from the proposed action and alternatives. Therefore, this analysis relies on federal criteria (the NAWQC) rather than *Ocean Plan* criteria.

Also under authority of California law, water quality criteria have been promulgated for the coastal watersheds of Los Angeles and Ventura counties in the *Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties* (*Basin Plan*) (California RWQCB 1994). This analysis considers these criteria for determining the significance of impacts on freshwater quality.

Table 4.4-1. Water Quality Impact Summary Matrix*

Alternative	Impact Conclusions: NEPA (On Land→ Territorial Waters)	Impact Conclusions: EO 12114 (Non-Territorial Waters)	Mitigation Measures
NO ACTION ALTERNATIVE	Mugu Lagoon: short-term concentrations for metals (0.06-2.7 µg/L), fuel (0.65-2.2 µg/L), and perchlorate (3.9-13.4 µg/L) below standards. Sea Range: PAHs (4.02-193 µg/L) below standards; battery constituents from FLEETEX activities (0.01-37.6 µg/L) exceed chronic criteria resulting in localized, short-term impacts. Other activities below standards. Less than significant impact.	*PAHs (4.02-141,000 µg/L); aircraft target activities temporarily exceed standards but quickly dissipate to levels at or below standards. Other activities below standards. Battery constituents from FLEETEX activities (0.01-37.6 µg/L) exceed chronic criteria resulting in localized, short-term impacts; other activities below standards. Less than significant impact.*	None.
MINIMUM COMPONENTS ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Mugu Lagoon: short-term concentrations for metals (0.06-2.7 µg/L), fuel (0.65-2.2 µg/L), and perchlorate (3.9-13.4 µg/L) below standards. Sea Range: PAHs (4.02-193 µg/L) below standards. Battery constituents from nearshore intercept and FLEETEX activities (7.1-37.6 µg/L) would exceed chronic criteria resulting in localized, short-term impacts. Less than significant impact.	*PAHs (4.02-141,000 µg/L); aircraft target activities would temporarily exceed standards but would quickly dissipate to levels at or below standards. Other activities below standards. Battery constituents from FLEETEX activities (37.6 µg/L) would exceed chronic criteria resulting in localized, short-term impacts. Less than significant impact.*	None.
PREFERRED ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Mugu Lagoon: short-term concentrations for metals (0.06-2.7 µg/L), fuel (0.65-2.2 µg/L), and perchlorate (3.9-13.4 µg/L) below standards. Sea Range: PAHs (4.02-193 µg/L) below standards. Battery constituents from nearshore intercept and FLEETEX activities (7.1-37.6 µg/L) would exceed chronic criteria resulting in localized, short-term impacts. Less than significant impact.	*PAHs (4.02-141,000 µg/L); aircraft target activities would temporarily exceed standards but would quickly dissipate to levels at or below standards. Other activities below standards. Battery constituents from FLEETEX activities (37.6 µg/L) would exceed chronic criteria resulting in localized, short-term impacts. Less than significant impact.*	None.

* Water quality concentrations of each activity are addressed independently, not collectively. NAWQC criteria are applicable only for short-term concentrations and not for loading or long-term effects. In addition, it is extremely unlikely that any two activities would affect the same volume of water, even if they occurred very close together in time.
PAH – polycyclic aromatic hydrocarbons

Table 4.4-2. NAWQC Standards for Contaminants of Concern in Saltwater Environment

	NAWQC (µg/L)	
Contaminant of Concern	**Acute (1-Hour Average[1])**	**Chronic (4-Day Average)**
Metals		
Nickel (Ni)	75.0	8.30
Lead (Pb)	140.0	5.60
Cadmium (Cd)	43.0	9.30
Copper (Cu)	2.9	2.90
Mercury (Hg)	5.6	0.25
Aluminum (Al)	--	--
PAH Constituents		
Naphthalene	2,350.0	none
Acenaphthene	970.0	710.00

[1] Represents instantaneous maximum.
µg/L – micrograms per liter
PAH – polycyclic aromatic hydrocarbons
Source: USEPA 1986.

4.4.1.2 Methodology - Marine Water Resources

Factors considered in determining whether an alternative would have significant impacts on marine water quality included the extent or degree to which:

- concentrations of chemicals in the water produced by the proposed action or alternatives would exceed NAWQC standards; or
- the proposed action or alternatives would affect existing or future beneficial uses (refer to Section 3.4.3.2).

A - Hazardous Constituents of Concern

Weapons testing involves the use of missile propellants, fuels, engine oil, hydraulic fluid, and batteries, all of which contain hazardous constituents that may affect water quality. Because water quality criteria exist for some of these constituents, it is possible to use a quantitative analysis to determine whether the potential concentrations of such constituents from weapons testing would have environmental effects.

The hazardous constituents of concern for missile propellants, fuels, engine oil, and hydraulic fluids are hydrocarbons (compounds containing only the elements of carbon and hydrogen). They can be present in a wide variety of substances, such as petroleum-based fuels (diesel, JP-5, JP-4, bunker fuel, and gasoline), oils, sludge, and lubricants (Johnston et al. 1989; Grovhoug 1992; Sheldecker 1992). The most toxic components of fuel oils are polycyclic aromatic hydrocarbons (PAHs), including benzene, toluene, xylene, and naphthalene. Some PAHs are hazardous to wildlife, but they are more commonly associated with hazards to human health (Hoffman et al. 1995). These chemicals are relatively volatile and highly water-soluble (Curl and O'Donnell 1977). In general, however, the greater the toxicity of an individual PAH, the less its water solubility.

B - Ocean Water Quality Criteria

In determining the significance of the impacts of PAHs on water quality, this analysis considers the federal criteria in the NAWQC, rather than the criteria in the California *Ocean Plan*. The NAWQC include maximum concentration levels for the protection of aquatic life from contaminants in water. Saltwater criteria exist for three individual PAH constituents: naphthalene, acenaphthene, and fluoranthene. Fluoranthene, however, is generally not present or is found in such low amounts (<0.1 percent) in refined petroleum that it was not considered in this analysis (National Research Council 1985).

Unlike the NAWQC, the California *Ocean Plan* does not establish criteria for individual PAHs because, in many cases, it is not possible to identify the individual constituents of petroleum-based products. Although individual PAHs vary in their composition and fate, the *Ocean Plan* criteria are based only on PAHs as a class. This, and the fact that the criteria were established for the protection of human health, which is not an issue where missile testing occurs on the Sea Range, made the *Plan*'s criteria for PAHs inappropriate as a measure of water quality impacts in this analysis.

C - General Assumptions

Current and proposed operations encompass a wide variety of scenarios occurring in many areas throughout the Sea Range. Consequently, a set of simplifying assumptions is necessary in order to estimate potential impacts on water quality. For purposes of this EIS/OEIS, the analysis of potential impacts on water quality are based on several assumptions that tend to overestimate potential PAH concentrations. First, the analysis assumes that all missile/target intercepts, with the exception of aircraft targets, would occur at 1,000 feet (300 m), although many could occur at much higher altitudes, as discussed in the description of the proposed action. Second, the analysis assumes there are no currents that would create a mixing zone. Third, the analysis assumes that the debris is dispersed evenly in a cone pattern 90º downward from the point of impact and that the water column from the surface down to 3 feet (1 m) is affected. Using these assumptions, the affected surface area is 3.1×10^6 square feet (2.8×10^5 m^2) and the affected volume is 7.3×10^7 gallons (2.8×10^8 L).

D - Aircraft Target Assumptions

Aircraft target tests were analyzed under a different set of simplifying assumptions because of the large amount of hazardous constituents that may enter the water with each event (approximately 2,200 pounds [1,000 kg]). Tests involving aircraft targets are generally "near-miss" tests in which the targets return intact to Point Mugu. In some instances, however, impacts do occur, and this can result in one of three scenarios: 1) the target is damaged but can be returned safely; 2) the target is damaged and cannot be returned safely; or 3) the target explodes. The first and third scenarios would not result in any water quality impacts because the target would either be returned (scenario 1) or all of its hazardous constituents would be vaporized/volatilized in an explosion (scenario 3). Only the second scenario would result in any hazardous constituents entering the water. Upon surface impact, the target would disintegrate and all of its remaining hazardous constituents would enter the water. They would be dispersed to an area as large as 1,722,000 square feet (160,000 m^2), depending on the angle of impact; a shallow angle would distribute debris over a larger area while a steeper angle would concentrate the debris.

This analysis assumes that all debris from aircraft target intercepts fall perpendicular to the water (i.e., concentrating constituents in a small area), thus minimizing the affected surface area and volume relative to the size of the impact. Surface impacts would occur at a speed of at least 500 knots (600 miles per hour or 970 km/hr) and could realistically affect an area up to five times the size of the aircraft (taking into consideration water displacement). A typical aircraft target is approximately 60 feet (18 m) long, 15 feet (5 m) high, and has a wingspan of approximately 40 feet (12 m). Therefore, with a wingspan of 40 feet (12 m), the analysis assumes the affected area would be encompassed by a circle with a diameter of

200 feet (60 m). Given the low density of the hazardous constituents (e.g., fuel, oil) relative to seawater, the analysis also assumes that only the top 3 feet (1 m) of the water column would be affected. Using these assumptions, the affected surface area would be 3.0 x 10^4 square feet (2.8 x $10^3 m^2$) and the affected volume would be 7.4 x 10^5 gallons (2.8 x 10^6 L). A summary of water quality calculations for PAH constituents is presented in Table 4.4-3.

Table 4.4-3. Water Quality Impact Calculations for PAHs

Activity	#/Year	PAHs[1] Total	PAHs[1] Per Event	PAH Concentration per Event (µg/L)
No Action Alternative				
Air-to-Air (without QF-4)	119	554.38	4.66	6.59
Air-to-Air (QF-4 only)	3	2,989.04	996.00	141,000.00
Air-to-Surface	20	99.92	5.00	7.07
Surface-to-Air	65	1,000.74	15.40	21.79
Surface-to-Surface	12	104.17	8.68	12.30
Subsurface-to-Surface	1	2.84	2.84	4.02
Ancillary Operations*	NA	51.12	NA	NA
FLEETEXs (2)	2	1,092.11	136.00[2]	193.00
Special Warfare Training	2	34.13	17.10	24.20
TOTAL - No Action Alternative (Baseline)		5,928.45		
Minimum Components Alternative (Includes No Action Alternative)				
Nearshore Intercept	8	717.28	89.7	127.0
FLEETEX (1)	1	464.32	116.0[2]	164.0
TOTAL – Min. Com. Alternative Only		1,181.60		
TOTAL - Min. Com. Alternative + Baseline		7,110.05		
Preferred Alternative (Includes No Action Alternative)				
Theater Missile Defense Element				
Boost Phase Intercept	3	70.81	23.6	33.4
Upper Tier	3	92.62	30.9	43.7
Lower Tier	3	67.29	22.4	31.7
Nearshore Intercept	8	717.28	89.7	127.0
Subtotal		948.00		
Training Element				
FLEETEX (1)	1	464.32	116.0[2]	164.0
Special Warfare Training	2	34.13	17.1	24.2
Subtotal		498.45		
TOTAL - Preferred Alternative Only		1,446.45		
TOTAL - Preferred Alternative + Baseline		7,374.90		

N/A = Not Applicable

[1] Based on Tables 4.13-2 and 4.13-4.

[2] FLEETEXs typically are concentrated in four Range Areas, so the "Per Event" number was divided by four to reflect this geographic distribution.

*Note: Ancillary operations encompass a wide variety of activities that occur throughout the year.

NAWQC (USEPA 1986)

PAH Constituents	Saltwater acute (µg/L)	Saltwater chronic (µg/L)
Naphthalene	2,350	none
Acenaphthene	970	710

E - Battery Assumptions

Batteries are another source of contaminants in the Sea Range (refer to Section 3.13). Batteries used in the range vary from extremely small (less than 0.04 ounce [1 g]) to very large (over 90 pounds [41 kg]). Constituents of concern in batteries can include potassium hydroxide electrolyte, lithium, lithium chloride, nickel cadmium, lead, and sulfuric acid. Of these, the NAWQC include maximum contaminant levels only for lead, nickel, and cadmium. This analysis incorporates similar assumptions in the determination of constituent concentrations for batteries as were used for PAHs, with the exception that the water to 3.3 feet (1 m) above the seafloor would be affected (as opposed to the upper 3.3 feet [1 m] of the water column). Therefore, the affected volume is the same, roughly 7.3 x 10^7 gallons (2.8 x 10^8 L). Unlike PAHs, however, battery constituents are denser and would sink to the bottom.

The analysis is based on three assumptions that tend to overestimate potential concentrations of constituents of concern: 1) that the constituents of concern constitute 33 percent of the total battery mass; 2) that the constituents are water soluble; and 3) that the constituents are 100 percent bio-available (i.e., readily available to react with the environment). A summary of water quality calculations for battery constituents is presented in Table 4.4-4. The effects of battery constituents on marine sediment quality are discussed in Section 4.5, Marine Biology.

F - Short-Term Effects

Once concentrations are determined for each activity, comparisons with the NAWQC are possible. The NAWQC provide both acute and chronic concentrations. Acute values are levels producing short-term effects (i.e., lethality) while chronic values produce long-term and/or sub-lethal effects. Concentrations below these levels are not anticipated to cause any adverse effects.

G - Long-Term Effects

The collective concentrations of various exercises throughout a year cannot be compared with the NAWQC because of assumptions underlying the criteria. The criteria apply to instantaneous or short-term concentrations, not to loading or long-term effects. Combining concentrations of several events over an undetermined temporal range and comparing them with NAWQC values does not provide a valid means to determine potential effects. Even if two events were to occur simultaneously on the Sea Range, it would be extremely unlikely that the two events would affect the same volume of water. Hence, the EIS/OEIS calculations for water quality analysis reflect each current and proposed activity independently.

4.4.1.3 Methodology - Other Water Resources

A - Impact Methodology

Factors considered in determining whether an alternative would have significant impacts on hydrology and freshwater quality at Mugu Lagoon included the extent or degree to which:

- the proposed action or alternatives would endanger public health and safety by creating or compounding a health hazard or safety condition, such as by contaminating drinking water sources;
- the proposed action or alternatives would threaten or damage unique hydrologic conditions in an area;

Table 4.4-4. Water Quality Impact Calculations for Battery Constituents

Activity	#/Year	Batteries (kg) [1] Total	Batteries (kg) [1] Per Event	Constituent Concentration per Event (µg/L)
No Action Alternative				
Air-to-Air	122	292.82	2.40	2.80
Air-to-Surface	20	1.41	0.07	0.08
Surface-to-Air	65	272.58	4.19	4.89
Surface-to-Surface	12	0.06	0.01	0.01
Subsurface-to-Surface	1	0.00	0.00	0.00
FLEETEX (2)	2	257.11	32.23[2]	37.60
TOTAL - No Action Alternative (Baseline)		823.98		
Minimum Components Alternative (Includes No Action Alternative)				
Nearshore Intercept	8	48.79	6.1	7.1
FLEETEX (1)	1	122.14	30.5[2]	35.7
TOTAL – Min. Com. Alternative Only		170.93		
TOTAL - Min. Com. Alternative + Baseline		994.91		
Preferred Alternative (Includes No Action Alternative)				
Theater Missile Defense Element				
Boost Phase Intercept	3	18.29	6.1	2.7
Upper Tier	3	27.44	9.2	4.0
Lower Tier	3	18.29	6.1	2.7
Nearshore Intercept	8	48.79	6.1	7.1
Training Element				
FLEETEX (1)	1	122.14	30.5[2]	35.7
TOTAL - Preferred Alternative Only		234.95		
TOTAL - Preferred Alternative + Baseline		1,058.93		

NAWQC (USEPA 1986) Constituents	Saltwater acute (µg/L)	Saltwater chronic (µg/L)
nickel	75	8.3
lead	140	5.6
cadmium	43	9.3

[1] Based on Tables 4.13-2 and 4.13-4.
[2] FLEETEXs typically are concentrated in four Range Areas, so the "Per Event" number was divided by four to reflect this geographic distribution.

- the proposed action or alternatives would violate laws or regulations adopted to protect or manage the water resource system; or
- the concentrations of chemicals in the water produced by the proposed action or alternatives exceed criteria in the *Basin Plan*.

Current and proposed activities that could have effects on non-marine water resources are limited to: 1) JATO bottles falling in Mugu Lagoon; and 2) deposition of target/missile launch combustion products onto soils at Point Mugu or San Nicolas Island. Deposition onto soils could have indirect impacts on freshwater resources.

For JATO bottles falling into the lagoon, the principal source of potential effects would be the unburned solid propellant residue in the bottles. These propellants typically contain ammonium perchlorate (NH_4ClO_4), aluminum compounds, and small amounts of copper and organic lead compounds. The analysis relies on ocean water quality criteria (NAWQC) for determining the significance of any impacts from aluminum and lead in Mugu Lagoon because the lagoon has an average salinity of 34 parts per thousand (ppt), similar to the open ocean (refer to Section 3.4.3.1). The NAWQC chronic concentration

(4-day average) in the marine environment is 5.6 µg/L for lead and 2.9 µg/L for copper. Aluminum is a relatively inert metal and is not a contaminant of concern (COC). Consequently, USEPA, Cal/EPA, and SWRCB have not promulgated a toxicity standard for aluminum.

Perchlorate is an inorganic chemical used in the manufacture of solid rocket propellants and explosives. It is not a COC, however, because it is extremely volatile and quickly breaks down into relatively inert by-products (Sax and Lewis 1987). Because perchlorate historically has not been considered a common contaminant, no federal or state drinking water standards exist (California Department of Health Services [DHS] 1997). The DHS has adopted a provisional action level for perchlorate in drinking water of 18 µg/L. Although not directly applicable because Mugu Lagoon is not a source of drinking water, this analysis uses the provisional 18 µg/L standard for NH_4ClO_4 in the absence of water quality criteria.

B - Mugu Lagoon Water Quality Calculations

JATO bottles from drone targets launched from the Building 55 Launch Complex fall into the marsh of Mugu Lagoon about 700 to 1,400 feet (210 to 420 m) south of the launch site (refer to Figure 2-3a). The Environmental Project Office estimates the area of potential effect to be a rectangle approximately 690 feet (210 m) from north to south and 1,080 feet (330 m) from east to west (NAWS Point Mugu 1998g). Water levels in this area of the lagoon are shallow and fluctuate with tidal cycles. For purposes of calculating effects, this analysis assumes a no-flow situation (e.g., all contaminants would affect the same volume of water) that overestimates potential contaminant concentrations. In addition, some of this area is not covered by water. Therefore, this analysis assumes an average depth of 1.6 feet (0.5 m), and an average water coverage (based on GIS data) of 75 percent. It also assumes that 99 percent of the solid propellant in JATO bottles is expended before the bottle drops into the lagoon (NAWCWPNS Surface Launch Division 1994; NAWS Point Mugu 1998h). Because release rates for unburned propellant residuals are not available, calculations in the analysis are based on all of the residual propellant going into solution at one time. The calculated concentrations are then compared against the relevant regulatory standard.

C - San Nicolas Island Water Quality Calculations

Launch activities during dry conditions could result in the deposition of very small amounts of aluminum oxide (Al_2O_3), hydrochloric acid (HCl), and lead (Pb) from missile exhaust products. Tables 4.1-2 and 4.1-3 provide the results of calculations on the amounts of these combustion products that could potentially be deposited onto the soil around the launch site. This water quality impact analysis addresses the potential effects of these depositions on water resources at the west end of San Nicolas Island.

4.4.2 No Action Alternative - Current Operations

4.4.2.1 Air-to-Air Operations

A - Marine Water Quality

Air-to-air intercepts occur primarily in non-Territorial Waters, typically in Range Areas 5A and 5B. As discussed earlier in the methodology description (see Section 4.4.1.2-D), aircraft target tests were analyzed separately due to the large amount of hazardous constituents that may enter the water. Air-to-air operations (excluding aircraft target testing) produce approximately 1,219.64 pounds (554.38 kg) of hazardous constituents throughout the year (refer to Table 4.13-2). Under the assumptions discussed in Section 4.4.1.2, analyses indicate the concentration of PAHs is 6.59 µg/L for each event. This value is *below criteria established in the NAWQC for naphthalene (acute = 2,350 µg/L) and acenaphthene (acute = 970 µg/L; chronic = 710 µg/L). This PAH concentration represents a less than significant impact on marine water quality for each air-to-air event.*

Baseline air-to-air operations involving aircraft targets produced approximately 6,589.64 pounds (2,989.04 kg) of hazardous constituents (refer to Table 4.13-2). Under the assumptions discussed in Section 4.4.1.2, analyses indicate the concentration of PAHs is 141,000 µg/L for each event. This value exceeds criteria established in the NAWQC for naphthalene (acute = 2,350 µg/L) and acenaphthene (acute = 970 µg/L; chronic = 710 µg/L). This would result in temporary, localized impacts in the affected area. PAH constituent levels would be below the NAWQC if, using the assumptions in this analysis, the affected volume were 1.4 x 10^8 gallons (5.5 x 10^8 L), roughly the equivalent of a cylinder with a radius of 1,393 feet (422 m) and a water depth of 3.3 feet (1 m). Fuel can spread at rates of about 300 feet (100 m) per hour on a calm day on the ocean. On a turbulent day (which is much more common for open ocean areas of the Sea Range), this dispersion rate increases notably. Therefore, it is possible that the volume of water initially affected – radius of 98 feet (30 m) – could spread to a volume approaching the one mentioned above – radius of 1,380 feet (422 m) – within a few hours after the aircraft target enters the water. Consequently, although NAWQC acute standards would be exceeded initially, this effect would not last more than a few hours. In addition, the standard evaporation rate for fuel at normal ocean temperatures is about 95 percent per day. Therefore, although the loss of an aircraft target into the water would initially exceed NAWQC standards, such a loss has less than significant impacts on water quality. Long-term impacts would be less than significant since ocean currents would continue to dilute hazardous constituent concentrations and since it is extremely unlikely that the same volume of water would be affected by more than one test. Even if two events were to occur simultaneously on the Sea Range, it would be extremely unlikely that the two events would affect the same volume of water.

Air-to-air operations would result in approximately 646 pounds (293 kg) of batteries expended in the Sea Range throughout the year (refer to Table 4.13-5). Under the assumptions discussed in Section 4.4.1.2, the resulting concentration of battery constituents would be 2.80 µg/L for each event. This value is below criteria established in the NAWQC for nickel (acute = 75 µg/L; chronic = 8.3 µg/L), lead (acute = 140 µg/L; chronic = 5.6 µg/L), and cadmium (acute = 43 µg/L; chronic = 9.3 µg/L). Thus, the concentration of battery constituents for each air-to-air event has a less than significant impact on marine water quality.

Some missile system components contain small amounts of mercury. Only 9.9 ounces (280 g) of lead and 6.2 ounces (176 g) of mercury were expended in the entire Sea Range during baseline operations over a 1-year period. There are no data for the geographic and time distribution of these constituents. However, based on the size of typical debris patterns and the fact that operations occur throughout the year, these amounts of lead and mercury are minimal and would not adversely affect marine water quality. This amount of lead would reach the NAWQC threshold only if it were expended all at one time and into a very small volume of water, represented by a cube less than 120 feet (37 m) on a side (to approach the chronic criteria [4-day average of 5.6 µg/L]). Similarly, mercury would approach the 0.25 µg/L standard only if it were expended all at one time in a volume of water represented by a cube less than 630 feet (192 m) on a side. These scenarios are very unlikely to occur as these constituents are expended in the Sea Range over time and large areas. For example, Range Area 4B is the area receiving the largest quantities of hazardous constituents per unit area – 2.92 pounds per NM^2 (0.383 kg/km^2). Even assuming this range area were to receive all of the lead and mercury expended in the Sea Range, such chemicals would be released over an area of about 667 NM^2 (2,289 km^2). Therefore, releases of lead and mercury associated with air-to-air operations do not have a significant impact on marine water quality.

B - Other Water Resources

Point Mugu

Water quality calculations for JATO bottles that fall in the Mugu Lagoon are presented in Table 4.4-5. As shown in the table, estimated short-term and long-term concentrations of NH_4ClO_4, lead, and copper are well below NAWQC criteria for these constituents, as is the concentration for perchlorate compared against the DHS. Target launch activities at Point Mugu also have the potential to result in solid propellant combustion products being deposited on soils surrounding the launch site, and subsequently affecting surface water sources. The amounts for a large drone target launch were calculated to be about 0.0002 ounces per square foot (0.058 g/m^2) of Al_2O_3, 0.00002 ounces per square foot (0.005 g/m^2) of HCl, 0.000003 ounces per square foot (0.001 g/m^2) of Pb, and 0.000001 ounces per square foot (0.0003 g/m^2) of Cu. Aluminum, Pb, and Cu occur at various background levels in soils at Point Mugu. Deposition amounts over an entire year would be well below average background levels at the launch location (refer to Section 4.1, Geology and Soils). Similarly, HCl deposition amounts would be offset by the buffering capacity of the soils. Therefore, water quality impacts associated with launch activities at Point Mugu are less than significant.

Table 4.4-5. Concentration of Residual JATO Bottle Propellants in Mugu Lagoon (µg/L)

Typical Solid Propellant Constituents	Water Quality Criteria [1]	Concentration Short-Term [2]		Concentration Long-Term [3]
		Small Drone Targets	Large Drone Targets	All Targets (1 year)
Ammonium perchlorate (NH_4ClO_4)	18.0[4]	3.90	13.40	0.30
Lead (Pb)	5.4	0.06	0.20	0.01
Copper (Cu)	2.9	0.14	0.05	<0.01
Aluminum compounds	--	0.81	2.70	0.06
PCTB/PB (JATO propellant)	16.0[5]	0.65	2.20	0.05

PCTB– carboxy terminated polybutadiene
PB – polybutene
1 Based on chronic (4-day average) criteria (USEPA 1986).
2 Short-term calculation assumptions: all constituents go completely into solution; short-term water volume affected is about 6,800 gallons (26,000 liters), or 0.1% of water in the area of concern. This represents an equivalent volume of water 1.6 feet (0.5 m) deep and 25 x 25 feet (7.5 x 7.5 m) on the surface.
3 Long-term calculation assumptions: all constituents go completely into solution; long-term water volume affected is about 6.8 million gallons (26 million liters), or 100% of water in the area of concern; 75% of JATO bottles fall into water (remainder fall on dry area).
4 No federal or state standards for perchlorate. California DHS has adopted a provisional action level for perchlorate in drinking water of 18 µg/L.
5 No water quality criteria specifically for PCTB/PB. Most relevant criteria are for PAH constituents, of which the standard for fluoranthene is the most stringent (16 µg/L).
Source: Ogden 1998; USEPA 1986.

San Nicolas Island

Target launch activities have the potential to deposit hazardous constituents at the launch sites at San Nicolas Island. Although there are no surface water sources in the immediate vicinity, major freshwater resources of the island are primarily located on the island's west end within 2 miles (3 km) of these launch locations. Perchlorate is typically associated with solid propellants used in missiles and targets. Perchlorate levels are 4.52 µg/L at Windmill Springs and 13.0 µg/L at Zitnic Springs; these levels do not exceed safe drinking water criteria (see Table 4.4-5). Water sampling for other constituents at these locations has not indicated abnormally high levels of contaminants (e.g., lead) in the water supply (NAWS Point Mugu 1998h). Target launch activities at San Nicolas Island also have the potential to result in solid propellant combustion products being deposited on soils surrounding the launch sites. The amounts for a large missile target launch were calculated to be about 0.0004 ounces per square foot (0.12 g/m^2) of Al_2O_3, 0.00003 ounces per square foot (0.009 g/m^2) of HCl, 0.000007 ounces per square foot (0.002 g/m^2) of Pb, and 0.000002 ounces per square foot (0.0006 g/m^2) of Cu. Aluminum, Pb, and Cu occur at various background levels in soils at San Nicolas Island. Deposition amounts over an entire year would be well below average background levels at the launch locations (refer to Section 4.1, Geology and Soils). Similarly, HCl deposition amounts would be offset by the buffering capacity of the soils. Therefore, water quality impacts associated with target launch activities at San Nicolas Island are less than significant.

4.4.2.2 Air-to-Surface Operations

A - Marine Water Quality

Air-to-surface operations include the inert mine drop. During this operation, inert mine shapes (either pieces of concrete in various shapes or steel casings filled with concrete) are released from aircraft to test the accuracy of a weapon system. The mine shapes are dropped in nearshore waters of Becher's Bay off Santa Rosa Island (refer to Figure 3.0-14). Because there are no hazardous constituents present in the mine shapes, impacts on ocean water quality do not occur.

Surface targets used during air-to-surface operations are located primarily in non-Territorial Waters. Air-to-surface operations produce approximately 220 pounds (100 kg) of hazardous constituents throughout the year (refer to Table 4.13-2). Under the assumptions discussed in Section 4.4.1.2, analyses indicate the concentration of PAHs is 7.07 µg/L for each event. This value is below criteria established in the NAWQC for naphthalene (acute = 2,350 µg/L) and acenaphthene (acute = 970 µg/L; chronic = 710 µg/L), and indicates that there are less than significant impacts on marine water quality for each event.

Air-to-surface operations result in approximately 3.1 pounds (1.4 kg) of batteries expended in the Sea Range throughout the year (refer to Table 4.13-5). Under the assumptions discussed in Section 4.4.1.2, analyses indicate the concentration of battery constituents is 0.08 µg/L for each event. This value is below criteria established in the NAWQC for nickel (acute = 75 µg/L; chronic = 8.3 µg/L), lead (acute = 140 µg/L; chronic = 5.6 µg/L), and cadmium (acute = 43 µg/L; chronic = 9.3 µg/L). This battery constituents concentration represents a less than significant impact on marine water quality for each air-to-surface event.

B - Other Water Resources

The SLAM surface target is located on the northwest portion of San Nicolas Island and consists of several stacks of empty shipping containers. The nearest surface water resources are Zitnic Springs (1 mile [2 km] northeast) and Windmill Springs (1 mile [2 km] east). A groundwater recharge area is located approximately 0.5 miles (1 km) northeast of the SLAM area (refer to Figure 3.4-5). Because of the low elevation of the SLAM area, it is unlikely that hazardous constituents enter the groundwater system and flow to the recharge area (NAWCWPNS Point Mugu 1997c). Therefore, impacts on surface and groundwater from air-to-surface operations do not occur.

4.4.2.3 Surface-to-Air Operations

A - Marine Water Quality

Surface-to-air operations produce approximately 2,202 pounds (1,001 kg) of hazardous constituents throughout the year (refer to Table 4.13-2). Under the assumptions discussed in Section 4.4.1.2, analyses indicate the concentration of PAHs is 21.8 µg/L for each event. This value is below criteria established in the NAWQC for naphthalene (acute = 2,350 µg/L) and acenaphthene (acute = 970 µg/L; chronic = 710 µg/L). This PAH concentration represents a less than significant impact on marine water quality for each surface-to-air event.

Surface-to-air operations result in approximately 602 pounds (273 kg) of batteries expended in the Sea Range throughout the year (refer to Table 4.13-5), including areas both within and outside the Territorial Waters limit. Under the assumptions discussed in Section 4.4.1.2, analyses indicate the concentration of battery constituents is 4.89 µg/L for each event. This value is below criteria established in the NAWQC for nickel (acute = 75 µg/L; chronic = 8.3 µg/L), lead (acute = 140 µg/L; chronic = 5.6 µg/L), and cadmium (acute = 43 µg/L; chronic = 9.3 µg/L). This battery constituents concentration represents a less than significant impact on marine water quality for each surface-to-air event.

As noted above, surface-to-air intercepts also occur in non-Territorial Waters. Potential impacts to marine water quality are the same as described above and are less than significant.

B - Other Water Resources

Effects of JATO bottles on water quality in the Mugu Lagoon are similar to those discussed previously (see Section 4.4.2.1-B). Impacts are less than significant.

4.4.2.4 Surface-to-Surface Operations

A - Marine Water Quality

Surface-to-surface intercepts occur primarily in non-Territorial Waters. Surface-to-surface operations produce approximately 229 pounds (104 kg) of hazardous constituents throughout the year (refer to Table 4.13-2). Under the assumptions discussed in Section 4.4.1.2, analyses indicate the concentration of PAHs is 12.3 µg/L for each event. This value is below criteria established in the NAWQC for naphthalene (acute = 2,350 µg/L) and acenaphthene (acute = 970 µg/L; chronic = 710 µg/L). This PAH concentration represents a less than significant impact on marine water quality for each surface-to-surface event.

Surface-to-surface operations result in approximately 0.13 pounds (0.06 kg) of batteries expended in the Sea Range throughout the year (refer to Table 4.13-5). Under the assumptions discussed in Section 4.4.1.2, analyses indicate the concentration of battery constituents is 0.01 µg/L for each event. This value is below criteria established in the NAWQC for nickel (acute = 75 µg/L; chronic = 8.3 µg/L), lead (acute = 140 µg/L; chronic = 5.6 µg/L), and cadmium (acute = 43 µg/L; chronic = 9.3 µg/L). This battery constituents concentration represents a less than significant impact on marine water quality for each surface-to-surface event.

B - Other Water Resources

There are no significant impacts on water quality at Mugu Lagoon.

4.4.2.5 Subsurface-to-Surface Operations

A - Marine Water Quality

Subsurface-to-surface intercepts occur primarily in non-Territorial Waters. Subsurface-to-surface operations produce approximately 6.3 pounds (2.8 kg) of hazardous constituents for one event per year (refer to Table 4.13-2). Under the assumptions discussed in Section 4.4.1.2, analyses indicate the concentration of PAHs is 4.02 µg/L for the event. This value is below criteria established in the NAWQC for naphthalene (acute = 2,350 µg/L) and acenaphthene (acute = 970 µg/L; chronic = 710 µg/L). This PAH concentration represents a less than significant impact on marine water quality for each subsurface-to-surface event.

B - Other Water Resources

Impacts on water quality at Mugu Lagoon do not occur.

4.4.2.6 Ancillary Operations Systems

Chaff and flare dispensing are conducted on the Sea Range during various weapons testing events. Chaff use in Territorial Waters is limited. The major components of flares and chaff are magnesium and aluminum, respectively. These elements are not listed in the NAWQC and have a less than significant impact on water quality (a discussion of potential impacts on marine biological resources is presented in Section 4.5, Marine Biology; Section 4.6, Fish and Sea Turtles; and Section 4.7, Marine Mammals).

Most chaff and flare use occurs in non-Territorial Waters of the Sea Range. For the reasons discussed above for Territorial Waters, potential water quality impacts from chaff and flare use in non-Territorial Waters are less than significant.

4.4.2.7 Current Fleet Exercise Training

A - Marine Water Quality

Missile and target intercepts associated with FLEETEX activities are located primarily in non-Territorial Waters. Current FLEETEX training operations produce approximately 2,047 pounds (1,092 kg) of hazardous constituents (refer to Table 4.13-2) for two events per year. Under the assumptions discussed in Section 4.4.1.2, analyses indicate the concentration of PAHs is 193 µg/L for each FLEETEX. This value is below criteria established in the NAWQC for naphthalene (acute = 2,350 µg/L) and acenaphthene (acute = 970 µg/L; chronic = 710 µg/L). Therefore, the resulting PAH concentration represents a less than significant impact on marine water quality for each FLEETEX.

Current FLEETEX training operations result in approximately 567 pounds (257 kg) of batteries expended in the Sea Range throughout the year (refer to Table 4.13-5). Under the assumptions discussed in Section 4.4.1.2, analyses indicate the concentration of battery constituents is 37.60 µg/L for each event. This value is below acute criteria established in the NAWQC for nickel (75 µg/L), lead (140 µg/L), and cadmium (43 µg/L). However, this value exceeds chronic criteria for these constituents (nickel = 8.3 µg/L, lead =5.6 µg/L, and cadmium = 9.3 µg/L). This can result in localized, short-term impacts of the affected area. Battery constituent levels would fall below the NAWQC if the affected surface area and volume were approximately 2.0 x 10^7 square feet (1.9 x 10^6 m^2) and 5.0 x 10^8 gallons (1.9 x 10^9 L), respectively. This would represent an area encompassed by a circle with a radius of *approximately 2,550 feet (777 m) with a water depth of 3.3 feet (1 m). The area used for this analysis is the equivalent of a circle with a 980-foot (300-m) radius, or roughly less than half the size of the area described above. It is likely that not all of the battery constituents would be released at once, and that less than half of the constituents would be bio-available. Therefore, using an analysis that tends to overestimate the potential concentrations of constituents entering the ocean, the calculated concentration of battery constituents from each FLEETEX event has a less than significant long-term impact on marine water quality.*

B - Other Water Resources

Impacts on water quality at Mugu Lagoon are less than significant.

C - Disposal of Shipboard Solid Waste

The Battle Group participants in a FLEETEX typically consist of six ships (refer to Table 3.0-6). Although a FLEETEX typically lasts only 2 days, ship participants may be present on the Sea Range for a week or more. Shipboard solid waste generation rates are dependent primarily on crew size, not specific ship class or mission. A general generation rate for Navy surface ships has been estimated at 3.06 pounds (1.36 kg) of solid waste per person per day (Naval Sea Systems Command [NAVSEA] 1996, as cited in Northern Division 1996). This general rate is broken down into separate rates for the following categories of solid waste: plastics, paper, cardboard, glass/metal, and food. One-week solid waste generation amounts for the types of ships typically associated with FLEETEXs are shown in Table 4.4-6.

Table 4.4-6. Shipboard Solid Waste Generation Estimates (in pounds) for a Single FLEETEX

	Generation Rate (lb/prsn/day)	Aircraft Carrier	Amphibian	Auxiliary	Combatant	Total
# ships		1	1	1	3	6
# persons/ship		6,286	852	630	409	NA
# days		7	7	7	7	NA
Solid Waste Type						
Plastics	0.20	8,800	1,193	882	1,718	12,593
Paper Cardboard	1.11	48,842	6,620	4,895	9,534	69,891
Glass Metal	0.54	23,761	3,221	2,381	4,638	34,001
Food	1.21	53,242	7,216	5,336	10,393	76,188
Total	**3.06**	**134,646**	**18,250**	**13,495**	**26,282**	**192,673**

Source: NAVSEA 1996, as cited in Northern Division 1996.

For current solid waste discharges, the Navy has instituted solid waste management guidelines and procedures for surface ships as published in OPNAVINST 5090.1B. The guidelines stipulate minimum distances from shore for discharges of solid waste and specify the forms in which various types of waste may be discharged. The types of shipboard wastes and circumstances (e.g., distance offshore) for allowable discharge by Navy vessels is addressed in Section 3.4, Water Quality (refer to Table 3.4-1). If guidelines shown in Table 3.4-1 are followed, impacts on marine water quality are less than significant.

As described above, assuming shipboard solid waste discharge guidelines are followed, impacts on marine water quality in non-Territorial Waters of the Sea Range are less than significant.

4.4.2.8 Littoral Warfare Training

A - Marine Water Quality

Current littoral warfare training operations produce approximately 75 pounds (34 kg) of hazardous constituents (refer to Table 4.13-2), the majority of which are diesel fuel and engine oil. Under the assumptions discussed in Section 4.4.1.2, analyses indicate the concentration of PAHs is 24.2 µg/L for each event. This value is below criteria established in the NAWQC for naphthalene (acute = 2,350 µg/L) and acenaphthene (acute = 970 µg/L; chronic = 710 µg/L). This PAH concentration represents a less than significant impact on marine water quality for each littoral warfare training event.

B - Other Water Resources

Impacts on water quality at Mugu Lagoon do not occur.

4.4.3 Minimum Components Alternative

This alternative includes impacts identified for the No Action Alternative since the testing, training, and facility modernization activities included in this alternative are proposed in addition to current operations.

4.4.3.1 Theater Missile Defense Element - Nearshore Intercept

A - Marine Water Quality

Nearshore intercept events would produce approximately 1,581 pounds (717 kg) of hazardous constituents for eight events during the year (refer to Table 4.13-3). Under the assumptions discussed in Section 4.4.1.2, analyses indicate the concentration of PAHs in a limited area is 127 µg/L for each event. This value is below criteria established in the NAWQC for naphthalene (acute = 2,350 µg/L) and acenaphthene (acute = 970 µg/L; chronic = 710 µg/L). This PAH concentration represents a less than significant impact on marine water quality for each nearshore intercept testing and training event.

Nearshore intercept events would result in approximately 108 pounds (49 kg) of batteries expended in the Sea Range throughout the year (refer to Table 4.13-5). In a scenario that includes the assumption that all battery constituents are released at one time, the resulting concentration of battery constituents would be 7.13 µg/L for each event. This value is below acute criteria established in the NAWQC for nickel (75 µg/L), lead (140 µg/L), and cadmium (43 µg/L). However, this value exceeds chronic criteria for lead (5.6 µg/L). This would result in localized, short-term impacts in the affected area. However, given the temporary nature of these impacts and the large volume of water in the Sea Range, the battery constituent concentration from nearshore intercept events would have a less than significant impact on marine water quality.

B - Other Water Resources

Since there are no surface or groundwater resources in the impact area, impacts on surface or groundwater quality would not occur.

4.4.3.2 Training Element – Additional FLEETEX

A - Marine Water Quality

Missile and target intercepts associated with FLEETEX activities are located primarily in non-Territorial Waters. Current FLEETEX training operations produce approximately 2,407 pounds (1,092 kg) of hazardous constituents (refer to Table 4.13-2), and the proposed action would add one additional FLEETEX with 1,023 pounds (464 kg) (refer to Table 4.13-3) for a total of approximately 3,430 pounds (1,556 kg) of hazardous constituents. The amount of hazardous constituents associated with one additional FLEETEX does not result in a 50 percent increase over the two conducted in the baseline year because the small numbers of live and inert warheads necessitated a slightly different distribution. There was also some variation in the number of surface targets. Rather than being just a 50 percent increase, the additional FLEETEX figures were specifically calculated based on the hazardous constituents anticipated to be expended (refer to Section 4.13.3.2). Under the assumptions discussed in Section 4.4.1.2, analyses indicate the concentration of PAHs is 164 µg/L for the additional FLEETEX. This value is below criteria established in the NAWQC for naphthalene (acute = 2,350 µg/L) and acenaphthene (acute = 970 µg/L; chronic = 710 µg/L), and indicates less than significant impacts on marine water quality for these constituents. Therefore, the resulting PAH concentration would represent a less than significant impact on water quality for the additional FLEETEX.

The proposed addition of one FLEETEX training operation per year would result in approximately 267 pounds (122 kg) of batteries expended in the Sea Range throughout the year (refer to Table 4.13-5). Under the assumptions discussed in Section 4.4.1.2, analyses indicate the concentration of battery constituents is 35.7 µg/L for each event. This value is below acute criteria established in the NAWQC for nickel (75 µg/L), lead (140 µg/L), and cadmium (43 µg/L). However, this value exceeds chronic criteria for these constituents (nickel = 8.3 µg/L, lead =5.6 µg/L, and cadmium = 9.3 µg/L). This would result in localized, short-term impacts in the affected area. Battery constituent levels would be below all NAWQC if the affected surface area and volume were approximately 1.9 x 10^7 square feet (1.8 x 10^6 m^2) and 4.7 x 10^8 gallons (1.8 x 10^9 L), respectively. This would represent an area encompassed by a circle with a radius of approximately 2,480 feet (756 m) with a water depth of 3.3 feet (1 m). The area used for this analysis is the equivalent of a circle with a 980-foot (300-m) radius, or roughly less than half the size of the area described above. It is likely that not all of the battery constituents would be released at once, and that less than half of the constituents would be bio-available. Therefore, a more realistic analysis that still tends to overestimate constituent concentrations shows that the battery constituent concentration for the additional FLEETEX event would have a less than significant long-term impact on marine water quality.

B - Other Water Resources

Since there are no surface or groundwater resources in the project area, impacts on surface or groundwater quality would not occur.

4.4.3.3 Facility Modernization Element - Multiple-Purpose Instrumentation Sites

A - Marine Water Quality

Construction of five multiple-purpose instrumentation sites on San Nicolas Island would not affect marine water resources and, therefore, would not impact marine water quality.

B - Other Water Resources

Construction activities associated with modernization could lead to degradation of surface and groundwater resources by directly impacting surface waters or groundwater recharge areas. Storm water runoff could increase with the additional amount of paved or compacted surface areas. San Nicolas Island has a National Pollutant Discharge Elimination System (NPDES) General Industrial Activities Storm Water Permit issued by the SWRCB. Urban storm water runoff is addressed in the station's Storm Water Pollution Prevention Program (SWPPP) which was established to identify sources of pollutants, materials, and wastes stored and generated that could contribute significant quantities of pollutants to storm water. The plan also identifies the best management practices for controlling pollutants in storm water runoff. Prior to construction of the five multiple-purpose instrumentation sites, the SWPPP would be amended to include the proposed facilities. In addition, a monitoring program would be established to assess facility storm water discharges and the effectiveness of the SWPPP in controlling pollutants in storm water discharge. An effective SWPPP and monitoring program would ensure that the project would not degrade storm water quality or impact existing and beneficial uses at San Nicolas Island. Therefore, impacts on surface and groundwater resources would be less than significant.

4.4.4 Preferred Alternative

This alternative includes impacts identified for the No Action Alternative since the testing, training, and facility modernization activities included in this alternative are proposed in addition to current operations.

4.4.4.1 Theater Missile Defense Element

A - Boost Phase Intercept

Marine Water Quality

Boost phase intercept events would produce approximately 157 pounds (71 kg) of hazardous constituents for three events throughout the year (refer to Table 4.13-4). Under the assumptions discussed in Section 4.4.1.2, analyses indicate the concentration of PAHs is 33.4 µg/L for each event. This value is below criteria established in the NAWQC for naphthalene (acute = 2,350 µg/L) and acenaphthene (acute = 970 µg/L; chronic = 710 µg/L). This PAH concentration represents a less than significant impact on marine water quality for each boost phase intercept event.

Boost phase intercept events would result in approximately 40 pounds (18 kg) of batteries expended in the Sea Range throughout the year (refer to Table 4.13-5), including areas both within and outside the Territorial Waters limit. In a scenario that includes the assumption that all battery constituents are released at one time, the resulting concentration of battery constituents would be 2.7 µg/L for each event. This value is below acute criteria established in the NAWQC for nickel (75 µg/L), lead (140 µg/L), and cadmium (43 µg/L) and the respective chronic criteria for these constituents (nickel = 8.3 µg/L, lead = 5.6 µg/L, and cadmium = 9.3 µg/L). Therefore, this battery constituents concentration represents a less than significant impact on marine water quality.

As noted above, boost phase intercepts could also occur in non-Territorial Waters. Potential impacts on marine water quality in non-Territorial Waters would be the same as described above and would be less than significant.

Other Water Resources

Since there are no surface or groundwater resources in the impact area, impacts on surface or groundwater quality would not occur.

B - Upper Tier

Marine Water Quality

Upper tier events would produce approximately 205 pounds (93 kg) of hazardous constituents for three events throughout the year (refer to Table 4.13-4). Under the assumptions discussed in Section 4.4.1.2, analyses indicate the concentration of PAHs is 43.7 µg/L for each event. This value is below criteria established in the NAWQC for naphthalene (acute = 2,350 µg/L) and acenaphthene (acute = 970 µg/L; chronic = 710 µg/L). This PAH concentration represents a less than significant impact on marine water quality for each upper tier testing or training event.

Upper tier events would result in approximately 60 pounds (27 kg) of batteries expended in the Sea Range throughout the year (refer to Table 4.13-5). In a scenario that includes the assumption that all battery constituents are released at one time, the resulting concentration of battery constituents would be 4.0 µg/L for each event. This value is below acute criteria established in the NAWQC for nickel (75 µg/L), lead (140 µg/L), and cadmium (43 µg/L) and the respective chronic criteria for these constituents (nickel = 8.3 µg/L, lead = 5.6 µg/L, and cadmium = 9.3 µg/L). Therefore, this battery constituents concentration represents a less than significant impact on marine water quality.

Other Water Resources

Since there are no surface or groundwater resources in the impact area, impacts on surface or groundwater quality would not occur.

C - Lower Tier

Marine Water Quality

Lower tier events would produce approximately 148 pounds (67 kg) of hazardous constituents for three events throughout the year (refer to Table 4.13-4). Under the discussed in Section 4.4.1.2, analyses indicate the concentration of PAHs is 31.7 µg/L for each event. This value is below criteria established in the NAWQC for naphthalene (acute = 2,350 µg/L) and acenaphthene (acute = 970 µg/L; chronic = 710 µg/L). This PAH concentration represents a less than significant impact on marine water quality for each lower tier testing or training event.

Lower tier events would result in approximately 40 pounds (18 kg) of batteries expended in the Sea Range throughout the year (refer to Table 4.13-5). In a scenario that includes the assumption that all battery constituents are released at one time, the resulting concentration of battery constituents would be 2.7 µg/L for each event. This value is below acute criteria established in the NAWQC for nickel (75 µg/L), lead (140 µg/L), and cadmium (43 µg/L) and the respective chronic criteria for these constituents (nickel = 8.3 µg/L, lead = 5.6 µg/L, and cadmium = 9.3 µg/L). Therefore, this battery constituents concentration represents a less than significant impact on marine water quality.

Other Water Resources

Since there are no surface or groundwater resources in the impact area, impacts on surface or groundwater quality would not occur.

D - Nearshore Intercept

Impacts from nearshore intercept events were discussed previously in Section 4.4.3.1. Impacts on water quality would be less than significant.

4.4.4.2 Training Element – Fleet Exercise and Special Warfare Training

A - Fleet Exercise Training

Impacts from an additional FLEETEX were discussed previously in Section 4.4.3.2. Impacts on water quality would be less than significant.

B - Special Warfare Training

Marine Water Quality

The proposed action would add two special warfare exercises to current operations that would produce approximately 75 pounds (34 kg) of hazardous constituents (refer to Table 4.13-4), the majority of which are diesel fuel and engine oil. Under the assumptions discussed in Section 4.4.1.2, analyses indicate the concentration of PAHs is 24.2 μg/L for each event. This value is below criteria established in the NAWQC for naphthalene (acute = 2,350 μg/L) and acenaphthene (acute = 970 μg/L; chronic = 710 μg/L). This PAH concentration represents a less than significant impact on marine water quality for each special warfare training event.

Other Water Resources

Since there are no surface or groundwater resources in the project area, impacts on surface or groundwater quality would not occur.

C - Disposal of Shipboard Solid Waste

Impacts from disposal of shipboard solid waste were discussed previously in Section 4.4.2.7-C. Impacts on water quality would be less than significant.

4.4.4.3 Facility Modernization Element – Point Mugu and San Nicolas Island

A - Point Mugu Modernizations

The use of two previously used launch pads would not impact surface or groundwater resources at Point Mugu or water quality of Mugu Lagoon. Under the proposed action, missile launches would occur at launch pad B or C, with solid propellant boosters falling into the ocean approximately 0.25 to 0.50 mile (0.40 to 0.80 km) offshore. Since nearly all of the propellant is expended before being jettisoned, impacts on nearshore water quality would result solely from booster casings entering the water. Given that the casings are not soluble and that a maximum of six per year would enter the water, impacts would be less than significant.

B - San Nicolas Island Modernizations

Increased Launch Capabilities

50K Launcher. The construction of a 50K launch pad at a site currently used for mobile launch activities would not affect surface or groundwater resources. The nearest surface water, Tule Creek, is located approximately 1.5 miles (2.4 km) northeast of the project site, and groundwater flow is northward, away from the groundwater recharge area (refer to Figure 3.4-5). Therefore, no impacts on surface or groundwater quality would occur. Impacts on marine water quality from the proposed project would not occur.

Vertical Launch System. The construction of a vertical launch system at San Nicolas Island is proposed. The main siting criteria includes an onshore location near sea level at an existing pad on the west end of the island (refer to Figure 2-3b). There are no surface water resources near the proposed site, although a groundwater recharge area is located approximately 1.25 miles (2.00 km) northeast of the proposed site (refer to Figure 3.4-5). Water flow from the project site is not expected to affect the recharge area. Therefore, significant impacts on surface or groundwater quality would not occur. Impacts on marine water quality would not occur from the proposed project.

Support Facilities

Impacts from the five proposed multiple-purpose instrumentation sites were discussed previously in Section 4.4.3.3. This discussion also applies to the proposed range support building. Impacts on water quality would be less than significant.

4.5 MARINE BIOLOGY

4.5.1 Approach to Analysis

The factors used to assess significance of impacts to marine biology include the extent or degree to which implementation of an alternative would result in the following:

- loss or degradation of sensitive marine habitats (e.g., lagoon, intertidal, and shallow subtidal), or
- loss or degradation of sensitive marine species (e.g., eelgrass, kelp).

"Sensitive" habitats or species are those that are demonstrably rare, threatened, or endangered; are protected by federal or state statutes or regulations; or have recognized commercial, recreational, or scientific importance. As discussed in Section 3.5.2.3, NMFS has recently published a final rule to list the white abalone as an endangered species under the ESA (NMFS 2001). Since this species is most abundant in waters between 80 and 100 feet deep (25 and 30 m; NMFS 2001), Sea Range testing and training activities may affect but would not adversely affect white abalone since operations occur primarily in much deeper water (i.e., greater than 164 feet [50 m] deep). In the unlikely event that white abalone were present within a testing or training area, activities associated with current and proposed Sea Range operations would not be expected to result in adverse effects to this species. The main potential impact would be from debris settling on white abalone habitat or on an individual. Given the extremely low density, both are unlikely and neither is likely to result in adverse impacts. Operations are not likely to result in the degradation or removal of abalone habitat. In addition, much of the Sea Range encompasses sandy bottom, and rocky substrate suitable for abalone habitat therefore would not be affected. As described in Section 4.4, current and proposed Sea Range activities would not have significant impacts on marine water quality. Therefore, since none of the alternatives addressed in this EIS are likely to adversely affect potential abalone habitat or marine water quality, impacts would not be significant. Informal consultation resulted in NMFS concurring with this determination (see Appendix G). A summary matrix of marine biology impacts is shown in Table 4.5-1. Impacts on fish and sea turtles are addressed in Section 4.6 and marine mammals in Section 4.7.

Hazardous constituents may also impact benthic marine organisms by affecting sediment quality. Due to their potential to affect ocean bottom sediments, battery constituents are of particular concern to this analysis. The quantitative analysis of potential impacts from battery constituents on marine sediment quality is based on several assumptions that tend to overestimate constituent concentrations (refer to Section 4.1.2.1). Due to the density of the material, it was assumed that battery components would sink to the bottom and affect the top 0.4 inches (1 cm) of sediment. Given these assumptions, the affected surface area is 3.1×10^6 square feet (2.8×10^5 m^2) and the affected volume is 7.8×10^5 cubic feet (2.8×10^4 m^3). Metals are not very soluble in seawater and would be released over an extended period of time; however, for this analysis it was assumed that the material was water soluble and bio-available (i.e., readily available to the environment).

Once concentrations were determined for each activity, comparisons were made with criteria from the National Oceanic and Atmospheric Administration (NOAA) Effects Range - Low (ER-L) values (Long and Morgan 1991; Long et al. 1995). The NOAA values were developed by analyzing data from the National Status and Trends Program and ranking the effects versus concentration for various metals and organics. The ER-L was determined to be a concentration at the low end (10 percent) of the range in which effects had been observed. This value is more restrictive than the Effects Range - Median (ER-M), which is a concentration approximately midway in the range of reported values associated with biological effects (i.e., a concentration where effects would be expected). The values are presented in

Table 4.5-1. Marine Biology Impact Summary Matrix

Alternative	Impact Conclusions NEPA (On Land→ Territorial Waters)	 *EO 12114* *(Non-Territorial Waters)*	Mitigation Measures
NO ACTION ALTERNATIVE	Concentration of sediment and water quality contaminants below criteria established for protection of aquatic life with the exception of current FLEETEX activities. Hazardous constituents from FLEETEX activities slightly exceed criteria for sediment quality and may produce localized, short-term impacts. No impacts on threatened and endangered species. No long-term changes to species abundance or diversity. Less than significant impact.	*Concentration of sediment and water quality contaminants below criteria established for protection of aquatic life (excluding QF-4 and FLEETEX activities). QF-4 activities may produce localized, short-term impacts in the open ocean away from sensitive resources. Hazardous constituents from FLEETEX activities slightly exceed criteria for sediment quality and may produce localized, short-term impacts. No impacts on threatened and endangered species. No long-term changes to species abundance or diversity. No loss or degradation of sensitive species habitat from missile or target debris. Less than significant impact.*	None.
MINIMUM COMPONENTS ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Concentration of sediment and water quality contaminants below criteria established for protection of aquatic life, with exception of the additional FLEETEX. Hazardous constituents from the current and additional FLEETEX activities slightly exceed criteria for sediment quality and may produce localized, short-term impacts. No impacts on threatened and endangered species. No long-term changes to species abundance or diversity. Potential loss of small amount of kelp within range of natural variability. Less than significant impact.	*Concentration of sediment and water quality contaminants below criteria established for protection of aquatic life, with exception of the additional FLEETEX. Hazardous constituents from the current and additional FLEETEX activities slightly exceed criteria for sediment quality, and may produce localized, short-term impacts. No impacts on threatened and endangered species. No long-term changes to species abundance or diversity. No loss or degradation of sensitive species habitat from missile or target debris. Less than significant impact.*	None.
PREFERRED ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Concentration of sediment and water quality contaminants below criteria established for protection of aquatic life, with exception of the additional FLEETEX. Hazardous constituents from the current and additional FLEETEX activities slightly exceed criteria for sediment quality, and may produce localized, short-term impacts. No impacts on threatened and endangered species. No long-term changes to species abundance or diversity. Potential loss of small amount of kelp within range of natural variability. Less than significant impact.	*Concentration of sediment and water quality contaminants below criteria established for protection of aquatic life, with exception of the additional FLEETEX. Hazardous constituents from the current and additional FLEETEX activities slightly exceed criteria for sediment quality, and may produce localized, short-term impacts. No impacts on threatened and endangered species. No long-term changes to species abundance or diversity. No loss or degradation of sensitive species habitat from missile or target debris. Less than significant impact.*	None.

parts per million (ppm) dry weight; this assumption also tends to overestimate the potential for effect because it does not account for water content and sediment type. These NOAA values can be used to help identify potentially adverse biological effects; however, the values do not constitute federal criteria or standards for sediment quality and are not intended for use in regulatory decisions or any other similar applications (Long and Morgan 1991). A summary of sediment quality calculations for battery constituents is presented in Table 4.5-2.

Table 4.5-2. Sediment Quality Impact Calculations for Battery Constituents

Activity	#/Year	Batteries (kg)[1] Total	Batteries (kg)[1] Per Event	Constituent Concentration (ppm) per Event
No Action Alternative				
Air-to-Air	122	292.82	2.40	0.1100
Air-to-Surface	20	1.41	0.07	0.0030
Surface-to-Air	65	272.58	4.19	0.1900
Surface-to-Surface	12	0.06	0.01	0.0005
Subsurface-to-Surface	1			
FLEETEX	2	257.11	32.23[2]	1.51
TOTAL - No Action Alternative (Baseline)		823.98		
Minimum Components Alternative (Includes No Action Alternative)				
Theater Missile Defense Element				
Nearshore Intercept	8	48.79	6.1	0.29
Training Element				
FLEETEX	1	122.14	30.5[2]	1.43
TOTAL - Min. Com. Alternative Only		170.93		
TOTAL - Min. Com. Alternative + Baseline		994.91		
Preferred Alternative (Includes No Action Alternative)				
Theater Missile Defense Element				
Boost Phase Intercept	3	18.29	6.1	0.11
Upper Tier	3	27.44	9.2	0.16
Lower Tier	3	18.29	6.1	0.11
Nearshore Intercept	8	48.79	6.1	0.29
Training Element				
FLEETEX	1	122.14	30.5[2]	1.43
Special Warfare Training	2	0	0	
TOTAL - Preferred Alternative Only		234.95		
TOTAL - Preferred Alternative + Baseline		1,058.93		

NOAA Values (Long and Morgan 1991; Long et al. 1995)

Constituents	ER-L (ppm)	ER-M (ppm)
nickel	20.9	51.6
lead	46.7	218.0
cadmium	1.2	9.6

[1] Based on Tables 4.13-4 and 4.13-5.

[2] FLEETEXs typically are concentrated in four range areas, so the "Per Event" value was divided by four to reflect this geographic distribution.

4.5.2 No Action Alternative - Current Operations

4.5.2.1 Air-to-Air Operations

A - Point Mugu Sea Range

A typical air-to-air scenario involves the test and evaluation of an airborne weapon system against an airborne target. The test missiles do not carry live warheads, and targets are not normally destroyed but are recovered for subsequent use. Test missiles are destroyed prior to impact with the water and are not normally recovered. Most activities associated with air-to-air operations (e.g., aircraft takeoff, flight, target recovery, landing of test aircraft) would not impact marine biological resources. Events that generally occur over Sea Range waters are firing of test missiles, launch and intercept of targets, and impact of debris into water. The only potential impacts on marine resources are from debris falling and destroying/degrading sensitive marine habitats or from debris contaminating sediment and water quality such that concentrations are hazardous to aquatic life.

Air-to-air operations contribute the highest volume of debris into the Sea Range annually. For baseline air-to-air operations, a total volume of 2,200 cubic feet (61 m^3) of material was expended in the Sea Range (refer to Section 4.13, Hazardous Materials, Hazardous Wastes, and Non-Hazardous Wastes). The range areas receiving the most debris typically are 5A and 5B. Average concentrations of debris on the sea floor would be about 1.2 cubic feet per NM^2 (0.01 m^3/km^2) in these two range areas, although volumes could be higher in certain areas. Debris may also be distributed to other range areas depending on the size of the debris and regional ocean current regime. Sensitive ocean bottom marine resources are not known to occur in these portions of the Sea Range. Outer range areas overlie deep water regions (approximately 1,640 feet to 13,123 feet [500 to 4,000 m] deep) where species abundance and diversity is typically low in comparison to shallow coastal regions. Debris would settle on soft-bottom habitat which has low species diversity relative to hard-bottom or nearshore habitats, and would eventually corrode or be buried by sediment. In areas where hard substrate is scarce, the debris may serve as a substrate or refuge for invertebrates and fishes.

Concentrations of potential contaminants associated with debris expended from current operations are below water quality criteria established for the protection of aquatic life (refer to Section 4.4, Water Quality) and would not significantly impact marine habitats (the water quality analysis of all current Sea Range activities, including air-to-air operations without aircraft target activities, indicates that the highest concentration for constituents of concern is for the two FLEETEXs [polycyclic aromatic hydrocarbon {PAH} = 193.23 µg/L], well below the most stringent saltwater criterion for PAH constituents [710 µg/L for acenaphthene]). Aircraft target activities can potentially result in temporary, localized impacts on water quality. However, these would occur in the open ocean away from many sensitive marine resources. In addition, many of the hazardous constituents of concern (e.g., fuel, oil) are less dense than seawater and would remain near the surface, thereby not affecting the benthic community. Sheens (oil or fuel) produced from these activities are not expected to cause any significant long-term impact on marine biological resources because a majority of the toxic components (i.e., aromatics) will evaporate within several hours to days and/or be degraded by biogenic organisms (e.g., bacteria, phytoplankton, zooplankton) (National Research Council 1985). This process may occur at a faster rate depending on sea conditions (e.g., wind and waves). Therefore, impacts on marine resources associated with additive debris accumulation in open ocean areas of the Sea Range are less than significant. (Impacts on fish and sea turtles are addressed in Section 4.6, and marine mammals in Section 4.7.)

Air-to-air operations result in approximately 646 pounds (293 kg) of batteries expended in the Sea Range throughout the year (refer to Table 4.13-5). Under the assumptions listed above (which tend to overestimate constituent concentrations), the resulting concentration of battery constituents in marine sediments is approximately 0.11 ppm for each event. This value is below criteria established by NOAA for nickel (ER-L = 20.9 ppm), lead (ER-L = 46.7 ppm), and cadmium (ER-L = 1.2 ppm). This battery constituents concentration represents a less than significant impact on marine sediment quality for each air-to-air event.

B - Mugu Lagoon

Under current operations, targets launched from NAS Point Mugu are launched from the Building 55 Launch Complex north of Mugu Lagoon. During baseline operations, 28 of the targets launched from Building 55 used two JATO bottles. The remaining 22 targets used one bottle each. A total of 78 JATO bottles can be assumed to be jettisoned into the lagoon over a 1-year period associated with current levels of activity. JATO bottles typically land 700 to 1,400 feet (210 to 420 m) in front of Building 55 into Mugu Lagoon. JATO bottles are constructed from metal alloy material which is relatively inert (i.e., does not readily react or decompose with other materials). About 99 percent of the solid propellant in JATO bottles is expended before entering the Mugu Lagoon (NAWCWPNS Surface Launch Division 1994; NAWS Point Mugu 1998h). Estimated short-term and long-term concentrations of residual propellant constituents are below established water quality criteria (refer to Section 4.4, Water Quality). There is very little mixing that occurs at this part of the lagoon, so some of these chemicals can settle in the lagoon sediments. Over a 1-year period of launches at current levels, a total of 4.1 ounces (117 g) of lead and 1.1 ounces (31 g) of copper can potentially settle into sediments. The actual amount would be less than this since some residual would likely remain in the JATO bottles. These quantities are small and do not substantially degrade sediment quality. In addition, the chemicals would deposit over an area of about 560,000 square feet (52,000 m^2). The resulting densities are extremely minimal – about 0.000007 ounces per square foot (0.0022 g/m^2) for lead and 0.000002 ounces per square foot (0.0006 g/m^2) for copper. Assuming that only the top 1 cm of sediment is affected over this area, the affected volume is approximately 18,400 cubic feet (520 m^3).

The resulting concentrations of residual metals in sediments have been calculated for this volume and are shown in Table 4.5-3. Based on current tempo projected over 1-year and 10-year periods, accumulated levels of metals in Mugu Lagoon sediments are compared against the appropriate NOAA ER-L sediment thresholds. As shown in the table, accumulation of metals from JATO bottle propellant residue is below the ER-L criteria established by NOAA. The 10-year accumulation amounts of lead and copper are only 3.0 and 1.1 percent, respectively, of ER-L criteria. In addition, air-to-air testing and training events comprise only a portion of all drone target launches. Therefore, JATO bottle propellants associated with air-to-air events would have less than significant impacts on Mugu Lagoon sediment quality.

Typical marine benthic invertebrates inhabiting the lagoon consist of snails, clams, mussels, worms, and shrimp. None of these species is listed as threatened or endangered by the USFWS. While there is a possibility that JATO bottles can fall or settle on a benthic invertebrate, the mortality of such species do not result in long-term changes in species abundance or composition, so impacts are less than significant.

NAWCWPNS has recently developed and implemented a JATO bottle recovery plan to remove the remaining accumulation of bottles in the lagoon and surrounding marsh (this is described in more detail in Section 4.8, Terrestrial Biology).

Table 4.5-3. Long-Term Amounts of Unburned Propellant in Mugu Lagoon Sediments

Combustion Product	NOAA Sediment Guidelines[1] (ppm)	Total Amounts[2] (kg)		Sediment Concentrations[3] (ppm)		10-yr. Accumulation vs. NOAA Guidelines
		1 Year	10 Years	1 Year	10 Years	
No Action Alternative						
Lead	46.7	0.12	1.17	0.14	1.40	3.0%
Copper	34.0	0.03	0.31	0.04	0.37	1.1%
Minimum Components Alternative[4]						
Lead	46.7	0.12	1.24	0.15	1.45	3.2%
Copper	34.0	0.03	0.33	0.04	0.39	1.2%
Preferred Alternative[4]						
Lead	46.7	0.12	1.24	0.15	1.49	3.2%
Copper	34.0	0.03	0.33	0.04	0.39	1.2%

[1] Analysis uses the most conservative NOAA guidelines—ER-L (Effects Range – Low). ER-L levels are constituent concentrations at which biological effects are observed in only 10% of marine organisms.
[2] Assumes 75% of JATO bottles fall into Mugu Lagoon and that 99% of the propellant is burned.
[3] Affected sediment volume is 52,000 m^2 area by 1 cm deep, with dry weight of 1,600 kg/m^3.
[4] Includes current operations.
Source: Ogden 1998; Department of Water Resources 1995.

4.5.2.2 Air-to-Surface Operations

The air-to-surface scenario involves testing weapons that support the Navy's strike/surface warfare mission. These tests often include an aircraft weapon system using a missile, bomb, mine, or any other object released from an aircraft for attack of an enemy surface target. Free-fall bombs and mine shapes are usually inert, without fusing or explosives, and are used to test the accuracy of a weapon system. Targets for this scenario are floating surface targets or the SLAM target area on the northwest tip of San Nicolas Island.

The SLAM target is located on the northwest portion of San Nicolas Island and consists of several stacks of empty shipping containers. The SLAM missile typically falls within a range from 200 feet (61 m) short of the target to 2,000 feet (610 m) past the target. In the instance of a malfunction, errant missiles are discarded into the Sea Range approximately 10 miles (16 km) from San Nicolas Island. In the unlikely event that this occurs, localized, short-term impacts on water quality could result but would not result in long-term, biologically significant impacts. Therefore, no impacts on marine biological resources are anticipated.

Another example of an air-to-surface scenario is the inert mine shape drop. During this operation, inert mine shapes (which consist of pieces of concrete in various shapes or steel casings filled with concrete) are released from aircraft to test the accuracy of a weapon system. The mine shapes are dropped in nearshore waters of Becher's Bay off Santa Rosa Island (refer to Figure 3.0-14). After the mine shapes are dropped, an Explosive Ordnance Disposal (EOD) team locates them for scoring purposes and recovery. Virtually all of the mine shapes equipped with pingers are recovered (for this analysis it was assumed that 40 percent of the mine shapes have pingers); the locations of those without pingers are often not determined and the mine shapes are therefore not recovered. The only potential impact on marine resources would be from mine shapes falling and destroying/degrading sensitive marine habitats and the accumulation of debris. Analyses indicate that 2,100 pounds (955 kg) of material with a volume of 34.6 cubic feet (0.96 m^3) can be deposited annually. The activity takes place in nearshore waters (water depth approximately 100 feet [30 m]) with nearby sensitive marine habitats such as subtidal reefs, kelp beds, and surfgrass beds. Habitat at this depth is primarily sandy bottom and is located in water too deep for the nearby kelp beds. The mine shapes disturb some sediments and may eventually sink into the sandy bottom but are not likely to affect sensitive hard bottom or nearshore habitat. The material can also have some beneficial effects by acting as a substrate or refuge for algae, invertebrates, and fishes. Therefore, impacts of inert mine shape drops on marine biological resources are less than significant.

Floating surface targets used in air-to-surface operations are usually not sunk and, if struck, are repaired for later use. The missiles do not carry live warheads and are destroyed on impact with the water. The only potential impact on marine resources from open water air-to-surface operations is from debris falling and destroying/degrading sensitive marine habitats. Baseline air-to-surface operations contributed approximately 560 cubic feet (16 m^3) of debris into the Sea Range (refer to Section 4.13, Hazardous Materials, Hazardous Wastes, and Non-Hazardous Wastes). Impacts are similar to those described for air-to-air operations in Section 4.5.2.1 (debris associated with air-to-surface operations is approximately 26 percent of the amount contributed from air-to-air operations); impacts are less than significant.

Air-to-surface operations result in approximately 3.1 pounds (1.4 kg) of batteries expended in the Sea Range throughout the year (refer to Table 4.13-5). Under the assumptions listed above, the resulting concentration of battery constituents in marine sediments is about 0.003 ppm for each event. This value is below criteria established by NOAA for nickel (ER-L = 20.9 ppm), lead (ER-L = 46.7 ppm), and cadmium (ER-L = 1.2 ppm). Therefore, this battery constituents concentration represents a less than significant impact on marine sediment quality for each air-to-surface event.

4.5.2.3 Surface-to-Air Operations

The effects of surface-to-air operations on marine biological resources in the open ocean environment are similar to those discussed above in Section 4.5.2.1 for air-to-air operations. Therefore, impacts on marine biological resources from debris in the open ocean environment are less than significant.

Surface-to-air operations result in approximately 602 pounds (273 kg) of batteries expended in the Sea Range throughout the year (refer to Table 4.13-5), both within and outside the Territorial Waters limit. Under the assumptions listed above, the resulting concentration of battery constituents in marine sediments would be 0.19 ppm for each event. This value is below criteria established by NOAA for nickel (ER-L = 20.9 ppm), lead (ER-L = 46.7 ppm), and cadmium (ER-L = 1.2 ppm). This battery constituents concentration represents a less than significant impact on marine sediment quality for each surface-to-air event.

As noted above, debris and batteries from surface-to-air operations may also fall in non-Territorial Waters. For the reasons described above, impacts on marine biological resources are less than significant.

4.5.2.4 Surface-to-Surface Operations

The effects of surface-to-surface operations on marine biological resources in the open ocean environment are similar to those discussed above in Section 4.5.2.1 for air-to-air operations. Therefore, impacts from debris on marine biological resources in the open ocean environment are less than significant.

Surface-to-surface operations result in approximately 0.13 pounds (0.06 kg) of batteries expended in the Sea Range throughout the year (refer to Table 4.13-5). Under the assumptions listed above, the resulting *concentration of battery constituents in marine sediments is about 0.0005 ppm for each event. This value is below criteria established by NOAA for nickel (ER-L = 20.9 ppm), lead (ER-L = 46.7 ppm), and cadmium (ER-L = 1.2 ppm). This battery constituents concentration represents a less than significant impact on marine sediment quality for each surface-to-surface event.*

4.5.2.5 Subsurface-to-Surface Operations

The effects of subsurface-to-surface operations on marine biological resources in the open ocean environment are similar to those discussed above in Section 4.5.2.1 for air-to-air operations. Therefore, impacts from debris on marine biological resources in the open ocean environment are less than significant.

4.5.2.6 Ancillary Operations Systems

Chaff and flares are the only ancillary operations systems that could potentially affect marine biology. An extensive review of literature, combined with controlled experiments, revealed that chaff and self-defense flares pose little risk to the environment or animals (U.S. Air Force 1997b; Naval Research Laboratory 1999). Chaff is relatively non-toxic and is unlikely to significantly affect marine biological resources. Research indicates that, overall, benthic worms and crabs are not affected by the aluminum-coated and uncoated fiber material that comprises chaff (Cataldo et al. 1992). Any potential effects of chaff fibers in the aquatic environment are expected to be immediate and short-term, and would have no long-term significant biological impacts. Therefore, impacts on marine biological resources from the limited use of chaff on the Sea Range are less than significant. Effects of chaff on marine organisms from potential ingestion are addressed in Section 4.6, Fish and Sea Turtles, and Section 4.7, Marine Mammals.

Potential impacts from flare use are limited to debris and ingestion issues for larger forms of marine life. These issues are addressed in Section 4.6, Fish and Sea Turtles, and Section 4.7, Marine Mammals.

For the reasons described above, impacts on marine biological resources from chaff and flare use in non-Territorial Waters are less than significant.

4.5.2.7 Current Fleet Exercise Training

FLEETEXs are conducted throughout the Sea Range and typically include a combination of the operations discussed in Sections 4.5.2.1 through 4.5.2.6. FLEETEXs usually last 2 to 3 days and involve a number of aircraft sorties, missile launches, target intercepts, and target recovery activities. Potential impacts on marine biological resources are limited to missile and target debris falling into the ocean and destroying/degrading sensitive marine habitats. While FLEETEXs use all areas of the Sea Range, debris patterns are typically located in outer range areas over deep water regions (e.g., Range Area 5A). As discussed for air-to-air operations (Section 4.5.2.1), sensitive ocean bottom marine resources are not known to occur in these regions; nevertheless, as previously discussed, impacts are less than significant.

Current FLEETEX training operations result in approximately 567 pounds (257 kg) of batteries expended in the Sea Range throughout the year (refer to Table 4.13-5). Under the assumptions listed above, the resulting concentration of battery constituents in marine sediments is approximately 1.51 ppm for each event. This value is below criteria established by NOAA for nickel (ER-L = 20.9 ppm) and lead (ER-L = 46.7 ppm). It is only slightly higher than the criteria for cadmium (ER-L = 1.2 ppm); this can result in localized, short-term impacts of the affected area. However, it is likely that not all of the battery constituents would be released at once, and that less than half of the constituents would be *available. Therefore, this analysis tends to overestimate the potential concentrations of constituents entering the ocean. Therefore, this battery constituents concentration represents a less than significant impact on marine sediment quality for each FLEETEX event.*

4.5.2.8 Littoral Warfare Training

Current littoral warfare training includes boat raids, airfield seizure, humanitarian assistance, and light-armor reconnaissance. Training exercises typically have been conducted at various locations on and surrounding San Nicolas Island. Beach areas are carefully selected to avoid or minimize damage to vegetation, wildlife, and cultural sites. Hydrographic and nearshore reconnaissance can be conducted in the waters off beaches that the Environmental Project Office has designated as not sensitive to these types of activities. The use of boats would not affect marine biological resources in the nearshore environment since turbulence in the surf zone associated with these activities is less then natural nearshore processes (e.g., wave action). Some amounts of fuel leakage from use of boats can occur in transit to San Nicolas Island, but these amounts are very small (74 pounds [34 kg] per year; refer to Section 4.13, Hazardous Materials, Hazardous Wastes, and Non-Hazardous Wastes). Therefore, marine biology impacts associated with littoral warfare training are less than significant.

4.5.2.9 Collective Impacts of the No Action Alternative

As described earlier, debris associated with the No Action Alternative over a 1-year period has less than significant impacts on marine biological resources. The following analysis addresses potential contaminant effects associated with battery constituents and physical effects associated with the accumulation of debris over longer periods of time (e.g., 10 years).

Under the No Action Alternative (current activities), a volume of 5,580 cubic feet (158 m^3) of non-hazardous materials is expended in the Sea Range over a 1-year period. The range areas receiving the most debris are 4A, 5A, and 6A. To conduct an analysis that tends to overestimate the potential for impacts, it was assumed that much of the debris falls in the same general regions of these range areas for many of the tests; therefore, the total volume of debris was calculated for distribution over half of these areas. Also, it is likely that, within the area of potential effect, debris could be concentrated more heavily in some areas than others. This could be a factor of where the debris falls into the ocean, surface and bottom currents, and ocean bottom topography. Consequently, certain areas can be assumed to have about 10 times more than the average debris density, while other areas can be assumed to have 10 times less than the average debris density. The results of the short- and long-term debris calculations are shown in Table 4.5-4.

The No Action Alternative contributes average debris concentrations on the sea floor of about 3.1 cubic feet per NM^2 (0.025 m^3/km^2). Over a 10-year period, the projected average concentrations would be about 31 cubic feet per NM^2 (0.25 m^3/km^2). In areas where more debris is concentrated, the projected 10-year average could be about 310 cubic feet per NM^2 (2.5 m^3/km^2). This long-term, high-average density equates roughly to the size of a box 54 inches (136 cm) on a side over a 0.3 NM^2 (1 km^2) area. For comparison purposes, this would be less than the size of a shoe box in relation to an entire football field.

Sensitive ocean bottom marine resources are not known to occur in these portions of the Sea Range. The debris settles primarily on soft-bottom habitat, deteriorates gradually over time, and does not adversely affect marine resources. Soft bottom habitats typically have low species diversity relative to hard-bottom or nearshore habitats. In such areas where hard substrate is limited, the presence of any hard substrate (even man-made objects such as debris) can provide a habitat or refuge for invertebrates and fishes, thus increasing the diversity and abundance of organisms in localized areas (USEPA 1990).

Table 4.5-4. Short- and Long-Term Debris Accumulation in the Sea Range

	No Action Alternative	Minimum Components Alternative	Preferred Alternative
Total Debris Volume (m^3)[a]	158.34	194.14	206.68
Affected Area (km^2)[b]	6,260	6,260	6,260
1-Year (m^3/km^2)			
Average Density	0.025	0.031	0.033
Low Density[c]	0.0025	0.0031	0.0033
High Density[d]	0.25	0.31	0.33
10-Year (m^3/km^2)			
Average Density	0.25	0.31	0.33
Low Density[c]	0.025	0.031	0.033
High Density[d]	2.5	3.1	3.3

[a] Based on Table 4.13-7.
[b] Affected area is assumed to be half of the range areas which receive the most debris (4A, 5A, 6A). These areas were obtained from Table 4.13-6.
[c] Low density is assumed to be 10 times smaller than average density.
[e] High density is assumed to be 10 times greater than average density.

Contaminant concentrations associated with debris expended from current activities are below water and sediment quality criteria established for protection of aquatic life and do not significantly affect marine habitats (refer to Section 4.1, Geology and Soils, and Section 4.4, Water Quality). The majority of debris for current testing and training occurs throughout Range Areas 3D, 4A, 4B, 5A, 5B, 5C, 6A, and M2. The surface area potentially affected by battery constituents from a single test or training event represents only 0.001 percent of these surface areas. The probability of the same area of marine sediments being affected more than once in a given year is very low. Therefore, long-term marine biology impacts associated with additive debris or battery constituent accumulation from current operations are less than significant.

For the reasons described above, long-term marine biological impacts associated with debris accumulation from current operations in non-Territorial Waters are less than significant.

4.5.3 Minimum Components Alternative

This alternative includes impacts identified for the No Action Alternative since the testing, training, and facility modernization activities included in this alternative are proposed in addition to current operations.

4.5.3.1 Theater Missile Defense Element - Nearshore Intercept

Nearshore intercept events would produce a very small debris pattern footprint since the intercept occurs at altitudes less than 1,000 feet (300 m). However, the density of the debris within the footprint would be higher since there is little time for dispersion. The only potential impact on marine resources from nearshore intercept testing and training would be from debris falling and destroying/degrading sensitive marine habitats around San Nicolas Island. Sensitive habitats are located in the nearshore subtidal and intertidal zones of San Nicolas Island. These areas are predominantly rocky habitat and support a diverse assemblage of marine organisms including sensitive marine species such as kelp, surfgrass, and lobster.

This area also supports commercially viable species (e.g., lobster, sea urchin) targeted by commercial fishing boats (Ventura County Commercial Fishermen's Association 1997). If smaller debris were to settle onto these areas, this may result in direct mortality of resident organisms. This would be considered a short-term impact and would be less than significant because many of the organisms that inhabit these areas are opportunistic and would quickly recolonize the area. However, the intercept is designed so that the entire debris pattern falling into the ocean is at least 1 NM (1.9 km) offshore. This would eliminate potential impacts on nearshore subtidal and intertidal zones.

Although kelp does occur 1 NM (1.9 km) off the northwestern tip of San Nicolas Island, it is a very small portion of the total kelp canopy around the island (Figure 4.5-1). Through use of a Geographic Information System (GIS) program, it was determined that, of the approximate 1.59 square miles ($4.12\ km^2$) of kelp surrounding the island, only about 0.05 square mile ($0.13\ km^2$) occurs within the debris pattern. Natural disturbances (e.g., temperature fluctuations, storm events) contribute to changes in the abundance of kelp; the surface area of kelp forests off San Nicolas Island has been variable through time (Dailey et al. 1993). If nearshore intercept debris fell directly onto a kelp bed, there is the possibility that the surface canopy could be affected. However, it is unlikely that kelp mortality would occur, even in the case of large debris. Once it reached the bottom, debris may also serve as a substrate for kelp attachment. Therefore, long-term impacts on kelp beds would not occur. In most cases, smaller debris might filter through the kelp and eventually settle on the bottom. Potential impacts from nearshore intercept debris would be limited to a maximum of eight occurrences per year. Of these eight events, less than half would be expected to occur off the northwestern edge of the island where kelp is most extensive. Natural ocean processes (e.g., storm-generated waves, currents, sea temperature, etc.) would be more likely to cause disturbance (Foster and Schiel 1985; Dayton et al. 1992). Given the natural variability of kelp beds, the limited number of nearshore intercept events per year, and the limited extent of effect, impacts would be less than significant.

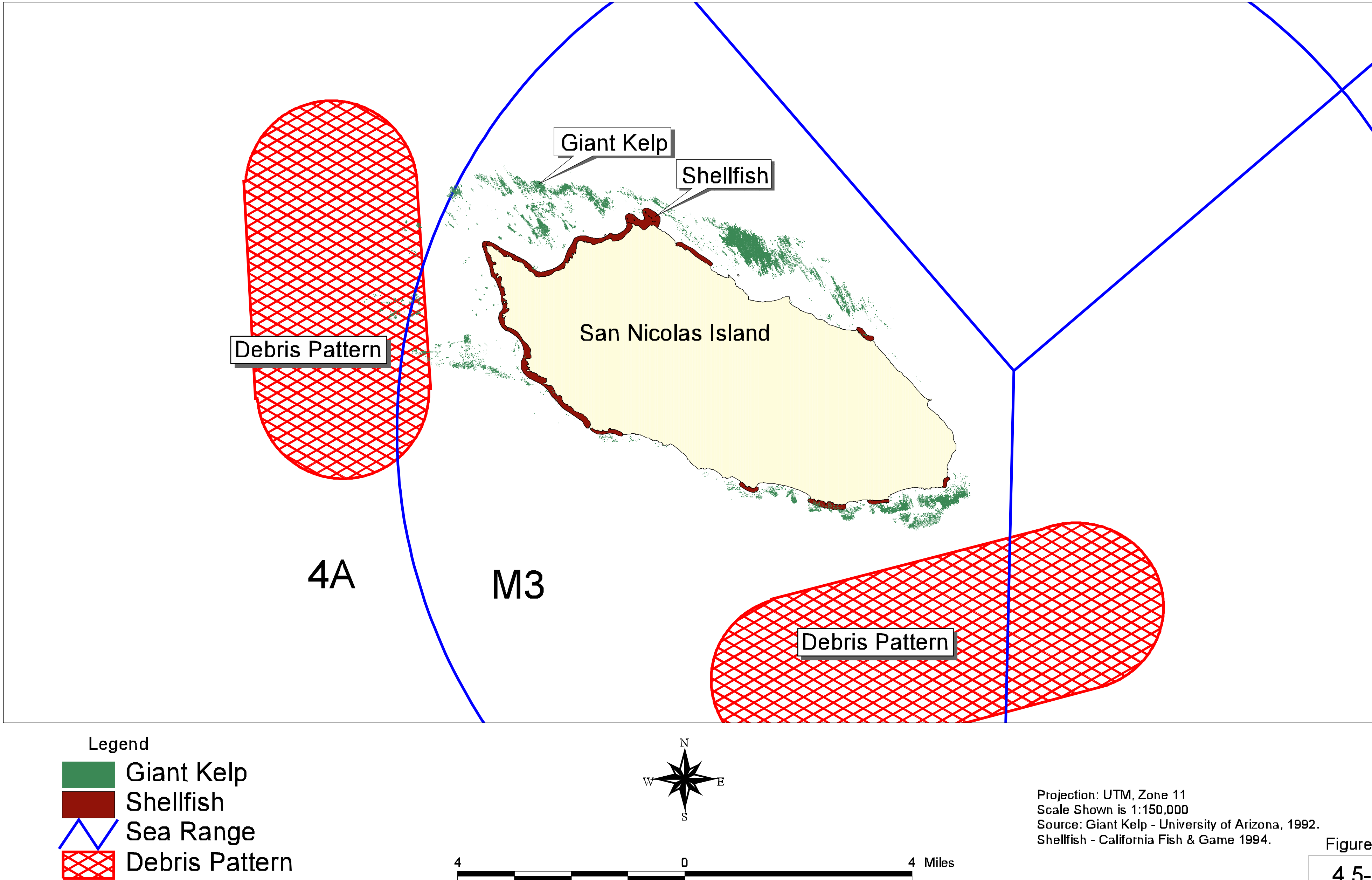
Concentrations of potential contaminants associated with nearshore intercept debris would be below water quality criteria established for the protection of aquatic life (refer to Section 4.4, Water Quality) and impacts would be less than significant.

Nearshore intercept testing and training would result in approximately 108 pounds (49 kg) of batteries expended in the Sea Range throughout the year (refer to Table 4.13-5). Under the assumptions listed above, the resulting concentration of battery constituents in marine sediments would be 0.29 ppm for each event. This value is below criteria established by NOAA for nickel (ER-L = 20.9 ppm), lead (ER-L = 46.7 ppm), and cadmium (ER-L = 1.2 ppm). Therefore, this battery constituents concentration represents a less than significant impact on marine sediment quality for each nearshore intercept event.

4.5.3.2 Training Element - Additional FLEETEX

The proposed addition of one FLEETEX training operation per year would result in approximately 267 pounds (122 kg) of batteries expended in the Sea Range throughout the year (refer to Table 4.13-5). Under the assumptions listed above, the resulting concentration of battery constituents in marine sediments would be 1.43 ppm for each event. This value is below criteria established by NOAA for nickel (ER-L = 20.9 ppm) and lead (ER-L = 46.7 ppm). However, this value slightly exceeds criteria for cadmium (ER-L = 1.2 ppm).

San Nicolas Island - Potential Nearshore Intercept Debris Patterns



Projection: UTM, Zone 11
Scale Shown is 1:150,000
Source: Giant Kelp - University of Arizona, 1992.
Shellfish - California Fish & Game 1994.

Figure 4.5-1

The likelihood of long-term impacts from battery constituents on sediment quality is low. The majority of debris from additional FLEETEX training would fall in Range Areas 4A, 5A, 5B, and 6A, typically in non-Territorial Waters. The surface areas potentially affected by battery constituents during the additional FLEETEX represent only 0.007 percent of these collective surface areas. Therefore, the probability of the same area of marine sediments being affected more than once in a given year is very low. Therefore, long-term impacts of battery constituents on marine sediment quality would be less than significant.

4.5.3.3 Facility Modernization Element – Multiple-Purpose Instrumentation Sites

Since activities would be located entirely onshore, construction of five multiple-purpose instrumentation sites on San Nicolas Island would have no impact on marine biological resources.

4.5.3.4 Collective Impacts of the Minimum Components Alternative

As described earlier, debris associated with the Minimum Components Alternative over a 1-year period would have less than significant impacts on marine biological resources. The following analysis addresses potential contaminant effects associated with battery constituents and physical effects associated with the accumulation of debris over longer periods of time (e.g., 10 years). The assumptions used are similar to those described for the analysis of the No Action Alternative (see Table 4.5-4).

Under the Minimum Components Alternative, a volume of 6,850 cubic feet (194 m^3) of non-hazardous materials would be expended in the Sea Range over a 1-year period. The range areas receiving the most debris would be 4A, 5A, and 6A. Average concentrations on the sea floor in these areas would be about 3.8 cubic feet per NM^2 (0.031 m^3/km^2). Over a 10-year period, the projected average concentrations would be about 38 cubic feet per NM^2 (0.31 m^3/km^2). In areas where more debris is concentrated, the projected 10-year average could be about 380 cubic feet per NM^2 (3.1 m^3/km^2). This long-term, high-average density equates roughly to the size of a box 57 inches (146 cm) on a side over a 0.3 NM^2 (1 km^2) area. For comparison purposes, this would be slightly larger than the size of a shoe box in relation to an entire football field.

Sensitive ocean bottom marine resources are not known to occur in these portions of the Sea Range. The debris would settle primarily on soft-bottom habitat, would deteriorate gradually over time, and would not adversely affect marine resources. Soft bottom habitats typically have low species diversity relative to hard-bottom or nearshore habitats. In such areas where hard substrate is limited, the presence of any hard substrate (even man-made objects such as debris) can provide a habitat or refuge for invertebrates and fishes, thus increasing the diversity and abundance of organisms in localized areas (USEPA 1990).

Contaminant concentrations associated with debris expended from proposed activities are below water and sediment quality criteria established for protection of aquatic life and would not significantly affect marine habitats (refer to Section 4.1, Geology and Soils, and Section 4.4, Water Quality). The majority of nearshore intercept debris would fall in Range Area M3 (although some debris would also fall in Range Area 4A). The surface area potentially affected by battery constituents from a single test or training event represents only 0.04 percent of the M3 surface area. The probability of the same area of marine sediments being affected more than once in a given year is very low. Therefore, long-term marine biology impacts associated with additive debris or battery constituent accumulation from proposed operations would be less than significant.

For the reasons described above, long-term marine biological impacts associated with additive debris accumulation from proposed operations in non-Territorial Waters would be less than significant.

4.5.4 Preferred Alternative

This alternative includes impacts identified for the No Action Alternative since the testing, training, and facility modernization activities included in this alternative are proposed in addition to current operations.

4.5.4.1 Theater Missile Defense Element

Potential impact on marine biology associated with the proposed TMD testing and training events would be limited to effects from missile and target debris falling and destroying/degrading sensitive marine habitats or from debris contaminating water quality such that concentrations would be hazardous to aquatic life. It is assumed that the majority of the debris would be dense (e.g., metal) and non-floating. Non-floating debris would disperse relative to weight, size, shape, and current/wind patterns before settling to the ocean floor. Heavier objects would settle to the bottom faster and would not disperse far from the impact area. Larger objects, depending on shape, may not necessarily settle quickly since objects with more drag may disperse due to currents. Smaller debris may also be dispersed over a large area due to currents. Most of the missile debris patterns would occur in deep water regions of the Sea Range and are not expected to significantly affect benthic marine organisms as the biota in these areas are generally impoverished. Non-hazardous debris pieces can actually provide habitat and increase species diversity in these areas. The water quality analysis (refer to Section 4.4, Water Quality) estimated that concentrations of constituents of concern resulting from proposed TMD testing and training events ranged from 30.94 µg/L to 123.67 µg/L PAH, far below the most stringent saltwater criterion for PAH constituents established for the protection of aquatic life (710 µg/L for acenaphthene). Concentrations of battery constituents were also estimated to be below established standards (refer to Section 4.4, Water Quality), indicating that contaminants associated with debris expended from proposed TMD activities would not significantly impact aquatic life. Potential impacts from each of the different TMD components are discussed below. Impacts on fish and sea turtles are discussed in Section 4.6 and marine mammals in Section 4.7.

<u>A - Boost Phase Intercept</u>

The debris pattern for boost phase intercept events would be located primarily in open ocean portions of the Sea Range (e.g., the northwest portion of Range Area 4A; approximately 660 to 3,280 feet [200 to 1,000 m] deep), although some intercepts could occur in Territorial Waters (e.g., west of San Nicolas Island). As discussed for air-to-air operations (Section 4.5.2.1), sensitive ocean bottom marine resources are not known to occur in these portions of the Sea Range; impacts from debris would be less than significant.

Boost phase intercept events would result in approximately 40 pounds (18 kg) of batteries expended in the Sea Range throughout the year (refer to Table 4.13-5). Under the assumptions listed above, the resulting concentration of battery constituents in marine sediments would be 0.11 ppm for each event. This value is below criteria established by NOAA for nickel (ER-L = 20.9 ppm), lead (ER-L = 46.7 ppm), and cadmium (ER-L = 1.2 ppm). Therefore, this battery constituents concentration represents a less than significant impact on marine sediment quality for each boost phase intercept event.

As noted above, although debris from boost phase intercept events could fall in Territorial Waters, the majority of intercepts would occur in non-Territorial Waters. For the reasons described above, impacts from debris or battery constituents would be less than significant.

B - Upper Tier

For upper tier events, the footprint of the safety hazard pattern would be located over several range areas that can be described as open ocean habitat. The only potential impact on marine resources from upper tier events would be from debris falling and destroying/degrading sensitive marine habitats. Potential impacts would be similar to those discussed for air-to-air operations (Section 4.5.2.1). Since sensitive ocean bottom marine resources are not known for the open ocean portion of the Sea Range, impacts would be less than significant.

Upper tier events would result in approximately 60 pounds (27 kg) of batteries expended in the Sea Range throughout the year (refer to Table 4.13-5). Under the assumptions listed above, the resulting concentration of battery constituents in marine sediments would be 0.16 ppm for each event. This value is below criteria established by NOAA for nickel (ER-L = 20.9 ppm), lead (ER-L = 46.7 ppm), and cadmium (ER-L = 1.2 ppm). Therefore, this battery constituents concentration represents a less than significant impact on marine sediment quality for each upper tier event.

C - Lower Tier

For lower tier events, the footprint of the safety hazard pattern would be located over several range areas. The only potential impact on marine resources from lower tier events would be from debris falling and destroying/degrading sensitive marine habitats. Potential impacts would be similar to those described for air-to-air operations (Section 4.5.2.1); impacts would be less than significant.

Lower tier events would result in approximately 40 pounds (18 kg) of batteries expended in the Sea Range throughout the year (refer to Table 4.13-5). Under the assumptions listed above, the resulting concentration of battery constituents in marine sediments would be 0.11 ppm for each event. This value is below criteria established by NOAA for nickel (ER-L = 20.9 ppm), lead (ER-L = 46.7 ppm), and cadmium (ER-L = 1.2 ppm). Therefore, this battery constituents concentration represents a less than significant impact on marine sediment quality for each lower tier event.

D - Nearshore Intercept

The effects of nearshore intercept events were discussed previously in Section 4.5.3.1; impacts would be less than significant.

4.5.4.2 Training Element – Fleet Exercise and Special Warfare Training

A - Fleet Exercise Training

The effects of one additional FLEETEX were discussed in Section 4.5.2.7; impacts would be less than significant.

B - Special Warfare Training

Special warfare operations onshore generally involve human activities of individuals on foot, group movement on foot, group climbing, clandestine patrolling, laying-in (i.e., lying down on the terrain), and communication by radio. Selection of beach areas for training is based not only on training requirements but also on the environmental sensitivity of the beach and inshore areas. Implementation of existing siting criteria would minimize effects on marine biological resources. Hydrographic and nearshore reconnaissance can be conducted in the waters off Point Mugu and San Nicolas Island. The use of these boats would not affect marine biological resources even in the nearshore environment since turbulence in the surf zone associated with these activities would be less than natural nearshore processes. Fuel leakage from boats in transit to and from San Nicolas Island is minimal (refer to Section 4.13, Hazardous Materials, Hazardous Wastes, and Non-Hazardous Wastes). Therefore, marine biology impacts associated with additional special warfare training would be less than significant.

4.5.4.3 Facility Modernization Element – Point Mugu and San Nicolas Island

A - Point Mugu Modernizations

The use of two previously used launch pads would not affect marine biological resources. Under the proposed action, missile launches would occur at Pad B or Pad C near the beach. Launch combustion products could potentially settle in the nearshore marine environment but would not adversely affect marine water quality (refer to Section 4.4.2.1-B). Therefore, impacts would be less than significant.

Some of the missile launches could include the use of solid propellant boosters. The boosters would land in the ocean approximately 0.25 to 0.50 mile (0.40 to 0.80 km) offshore. Since the propellant would be expended prior to the booster entering the ocean, water quality impacts would be less than significant and aquatic organisms would not be significantly impacted. The regions where the boosters would fall can be described as predominately sandy habitat. In general, sandy habitats are very dynamic and ever changing due to wave action and mobile substrate. Relatively few organisms inhabit this area compared to rocky intertidal or kelp bed habitat, and those that do have adapted to this environment. Therefore, impacts would be less than significant.

B - San Nicolas Island Modernizations

The construction of a 50K launch site at the Alpha Launch Complex and a vertical launch system at the Building 807 Launch Complex on San Nicolas Island would not affect any sensitive marine habitats or species. These areas are currently used for missile and target launching activities and do not impact the marine environment. Therefore, impacts of construction and operation of the proposed launch facilities would be less than significant. Other support facilities would be constructed onshore and would not affect marine resources. Therefore, impacts would be less than significant.

4.5.4.4 Collective Impacts of the Preferred Alternative

As described earlier, debris associated with the Preferred Alternative over a 1-year period would have less than significant impacts on marine biology. The following analysis addresses potential contaminant effects associated with battery constituents and physical effects associated with the accumulation of debris over longer periods of time (e.g., 10 years). The assumptions used are similar to those described for the analysis of the No Action Alternative (see Table 4.5-4).

Under the Preferred Alternative, a volume of 7,310 cubic feet (207 m^3) of non-hazardous materials would be expended in the Sea Range over a 1-year period. The range areas receiving the most debris would be 4A, 5A, and 6A. The Preferred Alternative would contribute average debris concentrations on the sea floor of about 4.0 cubic feet per NM^2 (0.033 m^3/km^2). Over a 10-year period, the projected average concentrations would be about 40 cubic feet per NM^2 (0.33 m^3/km^2). In areas where more debris is concentrated, the projected 10-year average could be about 400 cubic feet per NM^2 (3.3 m^3/km^2). This long-term, high-average density equates roughly to the size of a box 59 inches (149 cm) on a side over a 0.3 NM^2 (1 km^2) area. For comparison purposes, this would be slightly greater than the size of a shoebox in relation to an entire football field.

Sensitive ocean bottom marine resources are not known to occur in these portions of the Sea Range. The debris would settle primarily on soft-bottom habitat, would deteriorate gradually over time, and would not adversely affect marine resources. Soft bottom habitats typically have low species diversity relative to hard-bottom or nearshore habitats. In such areas where hard substrate is limited, the presence of any hard substrate (even man-made objects such as debris) can provide a habitat or refuge for invertebrates and fish, thus increasing the diversity and abundance of organisms in localized areas (USEPA 1990).

Contaminant concentrations associated with debris expended from proposed activities are below water and sediment quality criteria established for protection of aquatic life and would not significantly affect marine habitats (refer to Section 4.1, Geology and Soils, and Section 4.4, Water Quality). The majority of TMD debris would fall in Range Areas 4A, 5A, 5B, 5C, 6A, 6B, M2, and M3. The surface area potentially affected by battery constituents from a single test or training event represents only 0.001 percent of these surface areas. The probability of the same area of marine sediments being affected more than once in a given year is very low. Therefore, long-term marine biology impacts associated with additive debris or battery constituent accumulation from proposed operations would be less than significant.

For the reasons described above, long-term marine biological impacts associated with additive debris accumulation from proposed operations in non-Territorial Waters would be less than significant.

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4.6 FISH AND SEA TURTLES

4.6.1 Approach to Analysis

4.6.1.1 Impact Assessment Methods

In this section, the approach to the assessment of impacts on fish and sea turtles is presented, as well as a review of the literature on potential effects common to most activities. These include noise and disturbance and non-acoustic effects of contaminants, debris, and discarded expendable material.

The following factors were used to determine potential impacts on fish and sea turtles. The determination of significance is based on the review of the literature that is summarized below.

There are two main sources of potential impacts on fish and sea turtles: 1) direct physical injury and 2) detrimental behavioral effects.

- Death, injury, or failure to reach (or retardation in the time needed to reach) the next developmental stage is one factor for assessing potential impacts on fish eggs, on larvae and adult fish, and on sea turtles. Data are available to enable some predictions about the likelihood and extent of these kinds of effects.

- Exposure to underwater sound sometimes elicits behavioral reactions by fish, but there is little information on the effect of noise-induced behavioral changes on the well-being of fish. There are no data on behavioral effects of sound on fish eggs and larvae. Most of the information indicates that effects of noise on fish are transitory, so obvious changes in behavior may have inconsequential biological effects on the fish. In most cases, it appears that fright effects on fish should translate into negligible impacts on individuals and populations. Effects of noise on sea turtles are unknown.

Even if behavioral reactions are not indicative of significant negative impacts on the fish themselves, these behavioral reactions might lead to significant impacts on a fishery if the catchability of fish is reduced. The factor used to assess potential impacts on fisheries is the degree to which behavioral effects on fish reduce fish catchability and, thus, have a negative impact on the fishery.

Two Essential Fish Habitats (EFHs) are located within the region of influence (ROI): 1) Coastal Pelagic EFH and 2) Groundfish EFH (refer to Section 3.6). The National Marine Fisheries Service (NMFS) has developed Fishery Conservation Management Plans (FCMPs) that identify and describe each EFH. Potential impacts on EFH are addressed in Sections 4.6.2.13, 4.6.3.5, and 4.6.4.5 for the No Action, Minimum Components, and Preferred alternatives, respectively.

<u>A - Acoustic Impacts</u>

Fish

Effects on fish and the distances at which behavioral effects can occur depend on the nature of the sound, the hearing ability of the fish, and species-specific behavioral responses to sound. Changes in fish behavior can, at times, reduce their catchability and thus affect fisheries. The steps involved in assessing potential impacts of noise on fish are summarized below.

1. Prediction of noise contours for sources that correspond to the types of possible acoustic effects on fish:

    a. Short-term behavioral reactions,
    b. Long-term behavioral reactions,
    c. Changes in distribution, and
    d. Physical damage.

2. The received noise levels that correspond to each of the above were determined through a literature review. The review was used to describe effects and impacts associated with each of the above.

3. The relative abundance of each species of fish (refer to Section 3.6) present within the area encompassed within each noise/effect contour derived in steps 1 and 2 above was estimated.

4. Determination of whether there is an impact within each noise/effect contour. No impact would include no effect on fish or inconsequential changes in fish behavior. If there is an impact, it is described in terms of relative numbers affected vs. total relative population on the range and severity as defined below.

    a. Significant disturbance that affects the catchability of fish,
    b. Significant changes in the distribution of fish that could affect fisheries, and
    c. Permanent physical damage.

While baseline conditions describe the relative abundance of fish as estimated from fisheries data (refer to Section 3.6), estimates of the absolute abundance of fish are not available. There are some available estimates of abundance for only two or three species for the California coast, but it is not possible to estimate what percentage of those are found in the Sea Range. Thus, impacts on fish are expressed in relative terms.

There are two types of sound sources that are of major concern to fish and fisheries: 1) strong underwater pulsed sounds and 2) long-term (weeks) operation of high energy sonars. Neither of these sounds are associated with the proposed action or the alternatives. Most Sea Range operations addressed in this analysis produce brief, transient noise rather than steady, continuous sound. The one exception to this is ship noise. These types of sound are not expected to result in significant effects on the fish themselves. However, insignificant effects on fish can nonetheless cause significant effects on the catchability of fish and, hence, on the fishery. This assessment focuses on potential impacts on fish as they relate to catchability of fish and fisheries (also refer to Section 4.10, Land Use, and Section 4.12, Socioeconomics).

Sea Turtles

Sea turtles also react to noise. Noise impacts on sea turtles are assessed based on a similar approach as that described for fish. However, information on the abundance and distribution of sea turtles in the study area is limited. Although as many as four species of sea turtles (leatherback, loggerhead, olive ridley, and eastern Pacific green) are known to occur within the Sea Range, only the leatherback and eastern Pacific green are expected to be encountered on more than an occasional basis (refer to Section 3.6). While absolute abundance estimates of sea turtles in the Sea Range are not available, data on areas of concentration, migratory and local movements, feeding ecology, surfacing/dive behavior, and depths of dives are considered in the determination of potential exposure to noise sources. Known or expected seasonal information are also considered.

B - Non-Acoustic Impacts

Non-acoustic impacts of range activities on marine fish and sea turtles are also addressed. This section considers the effects and impacts of the physical presence of ships, aircraft, and other military hardware in the area. This also will include, but not be limited to, assessment of effects of:

1. Falling debris,
2. Fuel and other chemicals,
3. Chaff,
4. Flares, and
5. Surface impacts of missiles.

4.6.1.2 Review of the Effects of Noise on Fish

A - Hearing in Fish

Fish vary widely in their ability to hear sounds, with some species having very good auditory capabilities. In many of these fish, such as the herring, the swim bladder is connected directly to the inner ear. For herring, the upper frequency limit of hearing ranges from 4,000 to 13,000 Hz (Enger 1967). The upper limit of hearing in fish without this type of connection is only about 1,000 to 1,200 Hz (Enger 1967). Herring are also relatively sensitive to sound. At 50 to 1,200 Hz, the herring hearing threshold is about 75 to 80 dB re 1 µPa (Enger 1967) (refer to Appendix D for a discussion of noise terminology). Some other fish that have no direct connection between the swim bladder and ear have other adaptations to enhance hearing. These fish, along with those having a direct connection between swim bladder and ear, have been called "hearing specialists." Although it is difficult to compare hearing capabilities in air and water, the hearing sensitivity of hearing specialists is similar to that of other vertebrates after standardization of units (Popper and Fay 1993). Salmon and cod do not have a direct connection between swim bladder and inner ear, and are less sensitive to sound than are some other species of fish (Olsen 1969; Popper and Fay 1993). Cod and other species that are not hearing specialists do not hear well at frequencies above 500 Hz. For those marine species that have been measured, their thresholds at frequencies of 1,000 Hz are on the order of 120 to 130 dB re 1 µPa.

As shown below, the lowest (best) hearing thresholds for common fish species are below 500 Hz (Fay 1988). There is great diversity in the hearing abilities of different species of fish (Popper and Fay 1993). Some of this is doubtlessly accurate, but some is attributable to differences in measurement procedures. Three audiograms are available for cod; the sound pressure levels at this species' most sensitive frequency varies by 30 dB. Atlantic salmon may not be very sensitive to sound; their best threshold is 96 dB, a high (poor) value (Table 4.6-1).

Experiments cited by Fay (1988) and others did not expose fish to very high frequency sounds. As discussed in the following section, some species do react to sounds greater than 100 KHz. Due to this diversity in hearing abilities, one cannot make comprehensive statements concerning the ability of fish to detect sounds at a particular frequency and/or received level. However, it is clear that many species of fish, including some of those occurring in the study area, can hear low-frequency sound pulses, although most will not hear high frequencies very well.

Table 4.6-1. Hearing Thresholds (in dB re 1 µPa) for Various Species of Fish

Species	Hearing at Highest Measured Frequency	Hearing Threshold at Frequency of Best Hearing
Cod	119 dB @ 400 Hz	95 dB @ 283 Hz
Cod	110 dB @ 470 Hz	75 dB @ 160 Hz
Cod	140 dB @ 600 Hz	65 dB @ 150 Hz
Pollock	107 dB @ 470 Hz	81 dB @ 160 Hz
Plaice	126 dB @ 200 Hz	97 dB @ 110 Hz
Atlantic Salmon	132 dB @ 380 Hz	96 dB @ 160 Hz
Yellowfin Tuna	120 dB @ 1,000 Hz	89 dB @ 500 Hz

Source: Fay 1988.

B - Reactions of Fish to Underwater Sounds

Underwater noise can scare some fish. Sudden changes in noise level can cause fish to dive or to avoid the sound by changing direction. Time of year, time since the fish have eaten, and the nature of the sound all may determine whether, and how, fish will react to underwater noise.

Short, sharp sounds can startle herring. In one study, fish changed direction and moved away from the source, but schooling behavior was not affected (Blaxter et al. 1981). The fish reacted to sounds of 144 dB re 1 µPa at 80 or 92 Hz. However, when the sound level was increased slowly, sounds needed to be 5 dB higher to elicit the same response.

Schwarz and Greer (1984) studied the responses of penned herring to vessel and echosounder sounds. Recorded sounds were played back from a projector just outside of a 10-by-10 foot (3-by-3 m) experimental pen. Received sound levels in the center of the pen were 105 to 111 dB re 1 µPa. Three kinds of responses were noted by Schwarz and Greer (1984). Pearson et al. (1992) conducted a controlled experiment to determine the effects of airgun noise pulses on several species of rockfish off the California coast. They used an airgun with a peak source level of 223 dB re 1 µPa. They were able to determine the magnitude of received noise levels associated with these responses:

- Avoidance response, in which the fish formed a compact school and moved slowly away from the sound source.
- During the alarm response the school aggregated tightly, fled at high speed, dove repeatedly, and quickly changed directions. This was noted at received sound levels of 177 to 180 dB for the two sensitive species, and at 186 to 199 dB for other species.
- During the startle response fish flexed their bodies powerfully and then swam at high speed for 5 to 10 seconds without changing direction. School formation was not affected. This was noted at received levels of 200 to 205 dB re 1 µPa and above for two sensitive species, but not for two other species exposed to levels up to 207 dB.
- There was an overall threshold for the above behavioral response at peak pressures of about 180 dB.
- There was an extrapolated threshold of about 161 dB for subtle changes in the behavior of rockfish.

Schwarz and Greer (1984) did not observe a startle response to any playback sounds. The sounds of large vessels or accelerating small vessels mainly caused avoidance responses among the herring. The startle response was occasionally observed in response to other stimuli. Avoidance ended within

10 seconds of the "departure" of the vessel. When sounds were of equal received level, sounds of a larger vessel (dominated by lower frequencies) elicited a stronger reaction. The herring did not react to a 28 KHz echosounder or a 165 KHz sonar. Twenty-five percent of the fish groups habituated to the sound of the large vessel and 75 percent of the responsive fish groups habituated to the sound of the small boat. Pearson et al. (1992) noted a return to pre-exposure behaviors within the 20- to 60-minute exposure period. Chapman and Hawkins (1969) also noted that fish adjust rapidly to high sound levels.

Chapman and Hawkins (1969) tested the reactions of whiting (hake) in the wild to an airgun emitting low-frequency, high-amplitude pulses with peak levels of 220 dB re 1 μPa-m. The research vessel was anchored and the school of whiting was observed with an echosounder. The airgun fired intermittently. Before the airgun was fired, the fish were at 82- to 180-foot (25- to 55-m) water depth. In response to the sound pulses, the fish dove and formed a compact layer below 180-foot (55-m) water depth. By the end of an hour of exposure to the sound pulses, the fish had habituated; they rose in the water despite the continued presence of the sound pulses. The airgun was switched off and, when it resumed firing, the fish began to descend again, the habituation seeming to have been of short duration. The behavior of the fish in diving and forming a compact layer resembles the alarm response described by Schwarz and Greer (1984). Assuming spherical spreading from the single airgun, received levels would have been 192 dB re 1 μPa at 82 feet (25 m) and 185 dB at 180 feet (55 m).

Pulsed sounds emitted for a long period of time can alter the behavior of fish such that their catchability is reduced. Most of this information was generated by experiments on the effects of seismic acoustic pulses on fish. Løkkeborg and Soldal (1993) investigated effects of seismic shooting with arrays having source levels of about 239 to 250 dB re 1 μPa-m. Trawls were made before and during shooting. Cod catches during shooting were reduced by 79 to 83 percent compared to pre-shooting levels within the exploration area and within 6 miles (9 km) of it. Turnpenny and Nedwell (1994) estimated received levels of 160 to 171 dB. Dalen and Knutsen (1986), Engås et al. (1996), and others report reduced catches in the vicinity of seismic shooting. Dalen and Knutsen showed migration of one of three species groups out of the seismic exploration area and Engås et al. showed reduced catches up to 10 NM from the seismic shooting area. In these cases, seismic shooting with airgun arrays (≈250+ dB re 1 μPa-m, 6 shots/minute) continued for several days.

C - Effects of Shock Waves from Surface Impacts

For the purposes of this analysis, it is assumed that impulses produced by intact missiles and targets hitting the water are similar to those produced by explosives. Therefore, the literature on effects of high explosives has been used to estimate impacts. This may result in some overestimation of effects, given that impulses from impacts (especially of slower objects) will differ in some respects from the impulses caused by detonation of high explosives.

Effects on Adult Fish and Sea Turtles

Shock waves can injure or kill marine animals. The damage caused by a shock wave varies greatly with the source and with the type of animal exposed to it. The shock waves produced by high explosives are more damaging than those produced by black powder or airguns. It is the very short rise time of the overpressure caused by high explosives that kill fish and other marine animals. Most blast injuries in marine animals involve damage to air- or gas-containing organs (Yelverton 1981). Marine mammals and sea turtles have lungs and many species of fish have a swim bladder, which is a gas-filled organ used to control buoyancy. Marine mammals, sea turtles, and fish with swim bladders are vulnerable to effects of explosives while fish without swim bladders and invertebrates are much more resistant (Yelverton 1981;

Young 1991). During exposure to shock waves, the swim bladder oscillates and may rupture, in turn causing hemorrhages in nearby organs. In the extreme case, the oscillating swim bladder may rupture the body wall of the fish (Yelverton 1981). After a blast, most fish that die do so within 1 to 4 hours, and almost all do so within 24 hours (Yelverton et al. 1975; Yelverton 1981).

High explosives have short rise times of about 20 microseconds, shock pulse durations of about 0.2 to 0.5 milliseconds, and a velocity of detonation of 15,000 to 30,000 feet per second (4,570 to 9,140 m per second) (Urick 1975; Parrott 1991; Demarchi et al. 1998). After the initial shock pulse, pressure falls below ambient pressure then rises to a second maximum known as the first bubble pulse. The time between the shock and the first bubble pulse is 0.17 to 0.5 seconds, depending on the size of the explosive (Demarchi et al. 1998). Broadband source levels for high explosives are on the order of 267 to 280 or more dB re 1 µPa-m (Richardson et al. 1995).

Pressure pulses from black powder and airguns have slower rise times and cause relatively little injury to fish (Hubbs and Rechnitzer 1952). Black powder deflagrations produce pulses with long rise times of about 1 millisecond, initial pulse durations of up to 6 milliseconds or more and the explosive process occurs at speeds of 0.1 to 1 feet per second (0.03 to 0.3 m per second) (Urick 1975; Parrott 1991). Single airguns produce pulses with rise times on the order of 1 millisecond, an initial positive pulse of 2 milliseconds duration, followed by a negative pulse of about 3 to 5 millisecond duration (Parrott 1991).

Large objects hitting the water produce noises with source levels on the order 240 to 271 dB re 1 µPa and pulse durations of 0.1 to 2 milliseconds, depending on the size of the object (McLennan 1997). Objects associated with Sea Range operations hit the water with velocities of 300 to 3,000 feet per second (91 to 910 m per second). An instantaneous rise time has been assumed. The pulse produced by an object hitting the water is more similar to that produced by a high explosive blast than that produced by a black powder blast or seismic source. For the purposes of this assessment, it is assumed that the pulse produced by an object hitting the water is similar to that of a high explosive blast.

For high explosive blasts, mortality of fish correlates better with impulse, measured in units of pressure·time (Pascal•seconds), than with other blast parameters (Yelverton 1981). The received impulse depends on the mass of the charge, the depth of the charge, the distance from charge to fish, and the depth of the fish. The equations of McLennan were used to estimate the magnitude and duration of the pulse, converted to Pascal•seconds, and then the dipole transmission loss equation was used to estimate impulse at distances from the source. Peak sound exposure levels were also estimated (these data are presented in Section 4.7, Marine Mammals). Yelverton's (1981) equations were used to compute impulse and ranges from the source that produce mortality and injury to fish. The impulse levels that kill or damage fish with swim bladders have been determined empirically to be as follows (from Yelverton 1981):

50 percent Mortality	$\ln(I)=3.6136 + 0.3201 \ln(M)$
1 percent Mortality	$\ln(I)=3.0158 + 0.3201 \ln(M)$
No Injuries	$\ln(I)=2.0042 + 0.3201 \ln(M)$

where I = impulse (Pascal•seconds) and M = body mass of a fish with a swim bladder (g). Yelverton (1981) cautions against using these equations for fish weighing more than a few pounds because fish used in the experiments from which these equations were derived did not weigh more than 2 pounds (1 kg). The equations apply only to fish in open water and not near the bottom.

Based on the Yelverton equations, it was estimated that small anchovy (0.2 ounces [6 g]) with a swim bladder would not be injured by impulses up to 13 Pascal•seconds, while larger fish (7.1 pounds [3.2 kg]) with swim bladders would not be injured by impulses as large as 98 Pascal•seconds. Swim-bladder fish of 0.2 ounces (6 g) and 7.1 pounds (3.2 kg) would be expected to sustain 1 percent mortality if exposed to impulses of 36 and 270 Pascal•seconds, respectively.

These kinds of equations have not been produced for sea turtles. Young (1991), based on few available data, proposed that the minimum safe distance for sea turtles might be estimated as

$$R_T = 560W_E^{1/3}$$

where safe distance R_T is in feet and the weight of explosive W_E is in pounds. In order to use this equation, it is necessary to estimate the weight of explosive that would produce impulses equivalent to an intact missile hitting the water. The computed equivalent weight of explosive is only a rough approximation and is used here only to compute a possible safe range for sea turtles. The weight of explosive that would produce an impulse equivalent to an intact AQM-37E hitting the water is 0.125 pounds (0.06 kg). The weight of explosive that would produce an impulse equivalent to an intact Vandal hitting the water is 2.6 pounds (1.18 kg). Therefore, based on the equation shown above, the minimum safe distance for sea turtles from intact missiles hitting the water would range from 280 feet (85 m) to 770 feet (335 m).

A summary matrix of fish and sea turtle impacts is presented in Table 4.6-2.

4.6.2 No Action Alternative – Current Operations

The No Action Alternative includes air-to-air, air-to-surface, surface-to-air, surface-to-surface, and subsurface-to-surface operations and FLEETEXs. All of these activities involve aircraft overflights; ship and boat movements; missile and target launches and overflights; release of chaff and flares; and release of unspent fuel and debris. Each of these common activities and releases were evaluated and then an overall evaluation of each operation was made.

4.6.2.1 Effects of Aircraft and Missile Overflights

Sound does not transmit well from air to water (refer to Appendix D). The loudest noise is that produced by a Vandal target overflight at 20 feet (6 m) altitude above mean sea level (MSL) (refer to Appendix D). Peak sound pressure at 0.5 feet below the surface is 185 dB re 1 μPa. There are about eight Vandal flights per year. Overflights of other missiles and aircraft occur at higher altitudes. Aircraft overflights at 1,000 feet (300 m) produce similar peak pressures. There are about 4,000 aircraft sorties per year, about half of which are by aircraft capable of supersonic speeds. A small percentage of flights occur at altitudes of less than 1,000 feet (300 m). Based on research conducted by Schwarz and Greer (1984) and Fay (1988), noise levels produced by these overflights are not thought to cause physical damage to fish. The sounds could trigger alarm responses in some sensitive species in the upper 60 feet (18 m) of the water column. These effects are transitory. Impacts of underwater noise generated by overflights on fish are less than significant. The short-term behavioral effects on fish due to noise generated by overflights translates into less than significant impacts on fisheries.

For the reasons described above for Territorial Waters, potential impacts on fish and fisheries from overflights of aircraft, targets, and missiles in non-Territorial Waters are less than significant.

Table 4.6-2. Fish and Sea Turtles Impact Summary Matrix

Alternative	Impact Conclusions: NEPA (On Land→ Territorial Waters)	Impact Conclusions: EO 12114 (Non-Territorial Waters)	Mitigation Measures
NO ACTION ALTERNATIVE	Ship noise and noise caused by intact missiles may result in short-term behavioral changes in fish (e.g., fish may temporarily avoid the area); less than significant impact. No significant impacts on small number of sea turtles within the ROI.	*Ship noise and noise caused by intact missiles may result in short-term behavioral changes in fish (e.g., fish may temporarily avoid the area); less than significant impact. No significant impacts on small number of sea turtles within the ROI.*	None.
MINIMUM COMPONENTS ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Ship noise and noise caused by intact missiles may result in short-term behavioral changes in fish (e.g., fish may temporarily avoid the area); less than significant impact. No significant impacts on small number of sea turtles within the ROI. Potential loss of small numbers of fish due to immediate exposure of nearshore intercept debris. No significant impacts on fish populations or fisheries.	*Ship noise and noise caused by intact missiles may result in short-term behavioral changes in fish (e.g., fish may temporarily avoid the area); less than significant impact. No significant impacts on small number of sea turtles within the ROI.*	None.
PREFERRED ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Ship noise and noise caused by intact missiles may result in short-term behavioral changes in fish (e.g., fish may temporarily avoid the area); less than significant impact. No significant impacts on small number of sea turtles within the ROI. Potential loss of small numbers of fish due to immediate exposure of nearshore intercept debris. No significant impacts on fish populations or fisheries.	*Ship noise and noise caused by intact missiles may result in short-term behavioral changes in fish (e.g., fish may temporarily avoid the area); less than significant impact. No significant impacts on small number of sea turtles within the ROI.*	None.

4.6.2.2 Effects of Ships

The reactions of fish to research vessel sounds in the field have been measured with forward-looking sonars and downward-looking echosounders. Sound produced by a ship varies with aspect and is lowest directly ahead of the ship and highest within butterfly-shaped lobes to the side of the ship (Misund et al. 1996). Because of this directivity, fish that react to ship sounds by swimming in the same direction as the ship will be guided ahead of it (Misund 1997). Fish in front of a ship that show avoidance reactions will do so at ranges of 160 to 490 feet (50 to 350 m) (Misund 1997). In other instances, fish will avoid the ship by swimming away from the path and will become relatively concentrated to the side of the ship (Misund 1997). Most schools of fish will not show avoidance if they are not in the path of the vessel. When the vessel passes over fish, some species, in some cases, show sudden escape responses that include lateral avoidance and/or downward compression of the school (Misund 1997). In some cases, fish will show no reaction. Avoidance reactions are quite variable and depend on species, life history stage, behavior, time of day, whether the fish have fed, and sound propagation characteristics of the water (Misund 1997).

Modern Naval vessels are quiet compared to older warships and commercial vessels. Cavitation is a major source of propeller noise and decreases with increasing speed. Emitting air around the propellers (Urick 1975) can reduce propeller noise. The emitted air replaces the water vapor bubbles created by cavitation so they collapse with less force. The Navy has extensive experience in using bubble screens to reduce cavitation noise (Richardson et al. 1998), and these and other noise reduction mechanisms have been a common feature of Naval vessels for some time.

Effects on fish from Sea Range vessel activity are minor, occur within less than 1,600 feet (500 m) of the ship, and involve short-term changes in behavior such as fleeing to the side of the ship or forming compact schools in deeper water or on the bottom in shallow water. Naval vessels account for only about 9 percent of the ship traffic on the Sea Range (refer to Appendix D). Impacts of noise from naval ships on fish is less than significant. The short-term behavioral effects on fish due to ship noise translates into less than significant impacts on fisheries.

For the reasons described above for Territorial Waters, potential impacts on fish and fisheries from ship activities in non-Territorial Waters are less than significant.

4.6.2.3 Ancillary Operations Systems

A - Lasers

Use of laser systems for detection and guidance commonly occurs on the Sea Range, primarily in association with missile testing activities. The eye-hazard distance for the types of laser designators and range-finders used on the Sea Range is 12-NM (22-km) (refer to Section 3.0, Current Activities). The beam is very narrow. Also, these lasers are normally directed at military objects (e.g., missiles in flight above the water surface). Hence, the probability of illuminating a fish or sea turtle is extremely low. Further, given the low numbers of sea turtles on the Sea Range, the probability of contacting a sea turtle, especially their eyes, with a laser beam is very small. Impacts of current laser operations on fish and sea turtles are less than significant.

For the reasons described above for Territorial Waters, potential impacts on fish and sea turtles from laser operations in non-Territorial Waters are less than significant.

B - Chaff

An extensive review of literature, combined with controlled experiments, revealed that chaff is relatively nontoxic and its use poses little risk to the environment or animals (U.S. Air Force 1997b; Naval Research Laboratory 1999). The materials in chaff are generally non-toxic except in quantities significantly larger than those any marine fish or sea turtles could reasonably be exposed to from their use. Particulate tests and a screening health risk assessment concluded that the concern about chaff breaking down into respirable particle sizes is not a significant issue. Experiments have shown that animals should not suffer toxic or physical effects from chaff ingestion (U.S. Air Force 1997b). Marine fish could ingest chaff fibers with water or food, or their gills could become contaminated with chaff. Such effects are likely to be short-term and unlikely to cause internal damage to marine fish. There is no published evidence that chaff exposure has caused the death of a marine fish and experiments have shown no direct effects of chaff on marine animals (U.S. Air Force 1997b; Naval Research Laboratory 1999).

Sea turtles could ingest chaff fibers with food, although such effects are likely to be short-term and unlikely to cause internal damage. Impacts of chaff on fish and sea turtles are less than significant.

For the reasons described above for Territorial Waters, potential impacts on fish and sea turtles from chaff use in non-Territorial Waters are less than significant.

C - Flares

An extensive review of literature, combined with controlled experiments, revealed that self-defense flare use poses little risk to the environment or animals (U.S. Air Force 1997b). Toxicity is not a concern with self-defense flares since the primary material in flares, magnesium, has low toxicity (U.S. Air Force 1997b), and will normally combust before striking the land or sea surface. It is unlikely that marine fish or sea turtles ingest flare material because it rapidly sinks. Given the low numbers of sea turtles on the Sea Range, the probability of a sea turtle being injured by a falling dud flare and debris is extremely remote. Although impulse cartridges and initiators used in some flares contain chromium and lead, a screening health risk assessment concluded that they do not present a significant health risk in the environment (U.S. Air Force 1997b). Sea turtles could become entangled if they attempted to ingest the parachute attached to a ship-launched illumination flare. A small parachute resembles a jellyfish that are common prey of sea turtles. However, the parachute remains attached to the flare and sinks rapidly, resulting in a very short time of availability to sea turtles. Further, only about 11 ship-launched flares are used per year. Thus, the possibility of entanglement is very remote. Impacts of flares on fish and sea turtles are less than significant.

For the reasons described above for Territorial Waters, potential impacts on fish and sea turtles from flare use in non-Territorial Waters are less than significant.

D - Effects of Debris

Solid debris such as missile and drone aircraft parts, and floating target components (e.g., styrofoam, plastic parts) may be encountered by marine fish and sea turtles in the waters of the Sea Range. The primary hazard from persistent plastics and other debris to these animals is through entanglement leading to drowning, strangulation, or flesh damage. Entanglement in man-made debris is a very common source of damage and mortality among marine animals throughout the world (Kullenberg 1994).

Entanglement in military-related gear was not cited as a source of injury or mortality for any sea turtle recorded in a large marine mammal and sea turtle stranding database for Californian waters. This likely results from the relatively low level of military debris that remains on or near the sea surface. Parachute and cable assemblies used to facilitate target recovery are collected in conjunction with the target during normal operations. Floating debris, such as styrofoam floatation material, may be lost from target boats, but is inert and either degrades over time, or washes ashore as flotsam. A few fish could become entangled and die from contact or ingestion. Because of their scarcity on the Sea Range, it is unlikely that a sea turtle would be injured by contact with, or ingestion of, the relatively small amount of this lightweight material that is dispersed over the broad area of the Sea Range.

Metal fragments from targets and missiles sink quickly to the sea bottom and likely pose no threat to fish or sea turtles. Some of these may hit fish that are near the surface. A few fish may be killed. As shown in Section 4.7.2, Marine Mammals, the probability of a piece of debris hitting an uncommon marine mammal is very low (approximately 0.00001 rare and endangered animals per year). Sea turtles are uncommon in the Sea Range so the probability of a piece of debris hitting a sea turtle is also very low. Impacts of debris on marine fish and sea turtles are predicted to be less than significant.

For the reasons described above for Territorial Waters, potential impacts of debris on fish and sea turtles in non-Territorial Waters are less than significant.

E - Effects of Missile and Target Impacts

Intact Missiles and Targets

Intact missiles and targets can impact the water with great force and produce a large impulse and loud noises. Impulses of this magnitude could injure fish below the surface. The impulses causing 50 percent mortality for fish of various sizes are shown in Table 4.6-3. The distances from impact sites within impulses that could cause 50 percent mortality are also shown in this table.

Table 4.6-3. Impulses (Pascal•seconds) Causing 50 Percent Mortality of Fish of Various Sizes (from Yelverton's 1981 formula)

	Weight	50 percent Mortality	Distance (m)				
Fish Size	kg	Pascal•seconds	Phoenix	Harpoon	AQM-37	Vandal	AltAir
Anchovy	0.006	66	65	24	18	110	150
Sardine	0.06	138	35	12	9	68	100
Medium	1	339	20	5	4	28	53
Large	23	924	8	2	2	11	20

The numbers of intact missiles and targets hitting the sea in various range areas were multiplied by the area of impact (from Table 4.6-3) and the density of fish in the area (from Section 3.6). Using this procedure, an estimated 10.7 pounds (4.9 kg) of catch are killed annually in Territorial Waters. If populations are equivalent to 10 times the catch, then about 107 pounds (49 kg) of fish are potentially killed by intact missile and target impacts in Territorial Waters per year. The loss of this amount of fish is not biologically significant and has less than significant impacts on fish populations and fisheries.

An estimated 5.7 pounds (2.6 kg) of catch are killed in non-Territorial Waters. If populations are equivalent to 10 times the catch, then about 57 pounds (26 kg) of fish are potentially killed by intact missile and target impacts in non-Territorial Waters per year. The loss of this amount of fish is not biologically significant and has less than significant impacts on fish populations and fisheries.

There are no estimates of the abundance of sea turtles on the Sea Range, but they are far less numerous than are marine mammals. Approximately 0.001 marine mammals per year could be killed by impacts of intact missiles and targets (refer to Section 4.7.2). There are about 460,000 marine mammals on the Sea Range. Thus, the probability of a sea turtle being killed is far less than that of a marine mammal being killed and impacts are less than significant.

For the reasons described above, potential intact missile and target impacts on sea turtles in non-Territorial Waters are less than significant.

Missile and Target Debris

Most missiles hit their target or are disabled before hitting the water. Thus, most of these missiles and targets hit the water as fragments which quickly dissipate their kinetic energy within a short distance. Most fish are below the surface of the water. Therefore, fewer fish are exposed to mortality from falling fragments whose effects are limited to the near-surface than mortality from intact missiles and targets whose effects can extend well below the water surface.

There are no estimates of the abundance of sea turtles on the Sea Range, but they are far less numerous than are marine mammals. There are about 460,000 marine mammals on the Sea Range. Approximately 0.001 marine mammals per year could be killed by impacts of missile and target fragments (refer to Section 4.7.2). Thus, the probability of a sea turtle being killed is far less than that of a marine mammal being killed and impacts are less than significant.

For the reasons described above, potential impacts on fish and sea turtles from missile and target debris in non-Territorial Waters are less than significant.

<u>F - Effects of Release of Other Materials</u>

About 8,322 pounds (3,775 kg) of jet fuel and 550 pounds (250 kg) of other hydrocarbons were released into waters of the Sea Range in the baseline year (refer to Section 4.13, Hazardous Materials, Hazardous Wastes, and Non-Hazardous Wastes). Due to the nature of the activities, most of these materials are released in non-Territorial Waters. Petroleum products are harmful to fish. Jet fuel is toxic to fish but vaporizes very quickly. Assuming that a target disintegrates on contact with the water, its fuel is spread over a large area and dissipates quickly. In addition, fuel spills occur at different locations and at different times. As described in the water quality analysis (refer to Section 4.4, Water Quality), resulting concentrations of potential contaminants are below saltwater criteria established for the protection of aquatic life; impacts on fish and sea turtles are less than significant.

About 2,205 pounds (1,000 kg) of missile propellants, consisting of ammonium perchlorate, hydroxyl-terminated polybutadiene, mixed amine fuel, inhibited red fuming nitric acid (an oxidizer), mixtures of boron, potassium nitrate, and powdered aluminum were released in the baseline year. As in the case of jet fuel, this material is released at different times and locations and quickly dissipates on impact.

About 1,817 pounds (824 kg) of batteries were released in the baseline year. Their chemicals include a variety of potassium hydroxide electrolyte, lithium, lithium chloride, nickel cadmium, lead, and sulfuric acid. In addition, aluminum, iron, steel, and concrete are released. Concrete, aluminum, iron, lithium, lead, and steel are chemically innocuous (harmless) at concentrations found naturally, and arising from military operations. Magnesium is abundant in seawater (average concentration 0.135 percent) and, therefore, is not of concern. Considering the area over which the missile propellants and battery fluids are spread, the quantities dilute to concentrations too low to warrant concern. The water quality analysis of all current operations found that concentrations of all constituents of concern associated with the release of materials into the Sea Range were well below water quality criteria established to protect aquatic life (refer to Section 4.4, Water Quality). Impacts on marine fish and sea turtles associated with the release of hazardous constituents and other materials are less than significant.

For the reasons described above, potential impacts on fish and sea turtles from the release of hazardous constituents and batteries in non-Territorial Waters are less than significant.

4.6.2.4 Air-to-Air Operations

Sources of underwater noise associated with air-to-air operations include support boat activity and noise generated from aircraft that passes through the air/water interface and results in underwater sounds. Some fish could temporarily change their behavior in response to these noises. However, in all cases these are short-term behavioral responses with no long-term impacts on fish populations or fisheries. Impacts of air-to-air operations on fish and sea turtles are less than significant.

Current air-to-air intercepts could affect fish and sea turtles due to missile and target debris falling into the ocean, near-surface missile detonation, and release of unspent missile fuel. As discussed previously in this section, each of these activities has the potential to injure and/or kill small numbers of fish. However, the numbers involved are so small that impacts on fish populations are not significant, and impacts on fisheries are less than significant. Likewise, because of their scarcity on the range, it is unlikely that sea turtles are injured or killed in this manner because the probability of interaction between these activities and sea turtles is very low. Impacts on sea turtles are less than significant.

4.6.2.5 Air-to-Surface Operations

Air-to-surface activities include operations that drop inert mine shapes from aircraft into nearshore waters of Becher's Bay off Santa Rosa Island. The inert mine shapes are solid pieces of concrete used for simulation exercises and do not contain hazardous constituents. However, fish could be injured or killed from the physical impact of the mine shapes. As shown above for intact missile and target impacts, potential mortality of fish is very low. Impacts of air-to-surface operations on fish, fisheries, and sea turtles are less than significant.

Potential impacts on fish or sea turtles from air-to-surface intercepts are similar to those discussed above for air-to-air operations and are less than significant.

4.6.2.6 Surface-to-Air Operations

Potential impacts on fish or sea turtles from surface-to-air operations in Territorial Waters are similar to those discussed above for air-to-air operations. Impacts of surface-to-air operations on fish, fisheries, and sea turtles are less than significant.

Potential impacts on fish or sea turtles from surface-to-air operations in non-Territorial Waters are similar to those discussed above for air-to-air operations and are less than significant.

4.6.2.7 Surface-to-Surface Operations

Potential impacts on fish or sea turtles from surface-to-surface operations in Territorial Waters are similar to those discussed above for air-to-air operations. Impacts of surface-to-surface operations on fish, fisheries, and sea turtles are less than significant.

Potential impacts on fish or sea turtles in non-Territorial Waters are similar to those discussed above for air-to-air operations and are less than significant.

4.6.2.8 Subsurface-to-Surface Operations

Potential impacts on fish or sea turtles from subsurface-to-surface operations in Territorial Waters are similar to those discussed above for air-to-air operations. Impacts of subsurface-to-surface operations on fish, fisheries, and sea turtles are less than significant.

Potential impacts on fish or sea turtles in non-Territorial Waters are similar to those discussed above for air-to-air operations and are less than significant.

4.6.2.9 Ancillary Operations Systems

Potential impacts on fish and sea turtles from the use of ancillary operations systems are limited to chaff and flare use and have been discussed above in Section 4.6.2.3. The use of ancillary operations systems have less than significant impacts on fish, fisheries, and sea turtles.

4.6.2.10 Current Fleet Exercise Training

FLEETEXs include a combination of operations and activities evaluated in Sections 4.6.2.1 to 4.6.2.9. Impacts of these combined activities on fish, fisheries, and sea turtles in Territorial Waters are less than significant.

As discussed in Sections 4.6.2.1 to 4.6.2.9, impacts of these combined activities on fish, fisheries, and sea turtles in non-Territorial Waters are less than significant.

4.6.2.11 Littoral Warfare Training

Effects on fish and sea turtles from littoral warfare training are limited to the surface craft activities associated with beach landings. Underwater noise from the boat engines could cause short-term changes in fish behavior and cause temporary displacement of sea turtles. Sea turtles are rare in the Sea Range and so there is little possibility of interaction with sea turtles. In any event, such temporary behavioral changes result in negligible impacts. Impacts on fish, fisheries, and sea turtles are less than significant.

4.6.2.12 Collective Impacts of the No Action Alternative

As discussed previously in this section, the numbers of operations involved are so small that impacts on fish populations are not significant, and impacts on fisheries are less than significant. Likewise, because of their scarcity on the range, it is unlikely that sea turtles are injured or killed because the probability of interaction between Navy activities and sea turtles is very low. For these same reasons, collective effects of the No Action Alternative are unlikely to adversely affect fish and sea turtle populations within the ROI. Therefore, collective impacts of the No Action Alternative on fish and sea turtles are less than significant.

For the reasons described above, collective impacts of the No Action Alternative on fish and sea turtles in non-Territorial Waters are less than significant.

4.6.2.13 Essential Fish Habitat

As described in Section 3.6, two EFH zones (Coastal Pelagic and Groundfish) occur within the Point Mugu Sea Range, both extending from the coastline out to 200 miles (320 km). Based on the analyses conducted for this EIS/OEIS, the No Action Alternative does not adversely affect the Coastal Pelagic EFH or the Groundfish EFH. As described in Section 4.1, Geology and Soils, Section 4.4, Water Quality, and Section 4.5, Marine Biology, the No Action Alternative does not have significant impacts on ocean bottom sediments or marine water quality. Although some hazardous constituents enter the ocean as a result of Sea Range testing and training activities, resultant saltwater concentrations of constituents of concern are below criteria established for protection of aquatic life (refer to Section 4.4, Water Quality). Activities associated with the No Action Alternative do not have adverse direct or indirect impacts on ocean waters or marine sediments necessary to fish for spawning, breeding, feeding, or growth to maturity. Further, the No Action Alternative does not reduce the quality or quantity of EFH. Since the No Action Alternative does not adversely affect EFH, potential impacts on EFH in Territorial Waters are less than significant.

For the reasons described above, potential impacts from the No Action Alternative on EFH in non-Territorial Waters are less than significant.

4.6.3 Minimum Components Alternative

This alternative includes impacts identified for the No Action Alternative since the testing, training, and facility modernization activities included in this alternative are proposed in addition to current operations.

4.6.3.1 Theater Missile Defense Element – Nearshore Intercept

Potential effects on fish and sea turtles could result from missile and target debris within nearshore areas of San Nicolas Island during nearshore intercept events. Fish could be killed during a near-surface missile detonation, impact, or release of unspent fuel. Proposed nearshore intercept activities would distribute more hazardous constituents into the water than any of the other proposed TMD components. Each nearshore intercept event would produce a very small debris pattern footprint since the intercept would occur at altitudes of less than 1,000 feet (300 m). Since dispersion time would be limited, the density of debris in the pattern would be high, and it is likely that missile and target debris would settle on the ocean bottom in the San Nicolas Island nearshore environment. The water quality analysis of potential contamination from debris associated with nearshore intercept activities concluded that resulting saltwater concentrations of constituents of concern would be below standards established for the protection of aquatic life (refer to Section 4.4, Water Quality). However, fish in the immediate environment could be exposed to short-term hazardous constituents concentrations of up to 127 µg per liter (refer to Section 4.4, Water Quality). While dilution and dispersion would further reduce the concentration of hazardous constituents, some fish in the immediate vicinity could be killed due to immediate direct exposure to toxins, particularly unspent fuel. In addition to chemical effects, nearshore missile and target debris could cause injury or mortality to a very small number of fish as it falls through the water column. However, loss of a small number of fish with each nearshore intercept event (a maximum of eight per year) would not result in biologically significant impacts on fish populations. Impacts on fish and fisheries would be less than significant.

As described in Section 4.6.2.3, the probability that a missile or debris hitting the water would affect sea turtles is extremely low. Impacts of nearshore intercept activities on sea turtles would be less than significant.

4.6.3.2 Training Element – Additional FLEETEX

An additional FLEETEX includes a combination of operations and activities evaluated in Sections 4.6.2.1 to 4.6.2.9. Impacts of an additional FLEETEX on fish, fisheries, and sea turtles in Territorial Waters would be less than significant.

An additional FLEETEX includes a combination of operations and activities evaluated in Sections 4.6.2.1 to 4.6.2.9. Impacts of an additional FLEETEX on fish, fisheries, and sea turtles in non-Territorial Waters would be less than significant.

4.6.3.3 Facility Modernization Element – Multiple-Purpose Instrumentation Sites

This activity is limited to onshore locations and would not impact marine fish or sea turtles.

4.6.3.4 Collective Impacts of the Minimum Components Alternative

As discussed previously in this section, the numbers of operations involved are so small that impacts on fish populations would not be significant, and impacts on fisheries would be less than significant. Likewise, because of their scarcity on the range, it is unlikely that sea turtles would be injured or killed because the probability of interaction between proposed activities and sea turtles is very low. For these same reasons, collective effects of the Minimum Components Alternative would be unlikely to adversely affect fish and sea turtle populations within the ROI. Therefore, collective impacts of the Minimum Components Alternative on fish and sea turtles would be less than significant.

For the reasons described above, collective impacts of the Minimum Components Alternative on fish and sea turtles in non-Territorial Waters would be less than significant.

4.6.3.5 Essential Fish Habitat

As described in Section 3.6, two EFH zones (Coastal Pelagic and Groundfish) occur within the Point Mugu Sea Range, both extending from the coastline out to 200 miles (320 km). Based on the analyses conducted for this EIS/OEIS, the Minimum Components Alternative would not adversely affect the Coastal Pelagic EFH or the Groundfish EFH. As described in Section 4.1, Geology and Soils, Section 4.4, Water Quality, and Section 4.5, Marine Biology, the Minimum Components Alternative would not have significant impacts on ocean bottom sediments or marine water quality. Although some hazardous constituents would enter the ocean as a result of Sea Range testing and training activities, resultant saltwater concentrations of constituents of concern would be below criteria established for protection of aquatic life (refer to Section 4.4, Water Quality). Activities associated with the Minimum Components Alternative would not have adverse direct or indirect impacts on ocean waters or marine sediments necessary to fish for spawning, breeding, feeding, or growth to maturity. Further, the Minimum Components Alternative would not reduce the quality or quantity of EFH. Since the Minimum Component Alternative would not adversely affect EFH, potential impacts on EFH in Territorial Waters would be less than significant.

For the reasons described above, potential impacts from the Minimum Components Alternative on EFH in non-Territorial Waters would be less than significant.

4.6.4 Preferred Alternative

This alternative includes impacts identified for the No Action Alternative since the testing, training, and facility modernization activities included in this alternative are proposed in addition to current operations.

4.6.4.1 Theater Missile Defense Element

Potential effects on fish and sea turtles could result from missile and target debris and termination of missile flights within the Sea Range during TMD testing and training activities. Fish could be killed during a near-surface missile detonation, impact, or release of toxic unspent fuel. As described for current activities (see Sections 4.6.2.1 to 4.6.2.9), impacts from these activities would have less than significant impacts on fish, fisheries, or sea turtles.

As described in Section 4.6.3.1, of the four types of TMD, proposed nearshore intercept activities would distribute more hazardous constituents into the water than any of the other proposed TMD components. Some fish in the immediate vicinity of missile debris could be killed due to direct exposure to toxins or due to the physical impact of missile and target debris. Although some fish mortality could occur during any of the proposed TMD events, the loss of a small number of fish would not result in biologically significant impacts on fish populations. Impacts on fish and fisheries would be less than significant.

As shown in Section 4.6.2.3 the probability that a missile or debris hitting the water would affect sea turtles is extremely low. Impacts of TMD operations on sea turtles would be less than significant.

For the reasons described above, potential impacts of TMD operations on fish, fisheries, and sea turtles would be less than significant.

4.6.4.2 Training Element – Fleet Exercise and Special Warfare Training

<u>A - Fleet Exercise Training</u>

Potential adverse effects on fish and sea turtles could result from missile and target debris and termination of missiles within the Sea Range resulting from an additional FLEETEX. However, these impacts have been evaluated in Sections 4.6.2.1 to 4.6.2.9 and are considered less than significant. Some fish could temporarily change their behavior in response to noise produced during ship operations during a FLEETEX (about 2 to 3 days per FLEETEX). Such temporary behavioral changes would have negligible impacts on fish and no impacts on fish populations. Impacts of an additional FLEETEX on fish, fisheries, and sea turtles would be less than significant.

For the reasons described above, potential impacts of an additional FLEETEX on fish, fisheries, and sea turtles would be less than significant.

<u>B - Special Warfare Training</u>

Impacts on fish from two additional special warfare training events per year would be limited to surface craft activities associated with beach landings. Underwater noise from the boat engines could cause short-term changes in fish and sea turtle behavior. Because sea turtles are rare throughout the Sea Range, it is unlikely that any would be disturbed by these localized and relatively infrequent events. Such temporary behavioral changes would result in negligible impacts. Impacts of special warfare training on fish, fisheries, and sea turtles would be less than significant.

4.6.4.3 Facility Modernization Element – Point Mugu and San Nicolas Island

A - NAS Point Mugu Modernization

Proposed modernization at NAS Point Mugu includes the use of two previously used launch pads located along Beach Road for missile launches from NAS Point Mugu. Use of these onshore launch pads would have no impacts on fish. Some of the missile launches from the beach location could result in booster ejection into the waters off Point Mugu. Most of the propellant in the boosters is spent during the launch; unspent fuel would be very limited in quantity and there would be no significant impacts on water quality (refer to Section 4.4). Resulting impacts on fish would be negligible and there would be no impacts on fish populations. Beach launch activities at Point Mugu are unlikely to have any impact on sea turtles since sea turtles do not use the beaches in the study area. Impacts of NAS Point Mugu modernization on fish, fisheries, and sea turtles would be less than significant.

B - San Nicolas Island Modernizations

Effects on fish and sea turtles from modernization on San Nicolas Island would be limited to the resulting operations from construction of a 50K launch site and a vertical launch system. Potential impacts would be associated with missile and target debris entering the marine waters. Potential impacts on fish and sea turtles from these types of activities were addressed previously in Section 4.6.2.3. Impacts of San Nicolas Island modernizations on fish, fisheries, and sea turtles would be less than significant.

4.6.4.4 Collective Impacts of the Preferred Alternative

As discussed previously in this section, the numbers of operations involved are so small that impacts on fish populations would not be significant, and impacts on fish and fisheries would be less than significant. Likewise, because of their scarcity on the range, it is unlikely that sea turtles would be injured or killed because the probability of interaction between proposed activities and sea turtles would be very low. For these same reasons, collective effects of the Preferred Alternative would be unlikely to adversely affect fish and sea turtle populations within the ROI. Therefore, collective impacts of the Preferred Alternative on fish and sea turtles would be less than significant.

For the reasons described above, collective impacts of the Preferred Alternative on fish and sea turtles in non-Territorial Waters would be less than significant.

4.6.4.5 Essential Fish Habitat

As described in Section 3.6, two EFH zones (Coastal Pelagic and Groundfish) occur within the Point Mugu Sea Range, both extending from the coastline out to 200 miles (320 km). Based on the analyses conducted for this EIS/OEIS, the Preferred Alternative would not adversely affect the Coastal Pelagic EFH or the Groundfish EFH. As described in Section 4.1, Geology and Soils, Section 4.4, Water Quality, and Section 4.5, Marine Biology, the Preferred Alternative would not have significant impacts on ocean bottom sediments or marine water quality. Although some hazardous constituents would enter the ocean as a result of Sea Range testing and training activities, resultant saltwater concentrations of constituents of concern would be below criteria established for protection of aquatic life (refer to Section 4.4, Water Quality). Activities associated with the Preferred Alternative would not have adverse direct or indirect impacts on ocean waters or marine sediments necessary to fish for spawning, breeding, feeding, or growth to maturity. Further, the Preferred Alternative would not reduce the quality or quantity of EFH. Since the Preferred Alternative would not adversely affect EFH, potential impacts on EFH in Territorial Waters would be less than significant.

For the reasons described above, potential impacts from the Preferred Alternative on EFH in non-Territorial Waters would be less than significant.

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4.7 MARINE MAMMALS

This section summarizes the potential impacts on marine mammals of current and proposed Sea Range operations. Section 4.7.1 focuses on the approach used to assess impacts on marine mammals, including a short review of potential effects of phenomena common to many test and training operations on the Sea Range. These common phenomena include exposure to impulsive noise, aircraft overflights, vessel traffic, missiles or debris striking the water's surface, and other debris-related issues such as entanglement and release of hazardous constituents. Section, 4.7.2, No Action Alternative, evaluates the impacts of current Sea Range operations. Sections 4.7.3, Minimum Components Alternative, and 4.7.4, Preferred Alternative, then evaluate the impacts of current operations in addition to the operations envisaged under those two alternatives, relying on Sections 4.7.1 and 4.7.2 for documentation of the impacts of current Sea Range activities included within those alternatives.

This section summarizes information from the *Marine Mammal Technical Report* (NAWCWPNS Point Mugu 1998e), which was prepared in support of this EIS/OEIS and is incorporated by reference in accordance with CEQ regulations (refer to Section 4.0). The Technical Report contains the detailed rationale and analysis on which this chapter is based. It also includes a detailed account of the marine mammals occurring on the Sea Range, expanding on the summary of that topic contained in Section 3.7 of this EIS/OEIS. The Technical Report is organized in a sequence very similar to Sections 3.7 and 4.7 of the EIS/OEIS. The Technical Report includes a more comprehensive review of relevant literature and issues, and more detailed descriptions of the analyses on which the impact predictions are based.

4.7.1 Approach to Analysis

As defined in the Marine Mammal Protection Act (MMPA 1972, as amended 1994 – 16 U.S.C. § 1431 et seq.), the term "take" means "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal." Under the 1994 MMPA amendments, Congress defined and divided the term "harassment" to mean "any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A Harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B Harassment]." Compliance with the MMPA is addressed separately in Section 4.7.6.

For the purposes of this EIS/OEIS, the primary factor considered when determining the significance of impacts is their potential to have substantial long-term biological consequences to marine mammal populations. Minor and temporary behavioral responses with no likely consequences for the well-being of individual marine mammals (e.g., minor startle or alert reactions) are not considered to be biologically significant. Although there may in some cases be adverse impacts on individual marine mammals, these may not result in significant impacts to marine mammal populations. For example, if Navy activities on the Sea Range were to elicit stampedes into the water by pinnipeds hauled out on beaches, the possibility exists for injury or death of a small number of animals, especially pups. Although some individuals might be adversely affected, there would be no substantial or long-term consequences for the population provided that the numbers affected were small and did not involve endangered or threatened species. Further, there are no documented cases of injury or death to pinnipeds on the Sea Range as a result of stampedes triggered by military activities.

Another factor considered in determining the significance of impacts is to assess their potential to result in a reduction in the population size of any federally listed threatened or endangered marine mammal species. In such cases, adverse impacts on individuals are considered potentially significant.

4.7.1.1 Acoustic and Non-Acoustic Effects

Potential effects of Navy activities on marine mammals include acoustic and non-acoustic effects. Possible acoustic effects include behavioral disturbance (including displacement), acoustic masking, and (with very strong sounds) temporary or permanent hearing impairment. Injury by the shock wave resulting from a large, fast-moving object hitting the water surface could be considered either an acoustic or non-acoustic effect. Possible non-acoustic effects would include physical injury by falling debris, entanglement in debris, injury from Close-In Weapon System (CIWS) rounds, contact with hazardous constituents, ingestion of debris or hazardous constituents, and collisions with ships.

Possible Types of Acoustic Effects

Anthropogenic (man-made) sounds are known or suspected to have the following types of effects on marine mammals, depending on species, type of sound, proximity, duration of exposure, and other circumstances.

Disturbance: Disturbance responses can range from subtle changes in behavior detectable only through statistical analysis of quantitative behavioral data through brief alert or startle responses to short- or long-duration interruption of previous activities, with or without displacement. Disturbance responses often change upon repeated exposure to human activities. Behavioral habituation is the gradual waning of behavioral responsiveness if the animal learns that a repeated or ongoing stimulus lacks adverse consequences for the animal. Habituation is common among cetaceans and especially pinnipeds exposed repeatedly to noisy activities that are not associated with any negative consequences to the animals (reviewed in Richardson et al. 1995a, pp. 317-321). Partial or perhaps complete habituation of disturbance responses has probably occurred in some situations on the Sea Range.

Disturbance often occurs without leading to significant impacts if the latter are defined as impacts involving long-term consequences to individuals or stocks. Occasional alert responses or short-term avoidance reactions to human activities may not have adverse effects on individual marine mammals or their populations. Alert and short-term avoidance reactions are common responses to some natural phenomena such as predators as well as to some human activities. Marine mammals tolerate some interruptions of normal activities and some episodes of avoidance in response to natural or man-made disturbance.

However, disturbance reactions may have adverse effects on individuals if triggered frequently, or if the disturbance could lead to injury, death, or permanent separation of dependent pups from their mothers. For example, low-altitude overflights of pinnipeds on haul-out sites sometimes cause animals to stampede into the water. At the least, this is a temporary disruption of normal behavior. More seriously, aircraft-induced stampedes sometimes injure or kill some pinniped pups (Johnson 1977; Richardson et al. 1995a). However, injuries or deaths during aircraft-induced stampedes have not been reported on the Point Mugu Sea Range. Disturbance could also be significant if it leads to disruption of biologically important activities like feeding, breeding, or nursing the young to the extent that there is a reduction in population size.

Acoustic Masking: Marine mammals are adapted to cope with momentary masking by natural environmental sounds, such as thunder, and with extended periods of elevated natural noise, such as occur during storms. Brief transient sounds, such as those from aircraft overflights, are the most common types of strong man-made sounds received by marine mammals on the Sea Range. Most individual marine mammals are exposed to these very infrequently. Infrequent and brief cases of masking by man-made sound are not expected to have any significant consequences for marine mammals.

Consideration would need to be given to masking if there were any sources of man-made sound to which mammals on the Sea Range might be exposed for extended periods. However, there are very few such sources. The most notable would be ship noise from FLEETEXs. However, during a FLEETEX, high levels of continuous noise are limited to times when the ships are underway at high or at least moderate speed. In these cases the ships remain in any one area for only short periods of time and the resultant masking is not a concern. The issue of ship noise is addressed in more detail in Chapter 5, Cumulative Impacts.

Hearing Impairment: The possibility of hearing impairment should be considered in the case of sources of strong sound (e.g., low-altitude overflights by supersonic targets, which cause sonic booms). The lowest Sound Exposure Levels (defined in Appendix D, Overview of Airborne and Underwater Acoustics) at which Temporary Threshold Shift (TTS) is expected to become evident are discussed below for pinnipeds on land and in the water, and for toothed and baleen whales in the water. TTS is the mildest form of hearing impairment. For sound exposures at or somewhat above the TTS threshold, hearing sensitivity recovers rapidly after exposure to the noise ends. At least in terrestrial mammals, the received sound level from a single noise exposure must be far above the TTS threshold for there to be any risk of Permanent Threshold Shift (PTS), i.e., permanent hearing damage (Kryter 1985; Richardson et al. 1995a). Relationships between TTS and PTS thresholds have not been studied in marine mammals but are assumed to be similar to those in humans and other terrestrial mammals.

Impacts of missiles or targets with the ocean's surface produce shock waves (McLennan 1997) that, in rare circumstances, may be strong enough to injure or kill nearby marine mammals. The occurrence of shock waves strong enough to cause injury is not, strictly speaking, an acoustic phenomenon. However, those impacts would also produce a strong noise pulse that would propagate to longer distances (see Section 4.7.1.3-A). Hearing impairment in the form of TTS could extend out to distances beyond those where shock waves from a surface impact could injure non-auditory as well as auditory organs.

<u>Zones of Acoustic Influence</u>

To evaluate the potential effects of noise on marine mammals, it is conceptually useful to define zones or radii within which various effects are expected (Figure 4.7-1). The three zones considered in this EIS/OEIS are the zones of physical damage, responsiveness, and audibility (Richardson et al. 1995a). Not considered in this analysis is the "zone of masking," which is generally not relevant to activities on the Sea Range because of the transitory nature of most noise exposures on the Sea Range.

"Zone of Physical Damage": The smallest zone is the "zone of physical damage," including (in theory) death, injury, or permanent hearing loss. This zone is comparatively small because received levels of sound (or shock waves) must be very high to cause physical damage, and received levels generally diminish with increasing distance from the noise source. The zone of physical damage is an area where adverse impacts to individuals could occur if marine mammals were present and exposed to the high-level sounds.

"Zone of Responsiveness": This larger zone includes the area where animals respond behaviorally to the stimulus. As noted above, behavioral responses are often limited to subtle changes in behavior that are not immediately apparent to an observer (e.g., slight changes in breathing rates) or to brief alert or startle responses with no biological consequences to the animals. Other types of disturbance with potentially greater significance to marine mammals include interruptions of previous activities such as cessation of feeding or breeding behavior, and short- or especially long-term displacement. These latter types of effects might have negative consequences for the well-being of some individual mammals and their populations.

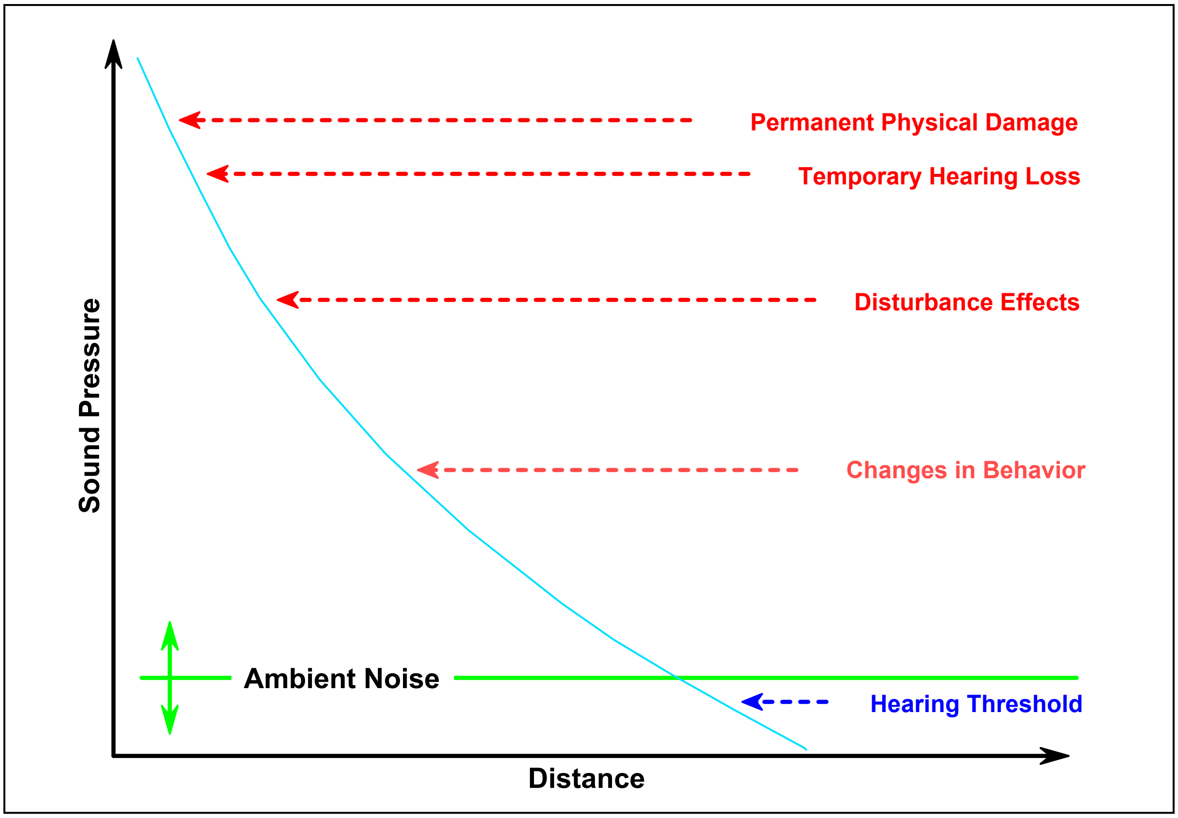


Figure 4.7-1
Potential Zones of Influence Around a Source of Strong Sound.
Note that received levels of most sounds are not sufficiently strong to cause permanent physical damage or temporary hearing loss at distances from the sound source where marine mammals are likely to occur.

"Zone of Audibility": The zone of audibility is the area within which the sound is detectable by the animal. This zone is usually (if not always) larger than the zone of responsiveness and is much larger than the zone of physical damage. This zone is generally larger than the zone of responsiveness because the sound levels necessary to elicit overt disturbance reactions are usually higher than the minimum detectable sound level (Figure 4.7-1). Simple detection of a man-made sound does not always elicit an overt disturbance reaction and does not result in an adverse effect unless it is strong enough to cause physical injury or a disturbance reaction with biological consequences.

Significance of Acoustic and Non-Acoustic Effects

Most activities conducted by the Navy on the Point Mugu Sea Range are transient from the perspective of a specific animal, with the potential source of disturbance at a given location lasting for no more than a few seconds, and in some cases for less than a second. This would remain so under the "Minimum Components" and "Preferred" alternatives. Also, as described in later sections, the frequencies and distributions of most military activities on the Sea Range are such that any given animal is or would be exposed to strong noise transients only infrequently.

A few of the activities conducted by the Navy may result in prolonged exposure to sounds (i.e., for more than a few seconds). Frequent exposure to transient sounds would fall into a similar category. Strong and/or prolonged disturbance is considered to have potentially adverse effects on individual animals. In rare cases these adverse effects could be significant to marine mammal populations if they could result in reductions in their populations. More specifically,

- Displacement of pinnipeds from beaches ("stampedes") could have adverse effects as it involves strong disturbance with the potential for injury of pups and separation of mothers from their pups.

- For mammals at sea, exposure to prolonged activities is considered to have potentially adverse effects on individuals and potentially significant impacts on populations if the activities exclude the mammals from important areas, such as feeding, breeding, or nursing areas, for a period of days or longer. Temporary displacement for less than one or two days is considered to be less than significant provided there is no potential for injury, pup separation, or TTS, and provided that these incidents are infrequent for any one marine mammal.

- Exposure to brief transient sounds such as those from aircraft flyovers often causes alert or startle reactions without any extended interruption of prior activities. Brief alert or startle responses are not considered to have adverse effects unless they are accompanied by other indicators of more severe disturbance.

- Cases in which the received level of transient sound is high enough to cause TTS are considered to have adverse impacts on the individuals involved and may be potentially significant to their populations, depending on the severity of the TTS and the status of the animals involved:

  - Single or infrequent cases of mild TTS do not cause permanent hearing impairment, and are not likely to have adverse effects.

  - If threatened or endangered species are involved, even a single exposure to mild TTS might be considered significant.

  - Frequent exposure of the same individuals to transient sounds strong enough to cause TTS might be significant, but the analysis summarized later in this section indicates that this does not occur on the Sea Range.

Based on the general principles outlined above, Table 4.7-1 shows the received levels of transient and prolonged sounds at which potentially significant disturbance reactions may begin to occur in pinnipeds, toothed whales, and baleen whales. For pinnipeds, separate criteria are listed for in-air sounds and in-water sounds. Following convention, in-air and underwater levels are quoted in decibels with respect to 20 microPascals (20 µPa) and 1 µPa, respectively. For transient sounds, the levels are converted to a Sound Exposure Level (SEL) basis. The SEL approach standardizes to an assumed duration of 1 second.

The following subsections provide additional rationale for each of the criteria listed in Table 4.7-1. More detailed rationale and literature review are included in the *Marine Mammal Technical Report* (NAWCWPNS Point Mugu 1998e). Information arising from observations on the Sea Range is mentioned here as well as in later sections dealing with specific impact predictions for the alternatives.

Table 4.7-1. Assumed Sound Pressure Criteria for Disturbance and Temporary Threshold Shift (TTS) in Pinnipeds and Cetaceans. In-air criteria are in dB re 20 microPascals; underwater criteria are in dB re 1 microPascal.

Criteria	Pinnipeds	Toothed Whales	Baleen Whales
Disturbance from Prolonged Sounds in Air (dB re 20 µPa)[a]	100[b]	N/A	N/A
Disturbance from Prolonged Sounds in Water (dB re 1 µPa)[a]	140[c]	140 (120 for sperm whales)[c]	120[c]
TTS from Transient Sounds in Air (dB re 20 µPa SEL)	145 for harbor seals & California sea lions[d]; 165 for northern elephant seals[d]	N/A	N/A
TTS from Transient Sounds in Water (dB re 1 µPa SEL)	190[d]	190 [d]	180[d]

[a] For the purposes of this EIS/OEIS, prolonged sounds are considered "more than a few seconds."
[b] Based on a review of published and reported behavioral responses to anthropogenic sound by pinnipeds hauled out in the Sea Range, as reviewed in the *Marine Mammal Technical Report*.
[c] Based on a review of published and reported behavioral responses to anthropogenic sounds, many of which are described in Richardson et al. (1995a).
[d] Based on published threshold values for TTS in one toothed whale species and speculative inference from in-air human TTS values (Kryter 1985; Richardson et al. 1995a; Ridgway et al. 1997), plus criteria in NMFS (1995).

<u>A - Pinnipeds on Land</u>

Transient Activities

In the absence of specific TTS data for pinnipeds in air, 145 dB re 20 µPa A-SEL is assumed to be the lowest level of transient sound that might cause TTS in harbor seals and California sea lions hauled out on land. For elephant seals, which have less-sensitive aerial hearing (Kastak and Schusterman 1998), a received level of 165 dB re 20 µPa A-SEL is assumed to be appropriate. These assumed TTS thresholds for single transient sounds are 120 dB above the absolute hearing thresholds at the frequencies where these species hear best. This approach is based on methods used to derive human TTS thresholds for transient sounds (Kryter 1985). For additional details on pinniped hearing, see Section 4.7.1.2-A (below) and the *Marine Mammal Technical Report*.

Prolonged Activities

For prolonged activities, a sound pressure level criterion of 100 dB re 20 µPa is considered appropriate as a disturbance criterion for pinnipeds hauled out within the Sea Range (Table 4.7-1). Stampedes of pinnipeds into the water rarely occur when received sound levels are less than 100 dB re 20 µPa. Stampedes occur during only a minority of exposures to 100 dB or more. Some animals (e.g., habituated animals) tolerate much higher sound levels without reacting strongly. In general, there is much variability, with some pinnipeds tolerating high levels of sound and others reacting to lower levels (see the *Marine Mammal Technical Report*).

B - Pinnipeds in the Water

Transient Activities

For pinnipeds in water, transient events are considered to have potentially adverse effects on individuals if TTS is expected. Transient events could cause significant effects depending on the severity of the TTS and the status of the animals involved (see above). Momentary alert or startle reactions in response to a single transient sound are not considered to have adverse effects. TTS thresholds for pinnipeds in water have not been published. However, for seismic surveys, NMFS (1995) concluded that there would be no hearing damage or TTS to pinnipeds in the water if the received level of seismic pulses did not exceed 190 dB re 1 µPa. This criterion has been used in several recent seismic monitoring and mitigation programs (e.g., NMFS 1995, 1997).

Many of the strongest underwater sounds produced by Navy activities are impulsive or otherwise brief transients as received by an individual animal. Aircraft, targets, and missiles produce sound for an extended period, but the period during which a given animal may be exposed to strong sounds from an aircraft, target, or missile flying over at low altitude is no more than a few seconds long. The duration of strong sound exposure is much less than 1 second for some of the strongest sounds like low-altitude sonic booms or missile impacts with the surface. Effects of brief transients on pinnipeds would be no greater than the effects of seismic pulses with similar received levels, and possibly less given the repeated nature of seismic pulses. Adverse effects on individuals and, in rare cases, potentially significant impacts on populations are assumed when underwater received levels of impulsive and transient sounds near pinnipeds exceed 190 dB re 1 µPa on an SEL basis.

Prolonged Activities

For pinnipeds in the water, prolonged activities would be considered to have a significant impact if there is a potential for the activities to exclude animals from important areas, such as feeding areas, for long periods of time. Temporary displacement (i.e., for a period of less than one to two days) is considered less than significant. The literature on pinniped reactions to prolonged exposure to underwater sounds indicates that pinnipeds generally tolerate exposure to high sound levels, especially when the animals are motivated to remain in the area to feed (Richardson et al. 1995a). There is no general consensus on an appropriate response criterion for this situation. However, based on the literature reviewed in Richardson et al. (1995a), it is apparent that pinnipeds exposed to prolonged or repeated underwater sounds are not likely to be displaced unless the overall received level is at least 140 dB re 1 µPa.

C - Toothed Whales in the Water

Transient Activities

For toothed whales (odontocetes) in water, transient events would be considered to have adverse effects on individuals if TTS is expected. They may be potentially significant to populations depending on the severity of the TTS and the status of the animals involved (see above). Momentary alert or startle reactions in response to a single transient sound are not considered to have adverse effects. For seismic surveys, NMFS (1995) concluded that there would be no hearing damage or TTS to toothed whales in the water if the received level of seismic pulses did not exceed 190 dB re 1 µPa. Also, Ridgway et al. (1997) found that the TTS threshold of the bottlenose dolphin is about 190 dB re 1 µPa for a 1-second sound pulse across a wide range of frequencies. Many of the sounds produced by Navy activities are impulsive or otherwise brief transients, as noted above for pinnipeds in the water. Effects on toothed whales are likely to be no greater than the effects of seismic pulses or the 1-second pulses of Ridgway et al. (1997). Adverse effects on individuals and, in rare cases, potentially significant impacts on populations are assumed when underwater received levels of impulsive and transient sounds near toothed whales exceed 190 dB re 1 µPa on an SEL basis.

Prolonged Activities

It is assumed that toothed whales exposed to prolonged sounds at received levels of 140 dB re 1 µPa or above may show avoidance. The rationale for this 140-dB criterion is the same as for pinnipeds in the water exposed to prolonged sounds (see above). There is no general consensus on an appropriate response criterion for this situation. However, based on the literature reviewed in Richardson et al. (1995a), it is apparent that most small and medium-sized toothed whales exposed to prolonged or repeated underwater sounds are unlikely to be displaced unless the overall received level is at least 140 dB re 1 µPa.

The limited available data indicate that the sperm whale is sometimes more responsive than other toothed whales. A 120 dB re 1 µPa criterion of disturbance by prolonged or repeated underwater sounds may be an appropriate conservative criterion for the sperm whale, as for baleen whales (see below).

Displacement of a small number of individuals for periods of a few days is considered to have adverse effects on individual whales. Longer-term displacement (i.e., for more than a few days), displacement of large numbers of individuals, or displacement of endangered species are considered to result in potentially significant impacts to populations.

<u>D - Baleen Whales in the Water</u>

Transient Activities

For transient events, NMFS (1995) concluded that there would be no effect on hearing sensitivity in baleen whales (mysticetes) if received levels of sound pulses do not exceed 180 dB re 1 µPa. This is an assumed value as there are no specific data on TTS or auditory thresholds in baleen whales. Momentary alert or startle reactions in response to a single transient sound are not considered to have an adverse effect. NMFS often assumes a disturbance threshold of 160 dB 1 µPa for baleen whales exposed to repeated transient pulses, e.g., from seismic exploration (e.g., NMFS 1997). However, most exposures of baleen whales on the Sea Range to transient sounds involve single transients, for which this EIS/OEIS and the associated *Marine Mammal Technical Report* consider the assumed 180 dB TTS criterion to be more appropriate. Adverse effects are assumed when underwater received levels of impulsive and transient sounds near baleen whales exceed 180 dB re 1 µPa on an SEL basis. These effects could be significant if they involve repeated exposure of some individuals, large numbers of individuals, or endangered species.

Prolonged Activities

Baleen whales exposed to steady sounds of 120 dB re 1 µPa sometimes (but not always) exhibit displacement (Malme et al. 1984; Richardson et al. 1995a). For the purposes of this EIS/OEIS, it is assumed that adverse effects may sometimes occur when underwater received levels of continuous or prolonged sounds near baleen whales exceed 120 dB re 1 µPa. It should be noted that the apparent avoidance threshold for gray whales exposed to repeated pulses of seismic sound was much higher, near 156 dB re 1 µPa SEL. Thus, the 120-dB criterion may be very conservative if applied to repeated transient sounds or to sounds that barely qualify as "prolonged" under the definition used in this analysis (i.e., several seconds in duration).

4.7.1.2 Effects of Noise on Marine Mammals

Marine mammals rely heavily on the use of underwater sounds to communicate and to gain information about their surroundings. Thus, it can be assumed that they also hear many anthropogenic sounds. There is concern about potential negative effects caused by the introduction of man-made noise into the marine environment. The reactions of marine animals to underwater noise can be variable and depend on the characteristics of the noise, the species involved, and the activity of the animal at the time of disturbance. Because underwater noise sometimes propagates for long distances, the radius of audibility can be large for strong noises. However, marine mammals usually do not react overtly to audible, but weak, anthropogenic sounds (Richardson et al. 1995a). Thus, the radius of responsiveness is usually much smaller than the radius of audibility (see Figure 4.7-1).

The sea is a naturally noisy environment (Urick 1983). The ability of marine mammals to detect and react to a man-made noise depends on the background or ambient noise level. Natural ambient noise often is related to sea state. Ambient noise tends to increase with increasing wind speed and wave height. In many areas, including southern California, shipping is a major contributor to ambient noise. Increases in ship traffic (and thus the shipping noise contribution to ambient noise) reduce the distances to which other man-made sounds can be detected by marine mammals. At closer distances, increases in ambient noise reduce the prominence (signal-to-ambient ratio) of the man-made sounds.

A - Hearing in Marine Mammals

Marine mammal hearing has been reviewed by several authors, notably Popper (1980a, b), Fobes and Smock (1981), Schusterman (1981a), Ridgway (1983), Watkins and Wartzok (1985), Johnson (1986), Nachtigall (1986), Moore and Schusterman (1987), Au (1993), and Richardson et al. (1995a).

Hearing in Pinnipeds

Pinnipeds, in comparison with toothed whales, tend to have a lower "best frequency," poorer sensitivity at the best frequency, and a lower "high-frequency cutoff." (The "best frequency" is the frequency at which hearing sensitivity is highest; the "high-frequency cutoff" is the frequency above which hearing sensitivity deteriorates very rapidly.) However, underwater hearing sensitivity at low frequencies such as 100 Hz is better in phocid seals (hair seals or true seals) than in toothed whales or otariids (eared seals). In-air hearing of phocid seals is less sensitive than underwater hearing, and the upper frequency limit is lower. Otariid seals are similar to phocid seals with regard to underwater hearing sensitivity at moderate frequencies. In air, otariids apparently have slightly greater sensitivity and a higher high-frequency cutoff than do phocids. The relative sensitivities of aerial and underwater hearing are difficult to compare, but otariids and especially phocids are found to be more sensitive to sounds in water than in air. Elephant seals have lower aerial hearing sensitivity than harbor seals or California sea lions, but better underwater sensitivity than the other species, at least at low frequencies (Kastak and Schusterman 1998; *Marine Mammal Technical Report*).

Background ambient noise often interferes with the ability of a pinniped (or other marine mammal) to detect a sound signal even when that signal is above the absolute hearing threshold. With short signals, such as sonic booms and some of the other brief impulsive sounds to which marine mammals might be exposed on the Sea Range, auditory threshold increases (i.e., deteriorates) as pulse duration decreases below about 0.1-0.2 seconds.

Toothed Whale Hearing

Hearing abilities of some toothed whales have been studied in detail (reviewed in chapter 8 of Richardson et al. 1995a). Underwater hearing sensitivity of several species has been determined as a function of frequency. In most of these tests, hearing sensitivity was determined only for frequencies above 1 kHz. However, for two species, the bottlenose dolphin and beluga whale (*Delphinapterus leucas*), hearing sensitivity has been extensively studied at low as well as moderate and high frequencies (Figure 4.7-2). In addition, some low-frequency audiometric data have been obtained recently for the Pacific white-sided dolphin (Tremel et al. 1998; see Figure 4.7-2) and for the Risso's dolphin and the false killer whale (Au et al. 1997).

The small- to moderate-sized toothed whales whose hearing has been studied have relatively poor hearing sensitivity at frequencies below 1 kHz, but extremely good sensitivity at and above several kHz. There are no specific data on the absolute hearing thresholds of the large, deep-diving toothed whales, such as the sperm whale.

The audiograms shown in Figure 4.7-2 refer to detection of pure tones of relatively long duration (0.2 second or more). For impulsive sounds less than 0.1-0.2 seconds in duration, detection thresholds of toothed whales are higher (Johnson 1968, 1991).

Baleen Whale Hearing

There is no direct information about the hearing abilities of baleen whales. Baleen whale calls are predominantly at low frequencies, mainly below 1 kHz (Richardson et al. 1995a), and their hearing is presumably good at corresponding frequencies. The anatomy of the baleen whale inner ear seems to be well adapted for detection of low frequency sounds (Ketten 1991, 1992, 1994). Thus, the auditory system of baleen whales is almost certainly more sensitive to low-frequency sounds than is the auditory system of the small- to moderate-sized toothed whales. However, auditory sensitivity in at least some species extends up to higher frequencies than the maximum frequency of the calls, and relative auditory sensitivity at different low-moderate frequencies is unknown. Baleen whales are known to detect the low-frequency sound pulses emitted by airguns and have been observed reacting to sounds at 3.5 kHz when received levels were 80-90 dB re 1 µPa (Todd et al. 1992). They also react to pingers at frequencies of 15 Hz to 28 kHz but not to higher frequencies (36 to 60 kHz) generated by pingers and sonars (Watkins 1986).

Sea Otter Hearing

There is no published information on sea otter hearing capabilities. As an indirect indication, most of the energy in the in-air calls of mothers and pups is at 3-5 kHz, but there are higher harmonics (Sandegren et al. 1973). Characteristics of underwater calls of sea otters have not been reported.

<u>B - Effects of Noise on Pinnipeds on Land</u>

Many researchers have described behavioral reactions of pinnipeds to human presence, boats, and aircraft. Although most of these data are anecdotal, they provide useful information about situations in which some species react strongly, react weakly or inconsistently, or do not react at all. No specific data on received sound levels are available for most of these incidents, but some reports mention the distances from sources where reactions were or were not found.

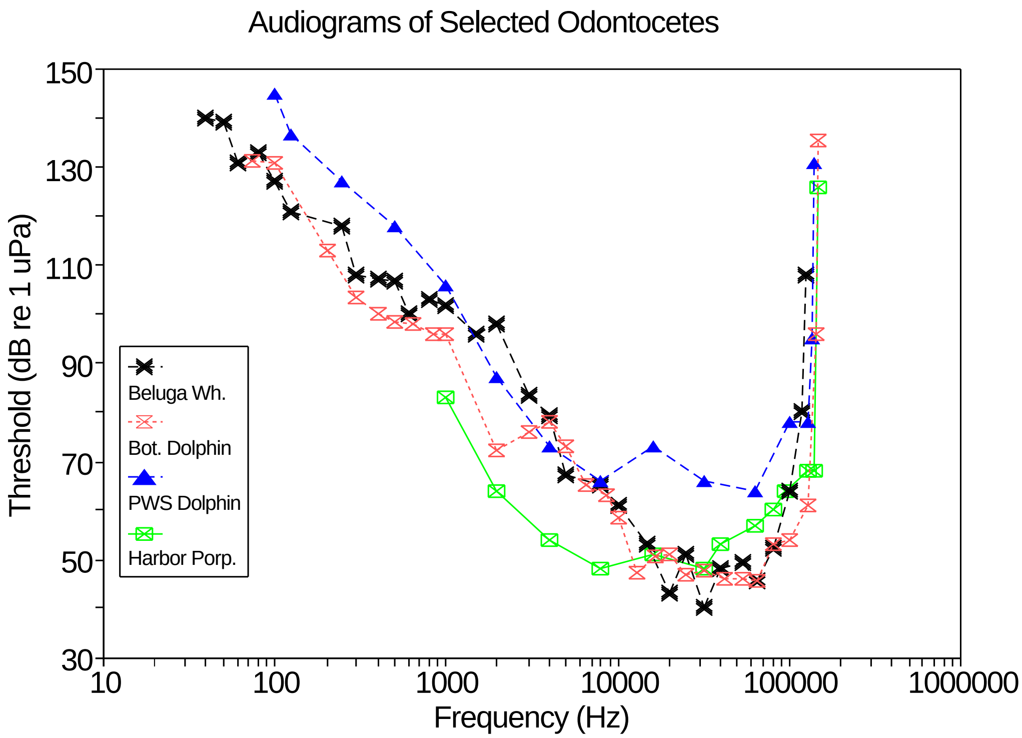


Figure 4.7-2
Underwater Audiograms of Selected Toothed Whale Species, Showing the Minimum Detectable Sound Level for Tonal Sounds at Various Frequencies.
Adapted from Richardson et al. (1995a) based on

- **bottlenose dolphin data of Johnson (1967),**
- **beluga data (averaged) of White et al. (1978), Awbry et al. (1988), Johnson et al. (1989),**
- **Pacific white-sided dolphin data of Tremel et al. (1998),**
- **harbor porpoise data of Andersen (1970).**

Almost all data on disturbance reactions of pinnipeds (and other marine mammals as well) have concerned short-term behavioral reactions. These studies often determined distances or received sound levels at which animals first reacted noticeably. In pinnipeds, recognized reactions usually involved cessation of resting or social interaction, and onset of alertness or avoidance. Observed avoidance reactions commonly involved movement from haul-out sites to water. Various other changes in behavior have also been attributed to disturbance. In most studies, little or no information has been obtained about the duration of altered behavior after disturbance.

Rarely is the significance of short-term behavioral responses to the long-term well-being of individuals and populations known. Most brief interruptions of normal behavior are likely to have little effect on overall energy balance and reproductive performance. However, physiological reactions may occur even if no overt behavioral response is evident (e.g., Chappell 1980; MacArthur et al. 1979, 1982). Uncertainties about physiological, long-term, and population consequences are common not only for pinnipeds, but for all types of marine mammals and all sources of disturbance.

In many cases, it is uncertain whether observed reactions of pinnipeds to noisy human activities were attributable to noise or to other stimuli. For pinnipeds within the Sea Range, most data concern reactions of hauled-out animals to airborne sounds. Comparing pinniped responses to anthropogenic sounds in the Sea Range vs. other localities may be of dubious legitimacy. There is evidence that pinnipeds in the Sea Range, and elsewhere, usually exhibit some degree of habituation to human activities to which they are familiar.

Reactions to Impulsive Noise

Pinnipeds seem quite tolerant of noise pulses from sonic booms, although reactions sometimes occur. The responses vary according to the season and age structure of the haul-out group. Focused sonic booms from Titan IV rockets may reach 10 to 18 pounds per square foot (480 to 860 Newtons/m^2), although actual measurements suggested that the levels received downrange of the South Vandenberg Air Force Base by pinnipeds were 8.4 to 9.5 pounds per square foot (400 to 450 Newtons/m^2). For longer-duration sounds, sound pressure levels for a Titan IV rocket launch as measured at Rocky Point (12.7 miles [20.4 km] away from the launch pad) were only 96.2 dB re 20 µPa – equivalent to a freight train passing at 50 feet (15 m). Prolonged or repeated sonic booms, very strong sonic booms, or sonic booms accompanying a visual stimulus such as a passing aircraft are most likely to stimulate seals to leave a haul-out area.

Pinnipeds may be startled when first exposed to small explosions or larger muffled blasts. An acoustic stimulus with sudden onset (such as a sonic boom or gunshot) may be analogous to a looming visual stimulus (Hayes and Saif 1967), which can be especially effective in eliciting flight or other responses (Berrens et al. 1988). However, pinnipeds appear to become quite tolerant of noise pulses from both explosive and non-explosive sources, even though close exposure to blasts and other sources of strong impulses might cause hearing damage or other injuries (Richardson et al. 1995a).

Aircraft Overflights

Pinnipeds hauled out on land often react to the airborne sound and/or sight of aircraft by becoming alert and, less often, by rushing or stampeding into the water. If they react, reactions tend to be strongest if the aircraft is flying low, passes nearly overhead, causes abrupt changes in sound, or causes a sonic boom. Helicopters may be more disturbing than fixed-wing aircraft, but the lack of data on sound exposure levels makes this difficult to evaluate.

Pinniped startle or flight reactions to airborne noise often habituate (i.e., become less pronounced upon repeated exposure). Habituation occurs at different rates for different species, different populations, and different groups within a population as a function of age, sex, and time of day (Schusterman and Moore 1980). Pinnipeds hauling out at various places on or near the Sea Range often show little reaction to aircraft. For example, harbor seals that haul out near the entrance to Mugu Lagoon are apparently habituated to the aircraft and helicopters that frequently fly overhead or nearby. However, on at least one occasion California sea lions (but not elephant seals) at San Nicolas Island were observed to stampede into the water upon exposure to three sonic booms in quick succession (NAWS Point Mugu 1998f). Stampedes can increase pup mortality due to crushing or increased rates of pup abandonment (Johnson 1977; other studies reviewed *in* Richardson et al. 1995a: 243*ff)*. However, this form of direct mortality has not been documented in the Sea Range.

Missile and Target Launches

Missile and rocket-assisted target launches are accompanied by high sound levels and sudden sound onsets (Cummings 1993). In most cases where pinnipeds in the Sea Range have been exposed to the sounds of large rocket launches (such as the Titan IV from Vandenberg Air Force Base), animals did not flush into the sea (details in Figure 4.7-6 of the *Marine Mammal Technical Report*). On at least three occasions, launch of a medium-sized missile or target from the west end of San Nicolas Island caused pinnipeds near the launch site to rush into the water. Two of these incidents were documented during recent (1999) monitoring efforts. However, for the majority of launches from San Nicolas Island during which pinnipeds were observed, no stampedes have been noted (NAWS Point Mugu 1998g). Launches of BQM-34 target drones from NAS Point Mugu have not normally resulted in harbor seals leaving their haul-out area at the mouth of Mugu Lagoon about 2 miles (3 km) to the side of the launch track.

Ship and Boat Traffic

There are many reports documenting that pinnipeds that are hauled out generally acclimate and tolerate ship and boat traffic (Richardson et al. 1995a). This appears to be the case for harbor seals that haul out in Mugu Lagoon. (Potential impacts from ship and boat traffic are addressed in Section 4.7.2.1.)

C - Effects of Noise on Pinnipeds in the Water

Reactions to Impulsive Noise

Pinnipeds in water are generally very tolerant of impulsive sounds (Richardson et al. 1995a). It is not known whether pinnipeds in water would voluntarily remain near sources of impulsive sounds if levels were high enough to cause hearing impairment (temporary or permanent) or other injuries.

Aircraft Overflights

There are no published reports of pinniped responses to aircraft noise when they are below the water's surface and receive the sound there. Pinnipeds in open water often dive when overflown by an aircraft at low altitude. However, these reactions appear to be short-term. In the Sea Range, where pinnipeds on land appear to have acclimated to low-level overflights by aircraft and missiles, reactions by pinnipeds in the water are expected to be infrequent, of brief duration, and with no adverse effects on individual animals.

Ship and Boat Traffic

In general, evidence about reactions of pinnipeds to vessels is meager and is largely for species not found in the Sea Range. The limited data suggest that seals often show considerable tolerance of vessels, even when they are conducting noisy activities such as seismic operations (see Harris et al. 1997, 1998).

D - Effects of Noise on Toothed Whales

Reactions to Impulsive Noise

There is little information on the effect of impulsive sound on toothed whales, and particularly on the specific pulse levels that may cause behavioral or other reactions. Some species may become silent (e.g., sperm whale) and/or move away from some sources of strong impulsive sounds, but the reactions vary depending on species and their activities. In the presence of abundant food or during sexual encounters, toothed whales sometimes are extremely tolerant of pulses of noise. There is no evidence of long-term changes in behavior or distribution as a result of occasional exposure to pulsed acoustic stimuli.

Aircraft Overflights

Most species of toothed whales do not appear to react to aircraft overflights, except when the aircraft fly at low altitude (below 500 feet [150 m]). Beaked whales, pygmy and dwarf sperm whales, and Dall's porpoise appear to react more notably to low-level aircraft overflights than do dolphins or sperm whales. Whales that do react will dive hastily, turn, or swim away from the flight path. Feeding or socializing whales are less likely to react than whales engaged in other activities. Reactions to overflights, if any, appear to be brief and there is no evidence that infrequent aircraft overflights cause long-term changes in whale distribution.

Ship and Boat Traffic

Many toothed whales show no avoidance reaction to vessels, and sometimes approach them (e.g., to bow-ride). However, localized avoidance of vessels can occur. Beaked whales and harbor porpoises often show avoidance (e.g., Barlow 1988; Polacheck and Thorpe 1990; Palka 1993; Lynn et al. 1995). Reactions can vary greatly even within a species. Avoidance is especially common in response to vessels of types used to chase or hunt the animals, although this is not an issue on the Sea Range. There is little evidence that toothed whales abandon areas because of vessel traffic.

<u>E - Effects of Noise on Baleen Whales</u>

Reactions to Impulsive Noise

In the presence of strong noise pulses from distant seismic vessels and (in a few cases) distant explosions, baleen whales (mainly humpback, gray, and bowhead whales) often have been observed behaving normally insofar as could be determined. However, most gray and bowhead whales show some avoidance of areas where there are repeated noise pulses with received pulse pressures exceeding 160-170 dB re 1 µPa (SEL near 156 dB re 1 µPa). Subtle behavioral and avoidance reactions sometimes occur at lower received levels (Richardson et al. 1986, 1995a).

Aircraft Overflights

Baleen whale reactions to aircraft flights are highly variable and depend on the species and activity of the animals. Most baleen whales are tolerant of single aircraft overflights, except (on some occasions) at altitudes lower than 500 feet (150 m). Even then, the reactions are short-term (e.g., a single hasty dive). There is no evidence that a single overflight causes more than short-term changes in distribution and behavior. (See review in the *Marine Mammal Technical Report*.)

Ship and Boat Traffic

When baleen whales receive low-level sounds from distant or stationary vessels, the sound often seems to be ignored. Some whales, especially minke whales, sometimes approach the sources of these sounds. When vessels approach whales slowly and non-aggressively, whales often exhibit unhurried avoidance maneuvers. In response to strong or rapidly-changing vessel noise, baleen whales often interrupt their activities and swim rapidly away. Avoidance is especially strong when a vessel heads directly toward the whale. Some whales travel as much as a few miles from their original location in response to a straight-line pass by a vessel through that site. Avoidance responses are not always effective in preventing collisions, injury, and mortality of baleen whales, especially the slower-swimming species such as gray and right whales (reviewed in Richardson et al. 1995a).

F - Effects of Noise on Sea Otters

Reactions to Impulsive Noise

The only information on the reactions of sea otters to impulsive sounds (airgun pulses) suggests that they are very tolerant of such sounds (Riedman 1983).

Aircraft Overflights

There are no published data on the reactions of sea otters to aircraft overflights.

Ship and Boat Traffic

The few data on reactions of sea otters to ships or boats indicate that sea otters generally tolerate close approaches (a few hundred yards). Sea otters sometimes move away from the vessel's trackline when a vessel approaches closer than a few hundred yards (e.g., Udevitz et al. 1995), but this displacement is probably localized and temporary. Sea otters on land may move into the water when a vessel travels along the coast 330 feet (100 m) from shore (Garrott et al. 1993).

4.7.1.3 Non-Acoustic Effects

A - Missile and Targets

Injury from Falling Debris

Large pieces of falling debris from missiles or targets may strike and injure or kill marine mammals. As a general guideline, pieces of debris with an impact kinetic energy of 11 foot-pounds (15 joules) or higher are hazardous to humans (Cole and Wolfe 1996; Appendix G *in* U.S. Air Force 1997a).

Shock Waves from Surface Impacts

For the purposes of this analysis, it is assumed that impulses produced by intact missiles and targets hitting the water are similar to those produced by explosives. Therefore, the literature on effects of high explosives has been used to estimate impacts. This may result in some overestimation of effects, given that impulses from impacts (especially of slower objects) will differ in some respects from the impulses caused by detonation of high explosives.

Specific physical characteristics of these impulses are not well defined, but the data on explosion effects provide some guidance. High explosive detonations have very short rise times of about 20 microseconds, shock pulse durations of about 0.2 to 0.5 milliseconds, and a velocity of detonation of 15,000 to 30,000 feet/second (4,570 to 9,140 m per second; Urick 1975; Parrott 1991; Demarchi et al. 1998). After the initial shock pulse, pressure falls below ambient pressure and then rises to a second maximum known as the first bubble pulse. The time between the shock and the first bubble pulse is 0.17 to 0.5 seconds, depending on the size of the explosive (Demarchi et al. 1998). Effective broadband source levels for high explosive charges of 1 to 44 pounds (0.5 to 20 kg) are on the order of 267 to 280 dB re 1 µPa at nominal 3.3-foot (1-m) distance (Richardson et al. 1995a).

Shock waves from some other sources have slower rise times and cause much less injury to animals in the water. For example, pressure pulses from black powder and airguns have slower rise times and cause relatively little injury to fish (Hubbs and Rechnitzer 1952). Black powder deflagrations produce pulses with long rise times of about 1 millisecond and initial pulse durations of up to 6 milliseconds or more (Urick 1975; Parrott 1991). Single airguns produce pulses with rise times on the order of 1 millisecond, an initial positive pulse of 2 milliseconds duration, followed by a negative pulse of about 3 to 5 millisecond duration (Parrott 1991).

Intact missiles and targets hitting the water produce shock wave and noise pulses with peak source levels on the order of 239 to 271 dB re 1 µPa at nominal 3.3-foot (1-m) distance, and pulse durations of 0.5 to 2 milliseconds, depending on the size and speed of the object (McLennan 1997). Missiles and targets will hit the water with speeds of 300 to 3,000 feet per second (91 to 914 m per second). The methodology of McLennan (1997) was used to estimate the associated impulses.

Shock waves that result from explosions, because of their high peak pressures and rapid changes in pressure (fast rise time), can cause severe damage to animals. The most severe damage takes place at boundaries between tissues of different density. Different velocities are imparted to tissues of different densities, and this can physically disrupt the tissues. Gas-containing organs, particularly the lungs and gastrointestinal tract, are especially susceptible (Yelverton et al. 1973; Hill 1978). Lung injuries can include laceration and rupture of the alveoli and blood vessels. This can lead to hemorrhage creation of air embolisms, and breathing difficulties. Intestinal walls can bruise or rupture, with subsequent hemorrhage and escape of gut contents into the body cavity.

For high explosive detonations, mortality and damage correlate better with impulse, measured in units of pressure x time (Pascal•seconds), than with other blast parameters (Yelverton 1981). McLennan (1997) derived simple equations to estimate the peak source level of the pulse produced by an intact missile hitting the water and its duration in milliseconds using the velocity of the missile and its surface area as input. This approach is conservative in that it overestimates the pulse produced by an object hitting the water (McLennan 1997). Peak source levels were reduced by 20 dB for an AltAir missile (McLennan 1997) and 15 dB for other missiles. The peak source levels in dB re 1 µPa at 3.3-foot (1-m) distance were then converted to impulse in Pascal•seconds.

An object hitting the water acts as a dipole source with most of the energy directed downward. Impulse at a given distance and depth from the source was estimated with the equation

$$I_{distance} = I_{source} \text{ x } \cos(\text{theta})/R$$

where I = impulse in Pascal•seconds, theta = the vertical angle from the source to the receiver, and R = the distance between source and receiver.

Yelverton (1981) produced equations for computing safe distances of marine mammals from an explosive source taking account of the animal's body mass. Large mammals are less susceptible than smaller ones. The impulse levels that kill or damage mammals have been determined empirically to be as follows (from Yelverton 1981):

50 Percent Mortality	ln(I) = 4.938 + 0.386 ln(M)
1 Percent Mortality	ln(I) = 4.507 + 0.386 ln(M)
No Injuries	ln(I) = 3.888 + 0.386 ln(M)

where I = impulse in Pascal•seconds and M = body mass in kilograms. These equations are based on data from submerged terrestrial mammals exposed to high explosive detonations. They may overstate the severity of injuries to marine mammals adapted for life in the water, especially when exposed to impacts associated with shock waves from intact missiles hitting the water rather than explosive detonations. The direct applicability of the equations to large marine mammals is particularly questionable, given that the largest animals from which data are available are sheep.

Based on the Yelverton (1981) equations, an impulse of 74 Pascal•seconds would be safe for a 7 to 9 pound (3 to 4 kg) marine mammal, i.e., even for a newborn calf of the smallest dolphin in the Sea Range. His equations suggest that no damage would occur to a 220 pound (100 kg) marine mammal exposed to an impulse of 289 Pascal•seconds or less, and to a 2,200 pound (1,000 kg) marine mammal exposed to an impulse of 702 Pascal•seconds or less. The safe level for a human swimmer near the surface is 14 Pascal•seconds (Yelverton 1981), and this could be taken as the magnitude of an absolutely safe impulse for marine mammals. In Section 4.7.2.1-C, Yelverton's equation is used to predict the lethal radius for marine mammals resulting from intact missiles and targets hitting the water.

When in proximity to hard (e.g., rock) bottom, shock waves may attenuate less rapidly than in open water. Hill (1978) and Wright (1982) suggest that calculated lethal ranges or safe distances should be doubled in these circumstances to ensure a conservative safety margin.

Intact missiles hitting the water produce a strong noise pulse as well as the aforementioned shock wave. Sound Exposure Level was computed from the peak source level and pulse duration derived from McLennan's (1997) equations. The received SELs at various distances from an intact missile hitting the water were computed assuming that the source was a dipole with spreading loss approximated by 20 $\log_{10}$ (cos theta/R) dB. Here, theta = the vertical angle from the source to the receiver, and R = the distance between source and receiver.

B - Chaff and Flares

An extensive review of literature, combined with controlled experiments, revealed that chaff and self-defense flares pose little risk to the environment or animals (U.S. Air Force 1997b; Naval Research Laboratory 1999). The materials in chaff are generally non-toxic in the quantities relevant to this analysis. Particulate tests and a screening health risk assessment concluded that the potential for chaff breaking down into respirable particle sizes is not a significant concern. In addition, effects from inhalation are not considered to be a significant issue since chaff particles do not pass the trachea and would represent a small percentage of the particulates regularly inhaled by animals, particularly at sea where chaff fibers sink. Chaff-like aluminized mylar strips fed to harp seals, *Phoca groenlandica*, as dietary markers were passed in the feces and the seals remained healthy (J.W. Lawson, LGL Ltd., unpublished data). Given the properties of chaff fibers (they are soft, flexible, and inert), skin irritation is not expected to be a problem for marine mammals. Consequently, few animals are expected to suffer physical effects from chaff ingestion.

Currently, there are approximately 15 flare operations annually on the Sea Range. Toxicity is not a concern with self-defense flares because the primary material in flares, magnesium, is not highly toxic (U.S. Air Force 1997b; Naval Research Laboratory 1999) and will normally combust before striking the land or sea surface. There have been no documented reports of wildlife consuming flare materials, and it is unlikely that marine mammals would ingest these materials. The probability of injury from falling dud flares and debris was found to be extremely remote. Although impulse cartridges and initiators used in some flares contain chromium and lead, a screening health risk assessment concluded that they do not present a significant health risk in the environment (U.S. Air Force 1997b; Naval Research Laboratory 1999).

Pinnipeds could ingest chaff fibers or flare debris with food; any effects of this are likely to be short-term and serious internal damage would not be likely to occur. Contact with chaff or flare debris is unlikely to cause injury to skin or eyes since contact would not be prolonged. On land, chaff fibers and flare debris are inert and would not cause entanglement. Also, chaff fibers on land are degraded to respirable particulates, and would not cause injury on inhalation, as they would not pass the trachea and are readily expelled on contact with nasal mucosa.

Cetaceans could ingest chaff fibers or flare debris with food, or baleen of baleen whales could become contaminated with chaff or flare debris. Such effects are likely to be short-term and unlikely to cause serious internal damage to cetaceans. Contact with chaff or flare debris is unlikely to cause injury to skin or eyes since contact would not be prolonged. Flare debris would be encountered in very small quantities and sinks in disturbed water.

Sea otters are unlikely to encounter chaff as it is not usually released in their nearshore habitat. If a sea otter did ingest chaff fibers or flare debris with food, effects are likely to be short-term and unlikely to cause serious internal damage. Contact with chaff or flare debris is unlikely to cause injury to skin or eyes since contact would not be prolonged, particularly as sea otters groom themselves frequently at the water's surface. Chaff fibers sink in disturbed water, and flare debris would be encountered in very small quantities.

C - Entanglement and Ingestion

Solid debris such as missile and aircraft parts, and floating target components (floatation foam, plastic parts), may be encountered by marine mammals on land or in the waters of the Sea Range. The primary hazards from persistent plastics and other debris to marine mammals are through entanglement (leading to drowning, strangulation, or flesh damage) and injury due to ingestion. Entanglement in man-made debris is a very common source of injury and mortality among marine mammals throughout the world (Kullenberg 1994). All types of material left in the ocean by the military during exercises were assessed for the potential to entangle marine mammals.

Entanglement in military-related gear was not cited as a source of injury or mortality for any marine mammal recorded in the NMFS database documenting strandings of marine mammals (and sea turtles) in southern California waters. This database includes some (not all) of the pinnipeds and cetaceans stranded near Point Mugu and on the shores of the Sea Range. The lack of such records is likely the product of the relatively low amounts of military debris that remain on or near the sea surface, and the fact that the potential entanglement hazards associated with cable and parachute assemblies of ship-launched defensive flares have been mitigated by current designs. These are self-scuttling and sink rapidly to the sea floor after cessation of function. Parachute and cable assemblies used to facilitate target recovery are designed to be collected in conjunction with the target during normal recovery operations. However, on infrequent occasions these assemblies cannot be recovered. Floating debris, such as foam floatation material, may be lost from floating target boats, but is inert and will either degrade over time, or wash ashore as flotsam. In any event, it is unlikely that a marine mammal would be injured by contact with, or ingestion of, the relatively small amount of this lightweight material that is dispersed over the broad area of the Sea Range.

Metal fragments disassociated from air- or seaborne targets by ordnance impacts sink quickly to the sea bottom and likely pose no threat to marine mammals.

Very few pieces of debris with the potential to entangle cetaceans are left in the water during military exercises. It is also unlikely that marine mammals would ingest this material as most of it is designed to sink to the bottom, or will be dispersed over a large area. Therefore, ingestion or entanglement impacts on marine mammals are predicted to be less than significant and are not addressed further in this section.

D - Hazardous Constituents

Hydrocarbons

About 8,322 pounds (3,775 kg) of jet fuel and 550 pounds (250 kg) of other hydrocarbons were released into waters of the Sea Range in the baseline year (refer to Section 4.13, Hazardous Materials, Hazardous Wastes, and Non-Hazardous Wastes). Due to the nature of the exercises, most of these materials are released in offshore waters. (Potential impacts from hazardous constituents are addressed in Section 4.7.2.10.) Jet fuel is toxic but vaporizes quickly. Assuming that a QF-4 disintegrates on contact with the water, its fuel will be spread over a large area and dissipate quickly. In addition, fuel spills are mostly likely to occur at widely separated locations and times.

Most marine mammals are not very susceptible to the effects of oil and hydrocarbon-based fuels. Whales, phocid seals, and sea lions rely on a layer of blubber for insulation, and oil fouling of the external surface does not appear to have any adverse thermoregulatory effects (Kooyman et al. 1977; St. Aubin 1990; Geraci 1990). However, sea otters, fur seals, and newborn seal pups rely on their fur for insulation and may be more susceptible to effects of contamination by hydrocarbon-based fuels, especially in cold-water conditions.

Whales could ingest spilled fuel or oil with food, or the baleen of baleen whales could become contaminated. Such effects are likely to be short-term and are unlikely to cause serious internal damage to cetaceans. Spills on the Sea Range are small and small amounts of ingested petroleum hydrocarbons are not highly toxic. Also, aviation fuels are volatile and will not remain on the sea surface for long. Contact with oil is unlikely to cause injury to skin or eyes unless contact is prolonged. Some cetaceans appear to be able to detect and avoid oil, but often they do not do so. There is no firm evidence of oil-spill related deaths of cetaceans even in the case of catastrophic spills orders of magnitude larger than those associated with Sea Range activities.

Pinnipeds do not exhibit large behavioral or physiological reactions to limited surface oiling, incidental exposure to contaminated food, or to vapors (St. Aubin 1990; Williams et al. 1994). Effects can be severe if seals surface in heavy oil slicks in confined areas or if oil accumulates near rookeries and haul-out sites (St. Aubin 1990). However, aviation fuels are volatile and would not form persistent slicks. Effects on pinnipeds of an oil or fuel spill in open water are likely to be minor. Fuel spills resulting from the crash of a QF-4 drone are most likely to occur in offshore waters, away from haul-out sites or breeding beaches.

The sea otter is the marine mammal that is most likely to suffer immediate and long-term injury or death from exposure to oil (Geraci and Williams 1990). One can assume that most of the otters that come into contact with a spill are likely to die, if not immediately then at some later time. The volatility of aviation fuel would reduce its potential effects relative to those of heavier oils. However, sea otters remain close to the shore in Territorial Waters whereas spills of fuel are most likely to occur offshore in non-

Territorial Waters. The potential for interaction between sea otters and fuel spills associated with Sea Range operations is remote.

Other Constituents

About 2,205 pounds (1,000 kg) of missile propellants, consisting of ammonium perchlorate, hydroxyl-terminated polybutadiene, mixed amine fuel, inhibited red fuming nitric acid (an oxidizer), mixtures of boron, potassium nitrate, and powdered aluminum were released into the water from Sea Range baseline operations. As in the case of jet fuel, this material is released at different times and locations and quickly dissipates in the air or on impact.

Other Materials

About 1,817 pounds (824 kg) of batteries are released in the Sea Range per year. Their chemicals include a variety of potassium hydroxide electrolyte, lithium, lithium chloride, nickel cadmium, lead, and sulfuric acid. In addition, aluminum, iron, steel and concrete are released. Aluminum, iron, lithium, lead, and steel are chemically innocuous (harmless) at both concentrations found naturally and at concentrations arising from the types of military operations evaluated in this EIS/OEIS. Magnesium is abundant in seawater (average concentration 0.135 percent) and, therefore, is not of concern. Considering the area over which the missile propellants and battery fluids are spread, quantities dilute to concentrations too low to warrant concern.

A summary of impacts on marine mammals is provided in Table 4.7-2. Impacts of the No Action Alternative, Minimum Components Alternative, and Preferred Alternative are summarized in the following sections.

4.7.2 No Action Alternative - Current Operations

The No Action Alternative includes air-to-air, air-to-surface, surface-to-air, surface-to-surface, and subsurface-to-surface operations, littoral warfare training, and FLEETEXs. These activities involve aircraft and missile overflights, ship and boat movements, target launches and overflights, release of chaff and flares, and release of unspent fuel and debris. In the following sections, activities common to all exercises are evaluated and then an overall evaluation of each operation provided. A detailed account of methods used for impact assessment with examples of calculations is presented in the *Marine Mammal Technical Report*. A summary of impacts on marine mammals is provided in Table 4.7-2. Impacts of the No Action Alternative are evaluated in this section. Impacts of the Minimum Components Alternative and Preferred Alternative are evaluated in following sections.

4.7.2.1 Impacts of Common Activities

<u>A - Aircraft and Missile Overflights</u>

Airborne Noise

Based on an analysis of data reported in Burgess and Greene (1998), Vandal target launches from San Nicolas Island produce a 100 dBA acoustic contour that extends an estimated 13,986 feet (4,263 m) from its launch track (Figure 4.7-3). This contour defines the area within which pinnipeds may sometimes react strongly (i.e., stampede into the water) when exposed to prolonged airborne sounds. The Vandal launch sound could be received for several seconds and, to be conservative, is considered to be a prolonged rather than a transient sound. Harbor seals, California sea lions, and elephant seals that haul

Table 4.7-2. Marine Mammal Impact Summary Matrix[1]

Alternative	Impact Conclusions NEPA (On Land→ Territorial Waters)	EO 12114 (Non-Territorial Waters)	Mitigation Measures
No Action Alternative	There is a low probability in any one year that any marine mammal is injured or killed by intact missile impacts or shock waves (0.0004), inert mine drops (0.0005), or falling debris from intercepts (0.0007) in Territorial Waters (Table 4.7-3). The probability that a threatened or endangered species is hit approaches zero. Impacts are less than significant. Small numbers of marine mammals (2.0 per year) experience TTS with no biological consequences in Territorial Waters (Table 4.7-3). The likelihood of any individual animal experiencing TTS more than once per year approaches zero. Impacts are less than significant.	*There is a low probability in any one year that any marine mammal is injured or killed by intact missile impacts or shock waves (0.0009), or falling debris from intercepts (0.001) in non-Territorial Waters (Table 4.7-3). The probability that a threatened or endangered species is hit approaches zero. Impacts are less than significant.* *Small numbers of marine mammals (2.1 per year) experience TTS (Table 4.7-3) with no biological consequences in non-Territorial Waters. The likelihood of any individual animal experiencing TTS more than once per year approaches zero. Impacts are less than significant.*	
	Pinnipeds on San Nicolas Island show little reaction to most transient sounds. However, recent Navy monitoring efforts revealed that pinnipeds stampeded during two separate Vandal launch events. Pinniped populations near the launch sites and around the entire island are expanding. Pinnipeds at Point Mugu are not exposed to sound levels that could cause disturbance. Population level impacts are less than significant.		Recent monitoring efforts at San Nicolas Island revealed that pinnipeds stampeded during two separate Vandal launch events. In response to these recent observations, the Navy applied for and received Incidental Harassment Authorization (IHA) from NMFS. In accordance with the IHA, where practicable, the Navy will adopt the following mitigation measures when doing so will not compromise operational safety requirements or mission goals: • prohibit personnel from entering pinniped haul-out sites below the missile's predicted flight path within two hours prior to launch; • avoid launch activities during harbor seal pupping seasons; • limit launch activities during other pinniped pupping seasons; • not launch target missiles at low elevation on launch azimuths that pass close to beach haul-out site(s); • avoid multiple target launches in quick succession over haul-out sites, especially when young pups are present; • limit launch activities during the night;

Table 4.7-2. Marine Mammal Impact Summary Matrix (continued)

Alternative	Impact Conclusions: NEPA (On Land→ Territorial Waters)	Impact Conclusions: EO 12114 (Non-Territorial Waters)	Mitigation Measures
NO ACTION ALTERNATIVE (continued)			• maintain a minimum altitude of 1,000 feet from pinniped haul-out sites during aircraft and helicopter operations; and • contact NMFS within 48 hours if injurious or lethal takes are discovered during marine mammal monitoring. A description of the activities covered under the IHA and a summary of the associated monitoring program are included in Appendix E of this EIS/OEIS.
MINIMUM COMPONENTS ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Increased debris would have a negligible effect on the overall probability of a marine mammal being injured or killed by intact missiles and falling debris hitting the water (Table 4.7-5). Small numbers of marine mammals (5.2 per year) may experience short-term TTS with no biological consequences (Table 4.7-5). Impacts would be less than significant. Pinnipeds on San Nicolas Island would show little reaction to nearshore intercepts. San Nicolas Island construction would not affect pinniped haul-out sites. Otherwise same as for No Action Alternative. Population-level impacts would be less than significant.	*Increased debris would have a negligible effect on the overall probability of a marine mammal being injured or killed by intact missiles and falling debris hitting the water (Table 4.7-5).* *Small numbers of marine mammals (2.3 per year) may experience short-term TTS with no biological consequences (Table 4.7-5). Impacts would be less than significant.*	As above.
PREFERRED ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Increased debris would have a negligible effect on the overall probability of a marine mammal being injured or killed by intact missiles and falling debris hitting the water (Table 4.7-6). Small numbers of marine mammals (5.2) per year may experience short-term TTS with no biological consequences (Table 4.7-6). Impacts would be less than significant. Some of the pinnipeds on western San Nicolas Island may react to some additional launches. Population-level impacts would be less than significant. Use of the beach launch pads at NAS Point Mugu and construction at San Nicolas Island would not affect pinniped haul-out sites. Additional launches from San Nicolas Island would have no long-term impacts. Received sound levels at the Mugu Lagoon haul-out site would remain below the disturbance threshold. Impacts would be less than significant.	*Increased debris would have a negligible effect on the overall probability of a marine mammal being injured or killed by intact missiles and falling debris hitting the water (Table 4.7-6).* *Small numbers of marine mammals (2.9) per year may experience short-term TTS with no biological consequences (Table 4.7-6). Impacts would be less than significant.*	As above.

[1]Numbers have been rounded within this table for readability.

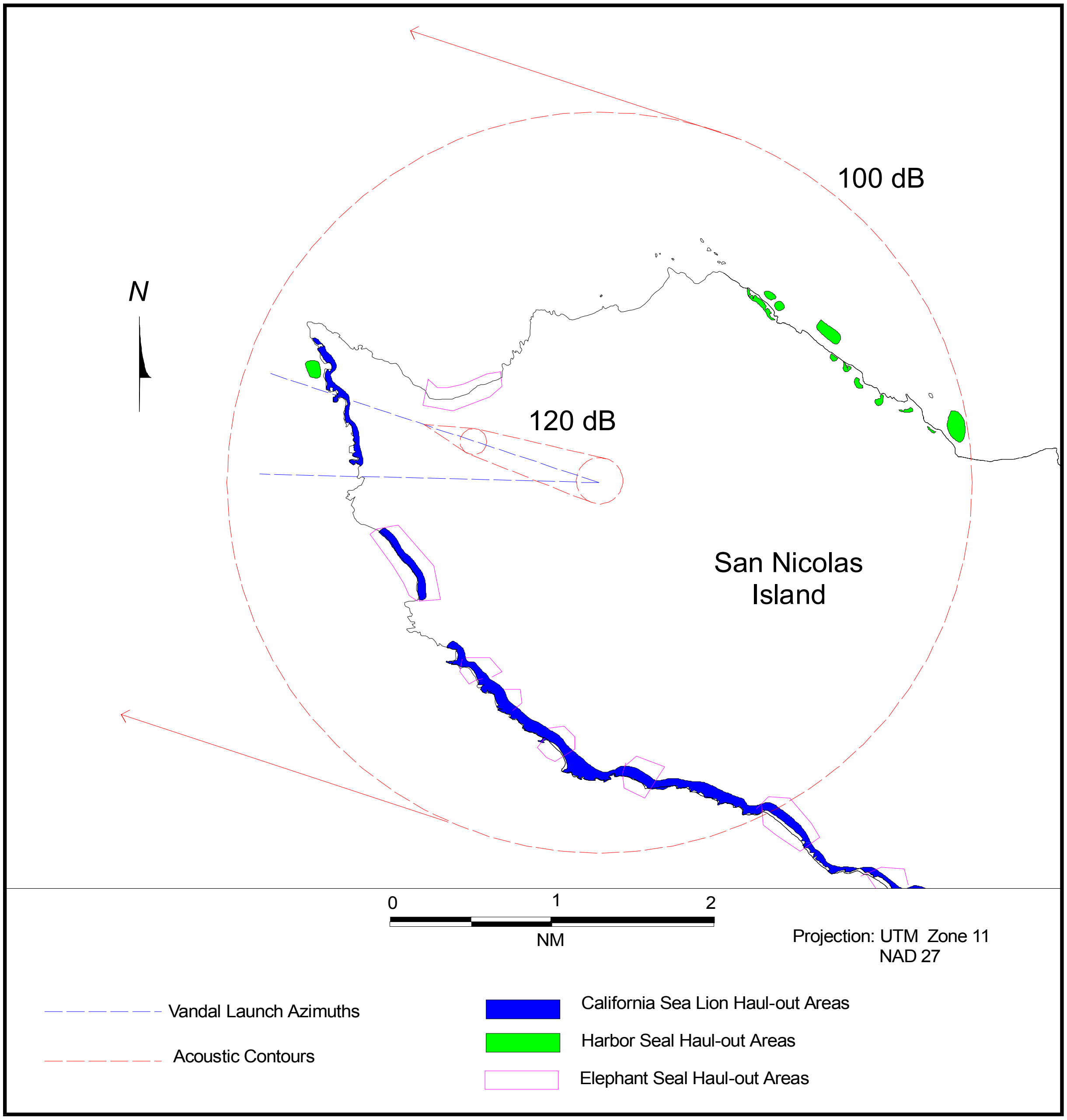


Figure 4.7-3
The 100 and 120 dB re 20 µPa Acoustic Contours for Vandal Target Launches from San Nicolas Island on an A-weighted Sound Exposure Level (SEL) Basis.

out on the western end of San Nicolas Island are within the perimeter of the 100-dBA contour shown on Figure 4.7-3. Targets reach transonic speed by the time they cross the western end of the island at moderate altitude, and accelerate to supersonic speed west of the island. The number of hauled-out pinnipeds within the 100-dBA contour was estimated from census data obtained during aerial and ground-based surveys conducted during 1989 to 1993 (M. Lowry, NMFS unpublished report). This estimate represents the average population size, including adults, subadults, and pups. All three species present are seasonal breeders. During their late January to early February breeding season, an average of

4,671 elephant seals were within the 100-dBA contour. The average number of California sea lions in this area ranged from 21,060 during their July breeding season to 7,895 during the period from October to April. About 60 percent of the harbor seals on San Nicolas Island, or about 280 individuals, occur within this area (NAWS Point Mugu 1998f).

Sonic booms have resulted in a startle reaction involving some movement of pinnipeds into the water, and noise from a distant exploding rocket caused most sea lions, but not elephant seals, to stampede into the water (Stewart et al. 1993). Observations of other potentially-disturbing noise events in the area suggest that pinnipeds often do not react strongly to prominent sounds (Greene et al. 1998a). However, initial evidence indicates that pinnipeds respond to sound produced by Vandal launches. Recent monitoring efforts at San Nicolas Island revealed that pinnipeds stampeded during two separate Vandal launches. The number of these pinnipeds that might actually be disturbed to the extent that they might flush into the water is undoubtedly less than the total population estimates.

Although recent evidence indicates that some pinnipeds stampede into the water in response to Vandal launches, there has been rapid growth in resident pinniped populations despite such launch operations (refer to Section 3.7.4). This could imply that there is little if any mortality or serious injury of pups due to stampedes into the water during Vandal or similar launches. In addition, there are only about eight Vandal launches per year under current conditions. Thus, impacts of Vandal launches on pinniped populations on San Nicolas Island are less than significant whether or not there are any adverse effects on individual pinnipeds. However, in response to the recent observations of pinnipeds during Vandal launches, the Navy applied for and received Incidental Harassment Authorization (IHA) from NMFS.

Missiles and subsonic BQM targets are occasionally launched from the west end of San Nicolas Island. During a launch of one of the larger and non-standard types of missiles from that site, pinnipeds near the launch site were observed to stampede into the water. This could be considered a potentially adverse impact on individual pinnipeds. However, launches of this type are very infrequent (less than one per year), and pinniped populations at San Nicolas Island are increasing. Impacts of launches from the west end of San Nicolas Island on pinniped populations of that island are less than significant despite infrequent cases of potential disturbance to individual pinnipeds.

BQM-34S target launches from NAS Point Mugu produce a 100 dBA acoustic contour that extends an estimated 4,500 feet (1,372 m) on either side of its launch track (Burgess and Greene 1998). The harbor seals that haul out in Mugu Lagoon are beyond the perimeter of this contour (approximately 2 miles away), and thus are unlikely to be disturbed. In addition, the BQM-34S target departs the launch site rapidly, in a direction heading away from the Mugu Lagoon haul-out area. Also, these harbor seals are exposed frequently to other types of man-made sounds. Any sound exposures from the BQM-34S target launch are transitory. Impacts of BQM-34S launches on marine mammals at Point Mugu are less than significant.

SLAM F/A-18 captive carry overflight tests at San Nicolas Island exposed pinnipeds at haul-out areas to more sound than would flights along the normal SLAM exercise trajectory. The F/A-18 produced sound levels up to 108.8 dBA re 20 μPa when the aircraft passed over the SLAM target area on the western end of the island at an altitude of 500 feet (150 m) (Greene et al. 1998a). Although received levels from several aircraft passes exceeded 100 dBA and a small proportion of the seals became alert, there were no significant disturbance responses to these overflights. The lack of a notable response was perhaps due to the acclimatory effect of the gradually increasing levels of sound during successive overflights at progressively lower altitudes (Greene et al. 1998a) plus the transient nature of the sounds. The impacts of current low-level subsonic overflight operations on marine mammals on San Nicolas Island are less than significant.

Supersonic aircraft flights are normally limited to high altitudes and overwater locations. On infrequent occasions, pinnipeds on land at San Nicolas Island can be exposed to sonic booms, usually from distant aircraft. Reactions by pinnipeds on land probably are limited to minor alert and startle responses most of the time (see Section 4.7.1.2-B). However, on rare occasions some animals may stampede into the water. It is possible that this could cause injuries to a few individuals, but this has not been documented on the Sea Range. Any effects on pinniped populations are less than significant, given the increasing population sizes.

The strongest noise originating from an aircraft or missile in flight over the Sea Range is produced by a low-flying supersonic Vandal target. Of the eight Vandal target flights currently conducted on the Sea Range annually, two occur at flight altitudes of 100 feet (30 m) or higher. Conservatively assuming these flights are at 100 feet (30 m), the TTS criteria (Table 4.7.1) would not be exceeded for any pinniped species on land or at the surface of the water. Six of the eight Vandal target flights per year may occur at altitudes as low as 20 feet (6 m) above the sea. A model was used to estimate sound pressures from these targets traveling at supersonic speeds of Mach 2.1 (refer to Appendix D), producing an N-wave at the water's surface with a duration of only 4.8 milliseconds as received at any one point below the flight track. Total sound energy exposure was estimated using Fourier analysis of the predicted N-wave to obtain the F-SEL levels. This spectrum was then A-weighted to estimate the A-SEL; the A-SEL value is about 9 dB below the F-SEL. Because of the short duration of the Vandal's sonic boom, the SEL value is much reduced relative to the peak pressure. Based on the model, the sound pressure level in air beneath these low-flying Vandals was estimated to have a peak pressure level of 177 dB re 20 µPa, and a corresponding SEL value of 139 dB A-SEL re 20 µPa. Thus, pinnipeds at the water's surface and with their heads above water would not be exposed to sound levels that might cause TTS. At 1 foot (30 cm) below the water's surface, the model predicts that the sound level would be 158.4 dB F-SEL re 1 µPa, which is also less than that thought necessary to elicit TTS in whales or pinnipeds underwater (Table 4.7.1). In addition, the extremely rapid passage of the Vandal targets at this altitude means that marine mammals would be exposed to increased sound levels for only very short time intervals, and they would be expected to exhibit no more than brief startle responses. Low-flying Vandal targets have less than significant impacts on marine mammals within Territorial Waters of the Sea Range.

Overflights of other targets and missiles are usually at altitudes greater than 100 feet (30 m), and sound produced by those targets is weaker than that from the Vandal. Overflights by aircraft are normally at altitudes of at least 1,000 feet (300 m). Therefore, none of the transitory noises produced during aircraft or missile overflights at these altitudes are expected to exceed the acoustic disturbance criteria for marine mammals at the surface of the water. Any changes in behavior or distribution of marine mammals at the water's surface in response to the sound of an aircraft such as the F/A-18 flying at 200 feet (60 m), which produces noise levels above the 100 dB aerial disturbance criteria (refer to Section 3.3, Noise), would be transitory and negligible. Although launches and overflights may cause behavioral disturbance to some pinnipeds on land, the impacts of overflights on pinnipeds on land, or in the sea with their heads above the water surface in Territorial Waters, are less than significant.

For the reasons described above for Territorial Waters, potential impacts on marine mammals from overflights of aircraft, targets, and missiles in non-Territorial Waters are less than significant.

Underwater Noise

Sound does not transmit well from air to water (refer to Appendix D). The strongest noise produced by an aircraft or missile in flight is produced by a Vandal target. At the minimum planned flight altitude of

20 feet (6 m), TTS criteria would not be exceeded for any marine mammal species at or below the water's surface. If Vandal flights did occur below the minimum altitude, some marine mammals may experience mild TTS. However, these flights are infrequent (approximately eight times per year) and the likelihood of any individual animal experiencing even mild TTS more than once per year approaches zero. This level of exposure has no biological consequences and impacts are less than significant.

Overflights of other missiles and aircraft, all of which are less noisy than the Vandal, are at altitudes higher than 60 feet (18 m). Therefore, none of the aircraft or other missile overflights are expected to exceed the TTS criteria for marine mammals in water. The sounds produced by supersonic aircraft or missiles may cause temporary changes in behavior or distribution of some marine mammals in the upper water column. These effects would be transitory. The impacts of aircraft and target overflights on marine mammals under the surface of the water in Territorial Waters are less than significant.

Submarine missile launches associated with subsurface-to-surface operations are a source of underwater and aerial sound during booster operation and in flight immediately following water emergence. In addition, these subsurface launches are sources of potential underwater noise as debris or the intact missile hit the water upon termination of the missile flights. Test launches of a water slug to simulate a torpedo launch are "detectable" within a 1.1-mile (1.8-km) radius (Department of National Defence [Canada] 1995). However, these launches produced only transient sound events.

No subsurface to surface missiles were fired during Sea Range baseline operations (refer to Section 3.0, Current Activities). Given the low number of missile launches from submarine platforms, it is likely that the sounds produced by these launches will cause no more than temporary changes in behavior or distribution of some marine mammals in the upper water column. These effects would be transitory. The impacts of submarine missile launches on marine mammals in Territorial Waters of the Sea Range are less than significant.

For the reasons described above for Territorial Waters, the impacts of aircraft, missile, and target overflights on marine mammals under the surface of the water in non-Territorial Waters are less than significant.

B - Ship Activities

Navy vessels account for only about 9 percent of the vessel traffic on the Sea Range (refer to Appendix D). Ships that are part of proposed Navy activities could sometimes cause short-term changes in baleen whale and sperm whale behavior, and localized displacement of these whales, if the ships approach the whales. However, Navy ships are designed and maintained to minimize noise. Also, baleen and sperm whales show little reaction to ships or boats if the vessel is moving slowly at constant speed on a constant course. While on the Sea Range, Navy vessels normally operate on a constant course, and will not normally continue to operate at the same location for longer than the time required to transit through that area or complete their test or training operation.

Therefore, sperm whales and baleen whales, such as the blue or fin whales that occur west of San Nicolas Island in summer (refer to Section 3.7.2.2), may sometimes be displaced temporarily by approaching Navy vessels, but these whales are not likely to be deterred from any one area for more than one to two days. The number of baleen or sperm whales that may be affected is highly variable, but any disturbance is temporary and is not considered biologically significant. Impacts of disturbance to baleen whales and sperm whales by Navy ships and boats operating on the Sea Range in Territorial Waters are less than significant.

There is no evidence that occasional ship and boat traffic causes biologically significant disturbance to pinnipeds or dolphins in open water (Richardson et al. 1995a). Harbor porpoises often show local avoidance of vessels, but harbor porpoises are mainly confined to nearshore waters inshore of the northern part of the Sea Range where Navy vessel traffic is infrequent. Dolphins frequently *approach* ships to ride the bow wave. Any impacts of disturbance from ships and boats on pinnipeds and dolphins in Territorial Waters are less than significant.

On infrequent occasions, whales and ships collide, resulting in injury or death to the whale. Most reports of ship collisions with marine mammals have involved baleen and sperm whales, but bottlenose dolphins also have been struck (Richardson et al. 1995a). Slow-moving species, especially the right whale and gray whale, are most likely to be struck by ships. There have been no reports of collisions with marine mammals on the Sea Range (NAWS Point Mugu 1998g). In assessing the likelihood of collisions on the Sea Range, it is relevant to consider the following: baleen and sperm whales often try to avoid approaching vessels, the limited amount of Navy vessel traffic on the Sea Range as compared with commercial vessel traffic, the fact that much of the time the Navy vessels on the Sea Range do not operate at high speed, and the absence of reported collisions on the Sea Range. Given this, it is unlikely that a marine mammal would be injured or killed by collision with a Navy vessel during any given year. Because of the rarity of the northern right whale (the species least able to avoid ships) on and near the Sea Range (refer to Section 3.7.2.2), the probability of a collision with this highly endangered species approaches zero. Although the possibility of a collision between a marine mammal and Navy vessel conducting Sea Range operations in Territorial Waters cannot be excluded, the frequency of collision is likely very low and effects on marine mammal populations are less than significant.

For the reasons described above for Territorial Waters, potential impacts on marine mammals from ship activities in non-Territorial Waters are less than significant.

C - Missile and Target Impacts

Missile and Target Debris

Pieces of debris from missiles and targets or intact missiles and targets could injure or kill marine mammals. Based on operations in the entire Sea Range during the baseline year, an estimated 0.002 marine mammals per year are hit by debris from a missile or target. This is equivalent to one serious injury or death in approximately 500 years. Many pieces of debris would have kinetic energy less than the human hazard threshold of 11 foot-pounds (15 joules) (see Section 4.7.1.3-A), so the calculated numbers of mammals that might be injured are overestimates. Even in the rare event that a marine mammal was seriously injured or killed, the impact on the population would be less than significant unless it was a rare and endangered species.

Based on operations in the Sea Range during the baseline year, an estimated 0.0007 marine mammals per year are hit by debris from a missile or target in Territorial Waters (Table 4.7-3). This is equivalent to one serious injury or death in approximately 1,400 years.

Based on operations in the Sea Range during the baseline year, an estimated 0.001 marine mammals per year are hit by debris from a missile or target in non-Territorial Waters (Table 4.7-3). This is equivalent to one serious injury or death in approximately 1,000 years.

Table 4.7-3. Numbers of Marine Mammals Exposed to Injury, Mortality, or Temporary Threshold Shift per Year During Current Operations[1]

Source of Mortality or Injury	Numbers of Marine Mammals Exposed		
	Territorial Waters	*Non-Territorial Waters*	Total
Injury or mortality from missile debris	0.00069	*0.00138*	0.00207
Injury or mortality from CIWS rounds	< 0.00001	*< 0.00001*	< 0.00001
Injury or mortality from inert mine drops	0.00047	*0.00000*	0.00047
Injury or mortality due to missile impact or shock waves	0.00042	*0.00085*	0.00127
Exposure to impulses causing Temporary Threshold Shift	1.95625	*2.09828*	4.05453
Intact missile and target shock waves	1.94033	*2.09345*	4.03378
CIWS gun noise[2]	0.01592	*0.00483*	0.02075
Low-flying vandal targets	0.00000	*0.00000*	0.00000

[1]Numbers included in the text have been rounded for readability.
[2]Applies only to seals with their heads above water.

Rare and endangered species make up an estimated 0.4 percent of the marine mammals in the Sea Range throughout the year based on the normalized densities described in Section 3.7 and the *Marine Mammal Technical Report*. Therefore, the probability of a rare and endangered species being seriously injured or killed by falling debris approaches zero (approximately 0.00001 animals per year).

The impact of pieces of debris from missiles and targets on marine mammals is less than significant.

Intact Missiles and Targets

The methodology described in Section 4.7.1.3-A was used to evaluate potential impacts from intact missiles and targets. Very strong impulses produced when high-speed large vehicles hit the water could affect marine mammals well below the surface of the water (Figure 4.7-4). The effects of the rate of pressure change from such an event (“rise time”) on hearing and on tissue trauma are not well known.

For the purposes of this EIS/OEIS, effects were estimated by creating five categories of vehicles based on their mass, surface area, and speed if they were to strike the water’s surface intact. For simplicity, these are categorized here as “Phoenix-type” (medium-sized supersonic), “Harpoon-type” (subsonic), “AQM-37/Sidewinder type” (smaller supersonic), Vandal, and “AltAir-type” (larger ballistic missiles). For the estimated proportions of launched vehicles that would hit the water within the Sea Range in one piece, a scenario was assumed where 100 percent of the Vandal-type targets and 17.5 percent of other targets would hit in one piece. It was further assumed that 50 percent of the AltAir-type and 25 percent each of the Phoenix-, Harpoon-, and Sidewinder-type missiles would hit the water intact.

The numbers of marine mammals being seriously injured or killed during current operations on a yearly basis were estimated. Yelverton’s (1981) equation was used to predict the impulses, in Pascal•seconds, that could cause serious injury or mortality to 1 percent of various kinds of marine mammals present. McLennan’s (1997) equation and the spreading loss equation presented in Section 4.7.1.3-A were then used to determine the distances from the contact point at which the impulse would diminish to the “1 percent injury/mortality” levels (Table 4.7-4). The results of these calculations were then applied to the

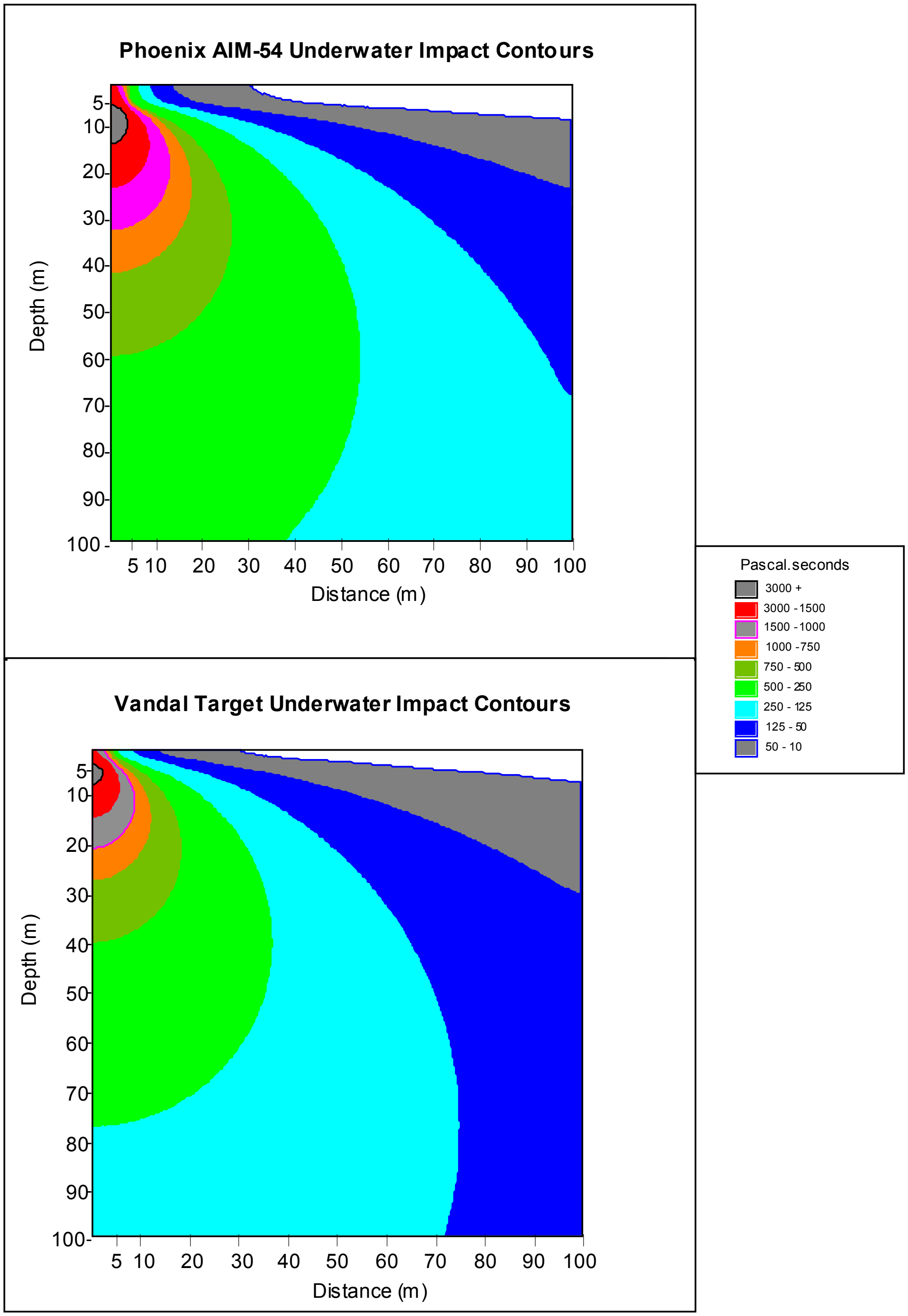


Figure 4.7-4
Underwater Impact Contours in Pascal•seconds for an Intact Phoenix Missile and Vandal Target Hitting the Water.
Calculated as described in the text and the *Marine Mammal Technical Report*.

Table 4.7-4. Impulses (in Pascal•seconds) Causing One Percent Mortality of Adult Marine Mammals with the Corresponding Distances from Missile Impacts at Which Those Impulses are Estimated to Occur

			Distance (m)				
	Body Weight (kg)	1% mortality·Pa•s	Phoenix	Harpoon	AQM-37	Vandal	AltAir
Baleen whales	11,000-100,000+	1304	1	2	0.1	8	12
Sperm whale	15,000-48,000	1304	1	2	0.1	8	12
Pilot whale	800	1197	1	2	1	8	15
Risso's dolphin	300	819	3	2	1	12	22
Bottlenose dolphin	200	701	3	3	2	14	26
White-sided dolphin	200	701	3	3	2	14	26
Common dolphin	75	480	5	4	3	20	37
Harbor porpoise	64	451	5	4	3	21	40
California sea lion	200	701	3	3	2	14	26
Harbor seal	65	451	5	4	3	21	40

numbers of intact missiles and targets hitting the water and to the density of marine mammals in each range stratum where these missiles or targets are expected to hit the water. Based on this procedure, an estimated 0.13 marine mammals per year are expected to be within the 1 percent injury/mortality radius. About 0.001 marine mammals are expected to be killed or seriously injured per year as a result of exposure to impulses from current Sea Range operations (Table 4.7-3).

An estimated 0.00042 marine mammals per year are expected to be killed or seriously injured as a result of exposure to impulses from current operations in Territorial Waters (Table 4.7-3).

An estimated 0.00085 marine mammals per year are expected to be killed or seriously injured as a result of exposure to impulses from current operations in non-Territorial Waters (Table 4.7-3).

When a rapidly-moving object strikes the water, the area within which marine mammals could be exposed to impulses strong enough to cause TTS is much larger than the area within which physical injury could occur (Figures 4.7-5 and 4.7-6). SELs at which TTS is expected are based on the provisional criteria summarized in Table 4.7.1. As a first approximation, the source levels and propagation of the noise pulse were estimated on the assumption that the impact behaves like a high-explosive detonation near the water's surface (see Section 4.7.1.3-A).

The number of marine mammals exposed to impulses strong enough to cause TTS was estimated taking account of animals at or near the surface (depths 0 to 33 feet [0 to 10 m]) and those submerged well below the surface. It was assumed that the average depth of a submerged marine mammal is 164 feet (50 m) and assumed that cetaceans in the Sea Range would be submerged 75 percent of the time. The latter figure is based on a conservative rounding of combined NMFS aerial survey estimates, which indicated that the average cetacean is submerged 72.2 percent of the time. It was further assumed that pinnipeds at sea within the Sea Range would be submerged 55 percent of the time. The pinniped figure is also based on combined NMFS aerial survey estimates, with less weight being given to elephant and harbor seals than to the more common California sea lions and fur seals.

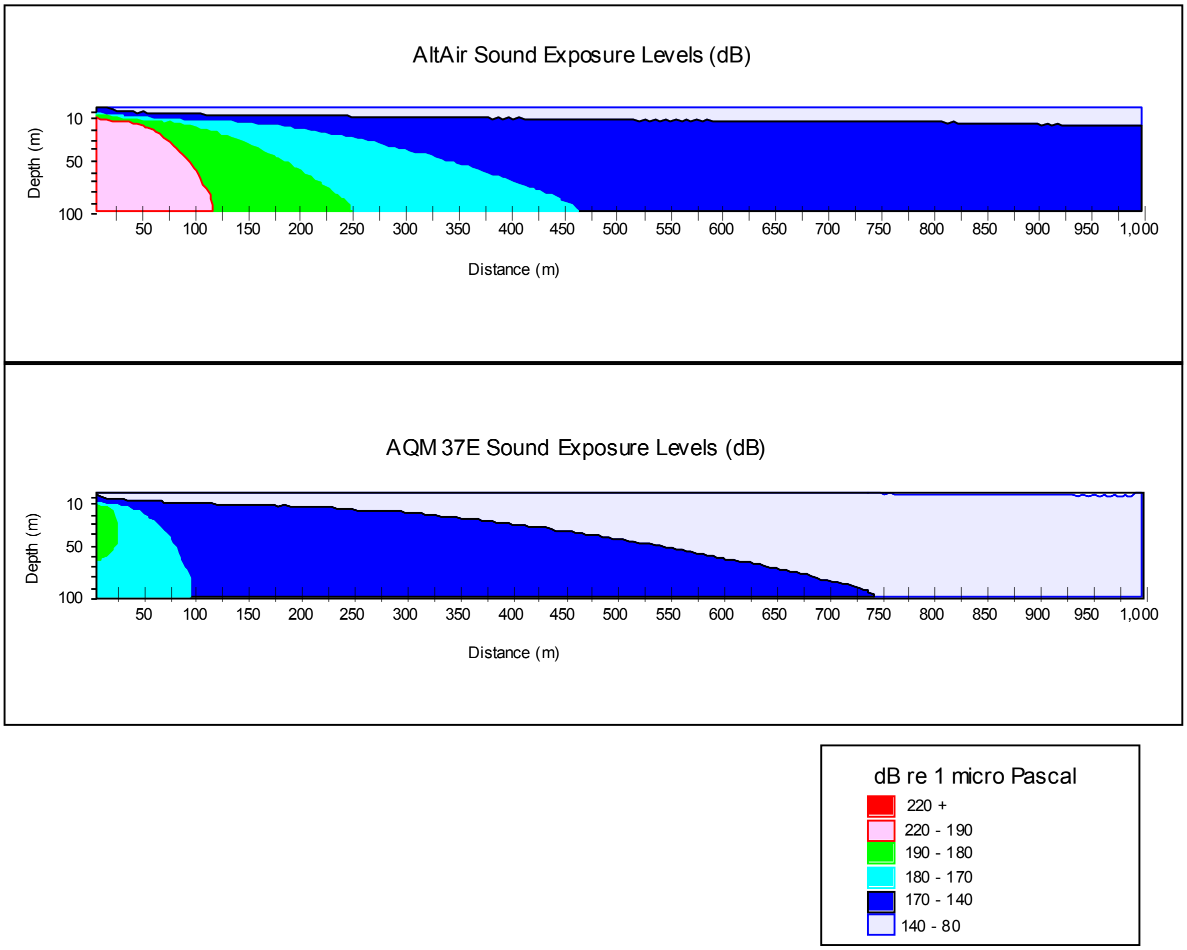
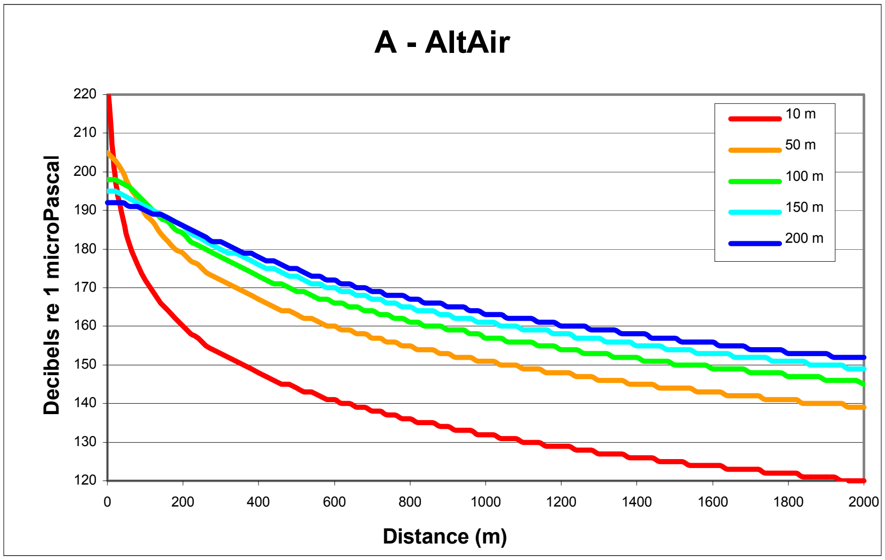


Figure 4.7-5
Sound Pressure Level Contours for Intact AltAir and AQM-37/Sidewinder Missiles Hitting the Water.

Using this procedure, an estimated 4.03[1] marine mammals (of an average population of 460,000 in the Sea Range) are exposed to TTS due to missiles or targets hitting the water during an average year (Table 4.7-3). Of these, about 0.063 individuals are threatened and endangered species. Any TTS is most likely to be mild, as the received level of the sound pulse is <10 dB above the TTS threshold within the great majority of the area of potential TTS. Thus, the effect of TTS would be transitory and would not be biologically significant to marine mammals. The probability that any individual marine mammal experiences TTS more than once per year approaches zero.

About fifty percent of the 4.03 marine mammals that are subject to TTS are in Territorial Waters (approximately 1.94 marine mammals) and, of these, about 0.003 individuals are threatened and endangered species.

[1] This value is the estimate of total numbers of animals affected based on summing appropriate decimal values across species. This calculation is described in more detail in Section 4.7.4.4-B.



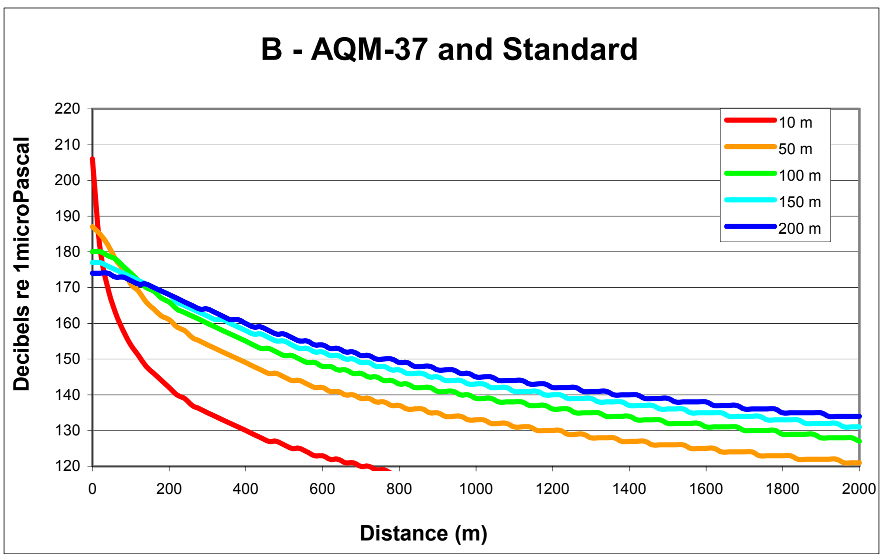


Figure 4.7-6
Sound Pressure Levels at Five Depths for Various Intact Missiles, Targets, and Mines Hitting the Water.

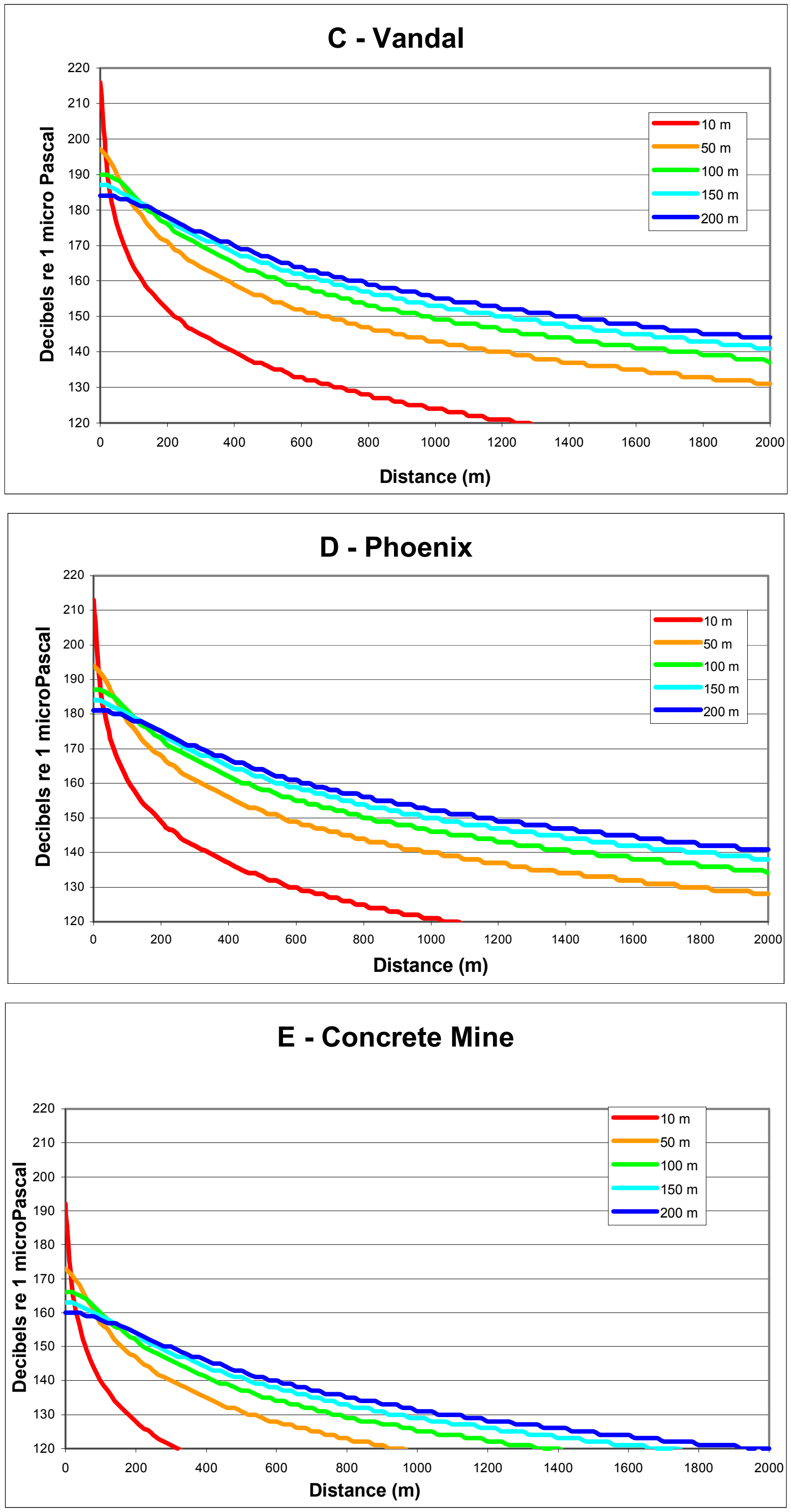


Figure 4.7-6 (continued)

An estimated 2.09 marine mammals are subject to TTS due to missiles or targets hitting the water in non-Territorial Waters during an average year (Table 4.7-3). Of these, about 0.06 individuals are threatened and endangered species.

In summary, the effects on marine mammals of surface impacts by intact missiles and targets are less than significant. The probability that any intact missile or target would kill or cause physical injury to a marine mammal is small (about 0.001 mammals per year with current Sea Range operations). An estimated 4.03 marine mammals per year are subject to a single TTS incident related to intact missiles or targets hitting the water. This would most likely be only a mild TTS, and would be transitory and not biologically significant.

D - Impacts Related to Close-In Weapon System (CIWS) Operations

The CIWS is a system designed to protect ships from anti-ship missiles. CIWS includes a six-barrel 20-mm caliber Gattling gun adapted from the Air Force M61 Vulcan cannon. The gun has a theoretical firing rate of 3,000 rounds per minute with a very low dispersion pattern for the projectiles. The projectiles have a muzzle velocity of 3,650 feet (1,113 m) per second and a maximum range of 4,875 feet (1,486 m). Typically the gun fires a burst of about 200 rounds. Each projectile weighs 0.22 pounds (0.10 kg) and has a tungsten penetrator. In the Sea Range, most CIWS rounds are fired in range areas 4A and 4B. These correspond to strata 4 and 5 used in the computation of marine mammal densities.

The number of marine mammals that could be injured or killed by rounds fired from CIWS operations was estimated in the following manner. The maximum area of water surface that might be struck by the rounds fired annually in the Sea Range was estimated as the cross-sectional surface area of a 20-mm round multiplied by the 3,000 rounds fired during the baseline year. For each affected stratum, the estimates of marine mammal densities that were derived for this EIS/OEIS (refer to Section 3.7.2-B) were used. The areas struck by projectiles in strata 4 and 5 were multiplied by the average marine mammal densities for strata 4 and 5 to obtain estimates of the numbers of marine mammals likely to be struck by CIWS rounds. Only those marine mammals expected to be at the surface at any given time were considered in this calculation. CIWS rounds fired directly into the water decelerate to non-lethal velocity within 22 inches (56 cm) of the water's surface after impact (NAWCWPNS Point Mugu 1998f) so the injury risk to cetaceans and pinnipeds swimming underwater would be very low. (The procedures used are described in more detail in Appendix B of the *Marine Mammal Technical Report*, "Estimates of Numbers of Marine Mammals at Sea that Might Be Injured or Killed.")

Based on average annual operations in the Sea Range, an estimated 4.0×10^{-6} marine mammals per year could be hit by rounds from a CIWS system. This is equivalent to one serious injury or death in approximately 285,060 years. In the highly implausible event that a marine mammal was seriously injured or killed, the impact of CIWS projectiles on its population would be less than significant unless it was a rare and endangered species. Based on average annual CIWS operations in the Sea Range, there could be one serious injury or death of an endangered whale species in approximately 307,779,583 years.

For the reasons described above, the impacts of CIWS operations on marine mammals in Territorial Waters are less than significant. About 1.6×10^{-9} of the marine mammals struck by CIWS projectiles per year could be endangered whales in Territorial Waters.

For the reasons described above, the impacts of CIWS operations on marine mammals in non-Territorial Waters are less than significant. Approximately 1.7×10^{-9} marine mammals struck by projectiles per year could be endangered whales in non-Territorial Waters.

The probability of a marine mammal sustaining injury due to the impulse generated by a CIWS round striking the water nearby was also calculated. A conservative approach was adopted that assumed that all CIWS rounds hit the water at a velocity equal to the muzzle velocity of 3,650 feet (1,113 m) per second. Rounds hitting the water at this velocity produce an impulse with a very short rise time—more rapid than that expected from a CIWS round that had traveled on through a ballistic trajectory to an impact location some distance from the gun. McLennan's (1997) equation and a spreading loss equation were used to determine the distances from the impact point at which the impulse would diminish to the "1 percent injury/mortality" levels predicted by Yelverton's (1981) equations (Table 4.7-4). (The received sound levels at various distances were computed assuming that the source was a dipole; described in more detail in the *Marine Mammal Technical Report.*) The predicted impulse produced by a CIWS round hitting the water would be 3.2 Pascal•seconds at 3.3-feet (1-m). The predicted impulse is well below the minimum impulse necessary to cause physical injury to a marine mammal. Yelverton's equations predict that a small mammal such as a harbor seal would sustain 1 percent injury/mortality when subjected to an impulse of 450 Pascal•seconds (Table 4.7-4). The applicability of the McLennan (1997) model to small high-speed projectiles is subject to considerable uncertainty. However, quite substantial refinements to the assumptions and equations could be made without substantially altering the conclusion that the impulse would not cause physical injury to marine mammals.

When a rapidly moving object strikes the water, the radius within which marine mammals are exposed to impulses strong enough to cause TTS is a much larger area than that within which physical injury could occur (Tables 4.7-5, 4.7-6). Sound exposure levels at which TTS is expected are based on the provisional NMFS (1995) criteria summarized in Table 4.7.1. The source level and propagation of the noise pulse from the impact of a CIWS round were estimated based on the assumption that it behaves like a high-explosive detonation near the water's surface (see Section 4.7.2.1-C). The estimated sound source level for a CIWS round striking the water's surface would be about 165 dB SEL re 1 µPa at 3.3-feet (1-m). This is well below the TTS threshold for a single transient event. Marine mammals would not be exposed to TTS caused by the noise of a CIWS round hitting the water. Even with model refinements, it is not expected that source levels would reach the assumed TTS threshold for baleen whales (180 dB SEL re 1 µPa).

Only one report is available that describes the source level of a CIWS gun, and presents a method of estimating the propagation of sound produced by this weapon system (Hannay et al. 1998). Using the Patter formula in a MathCAD computer model (refer to Appendix D), the area near the CIWS gun muzzles within which pinnipeds might be exposed to sounds of sufficient intensity to elicit TTS in air (145 dB SEL re 20 µPa) was estimated. A worse-case scenario was assumed where the gun fires horizontally, its muzzle 15 feet (5 m) above the water surface, and no ship structure between the gun and the water. In this case, the water surface exposed to 145 dB SEL re 20 µPa would be an approximately rectangular-shaped patch of 4,994 square feet (464 m^2). This patch would extend out 26 feet (7.9 m) along the line of the gun and laterally across the line of fire to 14 feet (4.3 m) on either side. The ship would move approximately 164 feet (50 m) during the burst. Assuming that the CIWS is fired 15 times per year on the Sea Range in areas 4A and 4B, then about 0.021 pinnipeds could be exposed to TTS. This is a conservative (high) estimate because it assumes that all pinnipeds at the water surface have their ears above water. Sound levels below the water surface would not exceed a value that might cause TTS in baleen whales or other marine mammals.

About 0.016 of the 0.021 pinnipeds exposed to TTS from CIWS gun noise would be in Territorial Waters (Table 4.7-3).

About 0.005 pinnipeds would be exposed to TTS from CIWS gun noise in non-Territorial Waters (Table 4.7-3).

In summary, the probability of CIWS rounds striking a marine mammal is extremely low. The impulsive energy produced by a CIWS round striking the water is insufficient to cause physical injury or TTS in marine mammals. About 0.021 pinnipeds per year could be exposed to TTS caused by the sound of the CIWS being fired. Firing the CIWS has less than significant impacts on marine mammal populations within the Sea Range.

4.7.2.2 Air-to-Air Operations

Each subsection from 4.7.2.2 through 4.7.2.6 briefly mentions the military activities associated with one type of test and training operation on the Sea Range (e.g., this subsection addresses air-to-air operations). Each subsection summarizes the expected impacts of those types of activities on marine mammals, based on the previous literature review and analysis. Several of those military activities (including aircraft operations, target launches, debris falling into the ocean, and intact missiles or targets impacting the ocean) recur in various different test and training operations.

Current air-to-air operations involve high-altitude aircraft operations, launch of targets from NAS Point Mugu, target debris falling into the ocean, occasional intact missiles or targets impacting the ocean, and possibly target recovery using a helicopter. As discussed in Section 4.7.2.1, no injuries or deaths, and few temporary alterations of behavior, are expected as a result of these operations. Debris from missile and target flights associated with air-to-air operations was included in the calculations summarized in Section 4.7.2.1-C. Impacts of air-to-air operations on marine mammals are less than significant.

As discussed in Section 4.7.2.1, elements of air-to-air operations occurring in Territorial Waters have less than significant impacts on marine mammals.

As discussed in Section 4.7.2.1, elements of air-to-air operations occurring in non-Territorial Waters have less than significant impacts on marine mammals.

4.7.2.3 Air-to-Surface Operations

Current air-to-surface operations involve the activities mentioned above, as well as ship activities, surface-based targets, and mine drops. The impacts on marine mammals are similar to those described in Section 4.7.2.1. As shown in Section 4.7.2.1, the probability that any of 300 missiles and targets (the approximate annual use for all types of current operations) hits a marine mammal is very low. There is also only a low probability that a marine mammal will be hit and injured or killed during inert mine drops as part of current air-to-surface operations (FLEETEX and otherwise). Impacts of inert mine drops on marine mammals are summarized in Section 4.7.2.7-D, below. Impacts of air-to-surface operations on marine mammals are less than significant.

As discussed in Section 4.7.2.1, elements of air-to-surface operations occurring in Territorial Waters have less than significant impacts on marine mammals.

As discussed in Section 4.7.2.1, elements of air-to-surface operations occurring in non-Territorial Waters have less than significant impacts on marine mammals.

4.7.2.4 Surface-to-Air Operations

Current surface-to-air operations involve the activities mentioned above in air-to-air operations, the launch of targets from San Nicolas Island or NAS Point Mugu, and the use of ships. The impacts of these activities on marine mammals are discussed in Section 4.7.2.1. Impacts of surface-to-air operations on marine mammals are less than significant.

As discussed in Section 4.7.2.1, elements of surface-to-air operations occurring in Territorial Waters have less than significant impacts on marine mammals.

As discussed in Section 4.7.2.1, elements of surface-to-air operations occurring in non-Territorial Waters have less than significant impacts on marine mammals.

4.7.2.5 Surface-to-Surface Operations

Current surface-to-surface operations involve a surface-based target and support boat, a ship, ship-launched missiles, and low-level pursuit by a chase aircraft. Impacts of individual activities are discussed in Section 4.7.2.1. The impacts of surface-to-surface operations on marine mammals are less than significant.

As discussed in Section 4.7.2.1, elements of surface-to-surface operations occurring in Territorial Waters have less than significant impacts on marine mammals.

As discussed in Section 4.7.2.1, elements of surface-to-surface operations occurring in non-Territorial Waters have less than significant impacts on marine mammals.

4.7.2.6 Subsurface-to-Surface Operations

Current subsurface-to-surface operations involve the activities mentioned above in surface-to-surface operations, as well as the use of a submarine to launch cruise missiles.

Subsurface missile launches are a source of underwater and aerial sound, launch debris (missile shrouds and spent booster motor), and combustion byproducts from booster propellant (see Section 4.7.1.3-D). In addition, these subsurface launches are sources of potential falling debris, or may result in intact missiles impacting the surface at the termination of the missile flight as discussed in Section 4.7.2.1-C. Given the low launch rate, there is an extremely low probability that one of these missiles would strike a marine mammal on launch. It is estimated that 5×10^{-7} marine mammals per year might be struck assuming a single launch per year in stratum 4. There is also a very low probability that any marine mammal would be struck by launch debris or propellants during the ascent through the water to the sea surface. Any residual byproducts of booster propellant combustion will quickly dilute in seawater (see Section 4.7.1.3-D). The impacts of current subsurface-to-surface operations on marine mammals are less than significant.

As discussed above, the launch of a subsurface missile in Territorial Waters has less than significant impacts on marine mammals. As discussed in Section 4.7.2.1, other elements of subsurface-to-surface operations occurring in Territorial Waters also have less than significant impacts on marine mammals.

Potential impacts from the launch of a subsurface missile in non-Territorial Waters are similar to those described for Territorial Waters and are less than significant. As discussed in Section 4.7.2.1, other elements of subsurface-to-surface operations occurring in non-Territorial Waters also have less than significant impacts on marine mammals.

4.7.2.7 Ancillary Operations

A - Radar and Microwaves

Safe levels for exposure of humans to non-ionizing electromagnetic radiation are discussed in Section 3.14 of this EIS/OEIS. At San Nicolas Island, the HERP (Hazards of Electromagnetic Radiation to Personnel) zones around the transmitters are confined to areas well within the interior of the island. The HERP zones exclude the beach areas where pinnipeds occur (refer to Figure 3.14-4). The same is true at NAS Point Mugu with the exception of very small areas just inside the entrance to Mugu Lagoon and at Laguna Point (refer to Figure 3.14-1). Pinnipeds hauled out at NAS Point Mugu and on San Nicolas Island reside below the elevation angles at which radar and other electromagnetic beams normally are directed from the transmitters, and in many cases (especially at San Nicolas Island) are not in the line of sight from the transmitters. Transmission of radar energy is largely limited to line-of-sight. Effects of electromagnetic radiation on marine mammals are less than significant.

B - Chaff and Flares

A review of literature, combined with controlled experiments, revealed that chaff and self-defense flare use pose little risk to the environment or to marine mammals (see Section 4.7.1.3-B). Marine mammals could ingest chaff fibers with water or food, or the baleen of baleen whales could trap small amounts of chaff. Such effects are likely to be short-term and unlikely to cause internal damage. Impacts of chaff on marine mammals are less than significant.

Toxicity is not a concern with self-defense flares since the primary material in flares, magnesium, is not highly toxic (see Section 4.7.1.3-B), and will normally combust before striking the land or sea surface. It is unlikely that marine mammals would ingest flare material because it rapidly sinks. The probability of a marine mammal being injured by a falling dud flare is extremely remote. Marine mammals, particularly pinnipeds, could become entangled in a parachute attached to a ship-launched illumination flare. A small parachute might resemble a jellyfish that is prey for some species of marine mammals. However, the parachute would remain attached to the flare and sink rapidly. Only about 15 flare operations occur per year. Thus, the possibility of entanglement is very remote and the impact of flares on marine mammals is less than significant.

For the reasons discussed above for Territorial Waters, potential impacts on marine mammals from chaff and flare use in non-Territorial Waters are less than significant.

C - Lasers

Use of laser systems for detection and guidance commonly occurs on the Sea Range, primarily in association with missile testing activities. The eye-hazard distance for the types of laser designators and range-finders used on the Sea Range is 12-NM (22-km) (refer to Section 3.0, Current Activities). The beam is very narrow. Also, these lasers are normally directed at military objects (e.g., missiles in flight above the water surface). Hence, the probability of illuminating a marine mammal is extremely low. Given the low probability of hitting marine mammals with debris (Section 4.7.2.1-C), the probability of contacting a marine mammal, especially its eyes, with a laser beam is very small. Impacts of current laser operations on marine mammals are less than significant.

For the reasons described above for Territorial Waters, potential impacts from current laser operations on marine mammals in non-Territorial Waters are less than significant.

D - Inert Mine Drops

Under current conditions, about 50 inert mine shapes are dropped per year during FLEETEX operations and other air-to-surface operations. Inert mine shapes are dropped in a controlled way over a small area of the Sea Range near Santa Rosa Island extending from a point offshore of Skunk Point to a point offshore of Carrington Point (refer to Figure 3.0-14). The drop area is monitored prior to and following the drop operation. The possibility that one or more mine shapes will strike and injure or kill a marine mammal is very low: estimated as 0.00047 marine mammals per year (Table 4.7-3; details in the *Marine Mammal Technical Report*).

The calculated radii around the impact points of inert mine shapes within which TTS might occur are very small – essentially zero for odontocetes and pinnipeds (190 dB re 1 µPa SEL criterion), and about 13 feet (4 m) for baleen whales (180 dB SEL criterion) (see the *Marine Mammal Technical Report*). The probability that any marine mammal would experience TTS as a result of an inert mine drop is negligible. The acoustic impacts of inert mines hitting the ocean's surface on marine mammals are less than significant.

Some mine shapes are designed for recovery. High-frequency (28-45 kHz) pingers with source levels of 175 dB re 1 µPa at 1 m are attached to about 40 percent of the inert mine shapes. The moderately high frequencies emitted by these pingers are inaudible or at most only faintly audible to baleen whales, but audible to seals, sea lions, and toothed whales. Their source levels are less than the assumed underwater TTS thresholds of pinnipeds and toothed whales (*cf.* Table 4.7-1), so TTS is not expected. High frequency sounds attenuate rapidly in seawater, so any disturbance effects would be localized if they occur at all. Because of the localized and pulsed (although repeated) nature of these sounds, any disturbance effects on pinnipeds or toothed whales are less than significant.

Given the low probability that an inert mine will strike a marine mammal or cause TTS, the impacts of inert mine shape drops on marine mammals are less than significant.

4.7.2.8 Current Fleet Exercise Training

FLEETEXs include a combination of operations and activities discussed in Sections 4.7.2.1 to 4.7.2.7. Some marine mammals could temporarily change their behavior in response to transient and more prolonged noise emissions during a FLEETEX (approximately 2-3 days per FLEETEX; less at any one location). However, temporary behavioral changes, including temporary localized displacement of some baleen and sperm whales by vessel traffic (Section 4.7.2.1-B), are not expected to have significant biological effects. Impacts of these combined activities on marine mammals are less than significant.

Those elements of a FLEETEX occurring in Territorial Waters have less than significant impacts on marine mammals.

Those elements of a FLEETEX occurring in non-Territorial Waters have less than significant impacts on marine mammals.

4.7.2.9 Littoral Warfare Training

Littoral warfare training is routinely done in areas not including beaches used by pinnipeds. If this training were done near beaches used by pinnipeds, any impacts on marine mammals from littoral warfare training would be a result of surface craft activities and beach landings. Underwater noise from the boat engines could cause short-term changes in behavior and temporary displacement of some species in the water. Such temporary behavioral changes in the water result in less than significant impacts.

If landings were made on beaches where pinnipeds are hauled out, then the activity would likely cause stampedes of pinnipeds into the water, which would constitute strong disturbance. This could result in the injury, death, or abandonment and subsequent death of some individual pinnipeds, especially of some pups and juveniles. However, under present policy, beach landings are normally limited to locations and seasons when pinnipeds are absent or scarce. With these existing procedures in place, impacts on marine mammals less than significant.

4.7.2.10 Hazardous Constituents

All hazardous constituents released into the environment during Sea Range activities are expected to be widely-scattered in very low concentrations. The water quality analysis indicated that saltwater concentrations of constituents of concern resulting from Sea Range operations are all well below water quality criteria established for the protection of aquatic life (refer to Section 4.4, Water Quality and the *Marine Mammal Technical Report*). During current Sea Range activities, releases of hazardous constituents have less than significant impacts on marine mammals.

Potential impacts on marine mammals from the release of hazardous constituents in Territorial Waters are less than significant.

Potential impacts on marine mammals from the release of hazardous constituents in non-Territorial Waters are less than significant.

4.7.2.11 Impact Summary, Current Operations

All of the current operations included in the No Action Alternative have less than significant impacts on marine mammal populations. It is possible that small numbers of individual marine mammals, mainly of the most common species, are subject to TTS from noise associated with surface impacts of missiles or targets, or to injury or death from pinniped stampedes on beaches, or (rarely) from falling debris or missiles. These effects have not been documented on the range, and do not lead to significant effects on marine mammal populations.

4.7.3 Minimum Components Alternative

This alternative would include current operations (as discussed above) plus nearshore intercept events close to San Nicolas Island, an increase from two to three FLEETEXs per year, and facility modernization at San Nicolas Island. Therefore, the impacts of this alternative would include those previously discussed plus the following additional impacts.

4.7.3.1 Theater Missile Defense Element – Nearshore Intercept

This type of event would include a target intercept at 50 to 1,000 feet (15-305 m) altitude at least 1 NM (1.9 km) offshore of the northwest or southeast end of San Nicolas Island. There would be a subsonic flight of a target parallel to the southern coast of San Nicolas Island 0.5-1 NM (0.9-1.9 km) off the shoreline at or below 1,000 feet (305 m) altitude. A supersonic missile (e.g., Standard) en route to the intercept would fly past the western or eastern end of the island, possibly as close as 1 NM (1.9 km) away.

Pinnipeds seem quite tolerant of sonic booms, although their responses to the booms vary according to the season and age structure of the hauled-out group (Section 4.7.1.2-B). The sonic boom from a Standard or similar missile is less intense than that from aircraft or the large missiles to which pinnipeds have occasionally been reported to react. Pinnipeds on the beaches at San Nicolas Island may show minor alerting responses to the sight or sound of the target, missile, or intercept, but a stampede from the beach into the water is not expected. Likewise, pinnipeds and sea otters in the water below the flight paths are not expected to show more than minor alerting responses or perhaps a hasty dive. These effects would be less than significant (Section 4.7.1.1).

Marine mammals could be hit by debris from the planned eight nearshore intercept events per year. Debris could land in nearshore areas proposed for this type of test or training event (i.e., 1 NM [1.9 km] or more offshore). The specific density of marine mammals in the nearshore waters around San Nicolas Island at different times of year has not been documented. However, pinniped densities there are undoubtedly higher than in the broader stratum extending out to 12-NM (22-km) offshore from San Nicolas Island for which approximate densities have been estimated. Also, sea otters occur off the western end of San Nicolas Island.

Even if the actual marine mammal density under the nearshore intercept point were five times higher than for the general area within 12-NM (22-km) of San Nicolas Island, the probability of a marine mammal being seriously injured or killed by falling debris from eight nearshore intercepts per year would be only about 0.0015 (Table 4.7-5). It is also very unlikely that a marine mammal would be injured or killed by the shock waves from a nearby impact during a nearshore intercept event (0.0001 animals per year). The number of animals likely to be exposed to a sound pulse strong enough to cause TTS, probably mild, is also low (3.1 per year; Table 4.7-5).

Impacts of nearshore intercept testing or training events on marine mammals would be less than significant.

4.7.3.2 Training Element – Additional FLEETEX

A FLEETEX includes a combination of operations and activities discussed in Sections 4.7.2.1 to 4.7.2.7 under the No Action Alternative. Some marine mammals (especially baleen or sperm whales) could temporarily change their behavior or show temporary avoidance in response to noise produced during a FLEETEX (approximately 2-3 days per FLEETEX; less than that at any one location). However, these temporary behavioral changes and avoidance are not expected to be biologically significant. Debris and shock waves from missiles and targets associated with an additional FLEETEX (i.e., three rather than two per year) are expected to kill or injure an additional 0.0005 marine mammals beyond the estimated 0.003 injured or killed during all current operations (Table 4.7-5). An additional 0.32 marine mammals per year might be subject to mild TTS due to exposure to strong sound pulses from missiles or targets striking the water (Table 4.7-5).

Any additional injuries or deaths are unlikely to occur in Territorial Waters (Table 4.7-5). An additional 0.09 marine mammals per year in Territorial Waters might be subject to mild TTS due to exposure to strong sound pulses from missiles or targets striking the water (Table 4.7-5). Also, during an additional FLEETEX, an additional 0.0002 marine mammals are predicted to be injured or killed during inert mine drops, based on the same assumptions given in Section 4.7.2.7-D (Table 4.7-5).

Table 4.7-5. Numbers of Marine Mammals Expected to be Exposed to Injury, Mortality, or Temporary Threshold Shift per Year Under the Minimum Components Alternative (For details, see the *Marine Mammal Technical Report*)[1]

Source of Injury or Mortality	Numbers of Marine Mammals Exposed: Territorial Water	*Non-Territorial Waters*	Total
Injury or mortality from missile debris			
Nearshore Intercept	0.0015	*0.0000*	0.0015
Additional FLEETEX	0.0000	*0.0003*	0.0003
Current Operations	0.0007	*0.0014*	0.0021
Total: Minimum Components Alternative + Current Operations	0.0022	*0.0016*	0.0038
Injury or mortality from inert mine drops			
Additional FLEETEX	0.0002	*0.0000*	0.0002
Current Operations	0.0005	*0.0000*	0.0005
Total: Minimum Components Alternative + Current Operations	0.0006	*0.0000*	0.0006
Injury or mortality due to missile impact or shock waves			
Nearshore Intercept	0.0001	*0.0000*	0.0001
Additional FLEETEX	0.0000	*0.0001*	0.0002
Current Operations	0.0004	*0.0009*	0.0013
Total: Minimum Components Alternative + Current Operations	0.0006	*0.0010*	0.0016
Exposure to impulses causing Temporary Threshold Shift[2]			
Nearshore Intercept	3.1078	*0.0000*	3.1078
Additional FLEETEX	0.0949	*0.2208*	0.3157
Current Operations (Includes CIWS gun noise[3])	1.9563	*2.0983*	4.0545
Total: Minimum Components Alternative + Current Operations	5.1589	*2.3191*	7.4780

[1] Numbers included in the text have been rounded for readability.
[2] Noise produced by low flying Vandal targets does not cause TTS.
[3] CIWS gun noise applies only to seals with their heads above water.

Debris and shock waves from missiles and targets associated with an additional FLEETEX are expected to kill or injure an additional 0.0004 marine mammals in non-Territorial Waters beyond those estimated to be injured or killed during current operations (Table 4.7-5). An additional 0.22 marine mammals per year in non-Territorial Waters might be subject to mild TTS due to exposure to strong sound pulses from missiles or targets striking the water (Table 4.7-5).

Overall, impacts of an additional FLEETEX (i.e., three rather than two exercises per year) on marine mammals would be less than significant.

4.7.3.3 Facility Modernization Element - Multiple-Purpose Instrumentation Sites

Construction of five multiple-purpose instrumentation sites on San Nicolas Island would occur at distances greater than 0.5 miles (0.8 km) from any marine mammal haul-out area, and thus would not interfere with seals hauled out on these beaches. Pinnipeds may be exposed to construction noise, or the visual stimuli of builders, construction equipment, and the transport of building materials. These activities would take place inland from the haul-out site. As a result, disturbances to pinnipeds on the beach would be less than if the source of disturbance originated either closer or from the direction of the sea (and their escape route). Impacts on marine mammals from construction would be less than significant.

New instrumentation may include operation of electronic devices transmitting microwave signals. As discussed in Section 4.7.2.7-A, pinnipeds that haul out on San Nicolas Island would not be exposed to significant electromagnetic radiation as a result of the construction of these new instrumentation facilities.

Thus, the impacts on marine mammals from construction and operation of the proposed multiple-purpose instrumentation sites would be less than significant.

4.7.3.4 Impact Summary - Minimum Components Alternative

In conclusion, impacts on marine mammal populations from all operations included in the Minimum Components Alternative, including current operations plus the additional components described above, would be less than significant. It is possible that small numbers of individual marine mammals, mainly of the most common species, would be subject to TTS from noise associated with surface impacts of missiles or targets, or to injury or death from pinniped stampedes on beaches, or (rarely) from falling debris or missiles. These effects have not been documented on the range during current operations. About 7.5 individual marine mammals per year would be subject to mild TTS from noise associated with missiles and targets striking the surface of the ocean, as compared with 4.1 during current operations (Table 4.7-5). Under the Minimum Components Alternative, approximately 0.005 marine mammals per year would be injured or killed by falling debris or shock waves generated by intact missiles hitting the water, as compared with 0.003 during current operations. Impacts of the Minimum Components Alternative on marine mammal populations would be less than significant.

4.7.4 Preferred Alternative

This alternative would include current operations (as discussed in Section 4.7.2), the three additional components described above under the Minimum Components Alternative, and several more components: TMD testing and training events, special warfare training, and facility modernization at NAS Point Mugu and San Nicolas Island. Therefore, the impacts of the Preferred Alternative would include those previously discussed plus the following additional impacts.

4.7.4.1 Theater Missile Defense Element

TMD events on the Sea Range could include boost phase intercept, upper tier, and lower tier testing and training operations. Three of each of these types of TMD events are proposed per year. It is not known whether any pinnipeds would stampede into the water during TMD launches from San Nicolas Island (see Section 4.7.2.1-A). At sea, these nine events would expose an estimated additional 0.0008 marine mammals per year to injury or mortality from debris, direct contact, or shock waves (Table 4.7-6). The calculations are described in detail in the *Marine Mammal Technical Report*. An additional 0.61 marine mammals per year would be exposed to TTS, probably mild (Table 4.7-6).

Any additional injuries or deaths are unlikely to occur in Territorial Waters (Table 4.7-6). An additional 0.06 marine mammals per year would be exposed to TTS, probably mild, in Territorial Waters (Table 4.7-6).

The nine TMD events would expose an estimated additional 0.0008 marine mammals to injury or mortality from debris, direct contact, or shock waves in non-Territorial Waters (Table 4.7-6). An additional 0.55 marine mammals per year would be exposed to TTS, probably mild, in non-Territorial Waters (Table 4.7-6).

Table 4.7-6. Numbers of Marine Mammals Expected to be Exposed to Injury, Mortality, or Temporary Threshold Shift per Year Under the Preferred Alternative (For details, see *Marine Mammal Technical Report*)[1]

Source of Injury or Mortality	Numbers of Marine Mammals Exposed: Territorial Water	*Non-Territorial Waters*	Total
Injury or mortality from missile debris			
Theater Missile Defense Element	0.0000	*0.0002*	0.0002
Nearshore Intercept	0.0015	*0.0000*	0.0015
Additional FLEETEX	0.0000	*0.0003*	0.0003
Current Operations (Includes CIWS rounds)	0.0007	*0.0014*	0.0021
Total: Preferred Alternative + Current Operations	0.0022	*0.0019*	0.0041
Injury or mortality from inert mine drops			
Additional FLEETEX	0.0002	*0.0000*	0.0002
Current Operations	0.0005	*0.0000*	0.0005
Total: Preferred Alternative + Current Operations	0.0006	*0.0000*	0.0006
Injury or mortality due to missile impact or shock waves			
Theater Missile Defense Element	0.0000	*0.0006*	0.0006
Nearshore Intercept	0.0001	*0.0000*	0.0001
Additional FLEETEX	0.0000	*0.0001*	0.0002
Current Operations	0.0004	*0.0009*	0.0013
Total: Preferred Alternative + Current Operations	0.0006	*0.0016*	0.0022
Exposure to impulses causing Temporary Threshold Shift[2]			
Theater Missile Defense Element	0.0576	*0.5540*	0.6116
Nearshore Intercept	3.1078	*0.0000*	3.1078
Additional FLEETEX	0.0949	*0.2208*	0.3157
Current Operations (Includes CIWS gun noise[3])	1.9563	*2.0983*	4.0545
Total: Preferred Alternative + Current Operations	5.2165	*2.8731*	8.0896

[1] Numbers included in the text have been rounded for readability.
[2] Noise produced by low flying Vandal targets does not cause TTS.
[3] CIWS gun noise applies only to seals with their heads above water.

Nearshore intercept events would also be part of the TMD Element. The characteristics and impacts of nearshore intercept events planned under the Preferred Alternative would be the same as those previously described under the Minimum Components Alternative.

A - Boost Phase Intercept

There could be a maximum of three boost phase intercept tests or training events per year if the Preferred Alternative is implemented. Boost phase intercept events could include the launch of a Lance or other missile weighing up to 50,000 pounds (22,700 kg, or about 1.5 times the weight of a Vandal) from the west-central part of San Nicolas Island. Because the launch profile would be more vertical than that of a Vandal, and the missile would be higher when crossing the beach, the effects of the missile's launch noise on pinnipeds are assumed to be no greater than those of the Vandal despite the somewhat greater weight (discussed in Section 4.7.2.1). Implementation of the Preferred Alternative, therefore, could be considered as resulting in an equivalent total of about eleven Vandal and boost phase intercept launches per year as compared with about eight Vandal launches per year now.

As noted in Section 4.7.2.1-A, recent observations revealed that some pinnipeds stampeded into the water in response to two separate Vandal launches. If pinnipeds react similarly to boost phase intercept launches, there would be some risk of injury or mortality of pups, primarily on the western third of San

Nicolas Island. There has been a rapid growth in resident pinniped populations despite Vandal and other current operations (see Section 3.7.4.3). Impacts of boost phase intercept launches on pinniped populations on San Nicolas Island would be less than significant whether or not there would be any adverse effects on individual pinnipeds.

There is a very low probability that a marine mammal would be killed by falling intact missiles or targets or debris used during three additional boost phase intercept events. The "Theater Missile Defense Element" lines in Table 4.7-6 show the estimated numbers for all three types of TMD components combined (3 boost phase intercept events, 3 upper tier events, and 3 lower tier events). Impacts of boost phase intercept testing and training on marine mammals would be less than significant.

B - Upper Tier

Upper tier testing and training events could include the firing of a target missile from San Nicolas Island. About three launches per year are expected. Effects would be similar to those for three boost phase intercept events per year as described above (Section 4.7.4.1-A).

Interceptor missiles could also be fired from a vessel in the Sea Range. Underwater noise from this launch would be very brief and would not significantly affect marine mammals.

There is a very low probability that a marine mammal would be killed by falling intact missiles or targets or debris produced by three very high altitude intercepts per year, or the impact of a non-intercepted target missile with the surface of the water. The "Theater Missile Defense Element" lines of Table 4.7-6 include all three types of TMD events that are planned. Impacts of upper tier testing and training events on marine mammals would be less than significant.

C - Lower Tier

Targets and missiles could be launched from San Nicolas Island during lower tier testing and training events. Assuming that launch noise levels would be about the same as those of the Vandal, acoustic impacts on pinnipeds at San Nicolas Island may be less than those of the Vandal because the launch profile would be more vertical than that of a Vandal.

Interceptor missiles could also be fired from a vessel in the Sea Range. Underwater noise from this launch would be very brief and would not affect marine mammals.

There is a very low probability that a marine mammal would be killed by falling intact missiles or targets or debris used during very high altitude intercepts or the impact of a non-intercepted target. The "Theater Missile Defense Element" lines of Table 4.7-6 include all three types of TMD events that are planned. Impacts of lower tier testing and training on marine mammals would be less than significant.

D - Nearshore Intercept

Nearshore intercept events under the Preferred Alternative would have the same characteristics and potential impacts as those described under the Minimum Components Alternative (Section 4.7.3.1). There is a very low probability of injury or mortality of a marine mammal during nearshore intercept operations (Table 4.7-6). Impacts of nearshore intercept testing and training events on marine mammals would be less than significant.

4.7.4.2 Training Element – Fleet Exercise and Special Warfare Training

A - Fleet Exercises

Under the Preferred Alternative, an additional FLEETEX would have the same characteristics and potential impacts as those described under the Minimum Components Alternative (Section 4.7.3.2). Some marine mammals (especially baleen or sperm whales) could temporarily change their behavior or show temporary avoidance in response to noise produced during a FLEETEX (approximately 2-3 days per FLEETEX; less than that at any one location). However, these temporary behavioral changes and avoidance are not expected to be biologically significant. Impacts of an additional FLEETEX on marine mammals would be less than significant.

B - Special Warfare

Impacts on marine mammals from special warfare training were evaluated in Section 4.7.2.9. Without mitigation (seasonal and/or location restrictions), special warfare training could have adverse impacts on pinnipeds hauled out on the beaches. However, under present policy, beach landings are normally limited to locations and seasons when pinnipeds are absent or scarce. With these existing procedures in place, impacts on marine mammals from two additional special warfare training exercises per year would be less than significant.

4.7.4.3 Facility Modernization - Point Mugu and San Nicolas Island

A - Point Mugu Modernizations

Under the Preferred Alternative, approximately six missiles per year may be launched from the existing B or C pads near the beach at NAS Point Mugu. Their distance from the haul-out area for harbor seals in Mugu Lagoon is sufficient to ensure that received sound levels would be below those predicted to cause disturbance. Any behavioral responses to launch noise would be limited to the short term and would be less than significant. Some of the missile launches could include the use of solid propellant boosters. The boosters would be ejected and fall into the ocean approximately 0.25 to 0.50 mile (0.40 to 0.80 km) offshore. Most of the propellant in boosters is expended during the launch; unspent fuel would be very limited in quantity and there would be no significant impacts on water quality (refer to Section 4.4). Given the extremely low probability of falling debris from other Sea Range operations injuring or killing a marine mammal (see Table 4.7-6), the probability that a booster would strike a marine mammal in the waters off Point Mugu would be very low. Impacts of proposed facility modernization at NAS Point Mugu on marine mammals would be less than significant.

B - San Nicolas Island Modernization

The proposed 50K launch site on San Nicolas Island would be located in the interior of the western portion of the island, near the present Vandal launch pad. It would be used to launch medium-sized missiles weighing up to 50,000 pounds (22,700 kg), including those that would be used as targets during TMD events. As discussed in Section 4.7.2.1, there are no data on responses of marine mammals to launch sounds of the types of missiles proposed here at the distances proposed. As in the case of Vandal launches, there is some possibility of stampedes. However, rocket launches do not appear to have had long-term effects on marine mammal populations on this island, given the increasing populations of elephant seals and California sea lions, and the stable population of harbor seals (Section 3.7.4.3). Although launches of 50K missiles may cause disturbance to some individual pinnipeds, no biologically significant impacts on marine mammal populations are expected.

Impacts of proposed construction at San Nicolas Island would occur on land and would not affect marine mammals on haul-out beaches.

Impacts of proposed facility modernization at San Nicolas Island on marine mammals would be less than significant.

4.7.4.4 Impact Summary - Preferred Alternative

A - Impacts

Impacts on marine mammal populations from all operations included in the Preferred Alternative, including current operations plus the additional components described above, would be less than significant. As for current operations alone, it is possible that small numbers of individual marine mammals might be subject to TTS from noise associated with surface impacts of missiles or targets, or to injury or death from pinniped stampedes on beaches. Approximately 0.006 marine mammals per year would be exposed to injury or mortality by falling debris or missile impacts under the Preferred Alternative; this would be 0.003 more than during current operations (Table 4.7-7). Effects on marine mammal populations would be less than significant.

B - Calculation of Numbers of Marine Mammals Subject to Injury, Mortality, or Temporary Threshold Shift

For each alternative (No Action, Minimum Components, and Preferred), the numbers of marine mammals that would be subject to injury or mortality as a result of direct hits by missile debris and (separately) as a result of shock waves from the impacts of intact missiles and targets striking the water nearby were estimated. The numbers that would be subject to TTS as a result of intact missiles and targets hitting the water were also calculated. TTS can occur out to a larger radius than direct physical injury by shock waves.

Separate calculations were performed for current operations, TMD, additional FLEETEX, and nearshore intercept events. The results from these calculations were combined as appropriate for the three alternatives. The computations for a given type of effect (e.g., TTS) were performed as follows:

1. The area of effect for each of the five types of targets or missiles was computed based on estimates of the numbers of intact missiles and targets expected to impact the water's surface within the Sea Range and the corresponding distances from missiles at which impacts could occur (see Tables 4.7-4, 4.7-5, and 4.7-6 of the *Marine Mammal Technical Report*).
2. For each species and stratum, the average annual density was multiplied by the area of effect for each of the five categories of target or missile.
3. The resultant numbers of animals exposed per missile or target impact were summed across species for each of the five vehicle types, and then multiplied by the numbers of vehicles landing in that stratum per year. These subtotals for the five vehicle types were then summed for each stratum.
4. The total numbers of animals affected were adjusted depending on whether the effects occurred only at the surface (debris) or at all depths (shock waves and TTS).

The densities of animals at the surface and below the surface were calculated as numbers per square kilometer and are decimal numbers. The area of effect for each missile or target category and species, in square kilometers, is also a decimal number. Missiles were apportioned to strata based on information

Table 4.7-7. Summary of Numbers of all Marine Mammals and Endangered Species Expected to be Exposed to Injury, Mortality, or Temporary Threshold Shift per Year as a Result of Objects Striking the Water Surface under all Alternatives[1]

Source of Injury or Mortality	Numbers of Marine Mammals Exposed			Numbers of Endangered Species Exposed		
	Territorial Waters	*Non-Territorial Waters*	Total	Territorial Waters	*Non-Territorial Waters*	Total
Intact Missile Hitting the Water						
• **Mortality due to Blast-like Effects**						
Total for Current Operations	0.000418	*0.000851*	0.001268	0.0000044	*0.0001345*	0.0001389
Total for Minimum Components Alternative[2]	0.000587	*0.000982*	0.001568	0.0000160	*0.0001612*	0.0001773
Nearshore Intercept	0.000143	*0.000000*	0.000143	0.0000112	*0.0000000*	0.0000112
Additional FLEETEX	0.000026	*0.000131*	0.000157	0.0000004	*0.0000267*	0.0000272
Total for Preferred Alternative[3]	0.000627	*0.001579*	0.002205	0.0000165	*0.0002444*	0.0002609
Theater Missile Defense	0.000040	*0.000597*	0.000637	0.0000004	*0.0000832*	0.0000836
Nearshore Intercept	0.000143	*0.000000*	0.000143	0.0000112	*0.0000000*	0.0000112
Additional FLEETEX	0.000026	*0.000131*	0.000157	0.0000004	*0.0000267*	0.0000272
• **Temporary Threshold Shift[4]**						
Total for Current Operations[5]	1.956251	*2.098280*	4.054531	0.0028550	*0.0601453*	0.0630003
Total for Minimum Components Alternative[2]	5.158919	*2.319088*	7.478007	0.0053812	*0.0667118*	0.0720930
Nearshore Intercept	3.107815	*0.000000*	3.107815	0.0023718	*0.0000000*	0.0023718
Additional FLEETEX	0.094852	*0.220808*	0.315661	0.0001544	*0.0065665*	0.0067209
Total for Preferred Alternative[3]	5.216521	*2.873080*	8.089601	0.0054981	*0.0783482*	0.0838463
Theater Missile Defense	0.057603	*0.553992*	0.611594	0.0001169	*0.0116364*	0.0117533
Nearshore Intercept	3.107815	*0.000000*	3.107815	0.0023718	*0.0000000*	0.0023718
Additional FLEETEX	0.094852	*0.220808*	0.315661	0.0001544	*0.0065665*	0.0067209
Debris from Missile or Target						
Total for Current Operations[6]	0.000689	*0.001384*	0.002074	0.0000004	*0.0000099*	0.0000104
Total for Minimum Components Alternative[2]	0.002201	*0.001635*	0.003836	0.0000014	*0.0000120*	0.0000134
Nearshore Intercept	0.001470	*0.000000*	0.001470	0.0000009	*0.0000000*	0.0000009
Additional FLEETEX	0.000042	*0.000251*	0.000293	0.0000000	*0.0000021*	0.0000021
Total for Preferred Alternative[3]	0.002217	*0.001863*	0.004081	0.0000014	*0.0000131*	0.0000145
Theater Missile Defense	0.000017	*0.000228*	0.000245	0.0000000	*0.0000011*	0.0000011
Nearshore Intercept	0.001470	*0.000000*	0.001470	0.0000009	*0.0000000*	0.0000009
Additional FLEETEX	0.000042	*0.000251*	0.000293	0.0000000	*0.0000021*	0.0000021
Injury or Mortality from Inert Mine Drops						
Total for Current Operations	0.000471	*0.0000000*	0.000471	0.0000083	*0.0000000*	0.0000083
Total for Minimum Components Alternative[2]	0.000644	*0.0000000*	0.000644	0.0000113	*0.0000000*	0.0000113
Additional FLEETEX	0.000173	*0.0000000*	0.000173	0.0000030	*0.0000000*	0.0000030
Total for Preferred Alternative[3]	0.000644	*0.0000000*	0.000644	0.0000113	*0.0000000*	0.0000113
Additional FLEETEX	0.000173	*0.0000000*	0.000173	0.0000030	*0.0000000*	0.0000030

[1] Numbers included in the text have been rounded for readability.
[2] Includes Current Operations, Nearshore Intercept, and additional FLEETEX.
[3] Includes Current Operations, Theater Missile Defense, Nearshore Intercept, and additional FLEETEX.
[4] Noise from low-flying Vandal targets does not cause TTS. CIWS gun noise applies only to seals with their heads above water.
[5] Includes CIWS gun noise.
[6] Includes CIWS rounds hitting the water.

provided in Chapter 2, Section 3.0, and Appendix B of the EIS/OEIS. Some of these numbers were also decimals. The numbers of animals affected, calculated by multiplication of these decimal values and summing across species are necessarily expressed as decimals because, for most species and types of effect, less than one animal per year is or would be exposed to effects. Sufficient decimal places were retained throughout the calculations to avoid biases that would result if intermediate values had been rounded.

Table 4.7-8 shows the estimated numbers of marine mammals of each species that are expected to be subject to TTS on a "per year" basis as a result of impacts of missiles and targets with the surface of the water. These values have been estimated by subdividing the overall estimated number of endangered plus all non-endangered species (e.g., 0.06 and 3.99 for "Current Operations") in proportion to the average annual densities of the various endangered and non-endangered species in the Sea Range. For most individual species, the expected number is less than one. However, these fractional numbers for individual species contribute to the estimated total number of all marine mammals that would be subject to TTS. The reciprocals of these fractional numbers are estimates of the average interval (in years) between successive occurrences of TTS to a member of that species. Also, these fractional numbers can be used to estimate the number of animals of each species expected to be subject to TTS over an interval exceeding one year in duration (assuming no change in tempo of operations).

Table 4.7-8. Numbers of Marine Mammals Expected to be Subject to Temporary Threshold Shift per Year as a Result of Intact Missiles and Targets Hitting the Water Under Each Alternative[1]

	Alternative		
Species	**Current Operations**	**Minimum Components**	**Preferred**
Endangered Species			
Blue whale	0.012635	0.014458	0.016815
Fin whale	0.007088	0.008111	0.009434
Sei whale	0.000045	0.000051	0.000059
Humpback whale	0.000458	0.000524	0.000610
Sperm whale	0.042774	0.048948	0.056928
Non-Endangered Species			
Gray whale	0.005720	0.010638	0.011502
Minke whale	0.001563	0.002907	0.003143
Beaked whales	0.024335	0.045260	0.048936
Killer whale	0.003157	0.005872	0.006349
Pilot whale	0.000000	0.000000	0.000000
Risso's dolphin	0.209899	0.390387	0.422095
Northern right whale dolphin	0.391508	0.728156	0.787299
Bottlenose dolphin	0.010980	0.020421	0.022079
White-sided dolphin	0.151364	0.281518	0.304384
Common dolphin	1.696958	3.156134	3.412483
Striped dolphin	0.030996	0.057649	0.062331
Dall's porpoise	0.047199	0.087784	0.094914
Harbor porpoise	0.000000	0.000000	0.000000
California sea lion	1.119173	2.067440	2.234032
Northern fur seal	0.168145	0.310613	0.335642
Northern elephant seal	0.107898	0.199318	0.215379
Harbor seal	0.022637	0.041817	0.045187

[1] Numbers included in the text have been rounded for readability.

Table 4.7-9 shows the estimated numbers of each species that are expected to be exposed to shock waves per year resulting from intact missile or target impacts. Table 4.7-10 shows the estimated numbers of marine mammals of each species that are expected to be exposed to missile debris per year.

Table 4.7-9. Numbers of Marine Mammals per Year Expected to be Exposed to Shock Waves Resulting from Intact Missiles or Targets Hitting the Water Under Each Alternative[1]

	Alternative		
Species	**Current Operations**	**Minimum Components**	**Preferred**
Endangered Species			
Blue whale	0.000028	0.000036	0.000052
Fin whale	0.000016	0.000020	0.000029
Sei whale	0.000000	0.000000	0.000000
Humpback whale	0.000001	0.000001	0.000002
Sperm whale	0.000094	0.000120	0.000177
Non-Endangered Species			
Gray whale	0.000002	0.000002	0.000003
Minke whale	0.000000	0.000001	0.000001
Beaked whales	0.000007	0.000009	0.000012
Killer whale	0.000001	0.000001	0.000002
Pilot whale	0.000000	0.000000	0.000000
Risso's dolphin	0.000060	0.000074	0.000103
Northern right whale dolphin	0.000111	0.000137	0.000192
Bottlenose dolphin	0.000003	0.000004	0.000005
White-sided dolphin	0.000043	0.000053	0.000074
Common dolphin	0.000483	0.000594	0.000831
Striped dolphin	0.000009	0.000011	0.000015
Dall's porpoise	0.000013	0.000017	0.000023
Harbor porpoise	0.000000	0.000000	0.000000
California sea lion	0.000314	0.000386	0.000540
Northern fur seal	0.000047	0.000058	0.000081
Northern elephant seal	0.000030	0.000037	0.000052
Harbor seal	0.000006	0.000008	0.000011

[1] Numbers included in the text have been rounded for readability.

4.7.5 Threatened and Endangered Species

There are six federally listed threatened and endangered species of marine mammals that might be found in the Sea Range (refer to Section 3.7). One of these species, the northern right whale, is very rare and is not expected to be found there. The other five species – blue, fin, humpback, sei, and sperm whale – are found in low to moderate numbers during some seasons (refer to Section 3.7).

None of the activities proposed by NAWCWPNS Point Mugu as part of the Preferred Alternative, including current operations, is likely to result in injury or mortality to a threatened or endangered species. An endangered whale could be killed by falling debris or injured or killed by impulse from an object striking the water nearby at high speed. However, the chance of this happening is very remote: approximately 0.0003 animals per year for all threatened and endangered species of marine mammals.

Table 4.7-10. Numbers of Marine Mammals per Year Expected to be Exposed to Missile Debris from Missiles or Targets Hitting the Water Under Each Alternative[1]

Species	Alternative		
	Current Operations	Minimum Components	Preferred
Endangered Species			
Blue whale	0.000002	0.000003	0.000003
Fin whale	0.000001	0.000002	0.000002
Sei whale	0.000000	0.000000	0.000000
Humpback whale	0.000000	0.000000	0.000000
Sperm whale	0.000007	0.000009	0.000010
Non-Endangered Species			
Gray whale	0.000003	0.000006	0.000006
Minke whale	0.000001	0.000002	0.000002
Beaked whales	0.000013	0.000023	0.000025
Killer whale	0.000002	0.000003	0.000003
Pilot whale	0.000000	0.000000	0.000000
Risso's dolphin	0.000109	0.000202	0.000215
Northern right whale dolphin	0.000203	0.000377	0.000401
Bottlenose dolphin	0.000006	0.000011	0.000011
White-sided dolphin	0.000079	0.000146	0.000155
Common dolphin	0.000882	0.001634	0.001738
Striped dolphin	0.000016	0.000030	0.000032
Dall's porpoise	0.000025	0.000045	0.000048
Harbor porpoise	0.000000	0.000000	0.000000
California sea lion	0.000573	0.001062	0.001129
Northern fur seal	0.000086	0.000159	0.000170
Northern elephant seal	0.000055	0.000102	0.000109
Harbor seal	0.000012	0.000021	0.000023

[1] Numbers included in the text have been rounded for readability.

Based on recent levels of Sea Range activity, threatened and endangered whales are not likely to experience TTS from missiles or targets entering the water near them (0.063 individuals of threatened and endangered species per year, or one every 16 years; Table 4.7-8). The annual estimates are 0.013 blue whales, 0.007 fin whales, 0.043 sperm whales, 0.0005 humpback whales, and 0.00005 sei whales.

Any impairment of hearing would be temporary and probably mild, and it is highly unlikely that any animal would be exposed to TTS more than once per year. TTS would not have significant biological consequences for individual whales. Overall, the impact of intact missiles or targets entering the water is less than significant.

Other Navy activities on the Sea Range such as low-level overflights by supersonic aircraft or targets, helicopters retrieving recoverable targets, and other activities may affect marine mammals. However, given that these activities are transient, highly mobile, and highly variable, they would not cause disruptions to natural behavior patterns to the point where such behavior patterns would be significantly altered or abandoned. In addition, as part of standard operating procedures on the Sea Range, the Navy implements the following marine mammal protection measures:

1. Navy vessels and aircraft do not intentionally interact with marine mammals.

2. Vessels on the Sea Range use safety lookouts 24 hours a day. The duties of these lookouts include looking for any and all objects in the water, including marine mammals. All sightings are reported to the ship's bridge and tracked.
3. When whales have been sighted in an area, ships increase vigilance and take reasonable and practicable actions to avoid collisions and activities that might result in close interaction of naval assets and marine mammals. Actions may include changing speed and/or direction and are dictated by environmental and other conditions (e.g. safety, weather).
4. In the event of a collision between a Navy vessel and a marine mammal, the Navy will notify NMFS as soon as practicable (normally within 48 hours of the incident) and provide a follow-up written report within 30 days. If the Navy is unable to provide a written report within 30 days, a schedule for submission will be provided to NMFS.
5. For intercepts close to San Nicolas Island, the Navy will increase marine mammal survey efforts beyond those for normal open ocean operations.

These measures apply to all marine mammal species and provide further assurance that the impacts of Sea Range aircraft and vessel activities would be less than significant.

The Navy initiated informal consultation under Section 7 of the Endangered Species Act during May of 2001 with the National Marine Fisheries Service (NMFS) for all activities on the Sea Range addressed in the EIS/OEIS. The consultation concluded in January of 2002; NMFS determined that all current and proposed Navy activities will not adversely affect federally listed species (see Appendix G).

As noted in Section 3.7.4.4, from 1987 to 1990, an "experimental population" of southern sea otters was translocated from central California to San Nicolas Island. Since 1989, the number of sea otters at the island has remained relatively stable at approximately 20 animals. In accordance with Public Law 99-625, the Navy must treat this experimental population as if they were proposed for listing. In accordance with Section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C § 1531), the U.S. Fish and Wildlife Service (USFWS) recently issued a Biological Opinion (BO) addressing all Navy activities on San Nicolas Island (refer to discussion in Section 4.8.5). The USFWS concluded that a conference opinion addressing the sea otter is not necessary because the Navy activities addressed in the programmatic BO, including actions addressed in this EIS, are not likely to jeopardize the species.

4.7.6 Compliance with the Marine Mammal Protection Act

NAWCWPNS Point Mugu has coordinated with NMFS concerning compliance with the MMPA (16 U.S.C. § 1431 et seq.) throughout the development of this analysis. Specifically for all activities at sea, the Navy has determined that there are no "takes" of marine mammals. Although there are no "takes" at sea, NAWCWPNS Point Mugu standard range clearance procedures include looking for marine mammals in predicted debris and impact areas. If marine mammals are observed in or near a predicted debris or impact area, activities are suspended or moved.

For pinnipeds hauled out on land, monitoring efforts at San Nicolas Island revealed that pinnipeds stampeded during two separate Vandal launch events. In response to these recent observations and coordination with NMFS, the Navy applied for and received Incidental Harassment Authorization (IHA) from NMFS. In accordance with the IHA, where practicable, the Navy will adopt the following mitigation measures when doing so will not compromise operational safety requirements or mission goals:

- prohibit personnel from entering pinniped haul-out sites below the missile's predicted flight path within two hours prior to launch;
- avoid launch activities during harbor seal pupping seasons;
- limit launch activities during other pinniped pupping seasons;
- not launch target missiles at low elevation on launch azimuths that pass close to beach haul-out site(s);
- avoid multiple target launches in quick succession over haul-out sites, especially when young pups are present;
- limit launch activities during the night;
- maintain a minimum altitude of 1,000 feet from pinniped haul-out sites during aircraft and helicopter operations; and
- contact NMFS within 48 hours if injurious or lethal takes are discovered during marine mammal monitoring.

A description of the activities covered under the IHA and a summary of the associated monitoring program are included in Appendix E of this EIS/OEIS.

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4.8 TERRESTRIAL BIOLOGY

4.8.1 Approach to Analysis

Activities associated with the proposed action and alternatives are complex, involving several types of weapon systems, targets, aircraft, ships, and operational scenarios. For purposes of analyzing impacts on terrestrial biological resources and seabirds, the type of operation and equipment is not as important as the resulting effects of operation. For example, the primary potential impact associated with aircraft is noise, regardless of the type of aircraft. Factors evaluated in the analysis include, but are not limited to: noise, sea-surface debris, beach landings, facility construction, and increased air and ship traffic. Major issues addressed include:

- Impacts on sensitive terrestrial species and seabirds resulting from potential missile impacts, debris impacts, and increased levels of noise;
- Impacts on seabird breeding and roosting sites based on operational locations and seasonal timing of disturbance; and
- Impacts on sensitive plant species and vegetation communities resulting from construction of new facilities.

In general, the primary factors used in determining significance of an impact on terrestrial resources and seabirds are sensitivity ratings and regulatory protection assigned by federal and state resource agencies (e.g., USFWS, CDFG) (federally and state-listed terrestrial plant and wildlife species known for the region of influence [ROI] were summarized in Table 3.8-1). The significance of a biological impact can be assessed at various geographical scales. Resources that are considered sensitive by federal or state agencies are the focus of this assessment. For the purposes of this EIS/OEIS, the factors used to assess significance include the extent or degree to which implementation of an alternative would:

- Substantially affect species listed as threatened or endangered by state and/or federal resource agencies; or
- Substantially affect sensitive habitats, including: a) habitats that are restricted at a regional scale; and/or b) habitats that serve as concentrated breeding or foraging areas and are limited in availability.

The significance of impacts is evaluated on local (Ventura County) and regional (coastal southern California) scales. For example, biological resources may be considered sensitive on a local scale but not at a larger regional scale. Impacts on birds resulting from increases in noise levels are evaluated using existing literature and studies by NAS Point Mugu. Ecologists at NAS Point Mugu have monitored roosting California brown pelican behavior and habitat in relation to human-caused disturbances, such as hunting and aircraft overflights; data from these studies are used to determine baseline conditions against which to evaluate the proposed actions.

For the purposes of addressing potential noise impacts on birds, the use of A-weighted sound levels was evaluated (refer to Appendix D). The evaluation revealed that A-weighted noise metrics (which attenuate low frequencies) are appropriate for use in determining potential noise impacts on birds. A-weighted metrics were thus used for this analysis.

Existing Geographic Information System (GIS) data layers are used to analyze the potential for missile impact debris to adversely affect seabirds. For example, typical debris patterns for each type of missile are overlaid on the seabird density layer to assess potential impacts.

Executive Order (EO) 13112, *Invasive Species*, was enacted on 3 February 1999 to improve the coordination of federal agency efforts in detecting, preventing, and controlling the existence of invasive vegetation and wildlife species. An invasive species is a non-native species whose introduction causes, or is likely to cause, economic or environmental harm or harm to human health. EO 13112 mandates specific actions to be undertaken by federal agencies, creates an interagency Invasive Species Council with an advisory committee, and directs that specific actions be taken by the council (including the creation of an Invasive Species Management Plan) within 18 months of the EO's issuance. Neither the Minimum Components nor the Preferred alternative would use, incorporate, or otherwise introduce invasive species to NAS Point Mugu, San Nicolas Island, or any other location within the Sea Range. Implementation of the Minimum Components or Preferred alternative would not result in the introduction of any invasive plant or wildlife species.

Current use of the existing instrumentation and support facilities on San Miguel, Santa Rosa, and Santa Cruz islands involves periodic maintenance activities. These activities do not have significant impacts on terrestrial biological resources. None of the alternatives addressed in this EIS/OEIS include new activities at these islands.

A summary matrix of terrestrial biology impacts is presented in Table 4.8-1.

4.8.2 No Action Alternative - Current Operations

Potential impacts that are common to all of the ongoing Sea Range operations include: direct impacts from aircraft, targets, missiles, ships, and debris; increases in ambient noise levels; and impacts resulting from launching a target or missile. Generally, the degree of impact is all that varies between operational scenarios. The following sections address potential impacts for each type of testing and training activity.

4.8.2.1 Air-to-Air Operations

Potential impacts on terrestrial biological resources and seabirds resulting from air-to-air operations over the Sea Range include:

- Bird strikes by planes, missiles, targets, or debris, and
- Increased noise levels.

Although operations occur throughout the Sea Range, typical flight patterns for aircraft include travel through Range Areas W1, 3B/W2, 3A, M5, 5A, 4A, 4B, and 3D. The clearance area is primarily in Range Areas 5A and 5B. Table 4.8-2 and Figure 3.8-1 summarize average seabird density per square mile for each range area. Range Area 4A has the highest density of seabirds for a given cell within the Sea Range (295 birds per square mile [114 birds/km^2]); however, the highest densities of seabirds occur adjacent to San Nicolas Island, outside of typical flight paths. Range Areas 5A and 5B have some of the lowest seabird densities, 3 and 17 birds per square mile (1 and 7 birds/km^2), respectively. The overall low density and variability of seabirds makes it unlikely that significant numbers of seabirds are struck by aircraft operations in the Sea Range.

Noise impacts on seabirds from low-level flights of missiles, planes, and targets may result in temporary interruption of foraging, resting, or flying behaviors. Due to the low density of seabirds on the Sea Range (less than 1 bird per acre [2.5 birds/ha]), short duration of any overflight, and their infrequent occurrence, noise impacts on seabirds on the Sea Range are less than significant.

Table 4.8-1. Terrestrial Biology Impact Summary Matrix

Alternative	Impact Conclusions NEPA (On Land→ Territorial Waters)	 EO 12114 (Non-Territorial Waters)	Mitigation Measures
NO ACTION ALTERNATIVE	The potential for bird strikes by aircraft, missiles, targets, and debris is low and precludes biologically significant impacts on bird populations. Increases in ambient noise levels from routine aircraft takeoffs and landings and missile and target launches from NAS Point Mugu sometimes result in temporary interruption of foraging, resting, or flying behaviors with no biologically significant impacts on bird populations.	*Potential impacts limited to debris effects on seabirds. Seabird density is low in affected areas and the potential for direct impacts is remote. Less than significant impact.*	
	Potential for adverse impacts to breeding cormorant colonies on San Nicolas Island due to human disturbance and gull predation resulting from launch activities (i.e., cormorants may leave their nests). Monitoring program ensures impacts remain less than significant.		Monitor existing cormorant colonies on San Nicolas Island to determine reaction to launches. Develop mitigation measures if an adverse reaction is observed.
	Potential impacts on sensitive species from direct hits from JATO bottles at both NAS Point Mugu and San Nicolas Island are less than significant given the very low probability of a strike, when considered on either an individual or yearly basis (Table 4.8-2).		
	Potential impacts on sensitive species habitat from JATO bottles accumulating in Mugu Lagoon or on San Nicolas Island are less than significant given implementation of the JATO bottle removal programs at NAS Point Mugu and San Nicolas Island.		
	Potential for adverse impact to snowy plovers nesting near the Building 807 Launch Complex on San Nicolas Island from human and vehicle traffic associated with launch operations. Mitigation measures have been developed in coordination with the USFWS and are described in the Biological Opinion issued by the USFWS and summarized in Section 4.8.5 of this EIS/OEIS.		Methods to offset disturbance have been developed in consultation with the USFWS and are described in the Biological Opinion issued by the USFWS and summarized in Section 4.8.5 of this EIS/OEIS.

Table 4.8-1. Terrestrial Biology Impact Summary Matrix (continued)

Alternative	Impact Conclusions: NEPA (On Land→ Territorial Waters)	Impact Conclusions: EO 12114 (Non-Territorial Waters)	Mitigation Measures
MINIMUM COMPONENTS ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Short-term increase in noise similar to current operations. Construction sites on San Nicolas Island would avoid sensitive habitat. Less than significant impact. An increase in operations would increase the potential for bird strikes from aircraft, missiles, targets, and debris but potential for strikes still low enough to preclude biologically significant impacts on bird populations. Small increase in JATO bottle use from the additional FLEETEX would have a negligible effect on the overall probability of a sensitive species being hit by a JATO bottle (Table 4.8-2); impacts would be less than significant. Current operations would continue and impacts identified for the No Action Alternative would occur.	*Potential impacts limited to debris effects on seabirds. Seabird density is low in affected areas and the potential for direct impacts is remote. Less than significant impact.*	As above for the No Action Alternative.
PREFERRED ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Short-term increase in noise similar to current operations. Construction sites on San Nicolas Island would avoid sensitive habitat. Less than significant impact. An increase in operations would increase the potential for bird strikes from aircraft, missiles, targets, and debris but potential for strikes still low enough to preclude biologically significant impacts on bird populations. Small increase in JATO bottle use from the additional FLEETEX would have a negligible effect on the overall probability of a sensitive species being hit by a JATO bottle (Table 4.8-2); impacts would be less than significant. Potential for adverse impacts to nesting snowy plovers from disturbance due to missile launches from Pad B and Pad C at NAS Point Mugu resulting in increased noise and human activity. Mitigation measures have been developed in coordination with the USFWS and are described in the Biological Opinion issued by the USFWS and summarized in Section 4.8.5 of this EIS/OEIS. Current operations would continue and impacts identified for the No Action Alternative would occur.	*Potential impacts limited to debris effects on seabirds. Seabird density is low in affected areas and the potential for direct impacts is remote. Less than significant impact.*	Methods have been identified in coordination with the USFWS and are described in the Biological Opinion issued by the USFWS and summarized in Section 4.8.5 of this EIS/OEIS. As above for the No Action Alternative.

Temporary increases in noise levels result from aircraft takeoffs and landings, and target and missile launches at NAS Point Mugu and San Nicolas Island. However, birds may become acclimated to periodic noise and, based on observations from NAS Point Mugu ecologists, routine noise events (e.g., aircraft takeoff and landing, target and missile launch) do not disturb birds at Point Mugu (NAWS Point Mugu 1997e). Sensitive biological resources (i.e., seabird colonies) do not occur adjacent to takeoff and landing locations on San Nicolas Island; therefore, noise impacts are not an issue. Target launches, except for Vandal launches, also do not occur adjacent to sensitive biological resources and noise impacts are not an issue. Potential impacts resulting from Vandal launches on San Nicolas Island are discussed further in Section 4.8.2.3. Current operations do not significantly impact terrestrial resources through increases in noise levels.

Jet-assisted takeoff (JATO) bottles are used for target launches at NAS Point Mugu and San Nicolas Island. Launches from Point Mugu occur from Building 55 and JATO bottles may travel from 155 to 2,000 feet (50 to 610 m), with the average distance traveled ranging from 700 to 1,500 feet (210 to 460 m). The bottles usually land in the same area of Mugu Lagoon (including intertidal mudflat, salt panne, and lower salt marsh habitats) and typically were not recovered in the past. Environmental Project Office staff estimate that there are currently 1,000 to 2,000 JATO bottles in Mugu Lagoon (NAWS Point Mugu 1997e). JATO bottles left in the lagoon may provide habitat for fish and invertebrates, but they may also eliminate habitat. For example, if the JATO bottles land on vegetated areas, they would eliminate the vegetation and potential sensitive species habitat (e.g., light-footed clapper rail, western snowy plover, and Belding's savannah sparrow; refer to Table 3.8-1). There are no data on the potential beneficial or deleterious effects of JATO bottles in the lagoon. It has been estimated that over 99 percent of fuel is expended prior to a JATO bottle entering the lagoon (NAWS Point Mugu 1998g), so water quality impacts are not expected (refer to Section 4.4, Water Quality). Impacts resulting from an individual JATO bottle are not considered significant because of their small size in relation to the acreage of the lagoon; however, cumulative impacts would be significant if large areas that support sensitive species are impacted through the accumulation of JATO bottles. NAS Point Mugu ecologists report that population numbers of sensitive species are stable, indicating that current operations are not significantly affecting sensitive species.

NAWCWPNS Point Mugu has recently implemented a program to recover JATO bottles. Recovery efforts in Mugu Lagoon are being conducted during the nonbreeding season for sensitive species; this avoids significant impacts to these species. Recovery efforts also involve methods to minimize trampling of wetland vegetation and causing undue stress to sensitive wildlife species. Areas of salt marsh bird's-beak are flagged and entry to such areas is prohibited. The recovery efforts are coordinated through and by the Environmental Division to ensure that there will be no impacts on sensitive species due to recovery operations.

Potential impacts resulting from JATO bottles directly striking a sensitive species were quantified using the following information and methods. JATO bottles land within a 660-by-420 m area (277,200 m^2) 100 percent of the time, and a 330-by-210 m portion of the larger area (69,300 m^2) 85 percent of the time. In other words, for every 100 JATO bottle launches, 85 of the bottles are expected to land in a 69,300 m^2 area, and 15 of the bottles are expected to land in a 207,900 m^2 area (i.e., 277,200 m^2 minus 69,300 m^2). Average bird density for California brown pelican, California least tern, Belding's savannah sparrow, and light-footed clapper rail was estimated for the 85 percent and 15 percent impact areas. In order to relate bird density to potential impact area, assumptions were made about the area an individual bird would occupy (referred to as a cell in the equations below). California brown pelicans were assumed to occupy 0.5 m^2 per individual, California least terns and light-footed clapper rails were assumed to occupy 0.25 m^2 per individual, and Belding's savannah sparrows were assumed to occupy 0.10 m^2 per individual.

The following equations were used to calculate the probability of a JATO bottle striking one of the four sensitive bird species.

Probability of a cell occupied by a bird in any area	=	(number of birds/total area)	
Where: Total Area	=	277,200 m^2/assumed area occupied by an individual bird	(4.8-1)
Probability of a bird occurring in the 85% impact area	=	(Probability of a cell occupied by a bird) (69,300 m^2/277,200 m^2)	(4.8-2)
Probability of a bird occurring in the 15% impact area	=	(Probability of a cell occupied by a bird) (207,900 m^2/277,200 m^2)	(4.8-3)
Probability of hitting a bird in the 85% impact area	=	(Equation 4.8-1) (Equation 4.8-2) (0.85)	(4.8-4)
Probability of hitting a bird in the 15% impact area	=	(Equation 4.8-1) (Equation 4.8-3) (0.15)	(4.8-5)
Probability of bird strikes over a year	=	(Probability of hitting a bird) (Number of JATO bottles per year)	(4.8-6)

Using equations 4.8-1 through 4.8-6, the probability of striking a sensitive bird species was estimated for the existing launch areas at NAS Point Mugu and San Nicolas Island. Because the calculations are complex, a detailed example is provided for the California brown pelican. The results for the other sensitive bird species are summarized in Table 4.8-2; the same equations were used for these calculations as were used for the brown pelican. The California brown pelican occurs at an estimated density of 12 birds within the 2,984,000-square-foot (277,200 m^2) impact area. If pelicans occupy 5.4 square feet (0.5 m^2) of space, the potential number of pelicans that can occur within the impact area are 554,400. In other words, there are 554,400 of the 5.4 square-foot (0.5 m^2) cells within the impact area. The probability that a cell is occupied by a pelican is calculated using equation 4.8-1 and is 2.16×10^{-5}. The probability that a pelican occurs within the 85 percent impact area is calculated using equation 4.8-2 and is 5.41×10^{-6}. The probability of hitting a bird in the 85 percent impact area is calculated using equation 4.8-4 and is 4.6×10^{-6}. The probability of striking a pelican within the 85 percent impact area over one year is 2.3×10^{-4}. The probability that a pelican occurs within the 15 percent impact area is 1.62×10^{-5} and the probability that a JATO bottle will hit a bird is 2.44×10^{-6}. In a given year, the probability that a pelican will be hit within the 15 percent impact area is 2.3×10^{-4}.

To simplify the results of the above calculations, the probability of a California brown pelican, California least tern, Belding's savannah sparrow, or light-footed clapper rail being struck by a JATO bottle within the impact area ranges from 1 bird in every 152,000 JATO bottle launches to 1 bird in every 9,740,000 JATO bottle launches. If 50 JATO bottles are used within a given year, the probability of a bird being struck ranges from 1 in 1,440 birds to 1 in 60,900 for the 15 percent and 85 percent impact areas, respectively.

Table 4.8-2. Estimated Probability of Bird Strikes from JATO Bottles at NAS Point Mugu (Current Launch Site)[1]

Species	Density		Area Occupied	Probability of Cell Occupied		Probability of Bird Occurring within a Given Area		Probability of Hit	
	85%	15%		85%	15%	85%	15%	85%	15%
California brown pelican	12	12	0.5	2.16E-05[2]	2.16E-05	5.41E-06	1.62E-05	4.60E-06	2.44E-06
California least tern	150	150	0.25	1.35E-04	1.35E-04	3.38E-05	1.01E-04	2.87E-05	1.52E-05
Belding's savannah sparrow	46	24	0.1	1.66E-05	8.66E-06	4.15E-06	6.49E-06	3.53E-06	9.74E-07
Light-footed clapper rail	6	12	0.25	5.41E-06	1.08E-05	1.35E-06	8.12E-06	1.15E-06	1.22E-06

Species	Annual Probability - 85%					Annual Probability - 15%				
	Number of Bottles					Number of Bottles				
	50	19	54	25	34	50	19	54	25	34
California brown pelican	2.30E-04	8.74E-05	2.48E-04	1.15E-04	1.56E-04	1.22E-04	4.63E-05	1.31E-04	6.09E-05	8.28E-05
California least tern	1.44E-03	5.46E-04	1.55E-03	7.19E-04	9.77E-04	7.61E-04	2.89E-04	8.22E-04	3.80E-04	5.17E-04
Belding's savannah sparrow	1.76E-04	6.70E-05	1.90E-04	8.82E-05	1.20E-04	4.87E-05	1.85E-05	5.26E-05	2.44E-05	3.31E-05
Light-footed clapper rail	5.75E-05	2.18E-05	6.21E-05	2.87E-05	3.91E-05	6.09E-05	2.31E-05	6.57E-05	3.04E-05	4.14E-05

[1] Areas of concern (85 percent and 15 percent) are depicted in Figure 2-3a.
[2] Scientific format. The number of 0's or #'s to the right of E determines the exponent's number of digits. E- places a minus sign by negative exponents (e.g., 2.16E-05 is equal to 2.16 x 10^{-5}).

The probability of a JATO bottle striking an individual bird is insignificant when considered as an individual or annual event. The number of JATO bottles used each year does not result in impacts to sensitive bird species. The above calculations assume that birds will not move from an area and are present year-round. The fact that birds are mobile, may fly away from an incoming bottle, and may not be present during a launch further reduces the likelihood of a JATO bottle striking a sensitive bird species.

Alternatively, missiles and targets could be launched from aircraft, negating the need for JATO bottles. This would eliminate the potential for JATO bottles landing in Mugu Lagoon. Aircraft are typically aloft for Sea Range exercises and missile and target launches from aircraft could easily be incorporated into current and future operations. Increasing the use of aircraft launches would reduce the potential for impacts on terrestrial biological resources from JATO bottles.

JATO bottles are used approximately 10 times per year for target launches from the Alpha Launch Complex on San Nicolas Island and the bottles are not recovered. JATO bottles land within coastal scrub habitat and could strike a sensitive species that occupies or forages in the scrub habitats (refer to Table 3.8-1). Island night lizards do not occur within the JATO bottle impact area and are not affected. San Nicolas Island foxes are known to occur in this area. Potential impacts to the San Nicolas Island fox were quantified using the methods and assumptions discussed above for launches at Point Mugu. For purposes of analysis, the impact area is assumed to be the same as previously discussed, and San Nicolas Island fox density is assumed to be 23.74 foxes/km^2 (2.3 x 10^{-5} foxes/m^2). This equates to approximately seven foxes occurring within the impact area. If foxes are assumed to occupy 0.5 m^2 of space, then

1.21×10^{-5} is the probability of a cell being occupied by a fox. The probability of a fox occurring within the 85 percent impact area is 2.88×10^{-6} and the probability of a fox being hit is 2.44×10^{-6}. The probability of a fox being hit within the 85 percent impact area over a year is 4.89×10^{-5}, or one in 489,000. The probability of a fox occurring within the 15 percent impact area is 9.21×10^{-6} and the probability of a fox being hit is 1.38×10^{-6}. The probability of a fox being hit within the 15 percent impact area over a year is 2.76×10^{-5}. In other words, there is a 1 in 276,000 chance of a fox being hit with a JATO bottle. Based on the low probabilities of a strike, the use of JATO bottles does not have significant impacts on San Nicolas Island foxes. Environmental Project Office staff have no records of direct strikes of wildlife from falling JATO bottles (NAWS Point Mugu 1998f).

NAWCWPNS Point Mugu is currently developing a plan to recover JATO bottles on San Nicolas Island. Recovery efforts would involve methods to minimize trampling of vegetation and causing undue stress to sensitive wildlife species. The final recovery plan will be coordinated through the Environmental Project Office to ensure that there would be no impacts on sensitive species due to recovery operations. Impacts resulting from current operations and proposed recovery of JATO bottles would not be significant if the above guidelines are followed.

Current air-to-air operations occur primarily over open water within the Sea Range. Seabird densities are typically low over the Sea Range (less than 1 bird per acre [2.5 birds/ha]), and those species that are present are generally on the water or at low altitudes above the water surface and below aircraft, missiles, and targets. Therefore, bird-strikes have not historically presented an operational constraint to activities on the Sea Range. Debris from air-to-air operations land in the open ocean, where seabird densities are lowest, and do not impact nearshore habitats where seabird densities are greatest. Due to the dispersed nature of seabirds in the open ocean and the dispersed pattern of debris fallout, the potential for debris to strike a bird or birds is minimal. Therefore, impacts on seabirds on the Sea Range as the result of aircraft flights and debris strikes are less than significant for current air-to-air operations.

4.8.2.2 Air-to-Surface Operations

Potential impacts on terrestrial biological resources due to air-to-surface operations are similar to those discussed in Section 4.8.2.1. Noise impacts on seabirds from low-level flights are less than significant. Impacts from aircraft, missile, and debris strikes are not significant. Potential impacts from JATO bottles accumulating in Mugu Lagoon are not significant given the recent implementation of the JATO bottle recovery program. The majority of operations occur over open water. However, air-to-surface tests can include use of the Surface Land Attack Missile (SLAM) missile target area on the northwest portion of San Nicolas Island (refer to Figure 3.0-2), and inert mine shapes can be dropped in nearshore waters of Becher's Bay off Santa Rosa Island (refer to Figure 3.0-14).

The SLAM target area, including the area of potential effect, occurs in sand dune, coastal strand, and *Lupinus* scrub vegetation communities (NAWCWPNS Point Mugu 1998a). Target areas are located in areas almost devoid of plants; the surrounding habitats are sparsely vegetated (NAWCWPNS Point Mugu 1998a). Missile debris and personnel moving through the vegetation to recover the debris affect a minimal number of plants. Because no sensitive species occur within the impact area, impacts to the existing sparse vegetation are insignificant. Also, due to the lack of vegetation and associated wildlife habitat in the immediate area surrounding the SLAM target and because of its infrequent use (25 to 85 firings over 20 years), impacts on terrestrial wildlife resources are less than significant. Potential impacts to terrestrial biological resources resulting from operation of the SLAM are further evaluated in the Environmental Assessment prepared for the SLAM exercises (NAWCWPNS Point Mugu 1998a).

Noise studies conducted for the SLAM indicate that impacts to birds, in particular Brandt's cormorant and western gulls, are less than significant (NAWCWPNS Point Mugu 1998a). Cormorants present during the November 1997 test overflights showed no response to the periodic and short-term increase in noise (NAWCWPNS Point Mugu 1998a). Although birds may fly in response to a loud sound, even sensitive species resume normal activities typically within a few moments and always within several minutes. The resumption of normal activity after a noise event is much quicker than that after a visual event, probably because the birds cannot localize the sound and do not associate it with any specific threat. Potential impacts to terrestrial biological resources resulting from operation of the SLAM are further evaluated in the Environmental Assessment prepared for the SLAM exercises (NAWCWPNS Point Mugu 1998a). Because there is a chance that cormorants may leave their nests during the breeding season in response to increases in noise from overflights or launches, the cormorant colony will continue to be monitored to determine if their are significant effects. If adverse reactions do occur, the activity causing the reaction will be stopped and appropriate corrective and mitigation measures will be implemented. These measures ensure that potential biological impacts remain less than significant.

An additional source of potential effect is associated with operations that drop inert mine shapes from aircraft into nearshore waters of Becher's Bay off Santa Rosa Island. Since no Navy activities occur on the island itself, potential impacts on terrestrial biological resources are limited to potential seabird strikes. In the Becher's Bay area, average seabird density is approximately 52 birds per square mile (20 birds/km^2). In comparison to outer waters of the Sea Range, seabird density is higher; however, it is unlikely that a significant number of birds are struck during these operations. Further, seabirds would be able to detect a falling object the size of a mine shape and effectively avoid it. Therefore, physical impacts of inert mine shape drops on seabirds near Becher's Bay are less than significant.

Air-to-surface operations occur primarily over open water within the Sea Range. As described in Section 4.8.2.1, seabird densities are typically low in these areas and the potential for debris to strike a bird is minimal; impacts are less than significant.

4.8.2.3 Surface-to-Air Operations

Noise levels associated with Vandal target launches are expected to exceed 100 dB along the western end of San Nicolas Island (refer to Figure 4.7-3). Brandt's cormorant, western gull, western snowy plovers, and black oystercatcher colonies all occur within the 100 dB contour and may be affected by the noise associated with a Vandal launch. Although ambient noise levels may exceed 100 dB (as a result of wind), there is still a potential that the short, periodic noise from launches will adversely affect breeding seabirds on San Nicolas Island. Cormorants and other seabirds were not found to respond to increases in noise from jet overflights (NAWCWPNS Point Mugu 1998c). However, the presence of personnel associated with Vandal launches may be disruptive to cormorants.

Brandt's cormorants are extremely sensitive to human disturbance and predation by gulls. Cormorants are known to leave their colony upon first sight of humans (NAWCWPNS Point Mugu 1998a). If this were to occur, gulls adjacent to the colony would be expected to prey upon chicks and eggs, which could destroy the breeding colony of cormorants for the year. Because there is the potential to adversely impact the breeding colony of cormorants on San Nicolas Island, the existing colonies are monitored to determine their reaction to various military activities. If an adverse reaction is observed, the activity will be stopped until appropriate control and/or mitigation measures are developed. This action ensures that no significant impacts to the cormorant colony occur.

Western snowy plovers have established nesting sites around the periphery of the Building 807 Launch Complex (the closest nest observed in 1998 was located approximately 984 feet [300 m] from the site)

(NAWS Point Mugu 1998f). Snowy plovers nesting in the area may be affected by increased human and vehicle traffic at this site. To offset the potential for adverse impact, regular monitoring of the area is conducted during the breeding season to determine usage and nest locations. Active nests are protected from human disturbance by the placement of physical barriers. To prevent nesting at the launch site itself or on the access route to the launcher, the substrate can be altered to make the area unsuitable for nesting. Further methods to offset disturbance and losses have been developed in consultation with the USFWS (see Section 4.8.5). These measures ensure that no significant impacts occur.

There is the potential for fires from launch activities associated with the Vandal missile target. Small spot fires typically occur with every Vandal launch; however, such fires are extinguished quickly due to the implementation of standard fire prevention and launch operation procedures. Every 2 to 3 years, a fire may burn a larger area (approximately 1 acre [0.4 ha]), and every 5 to 10 years a fire may burn an area up to approximately 20 acres [8 ha] (NAWS Point Mugu 1998f). The Fire Department historically attempted to actively extinguish all fires on San Nicolas Island. However, a "controlled burn" policy has been adopted at the recommendation of the Environmental Project Office. It was found that the disturbance created by firefighting equipment was more damaging to the environment than the fires. Impacts on federally listed species are not expected from accidental fires. However, a larger fire could potentially affect the state-listed San Nicolas Island fox, which is relatively common on the island. There is a potential that a 5- to 20-acre (2- to 8-ha) fire could interfere with fox reproduction during the weaning period of the breeding season. During this period (pupping season typically occurs from late February through April), pups cannot leave their dens (pups are typically mobile by June) and would not be able to move away from the burn zone. From a demographic perspective, this impact is considered less than significant due to the small area of potential denning habitat involved. In addition, the infrequent occurrence of large fires (about every 5 years) would not have long-term biologically significant impacts on the San Nicolas Island fox.

Potential impacts on terrestrial biological resources due to surface-to-air operations in non-Territorial Waters are similar to those discussed in Section 4.8.2.1. A range area that typically receives a greater number of intercept events, 6A, has one of the lowest densities of seabirds (3 birds per square mile [1.2 birds/km^2]) and impact with targets, missiles, and/or debris is unlikely because of the low density. Impacts on seabirds on the Sea Range associated with debris are less than significant.

4.8.2.4 Surface-to-Surface Operations

Potential impacts on terrestrial biological resources due to surface-to-surface operations are similar to those discussed in Section 4.8.2.1. Surface-to-surface operations occur over a large portion of the Sea Range but intercepts are primarily concentrated in Range Area 4B. Air traffic passes through Range Areas W1, 3A, 3B/W2, 3D, W-290, M5, M3, and 4A. Impacts from noise, missile and target launches, and aircraft strikes are similar to those discussed in Section 4.8.2.1. Impacts of surface-to-surface operations are less than significant.

Target intercept typically occurs in Range Area 4B, which has an average seabird density of 69 birds per square mile (27 birds/km^2). Although bird density is higher in this area than areas further offshore, it is still low enough to make a bird strike unlikely. Impacts on seabirds from debris associated with surface-to-surface intercepts are less than significant.

4.8.2.5 Subsurface-to-Surface Operations

Potential impacts on terrestrial biological resources due to subsurface-to-surface operations (i.e., from noise, missile and target launches, and aircraft strikes) are similar to those discussed in Section 4.8.2.1. Impacts of subsurface-to-surface operations are less than significant.

Subsurface-to-surface activities are concentrated in the southern portion of the Sea Range and target intercept typically occurs in Range Area 4A. Average seabird density within Range Area 4A is 295 birds per square mile (114 birds/km^2). The potential for bird strikes is greater than for other operations described above; however, the overall low density of seabirds makes a bird strike improbable. Impacts on seabirds from debris associated with subsurface-to-surface intercepts are less than significant.

4.8.2.6 Ancillary Operations Systems

Radar and laser use is not expected to affect terrestrial resources or seabirds because of the limited area of exposure for a receptor from radar or laser facility (in other words, the radar and laser beams are not extending over a wide area and are directed at specific targets). Also, wildlife are only periodically exposed to radar or lasers since they are not used continually and wildlife is mobile. Given the low probability of hitting terrestrial resources or seabirds with debris, the probability of contacting wildlife with a laser beam approaches zero.

Since chaff and flare use is restricted to open ocean areas, terrestrial species are not affected. There is the remote chance for seabird exposure to chaff and flares. Potential impacts are limited to physical strikes from flares and ingestion of chaff. Flare strikes are unlikely since birds can identify and avoid falling objects. Chaff ingestion occurs only if birds consume chaff floating on the water surface. However, chaff is relatively non-toxic (U.S. Air Force 1997b; Naval Research Laboratory 1999). Since chaff use is limited and wave action reduces the availability of it on the surface, it is unlikely that frequent chaff ingestion occurs. Further, seabird density in the open water portions of the Sea Range is typically low, especially where chaff is dropped (i.e., at least 10 NM [19 km] offshore). Impacts are less than significant.

For the reasons described above, impacts on seabirds from chaff and flare use in non-Territorial Waters are less than significant.

4.8.2.7 Current Fleet Exercise Training

FLEETEX operations are conducted throughout the Sea Range and typically involve a combination of the operations discussed in Sections 4.8.2.1 through 4.8.2.6. FLEETEXs usually last 2 to 3 days and may involve a number of aircraft sorties, missile launches, and target launches. Due to the low density of seabirds in the open ocean and the short period of FLEETEX operations (6 days maximum per year), impacts on seabirds from aircraft, missile, target, and ship activity are less than significant. Physical impacts on seabirds from target launches at NAS Point Mugu and San Nicolas Island are less than significant (see Section 4.8.2.1). Impacts from JATO bottles accumulating in Mugu Lagoon are not significant given recent implementation of a JATO bottle recovery plan (see Section 4.8.2.1).

Although FLEETEX activities occur throughout the Sea Range, debris patterns are typically located in outer range areas. As discussed in Section 4.8.2.1, seabird densities are typically low in these areas (less than 1 bird per acre [2.5 birds/ha]) and debris strikes are unlikely. Due to the low density of seabirds, the dispersed pattern of debris fallout, and the short period of FLEETEX operations (6 days maximum per year), impacts on seabirds in non-Territorial Waters are less than significant.

4.8.2.8 Littoral Warfare Training

Littoral warfare training on the Point Mugu Sea Range consists of small-scale amphibious warfare training and Navy special warfare training. Environmental Project Office staff have developed siting criteria for use of beaches at San Nicolas Island that protect sensitive species and their habitats. Terrestrial activities primarily occur in developed or disturbed areas. Impacts from littoral warfare training are not significant because of the environmental siting criteria, use of already developed or disturbed areas, infrequent occurrence, and training of the involved personnel (SEALs are trained not to leave any sign of their presence).

4.8.3 Minimum Components Alternative

This alternative includes impacts identified for the No Action Alternative since the testing, training, and facility modernization activities included in this alternative are proposed in addition to current operations.

4.8.3.1 Theater Missile Defense Element - Nearshore Intercept

A - Point Mugu Sea Range

As discussed in Section 3.8, seabirds are the main terrestrial biological resource in the Sea Range that may be impacted by proposed TMD events. In comparison to open ocean areas, seabird density is usually higher in nearshore areas, although seabird density can vary greatly among seasons and years, as shown in the Xantus' murrelets study, discussed in the Point Mugu Natural Resources Summary Report (NRSR) (NAWCWPNS Point Mugu 1999). The overall low density and variability of seabirds, combined with the large area in the Sea Range available for military actions, makes it unlikely that significant numbers of seabirds would be struck by aircraft, targets, missiles, and debris associated with nearshore intercept activities.

Changes in existing noise levels from this alternative would not result in significant impacts to seabirds because the birds are mobile and suitable habitat is available in the immediate vicinity. For the same reason, the presence of ships and aircraft would not be expected to significantly impact seabirds. Also, this alternative would be of short duration (eight testing or training events per year) and would require only temporary avoidance of the area.

B - Point Mugu

Studies by Environmental Project Office personnel have shown that noise from aircraft takeoffs and landings does not significantly affect wildlife (NAWS Point Mugu 1997e). Bird-aircraft strike hazard (BASH) data indicate that anywhere from 10 to 60 birds have been struck within any given year. Given the recent increase in aircraft activity associated with the E-2 aircraft squadron realignment to NAS Point Mugu (Southwest Division 1998), bird strikes could be higher than this by about 30 percent (or about 10 to 80 incidents per year). However, this number is more indicative of the number of reports of bird strike incidents and not the total number of birds struck. Based on a recent BASH study at Whidbey Island, the actual number of bird strikes is probably five times the number of reported strikes; therefore anywhere from 50 to 400 bird strike incidents probably occur over a given year. The majority of reported bird strikes occurred with propeller-driven planes. Swallows, killdeers, and shorebirds comprised the majority of reported birds struck. The number of reported bird strikes is less than 1 percent of the total number of birds that inhabit, or travel through, NAS Point Mugu; therefore, impact from bird strikes would be less than significant.

C - San Nicolas Island

Changes in existing noise levels at San Nicolas Island from this alternative are not likely to result in significant impacts to seabirds because of the short duration of a launch, typically from an offshore platform. Noise studies conducted for the SLAM indicate that impacts to birds, in particular Brandt's cormorant and western gulls, are less than significant (NAWCWPNS Point Mugu 1998a). Cormorants present during the November 1997 test overflights showed no response to the periodic and short-term increase in noise (NAWCWPNS Point Mugu 1998a). Although birds may fly in response to a loud sound, even sensitive species resume normal activities, typically within a few moments and always within several minutes. The resumption of normal activity after a noise event is much quicker than that after a visual event, probably because the birds cannot localize the sound and do not associate it with any specific threat. Potential impacts to terrestrial biological resources resulting from operation of the SLAM are further evaluated in the Environmental Assessment prepared for the SLAM (NAWCWPNS Point Mugu 1998a). Because there is a chance that cormorants may leave their nests during the breeding season in response to increases in noise from overflights or launches, the cormorant colony will continue to be monitored to determine if there are significant effects. If adverse reactions do occur, the activity causing the reaction would be stopped and appropriate corrective and mitigation measures would be implemented. These measures ensure that potential biological impacts would be less than significant.

Subsonic targets would be flown a minimum of 0.5 NM (0.9 km) off the coast of San Nicolas Island. At this distance offshore, there would be no significant impacts on terrestrial species or nesting seabirds on the island. Noise generated from the subsonic targets at this distance would be less than that to which animals are routinely exposed on the island.

Debris from this operation would fall within nearshore waters (at least 1 NM [1.9 km] offshore) but would not land on San Nicolas Island. Because the debris would be landing in an area of higher seabird density, the chance for a strike increases. Kelpbeds are located within the potential debris impact area, and seabirds typically forage in these areas. Based on the predicted intercept area (approximately 55 square miles), seabird density is approximately 189 birds per square mile (73 birds/km^2), or less than 1 bird per acre (2.5 birds/ha). It is unlikely that a significant number of birds would be struck and this impact would be considered less than significant.

4.8.3.2 Training Element – Additional FLEETEX

Impacts would be the same as those described for current operations in Section 4.8.2.7. The addition of one FLEETEX per year would not significantly impact terrestrial biological resources or seabirds within the Sea Range. FLEETEX operations are conducted throughout the Sea Range and involve a combination of the separate exercises described in Sections 4.8.2.1 through 4.8.2.6. An additional FLEETEX would increase the number of current aircraft sorties by 57, the number of ships and boats by 18, the number of missiles by 34, and the number of targets by 33. This increase can be considered sequential and not exponential because an additional FLEETEX would not occur at the same time as a current FLEETEX. Because the same flight routes would be used for the additional FLEETEX, the highest bird density encountered would be 295 birds per square mile (114 birds/km^2) (Range Area 4A). However, the majority of flight routes would occur in Range Areas 5A and 5B, which have some of the lowest seabird densities, 3 and 17 birds per square mile (1 and 7 birds/km^2), respectively.

Additional boat and ship traffic would not significantly affect seabirds. Seabird density is greatest closest to shoreline habitat and ships and boats used during the FLEETEX would be in open waters, in areas of low bird density. Also, ships and boats are large, relatively slow moving vessels that can be easily avoided by seabirds.

Additional target and missile firing from planes, ships, and land-based facilities on NAS Point Mugu and San Nicolas Island would not significantly affect seabirds or terrestrial resources. Of the additional 33 targets, the majority of debris would fall into open waters, where seabird density is less than 1 bird per acre (2.5 birds/ha). Additional launches from NAS Point Mugu and San Nicolas Island would increase the number of JATO bottles used in a given year. As shown previously in Table 4.8-2, the increase would have a negligible effect on the overall probability of a JATO bottle striking a sensitive species. Collective impacts would not be significant.

Since most FLEETEX activities occur in the open ocean, this activity would not impact terrestrial biological resources. Debris from the intercepted targets during the FLEETEX would land in the ocean and settle to the bottom. The primary locations for these intercepts would be deep water areas. Due to the low density of seabirds in the open ocean (less than 1 bird per acre [2.5 birds/ha]), the dispersed pattern of debris fallout, and the addition of only one FLEETEX per year over current levels, impacts on seabirds would be less than significant. There is a very slight chance for the possibility of impacts to increase within the Sea Range during the migratory season as bird density may increase. However, since seabird densities would still be low in relation to the surface area of the Sea Range and birds can avoid a majority of the equipment used during the exercise, impacts would be less than significant.

4.8.3.3 Facility Modernization Element - Multiple-Purpose Instrumentation Sites

An ongoing policy which is also compliant with EO 13112 (Invasive Species) requires that all construction vehicles and equipment are cleaned prior to transport to San Nicolas Island to ensure that non-native species would not be introduced to the island.

The construction of five multiple-purpose instrumentation sites on San Nicolas Island would not result in significant impacts on terrestrial biological resources. These facilities have been sited to avoid sensitive biological resources. The facilities would be placed in coastal scrub, barren, or previously disturbed habitats. Impacts would be less than significant.

4.8.4 Preferred Alternative

This alternative includes impacts identified for the No Action Alternative since the testing, training, and facility modernization activities included in this alternative are proposed in addition to current operations.

4.8.4.1 Theater Missile Defense Element

Bird-strikes would continue to be a potential hazard under the proposed TMD Element. Bird-strikes have not historically presented an operational constraint to activities at NAS Point Mugu or the Sea Range since seabird densities are low over these open water areas. Since the proposed action would not involve any substantial increases in aircraft-related activities that are already occurring, these actions are unlikely to result in an increase in bird strikes around Point Mugu or on the Sea Range. Therefore, impacts resulting from bird strikes would be less than significant. There would be little change in noise levels from current baseline levels (refer to Section 4.3, Noise) to which birds and other wildlife have become acclimated (NAWS Point Mugu 1997e); therefore, noise impacts on terrestrial biological resources would be less than significant.

A - Boost Phase Intercept

Point Mugu Sea Range

As discussed in Section 3.8, seabirds are the main terrestrial biological resource in the Sea Range that may be impacted by the proposed activity. Seabird density is usually greatest in nearshore areas, and seabird density can vary greatly among seasons and years, as shown in the Xantus' murrelets study (Whitworth et al. 1997) and as discussed in Section 3.8.2. Average seabird density within the defined safety hazard pattern in Territorial Waters is approximately 40 birds per square mile (15 birds/km^2). The overall low density and variability of seabirds, combined with the large area in the Sea Range that would be used for boost phase intercepts, make it unlikely that significant numbers of seabirds may be struck by aircraft, ships, targets, missiles, and debris from the proposed action.

Changes from existing noise levels associated with boost phase intercept activities would not likely result in significant impacts to seabirds because the birds are mobile and suitable habitat is available adjacent to the activity. For the same reason, the presence of ships and aircraft are also not expected to significantly impact seabirds. Also, the proposed action would be of short duration and may require only temporary avoidance of the area.

Debris from the boost phase intercept events would land in the open ocean and would not impact terrestrial habitats or species. Due to the low density of seabirds on the Sea Range (less than 1 bird per acre [2.5 birds/ha]) and the dispersed pattern of debris fallout, the probability of debris affecting seabirds is negligible. Therefore, impacts would be less than significant.

San Nicolas Island

Changes from existing noise levels associated with boost phase intercept activities would not likely result in significant impacts to seabirds because of the short duration of a launch. Vandal launches from San Nicolas Island produce a 100 dBA acoustic contour that extends 13,986 feet (4,263 m) from its launch track (refer to Figure 4.7-3). A 120 dBA acoustic contour in the immediate area of the launch is also shown on Figure 4.7-3. Noise levels generated by Vandal target launches are expected to exceed 100 dB along the western end of San Nicolas Island (Figure 4.7-3). Brandt's cormorant, western gull, western snowy plovers, and black oystercatcher colonies all occur within the 100 dB contour and may be affected by the noise associated with a Vandal launch. Although ambient noise levels may exceed 100 dB (as a result of wind), there is still a potential that the short, periodic noise from launches will adversely affect breeding seabirds on San Nicolas Island. Cormorants and other seabirds were not found to respond to increases in noise from jet overflights (NAWCWPNS Point Mugu 1998c). Section 4.7.2.1 provides a more detailed discussion of expected noise levels resulting from current and proposed actions.

Brandt's cormorants are extremely sensitive to human disturbance and predation by gulls. Cormorants are known to leave their colonies upon first sight of humans (NAWCWPNS Point Mugu 1998a). If this were to occur, gulls adjacent to a colony would be expected to prey upon chicks and eggs and this could destroy the breeding colony of cormorants for the year. Because there is an indirect potential to significantly impact cormorants, existing colonies will continue to be monitored to determine their reaction to various military activities. If an adverse reaction is observed, the activity would be stopped until appropriate control and/or mitigation measures are developed. These measures ensure that potential impacts to cormorants would be less than significant.

B - Upper Tier

Impacts on terrestrial biological resources within U.S. Territory would be similar to those described above for boost phase intercept events. Potential impacts from noise, launch operations, and aircraft strikes would be less than significant.

Potential impacts on terrestrial biological resources from upper tier events in non-Territorial Waters would be limited to potential seabird strikes from intercept debris. The likelihood of striking a bird is less during this operation than it is during boost phase intercept testing and training because, although there is a larger safety hazard pattern, it is further from the nearshore environment. Average seabird density within the defined safety hazard pattern is approximately 11 birds per square mile (4 birds/km^2). Impacts of upper tier testing and training would be less than significant.

C - Lower Tier

Impacts on terrestrial biological resources within U.S. Territory would be similar to those described above for boost phase intercept events. Potential impacts from noise, launch operations, and aircraft strikes would be less than significant.

Potential impacts on terrestrial biological resources from lower tier events in non-Territorial Waters would be similar to those described for upper tier events. This operation presents a slightly higher chance of striking a bird (approximately 45 birds per square mile [17 birds/km^2]) than that of an upper tier operation. However, since the chance of a bird strike would still be minimal, and the chance of hitting a significant number of birds would be minimal, this impact would not be significant. Impacts of lower tier testing and training would be less than significant.

D - Nearshore Intercept

Potential impacts on terrestrial biological resources from nearshore intercept events were addressed previously in Section 4.8.3.1. Impacts would be less than significant.

E - Collective Impacts of Theater Missile Defense Element

Overall impacts on terrestrial biological resources resulting from proposed TMD testing and training would not be significant. The differences in the programs discussed above can be characterized by the phase of flight of the target missiles and proximity to the defended assets. These differences would result in relatively small differences in impacts resulting from noise and debris patterns. The increase in aircraft sorties is less than 5 percent of current operations. Expected collective impacts and their significance are discussed below.

Point Mugu Sea Range

Seabirds are the main terrestrial biological resource in the Sea Range that may be impacted by the proposed activity. The overall low density and variability of seabirds, combined with the large area in the Sea Range available for military actions, makes it unlikely that significant numbers of seabirds may be struck by aircraft, ships, targets, missiles, and debris from the proposed action.

Changes in existing noise levels from the proposed action would not result in significant impacts to seabirds because the birds are mobile and suitable habitat is available adjacent to the activity. For the same reason, the presence of ships and aircraft are also not expected to significantly impact seabirds. Also, the proposed action would be of short duration and may require only temporary avoidance of the area.

Seabirds are the only terrestrial biological resource occurring in non-Territorial Waters of the Sea Range, and seabird density tends to be lowest in these offshore areas. For the reasons described above for Territorial Waters, potential noise and debris impacts on seabirds in non-Territorial Waters associated with the proposed TMD element would be less than significant.

Point Mugu

Aircraft that originate from NAS Point Mugu may impact wildlife through noise impacts or air strikes. Studies by Environmental Project Office personnel have determined that noise from aircraft takeoffs and landings does not significantly affect wildlife (NAWCWPNS Point Mugu 1997e). Bird strike data indicate that anywhere from 10 to 80 birds have been struck within a given year. However, this number is more indicative of the number of reports of bird strike incidents and not the total number of birds struck. A study at Whidbey Island, Washington, found that the actual number of bird strikes was 5 times the number of reported strikes. Therefore, 50 to 400 birds are likely to be struck within any given year. The majority of reported bird strikes occurred with propeller driven planes. Swallows, killdeers, and shorebirds comprised the majority of reported bird strikes. The number of reported bird strikes is less than 1 percent of the total number of birds that inhabit, or travel through, NAS Point Mugu; therefore, the impacts of bird strikes at NAS Point Mugu would not be significant.

San Nicolas Island

Changes in existing noise levels from the proposed action would not likely result in significant impacts to seabirds because of the short duration of a launch. Noise studies conducted for the SLAM determined that potential acoustic impacts to birds are not significant (NAWCWPNS Point Mugu 1998a). Additional noise studies (discussed in Section 4.7.2.1) determined that noise levels from the proposed action would not exceed ambient noise levels, except during brief instances of low overflights.

Activities and personnel at the Alpha Launch Complex do not significantly affect nesting seabird colonies. However, personnel and activity associated with the Building 807 Launch Complex have the potential to adversely affect western snowy plovers. NAS Point Mugu is currently coordinating with the USFWS to determine the type and degree of impact associated with activities at Building 807.

4.8.4.2 Training Element – Fleet Exercise and Special Warfare Training

A - Fleet Exercise Training

Terrestrial effects associated with one additional FLEETEX per year would be as described under the Minimum Components Alternative (see Section 4.8.3.2); impacts would be less than significant.

B - Special Warfare Training

In addition to the ongoing amphibious operations at their current level of activity, the proposed action would incorporate a two-fold increase in special warfare training activity by SEALs. The areas of the range required to perform these training events are the currently used nearshore and beach areas of San Nicolas Island. Beach areas and nearshore terrestrial environments would be disturbed from foot traffic of personnel (between 10 and 30 people). Low-altitude helicopter activity would occur primarily over the water or over approved areas such as the San Nicolas Island airstrip.

Since the selection of beach areas for littoral warfare training is based on the environmental sensitivity of the beach and nearshore areas, these activities are not expected to affect any sensitive habitats or species. If activity occurs during the breeding season, impacts are likely to be significant as human presence is more detrimental than noise. However, current environmental restrictions placed on training sites would preclude this potential impact. Therefore, impacts on terrestrial biological resources would be less than significant.

4.8.4.3 Facility Modernization Element – Point Mugu and San Nicolas Island

A - Point Mugu Modernizations

Beach Launch Capability

If this Facility Modernization Element is implemented, two previously used beach launch pads (pads B and C) at NAS Point Mugu would be used to launch approximately 6 missiles per year (refer to Figure 2-3a). No construction would be required and the sand dunes just to the south would not be affected. Launching over the beach, resulting in a lower altitude over the beach than current launches from a truck in front of the Building 55 Launch Complex, may impact sensitive species that use beach habitat. Federally listed threatened and endangered species, including western snowy plover and California brown pelican, are known to occur in this area. Snowy plovers forage from the splash zone to the upper part of the beach, and breed and nest along beach habitat in this area. The noise and activity resulting from a missile launch at this location could potentially disturb nesting snowy plovers.

Measures to ensure that western snowy plovers are not affected by missile launches from the beach pad site would be implemented. These include: conducting regular surveys and monitoring the nesting sites within the area during the breeding season; protecting active nest sites from human disturbance by the placement of barricades and signs; and additional measures to be identified in coordination with the USFWS.

Some of the missile launches could include the use of solid propellant boosters (similar to JATO bottles). The boosters would land in the ocean approximately 0.25 to 0.50 mile (0.40 to 0.80 km) offshore. This distance is sufficient to preclude potential impacts on California brown pelican and western snowy plover foraging and roosting areas. Although the density of seabirds increases closer to shore, the densities would still be so small as to preclude the likelihood of a booster striking a seabird. Also, seabirds would be able to detect a falling object the size of a booster and effectively avoid it. Therefore, physical impacts of missile launches on seabirds transiting nearshore areas at NAS Point Mugu would be less than significant.

B - San Nicolas Island Modernizations

An ongoing policy which is also compliant with EO 13112 (Invasive Species) requires that all construction vehicles and equipment are cleaned prior to transport to San Nicolas Island to ensure that non-native species would not be introduced to the island.

Increased Launch Capabilities

A 50K launch site would be added near the Alpha Launch Complex, which is currently used for target launches. The area is currently disturbed and is used for mobile launch activities. A vertical launcher would also be placed on an existing pad at the Building 807 Launch Complex and would not require any ground disturbance. Neither of these additional launch facilities would impact sensitive plant species or vegetation communities and impacts would be less than significant.

Use of the 50K or vertical launcher may result in increased noise levels. However, as discussed in the preceding sections, periodic increases in noise would not result in significant impacts to sensitive species.

Support Facilities

Support facilities have been sited to avoid sensitive biological resources. The range support building and multiple-purpose instrumentation sites would be placed in coastal scrub or barren habitats that are not known to contain sensitive plant or wildlife species. Impacts would be less than significant.

4.8.5 Compliance with the Endangered Species Act

Consultation regarding threatened and endangered species is addressed in Section 7 of the Federal Endangered Species Act of 1973, as amended (16 U.S.C. § 1531). In particular, Section 7(a)(3) requires a federal agency to consult with the appropriate regulatory agency (in this case the USFWS) if the agency has reason to believe that any proposed federal action could directly or indirectly affect an endangered or threatened species. The United States Department of Interior (DOI) developed regulations that implement the provisions of Section 7 and detail the methods for implementation.

A formal consultation is a process between the USFWS and the federal agency that commences with the federal agency's written request for consultation under Section 7(a)(2) of the Act and concludes with the USFWS's issuance of a Biological Opinion (BO) under Section 7(a)(3). This written request is called "initiation of formal consultation." A formal consultation is required when the federal agency determines through a Biological Assessment (BA) or informal consultation that the proposed action "may affect" a listed species or its critical habitat. If it is determined that the proposed action would not affect a listed species or its critical habitat, then a formal consultation is not required.

A BO includes:

- a summary of the information on which the opinion was based (the information is provided by the federal agency);
- a detailed discussion of the effects of the action on the listed species or critical habitat; and
- the USFWS's opinion on whether the action is likely to jeopardize the continued existence of a listed species.

The BO may include an incidental take statement that specifies the amount of "take" that is allowed, reasonable and prudent measures that the USFWS considered necessary or appropriate to minimize such "take," and compliance terms and conditions for implementing reasonable and prudent measures.

To "take" is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect an endangered or threatened species or to attempt to engage in any of these activities." Harm not only includes killing a species, but activities that modify or significantly degrade habitat that could result in death or injury to individual members of a species by significantly disrupting their essential behavioral patterns. Potential affects include leaving a nest for brief periods as a result of noise or human presence; destruction or alteration of foraging, nesting, and roosting habitat; and mortality.

Two BOs, one addressing all base activities at Point Mugu and the other addressing all activities on San Nicolas Island, were issued by the USFWS. The BOs address all significant impacts to sensitive species and their critical habitat, including recently designated western snowy plover habitat at Point Mugu and San Nicolas Island. The activities determined to be having or expected to have an effect on listed species are summarized below, followed by a summary of associated mitigation measures.

4.8.5.1 Point Mugu

The Navy initiated a programmatic formal consultation under Section 7 of the Endangered Species Act in January of 1999 with the USFWS. The consultation addresses all activities that may affect federally listed species under USFWS jurisdiction located at NAS Point Mugu. The Navy submitted a final Biological Assessment in March 1999, and the USFWS issued the No Jeopardy Final Programmatic Biological Opinion in June 2001 (USFWS 2001). The Programmatic BO includes all activities addressed in this EIS/OEIS. The following section summarizes the relevant portions of the Biological Opinion and the associated mitigation measures.

Missile launches and aircraft overflights have been identified as potentially affecting sensitive resources at Point Mugu. JATO bottles have been identified as potentially "taking" western snowy plovers and light-footed clapper rails through physical impacts and recovery options. Aircraft overflights may affect western snowy plovers, California least terns, California brown pelicans, and light-footed clapper rails by causing species to move off their nests, disrupting their behavior, and striking the birds. As noted previously, the use of two previously used launch pads near the beach could affect sensitive species that use beach habitats.

The Navy has recently implemented a JATO bottle removal program for the salt marsh in front of Building 55. This program, which includes seasonal restrictions on recovery activities, is expected to benefit sensitive avian species at Mugu Lagoon. Additional mitigation and conservation measures identified in coordination with the USFWS, many of which are ongoing, include:

- The asphalt parking lot at Holiday Beach will be removed and restored to sandy beach habitat for the western snowy plover.
- A non-native plant eradication program shall be implemented to remove all exotic plant species within western snowy plover and light-footed clapper rail habitats.
- Population monitoring of salt marsh bird's-beak, western snowy plover, California least tern, and light-footed clapper rail shall be standardized and used consistently.
- Areas where physical parameters are appropriate and no other use is anticipated shall be restored as salt marsh, sandy beach, or other habitat for listed species.
- Habitat for the western snowy plover at Pad Alpha shall be restored by the removal of catapult berms.
- Because variations from standard procedures were the cause of some adverse effects to listed species, aircraft overflights will be modified and monitored by air operations personnel to stay strictly within the following guidelines established by the Navy:

a. All rotorcraft shall be kept at or above 500 feet above ground level (AGL) over listed species habitat, or shall be directed one mile offshore or one mile to the north of listed species habitat without altitude limits.
b. All fixed-wing aircraft shall obey flight deck limits of 500 feet AGL over listed species habitat, or shall be directed one mile offshore or one mile to the north of listed species habitat without altitude limits.
c. Arriving and departing aircraft shall follow designated flight paths over habitat identified as supporting listed species. Aircraft will not "cut corners" to shorten arrival and departure paths.

- Base personnel and contractors shall be educated on the identification and importance of conserving listed species, and their personal responsibilities in this regard.
- All mitigation measures shall be monitored to determine their effectiveness in avoiding and minimizing take of listed species. If mitigation measures are not effective, corrective measures shall be implemented.

4.8.5.2 San Nicolas Island

The Navy initiated a separate programmatic formal consultation under Section 7 of the Endangered Species Act in December 2000 with the USFWS. The consultation addresses all activities with may affect federally listed species under USFWS jurisdiction located at San Nicolas Island. The Navy submitted a final Biological Assessment in December 2001, and the USFWS issued the No Jeopardy Final Programmatic Biological Opinion in October 2001 (USFWS 2001). The Programmatic BO includes all activities addressed in this EIS/OEIS. The following section summarizes the relevant portions of the Biological Opinion and the associated mitigation measures.

Target and missile launches from the two existing launch locations (Alpha Launch Complex and Building 807 Launch Complex) and the two proposed launchers (vertical launcher and 50K launcher) may affect California brown pelicans and western snowy plovers that use the west end of the island for roosting and foraging. Western snowy plovers also nest on the west end of the island. Missile launches and associated vehicle and personnel activity at the Building 807 Launch Complex may potentially result in disturbances to nesting western snowy plovers. As noted previously, environmental restrictions placed on special warfare training sites would preclude potential impacts on sensitive species. The sites and access roads for the proposed facility modernizations at San Nicolas Island would be sited to avoid sensitive species.

The Navy has closed the south side of the island to all activities. This closure area protects three species of marine mammals, western snowy plovers, Brandt's cormorants, western gulls, and California brown pelicans. This measure also provides undisturbed habitat for a variety of other wildlife species. Additional mitigation and conservation measures identified in coordination with the USFWS, many of which are ongoing, include:

- To prevent disturbance of the federally listed western snowy plover, nesting areas are closed during the breeding season. Signs and barricades alert personnel of closure areas.
- The distribution and status of listed species are regularly and consistently monitored. Listed species habitat in or near operational areas is surveyed frequently to assess potential for effects to listed species by Navy activities.
- Permanent and visiting island personnel attend a mandatory "environmental briefing." Federal legislation and Navy regulations regarding protected species are emphasized, along with their personal responsibilities in this regard.

- Habitat expansion for the island night lizard is accomplished by utilizing cactus and boxthorn (*Lycium californicum*) as dominant components in revegetation efforts.
- The substrate immediately adjacent to the Building 807 launch area may be altered during the nonbreeding season to make the area unappealing for nest site selection by snowy plovers (this area is not designated critical habitat for the species).
- Construction equipment, vehicles, and supplies will be thoroughly cleaned and inspected prior to shipment to San Nicolas Island to reduce the potential for introduction of non-native species.
- Staging areas for temporary storage of equipment and materials will be sited in areas with low island night lizard densities whenever feasible.
- The sites and access roads for proposed facility construction projects will be placed to avoid habitat which may harbor island night lizards.

4.9 CULTURAL RESOURCES

4.9.1 Approach to Analysis

The methodology for identifying, evaluating, and mitigating impacts on cultural resources has been established through federal laws and regulations including the National Historic Preservation Act (NHPA) (16 U.S.C. 470), the Archaeological Resource Protection Act (ARPA) (16 U.S.C. § 470aa et seq.), the Native American Graves Protection and Repatriation Act (NAGPRA), and the American Indian Religious Freedom Act (AIRFA).

The primary factor used to assess significance includes the degree or extent to which implementation of an alternative would alter the property's characteristics, including relevant features of its environment or use that qualify it as significant according to National Register of Historic Places (National Register) criteria. Impacts may include the following:

- physical destruction, damage, or alteration of all or part of the resources;
- alteration of the character of the surrounding environment that contributes to the resource's qualifications for the National Register;
- introduction of visual, audible, or atmospheric elements that are out of character with the resource or alter its setting; and
- neglect of the resource resulting in its deterioration or destruction.

Potential impacts are assessed by: 1) identifying project activities that could directly or indirectly affect significant resources; 2) identifying the known or expected significant resources in areas of potential impact; and 3) determining whether a project activity would have no effect, no adverse effect, or an adverse effect on significant resources (36 C.F.R. 800.9). Direct impacts are usually those associated with ground disturbance, although architectural resources may be impacted by activities that destroy or modify the structure itself. Indirect impacts on significant resources can result from improved access leading to vandalism or changes in land status or other actions that limit scientific investigation.

Potential impacts to cultural resources may occur from increased noise or changes from ground-disturbing activities involving construction, modification, or the use and maintenance of facilities. Impacts on traditional Native American properties can be determined through consultation with the affected Native American groups. However, ground disturbance to prehistoric archaeological sites (especially rock art sites), disturbance to traditionally used plant and animal resources, and increased noise over sacred or traditional use areas have often been cited by Native Americans as significant impacts.

If significant resources should be affected by project activities, impacts that would otherwise be found to be adverse may be considered not adverse under the following conditions:

- when the historic property is of value only for its potential contribution to archaeological, historical, or architectural research, and when such value can be substantially preserved through the conduct of appropriate research, and such research is conducted in accordance with applicable professional standards and guidelines; or
- when the undertaking is limited to the rehabilitation of buildings and structures and is conducted in a manner that preserves the historical and architectural value of the affected historic property through conformance with the Secretary of the Interior's Standards and Guidelines for Rehabilitation.

Impacts on cultural resources primarily would be due to the modernization, modification, demolition, and construction of new facilities at San Nicolas Island and NAS Point Mugu; impacts to nearshore and offshore sites from target and weapons debris; and impacts of the use of inert mine shapes in Becher's Bay. Modernization and modification of structures could have an adverse effect if they alter the structure's outward appearance or characteristics that invoke the historical period during which it was constructed. Abandonment and deterioration of significant structures is considered to be an adverse impact because it naturally leads to an alteration in structural integrity through time. Construction of new facilities could disturb archaeological sites through ground disturbance during the building process or could change the surroundings of significant structures by introducing contrasting visual elements. Use of targets (either inert or live) could disturb archaeological sites through ground disturbance activities within impact areas, while use of launching facilities could affect sites through increased erosion resulting from loss of vegetation due to fires. Ground disturbance can negatively affect archaeological sites by moving or mixing materials that detract from the site's ability to address significant research questions about the past. Archaeological sites in the project areas tend to be shallow so that minimal trenching, grading, or excavation can affect adversely the integrity of tools, food remains, and other materials. Target and weapon debris would have minimal impacts to archaeological sites that are significant for their research potential. The debris would be confined to the surface, the area of a site with the greatest potential for previous disturbance, and would not have a negative effect on any subsurface remains. Debris would have no impact on buried sites. A secondary impact to archaeological sites could occur during the cleanup of debris. Surface materials could be trampled or moved by cleanup crews. The impacts, however, are considered to be minimal since surface materials in the project areas are frequently moved by wind and shifting sands. Current use of the existing instrumentation and support facilities on San Miguel, Santa Rosa, and Santa Cruz islands involves periodic maintenance activities. These activities have no impact on cultural resources. Further, none of the alternatives addressed in this EIS/OEIS include new activities at these islands. A summary matrix of cultural resource impacts is presented in Table 4.9-1.

4.9.2 No Action Alternative - Current Operations

4.9.2.1 Air-to-Air Operations

Potential impacts on cultural resources from current air-to-air operations are limited to missile and target debris falling into the ocean and affecting shipwrecks and submerged archaeological resources. However, these potential impacts are not considered significant because there are few cultural resources located outside of nearshore areas. Some shipwrecks may occur in offshore waters, but most shipwrecks are located near islands and the mainland, outside of current debris patterns. Shipwrecks have been recorded in offshore waters, but a predictive model of shipwreck locations within the Point Mugu Sea Range indicates that most shipwrecks are located less than 0.5 NM (0.9 km) from islands and the mainland. Submerged shipwrecks located more than 10 NM (19 km) from land are unlikely to be affected by debris because they occur at a low density (fewer than 20 ships over 36,000 square miles [93,200 km^2]) and at such great depths (greater than 3,000 feet [914 m]) that the debris is unlikely to land on any resources. Underwater archaeological resources are also more likely to occur in nearshore areas less than 1 NM (1.9 km) from land. Since air-to-air intercepts take place primarily over deep water areas of the Sea Range, and the resulting debris patterns do not affect areas less than 1 NM (1.9 km) from land, there are no expected impacts to cultural resources from current air-to-air operations.

Table 4.9-1. Cultural Resources Impact Summary Matrix

Alternative	Impact Conclusions NEPA (On Land→ Territorial Waters)	 EO 12114 (Non-Territorial Waters)	Mitigation Measures
NO ACTION ALTERNATIVE	Potentially significant but mitigable impact on submerged cultural resources in Becher's Bay.	*Few cultural resources offshore. No significant impacts on submerged resources.*	If inert mine shape drops or cleanup activities occur nearshore of the hazard area and expose cultural resources, initiate data recovery measures in accordance with Section 106. Resulting impacts would be less than significant.
MINIMUM COMPONENTS ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Potential for significant but mitigable impacts on subsurface archaeological deposits during construction on San Nicolas Island.	*Few cultural resources offshore. No significant impacts on submerged resources.*	Implement construction requirement to halt work upon discovery of resource/Section 106 consultation. Resulting impacts would be less than significant.
PREFERRED ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Potential for significant but mitigable impacts on subsurface archaeological deposits during construction on San Nicolas Island.	*Few cultural resources offshore. No significant impacts on submerged resources.*	Implement construction requirement to halt work upon discovery of resource/Section 106 consultation. Resulting impacts would be less than significant.

4.9.2.2 Air-to-Surface Operations

Adverse impacts to cultural resources from air-to-surface operations could result from the following actions:

- use of the SLAM target area on the western tip of San Nicolas Island;
- missile/target debris in offshore waters; and
- dropping inert mine shapes from aircraft into nearshore waters of Becher's Bay off Santa Rosa Island (refer to Figure 3.0-14).

Effects due to target use on San Nicolas Island are less than significant. The SLAM target on San Nicolas Island has been in use since 1989. In an Environmental Assessment (EA) that evaluated the effects of the use of the SLAM target, it was determined that although the impact area contained portions of archaeological site CA-SNI-168, a site eligible for the National Register, that data recovery investigations (Rosenthal et al. 1997) within the area of effect preserved the scientific significance of archaeological remains and that use of the facility does not have an adverse impact on the site (NAWCWPNS Point Mugu 1997c). Another archaeological site eligible for the National Register, site CA-SNI-169, is also located within the SLAM impact area. Data recovery at site CA-SNI-169 was completed in 1998. Data recovery has effectively mitigated adverse effects and impacts are less than significant.

Inert mine shapes dropped into the nearshore areas at Becher's Bay could significantly impact cultural resources. Shipwreck remains have been discovered near the pier at Becher's Bay, and at least two ships have been lost in the area. Although the National Park Service surveyed the area between the pier and Carrington Point using side-scan sonar and a magnetometer in 1985 with negative results, shipwreck remains are periodically uncovered during winter storms. Dropping or recovering inert mine shapes could destroy fragile remains if the drop zone overlaps with the locations of submerged or shallowly buried shipwrecks. The inert mine drop zone is located off the coast of Becher's Bay between Skunk Point and Carrington Point (refer to Figure 3.0-14). The surface hazard area is 2 NM (3.7 km) wide and 5 NM (9.3 km) long and is located between 0.5 NM (0.9 km) and 2 NM (3.7 km) from the shore. The target points occur in the center of the hazard area, which is located between 1.5 NM (2.8 km) and 3 NM (5.6 km) from the shore. A predictive model of shipwreck locations in the Sea Range indicates that shipwrecks are most likely to be found within 0.5 NM (0.9 km) of land. The shipwreck found at Becher's Bay was on the beach. If the impact area is confined to the hazard area, significant impacts on cultural resources are unlikely. If inert mine shapes fall outside of the hazard area and closer to land or if cleanup activities disturb the beach and nearshore area, then adverse effects to significant resources could occur. These effects are reduced to less than significant levels through implementation of the following mitigation measures:

- Conduct a thorough survey of the entire impact area, in addition to a buffer zone, for the presence of shipwrecks.
- If resources are found to be present, then conduct Section 106 consultation.
- If inert mine shapes or cleanup activities expose or damage cultural resources, then data recovery measures are initiated in accordance with Section 106 of the NHPA to record and preserve scientific information in keeping with a research design and using accepted professional standards (Secretary of the Interior's *Standards and Guidelines*).

Potential impacts on cultural resources from missile and target debris in offshore areas are unlikely because of the sparse distribution of resources as described in Section 4.9.2.1. Impacts on submerged resources are also unlikely because of the small size of the debris and the likelihood that it only affects the surface of any submerged resource. As discussed above, the surface is the area of the site most likely to have been previously disturbed; additional modern debris has little effect on the research potential of these sites. In addition, depending upon currents, erosion, weather, and location, submerged resources are probably buried by sediments. Therefore, no impacts to cultural resources occur from debris associated with current air-to-surface operations.

4.9.2.3 Surface-to-Air Operations

Potential impacts on cultural resources from current surface-to-air operations are limited to missile and target debris falling into the ocean and affecting shipwrecks and submerged archaeological resources. Potential impacts on cultural resources in Territorial Waters are the same as those discussed in Section 4.9.2.1; there are no significant impacts on cultural resources from current surface-to-air operations.

Potential impacts on cultural resources in non-Territorial Waters are the same as those discussed in Section 4.9.2.1; there are no significant impacts on cultural resources from current surface-to-air operations.

4.9.2.4 Surface-to-Surface Operations

Potential impacts on cultural resources are the same as those discussed in Section 4.9.2.1; there are no impacts to cultural resources from current surface-to-surface operations.

4.9.2.5 Subsurface-to-Surface Operations

Potential impacts on cultural resources are the same as those discussed in Section 4.9.2.1; there are no impacts to cultural resources from current subsurface-to-surface operations.

4.9.2.6 Ancillary Operations Systems

The use of ancillary operations systems does not involve potential direct impacts to cultural resources such as ground disturbance or modification, construction, or demolition of structures. The use of chaff and flares is limited to ocean areas; there are no impacts on cultural resources on land. In addition, existing ancillary systems do not contribute indirect effects due to the introduction of visual or audible elements that are out of character with the existing Sea Range environment, or due to increased access considerations. The use of ancillary operations systems has no impact on cultural resources.

The use of chaff and flares in non-Territorial Waters has no impact on cultural resources.

4.9.2.7 Current Fleet Exercise Training

Potential impacts to cultural resources from current FLEETEX operations are limited to missile and target debris falling in the ocean and affecting shipwrecks or submerged archaeological resources. As described in Section 4.9.2.1, significant impacts are unlikely to result from missile debris and termination of missiles within the Sea Range.

4.9.2.8 Littoral Warfare Training

Littoral warfare training involves beach landings, reconnaissance, parachute drops, and various tactical maneuvers. Impacts to cultural resources could result from erosion or vandalism through increased access to sensitive areas. However, beach areas used for littoral warfare training are chosen to avoid or minimize damage to cultural resources. Therefore, no impacts on cultural resources occur due to existing limitations placed on littoral warfare training. If archaeological resources are disturbed directly during training or indirectly through erosion, then Section 106 consultation is initiated.

4.9.3 Minimum Components Alternative

This alternative includes impacts identified for the No Action Alternative since the testing, training, and facility modernization activities included in this alternative are proposed in addition to current operations.

4.9.3.1 Theater Missile Defense Element – Nearshore Intercept

Significant impacts to cultural resources would be unlikely to result from the location of debris patterns associated with proposed nearshore intercept activities off the coast of San Nicolas Island. The debris pattern, although within the nearshore area, would be restricted to more than 1 NM (1.9 km) from the island. A recent study (NAWCWPNS Point Mugu 1997d) developed a model for predicting potential locations of underwater archaeological resources offshore from San Nicolas Island. Given the location of sites on San Nicolas Island and the extent of the shoreline more than 8,500 years ago, submerged archaeological sites are most likely to occur near rocky shore environments, near water sources, and no greater than 1 NM (1.9 km) from the existing shoreline. A predictive model of shipwrecks within the Sea Range also indicated that shipwreck remains are most likely to be found in the nearshore area, at no greater than 0.5 NM (0.9 km) from the shore, although underwater site reconnaissance is required to validate modeling results and confirm locations for potential underwater resources.

Each nearshore intercept testing or training event would produce a very small debris pattern footprint since the intercept would occur at altitudes less than 1,000 feet (300 m). Since dispersion time would be limited, it is likely that missile and target debris would settle on the ocean bottom in the San Nicolas Island nearshore environment. In the remote case that missile/target debris settled on the surface of an underwater archaeological resource, damage to the resource would not be likely due to the size of the debris; in most cases the missile would be destroyed upon impact and smaller pieces would settle to the bottom. Techniques related to cleanup and disposal would not involve excavation and if archaeological remains were discovered, they would be recorded and avoided. Further, it is likely that submerged resources would be covered with at least some sediment because of settling processes and shifting sand movement over the years. However, debris accumulation on the seafloor may hinder remote sensing techniques used to locate submerged resources. Given the location of debris patterns more than 1 NM (1.9 km) from the shore and the low potential for resources in this area, nearshore intercept events would be unlikely to affect cultural resources. If the debris fell on a resource, the impact on the scientific potential of the resource would be minimal and result in impacts that would be less than significant.

4.9.3.2 Training Element – Additional FLEETEX

Potential impacts to cultural resources would be limited to the effects of missile debris and termination of missiles within the Sea Range resulting from an additional FLEETEX. Because debris patterns from FLEETEXs mainly occur in offshore areas, cultural resources are unlikely to be affected and impacts would be less than significant as discussed in Section 4.9.2.1.

4.9.3.3 Facility Modernization Element – Multiple-Purpose Instrumentation Sites

Construction of five 15,000 square feet (1,394 m^2) structures on San Nicolas Island could impact cultural resources. Ground disturbance through leveling, grading, heavy machinery use, and filling could disturb surface and subsurface archaeological materials. However, the entire island has been surveyed and construction of facilities would be designed to avoid known archaeological sites. Adverse impacts on currently unknown archaeological subsurface deposits could occur during ground disturbing activities. The area chosen for construction would be evaluated for the presence of buried archaeological sites and appropriate actions would be taken to minimize or eliminate any impacts. This potential impact would also be mitigated to a less than significant level because any contract, lease, or permit for construction at San Nicolas Island would include a requirement to halt work in the event of a discovery of archaeological materials. If subsequent avoidance is not possible, then consultation in accordance with Section 106 of the NHPA would be initiated to mitigate adverse impacts to the resource. Resulting impacts would be less than significant.

4.9.4 Preferred Alternative

This alternative includes impacts identified for the No Action Alternative since the testing, training, and facility modernization activities included in this alternative are proposed in addition to current operations.

4.9.4.1 Theater Missile Defense Element

A - Boost Phase Intercept

Potential impacts to cultural resources would be limited to the effects of missile and target debris and termination of missiles within the Sea Range due to boost phase intercept testing and training events. Under the proposed action, the Navy could conduct up to three boost phase intercept events per year. The debris pattern would be spread over a large area located offshore. Although the debris pattern for boost phase intercept events would be located primarily in non-Territorial Waters, some intercepts could occur in Territorial Waters (e.g., west of San Nicolas Island). Because of the limited number of proposed events and the great depth of water over which the debris pattern would extend (see discussion in Section 4.9.2.1), underwater archaeological resources would not be affected by boost phase intercept testing and training. Significant impacts on cultural resources would not occur.

As noted above, the majority of boost phase intercepts would occur in non-Territorial Waters. As described in Section 4.9.2.1, impacts on cultural resources from debris would not be significant.

B - Upper Tier

As discussed in Section 4.9.2.1, potential impacts on cultural resources due to debris falling into the Sea Range are unlikely. The debris pattern footprint expected for upper tier testing and training would be located entirely over offshore waters. Potential effects on underwater cultural resources, expected mainly for nearshore areas, would not occur. No significant impacts to cultural resources would result.

C - Lower Tier

Potential impacts on cultural resources from lower tier testing and training would be as described above for upper tier; significant impacts would not occur.

D - Nearshore Intercept

Potential effects to cultural resources are the same as those discussed in Section 4.9.3.1. Given the location of debris patterns more than 1 NM (1.9 km) from shore and the low potential for resources in this area; the minimal effect of debris on the scientific potential of these resources; and the likelihood that submerged resources would be covered with at least some sediment because of settling processes and shifting sand movement over the years, impacts would be less than significant. Audible and visual intrusions from target and missile flights would not be significant given the current level of military activities in the area.

4.9.4.2 Training Element – Fleet Exercise and Special Warfare Training

A - Fleet Exercise Training

Potential impacts on cultural resources are the same as those discussed in Section 4.9.3.2. Because debris patterns from FLEETEXs mainly occur in offshore areas, cultural resources are unlikely to be affected and impacts would be less than significant.

B - Special Warfare Training

Potential impacts to cultural resources are the same as those discussed in Section 4.9.2.8. Beach areas used for special warfare training are chosen to avoid or minimize damage to cultural resources. Therefore, no impacts on cultural resources would occur due to existing limitations placed on special warfare training. If archaeological resources are disturbed directly during training or indirectly through erosion, then Section 106 consultation would be initiated.

4.9.4.3 Facility Modernization Element – Point Mugu and San Nicolas Island

Potential impacts to cultural resources could result from the modernization, modification, demolition or construction of facilities at NAS Point Mugu and San Nicolas Island. These effects could involve the alteration or destruction of a significant structure or the disturbance of archaeological sites through ground disturbance and damage to remains from grading, leveling, filling, or use of heavy equipment.

A - Point Mugu Modernizations

There would be no modifications to structures at NAS Point Mugu under the Facility Modernization Element. The proposal includes the reuse of two launch pads along Beach Road for missile launches and continued use of Building 55 as a target launching facility. Missiles currently launched by truck in front of Building 55 would be launched from either the Bravo pad (Pad B) or Charlie pad (Pad C) and total approximately six missile launches per year. No construction or pad refurbishment is required. The Bravo pad is part of the Bravo Launch Complex (formerly known as the Baker Launch Complex), which includes three buildings considered to meet the criteria for eligibility to the National Register for significance associated with the Cold War. Reuse of the launch pad would not adversely affect the facility since it does not require modifications and proposed use is similar to the historical use of the facility and does not detract from its historical significance. Minor utility upgrades, if required, would not alter the criteria that make the facility significant and therefore would not adversely affect the complex. No impacts to the complex would result from this action. It has been determined that Pad C does not meet criteria for eligibility to the National Register (Wee and Byrd 1997). Impacts from the proposed Point Mugu modernizations would be less than significant.

Under the Preferred Alternative, some of the missile launches could include the use of solid propellant boosters. The boosters would be ejected and fall into the ocean approximately 0.25 to 0.50 mile (0.40 to 0.80 km) offshore. In the remote case that a booster settled on the surface of an underwater archaeological resource, damage to the resource would not be likely since submerged resources would be covered with at least some sediment due to settling processes and shifting sand movement. In addition, if an expended booster fell on a resource, the effect on the scientific potential of the resource would be minimal and result in impacts that would be less than significant.

Building 55, considered to be an "exceptionally significant" Cold War-era resource and listed on the National Register, would continue to be used as a target launch facility and would be maintained as appropriate. No impact to the building would result from this action.

B - San Nicolas Island Modernizations

Modernizations on San Nicolas Island would include construction of new facilities, including a 50K launch site, a Vertical Launch System, a new range support building, and five multiple-purpose instrumentation sites.

Construction of facilities has the potential to adversely affect archaeological sites on San Nicolas Island. However, the entire island has been surveyed and construction would be designed to avoid known archaeological sites both during construction and during use of the facilities. Adverse impacts on currently unknown archaeological subsurface deposits could occur during ground disturbing activities. The area chosen for construction would be evaluated for the presence of buried archaeological sites and appropriate actions would be taken to minimize or eliminate any impacts. This potential impact would also be mitigated to a less than significant level because any contract, lease, or permit for construction at San Nicolas Island would include a requirement to halt work in the event of a discovery of archaeological materials. If subsequent avoidance is not possible, then consultation in accordance with Section 106 of the NHPA would be initiated to mitigate adverse effects to the resource. Resulting impacts would be less than significant.

The Permanent Radar Tower (Building 138) is the only significant architectural structure on San Nicolas Island. Since repairs and modifications to this structure are not proposed, there would be no impact on significant architectural resources on San Nicolas Island.

4.9.5 Compliance with the National Historic Preservation Act

As discussed in the previous section, the proposed action would not involve effects on National Register or eligible properties. Documentation of this determination has been provided to the California State Historic Preservation Officer (SHPO). (Refer to Appendix G, Agency Correspondence.) No further steps are necessary to comply with the NHPA. In the event unknown cultural resources are discovered during the proposed action, appropriate measures under Section 106 would be implemented.

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4.10 LAND USE

4.10.1 Approach to Analysis

This section addresses the potential for NAWCWPNS activities to affect land use within the Sea Range boundaries and within the areas including and surrounding NAS Point Mugu. Factors used to assess significance include the extent or degree to which implementation of an alternative would cause substantial changes to currently approved or planned land uses. This analysis focuses primarily on proposed Sea Range activities and how they may affect issues such as commercial shipping, recreational boating, commercial and recreational fishing, and ocean tourist activities, particularly in the coastal zone. Although the land use analysis is a qualitative effort, much of the information is based on the quantitative analyses presented in Sections 4.6, Fish and Sea Turtles; 4.11, Traffic; and 4.12, Socioeconomics. For example, the potential for above-water and below-water sound sources to affect the catchability of fish is analyzed in Section 4.6, Fish and Sea Turtles. The results of this effort are then incorporated into the land use analysis to determine potential effects on recreational and commercial fisheries. The analysis also focuses on the clearance areas surrounding safety hazard patterns for current and proposed operations and the potential of clearance activities to limit current land uses in the Sea Range. Current surface access restrictions at San Nicolas Island are addressed, including the potential for proposed activities to increase or decrease access to the island. Access restrictions associated with use of the proposed launch pads at NAS Point Mugu are also addressed.

Current use of the existing instrumentation sites and support facilities on San Miguel, Santa Rosa, and Santa Cruz islands involves periodic maintenance activities. These activities are consistent with the intended use of these sites and land use impacts are less than significant. None of the alternatives addressed in this EIS/OEIS include new activities at these islands, and no change to current land use is proposed. These sites are included in the Coastal Consistency Determination (CCD) prepared to address the alternatives considered in this EIS/OEIS.

The results of the noise analysis are incorporated into the land use analysis as needed. Specifically, this analysis addresses the potential for noise contours associated with existing and proposed activities to affect current and planned land use in the areas surrounding NAS Point Mugu. Compatibility of the proposed action with local planning policies and state coastal policies (which apply to coastal waters extending 3 NM [5.7 km] from any land mass) are specifically addressed. These issues are described in greater detail in the CCD. A summary matrix of land use impacts is presented in Table 4.10-1.

4.10.2 No Action Alternative - Current Operations

Both military and non-military (e.g., commercial and recreational) entities have been sharing use of the airspace comprising, and the ocean surface underlying, the Sea Range for more than 50 years. Both entities have established an operational coexistence consistent with federal, state, and local plans and policies and compatible with each interest's varying objectives. Range clearance procedures on the Sea Range are implemented prior to each operation to ensure that marine vessels and civilian air traffic are outside of the clearance area (refer to Section 3.0.2.1-F). The following subsections detail land use activity coordination between Sea Range operations and non-participants using this area.

4.10.2.1 Air-to-Air Operations

Air-to-air intercepts typically occur in outer portions of the Sea Range (Range Areas 4A, 4B, 5A, 5B, 6A, 6B, and 6C). The safety hazard patterns and associated clearance areas typically occur on the outer part of the Sea Range in the same area as the western approach shipping lane. According to the Historic

Table 4.10-1. Land Use Impact Summary Matrix

Alternative	Impact Conclusions NEPA (On Land→ Territorial Waters)	EO 12114 (Non-Territorial Waters)	Mitigation Measures
NO ACTION ALTERNATIVE	No change to existing land use. Less than significant impact.	*No change to existing land use. Less than significant impact.*	None.
MINIMUM COMPONENTS ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Closure of San Nicolas Island to peak commercial fishing 2-4 days per year. Less than significant impact.	*No substantial changes to current or planned land use. Less than significant impact.*	None.
PREFERRED ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Closure of San Nicolas Island to peak commercial fishing 2-4 days per year. Less than significant impact.	*No substantial changes to current or planned land use. Less than significant impact.*	None.

Temporal Shipping (HITS) database, it is possible that about three commercial shipping vessels might be present in the clearance area prior to NOTMAR issuance; recreational vessels, commercial fishing vessels, and tourist boats are not likely to be in this area. Certain fisheries (e.g., drift gill netting for pelagic shark and swordfish) occur in the open ocean environment. However, the majority of commercial fishing vessels and recreational boaters typically operate in nearshore areas and are not likely to be in a clearance area prior to a test. Testing activities are not conducted until vessels are clear of the area in accordance with the range clearance procedures previously described. Therefore, land use impacts of air-to-air operations are less than significant.

4.10.2.2 Air-to-Surface Operations

Navy vessels often transit the inner Sea Range to reach the testing locations; Navy vessel transit, however, does not affect the activities of other marine vessels in the area.

Inert mine shape drops are occasionally conducted at Becher's Bay off Santa Rosa Island (refer to Figure 3.0-14), within the boundaries of the Channel Islands National Marine Sanctuary (CINMS). The safety areas for these tests typically occur south of the area where the western approach and the northern approach shipping lanes converge. This location has a much higher likelihood of having recreational vessels present. However, the two aircraft that conduct the drop also perform surveillance of the area to ensure that no vessels are present. These operations occur infrequently and are of short duration; there are no long-term impacts to recreational uses since recreational activity resumes following testing. Recovery operations consist of one commercial vessel with divers retrieving the concrete mine shapes following drops. This activity does not affect recreational or commercial use of this area. Therefore, land use impacts of inert mine shape drop operations are less than significant.

Air-to-surface operations typically occur in outer portions of Range Areas 4A, 4B, and 5B. According to the HITS database, it is likely that about three commercial shipping vessels might transit the clearance area surrounding the safety hazard pattern prior to NOTMAR issuance; recreational vessels and *commercial fishing vessels could also be in this area. Testing activities are not conducted until vessels are clear of the area in accordance with the range clearance procedures previously described. Therefore, typical air-to-surface operations do not have a significant impact on land use.*

4.10.2.3 Surface-to-Air Operations

Navy vessels often transit the inner Sea Range to reach the testing locations; Navy vessel transit, however, does not affect the activities of other marine vessels in the area.

Surface-to-air intercepts typically occur in non-Territorial Waters (Range Areas 5A/6A), although some missile/target intercepts occur in Territorial Waters west of San Nicolas Island (Range Area 4A). A large safety hazard pattern is associated with both the missile (typically fired from a cruiser southwest of San Nicolas Island) and the Vandal missile target (fired from San Nicolas Island to the west). However, very few vessels use the clearance area surrounding these safety hazard patterns (an average of 0.01 vessels might transit these areas prior to NOTMAR issuance according to the HITS database). Testing activities are not conducted until vessels are clear of the area in accordance with the range clearance procedures previously described. Therefore, land use impacts of surface-to-air operations are less than significant.

As noted above, surface-to-air intercepts typically occur in non-Territorial Waters. For the reasons described above, impacts on land use in non-Territorial Waters are less than significant.

4.10.2.4 Surface-to-Surface Operations

Navy vessels often transit the inner Sea Range to reach the testing locations; Navy vessel transit, however, does not affect the activities of other marine vessels in the area.

Onshore missile launches require clearance of areas at and around Point Mugu and San Nicolas Island (see previous discussion in Section 4.10.2). Testing activities are not conducted until vessels are clear of the area in accordance with the range clearance procedures previously described. Therefore, land use impacts of typical surface-to-surface operations are less than significant.

Surface-to-surface intercepts typically occur in outer portions of the Sea Range (Range Areas W-60, 4A, 4B, 5A, and 5B). Potential land use effects associated with surface-to-surface operations are the same as those described for air-to-air operations (see Section 4.10.2.1). The safety areas for these tests typically occur south of the western approach shipping lanes. According to the HITS database, it is possible that about six vessels might be present in the clearance area surrounding the safety hazard pattern prior to NOTMAR issuance; recreational vessels and commercial fishing vessels are not usually in this area (they are typically closer to San Nicolas Island in this portion of the Sea Range). Testing activities are not conducted until vessels are clear of the area in accordance with the range clearance procedures previously described. Therefore, land use impacts of typical surface-to-surface operations are less than significant.

4.10.2.5 Subsurface-to-Surface Operations

Navy vessels often transit the inner Sea Range to reach the testing locations; Navy vessel transit, however, does not affect the activities of other marine vessels in the area.

Subsurface-to-surface intercepts typically occur in outer portions of the Sea Range (Range Areas 4A, 5A, 6A, and 7A). The surface target is typically sunk just outside Territorial Waters. Safety areas for these tests typically occur south of the western approach shipping lanes. According to the HITS database, it is *possible that about four vessels might be present in the clearance area surrounding the safety hazard pattern prior to NOTMAR issuance. Recreational vessels and commercial fishing vessels could potentially be in this portion of the Sea Range. Testing activities are not conducted until vessels are clear of the area in accordance with the range clearance procedures previously described. Therefore, land use impacts of typical subsurface-to-surface operations are less than significant.*

4.10.2.6 Ancillary Operations Systems

Ancillary operations systems include radar systems, communications systems, chaff and flare use, and laser systems (used for measurement purposes). These systems are implemented at times and locations deemed appropriate for their use. These systems do not result in conflicts with other non-military users of the Sea Range. Therefore, land use impacts of ancillary operations systems are less than significant.

For the reasons described above, the use of ancillary operations systems in non-Territorial Waters has less than significant impacts on land use.

4.10.2.7 Current Fleet Exercise Training

Navy vessels often transit the inner Sea Range to reach the testing locations; Navy vessel transit, however, does not affect the activities of other marine vessels in the area.

Operations associated with FLEETEXs require clearance of areas at and around Point Mugu and San Nicolas Island (see previous discussion in Section 4.10.2). Operations are not conducted until vessels are clear of the area in accordance with the range clearance procedures previously discussed. Land use impacts from launches associated with FLEETEX activities are less than significant.

Two FLEETEXs are conducted each year and last approximately 2 to 3 days each. The major activities associated with FLEETEXs are conducted in the outer Sea Range, primarily in Range Areas 4A, 4B, 5A, and 5B. The primary locations for the missile/target intercepts are Range Areas 5A and 5B. Safety areas for these tests encompass portions of the western and northern approach shipping lanes (refer to Figure 3.10-1). According to the HITS database, it is possible that about six vessels might be present in the clearance area surrounding the safety hazard pattern prior to NOTMAR issuance. Some recreational vessels and commercial fishing vessels could potentially be in areas north and northwest of San Nicolas Island in this portion of the Sea Range. These vessels have the option of moving to a different area in order to stay away from the clearance area. Temporary relocation or re-routing for safety purposes does not significantly affect these land uses, particularly over a relatively short (2 to 3 day) period. Operations are not conducted until vessels are clear of the area in accordance with the range clearance procedures previously discussed. Therefore, land use impacts of FLEETEXs are less than significant.

4.10.2.8 Littoral Warfare Training

A - Small-Scale Amphibious Warfare Training

Small-scale amphibious warfare training occurs only four times per year and is typically very localized at San Nicolas Island. Environmental constraints limit times and locations at San Nicolas Island that training can occur (refer to Table 3.0-7). Commercial shipping, recreational boating, commercial and recreational fishing, and ocean-oriented tourist activities are not common offshore from Point Mugu. These activities are more commonplace at San Nicolas Island. Small boats use various nearshore waters in order to access the coastal locations at San Nicolas Island and at Point Mugu. Areas needed for this boat activity are small in comparison to areas of San Nicolas Island that are cleared for safety purposes during current target launches. In addition, San Nicolas Island and NAS Point Mugu are Navy-owned installations whose land use is dedicated to military testing and training purposes. Therefore, land use impacts of small-scale amphibious warfare training are less than significant.

B - Special Warfare Training

Special warfare training occurs only twice per year and is typically very localized at San Nicolas Island. Environmental constraints limit the times and locations at San Nicolas Island that training can occur (refer to Table 3.0-7). The areas needed for this activity are small in comparison to areas of San Nicolas Island that are cleared for safety purposes during current target launches. In addition, San Nicolas Island is Navy-owned and its land is dedicated to military testing and training purposes. Therefore, land use impacts of special warfare training are less than significant.

4.10.3 Minimum Components Alternative

This alternative includes impacts identified for the No Action Alternative since the testing, training, and facility modernization activities included in this alternative are proposed in addition to current operations.

4.10.3.1 Theater Missile Defense Element - Nearshore Intercept

Proposed nearshore intercept activities involve eight test or training events per year at San Nicolas Island. To account for potential "scrubbed" or canceled operations, the entire area around the island (i.e., surface restricted areas Alpha, Bravo, and Charlie; refer to Figure 3.14-5) would be cleared of non-participating vessels up to 16 times per year. The safety hazard pattern would primarily be located be in Range Areas M3 and 4A, as well as small portions of 3A and M5 (refer to Figure 2-2d). Depending on the missile/target geometry, the debris pattern would occur either off the southeast coast or off the west end of San Nicolas Island. In either case, the clearance area surrounding the safety hazard pattern would have to be clear of all non-participating vessels. This would include all three surface restricted areas (Alpha, Bravo, and Charlie) surrounding the island. Commercial fishing boats, recreational fishing boats, and sport diving boats would be restricted from the clearance area during each event. Occasional restrictions currently occur for target launches at various times throughout the year. This does not substantially affect commercial fishing activities because fishermen are allowed to fish in other areas during each launch. Closing the entire island for nearshore intercept events could potentially affect commercial fishermen in the area, particularly if closures were to occur between October and March when fishing is heaviest. The number of commercial fishing boats at San Nicolas Island can vary from 30 to 50 boats during peak periods (Ventura County Commercial Fisherman's Association 1998). Of the eight proposed nearshore intercept events per year, only one or two (requiring up to four closures) would be likely to occur during peak fishing season, and this would require cessation of fishing activities for only eight hours per each closure day. It would be likely that lost revenue would be temporary and could be recaptured at another time (i.e., a "lost" day would not preclude fisherman from maximizing revenues over the course of the fishing season). In addition, NAWCWPNS personnel have implemented successful communication procedures with commercial fishermen at San Nicolas Island to minimize effects on commercial activities (Ventura County Commercial Fisherman's Association 1997). Long-term use of the island for fishing would not be impacted. These activities would not substantially change current land use activities and would result in no permanent land use changes. Therefore, land use impacts of nearshore intercept testing and training on commercial fishing activities at San Nicolas Island would be less than significant.

4.10.3.2 Training Element – Additional FLEETEX

The proposed increase of one FLEETEX per year would require additional aircraft sorties, missile and target launches, and ship events. Navy vessels associated with a FLEETEX could transit the inner Sea Range to reach the testing locations; Navy vessel transit, however, would not affect the activities of other marine vessels in the area.

Operations associated with the additional FLEETEX would occur from NAS Point Mugu and from San Nicolas Island. Since the duration of a FLEETEX is only 2 to 3 days, the addition of one exercise would increase activity levels by less than 4 percent of the days available on the Sea Range per year. Operations would not be conducted until vessels are clear of the area in accordance with the range clearance procedures previously discussed. For these reasons, land use impacts associated with the additional FLEETEX would be less than significant.

For the reasons described above, impacts of one additional FLEETEX in non-Territorial Waters would be less than significant.

4.10.3.3 Facility Modernization Element – Multiple-Purpose Instrumentation Sites

Construction of proposed multiple-purpose instrumentation sites would occur at interspersed locations on the mesa area of San Nicolas Island where similar facilities are currently located. The minimal amount of construction would not result in significant impacts to land use. The proposed facilities would support operations consistent with current activities on San Nicolas Island. Therefore, no land use impacts would occur.

4.10.4 Preferred Alternative

This alternative includes impacts identified for the No Action Alternative since the testing, training, and facility modernization activities included in this alternative are proposed in addition to current operations.

4.10.4.1 Theater Missile Defense Element

<u>A - Boost Phase Intercept</u>

As part of the boost phase intercept events, two or three target launches could occur at San Nicolas Island; commercial fishing boats, recreational fishing boats, and sport diving boats would be restricted from the west end of San Nicolas Island during the event. Such occasional restrictions for current activities, however, do not substantially affect commercial activities even during peak fishing periods (Ventura County Commercial Fisherman's Association 1998). With advance coordination, fishermen are usually allowed to fish in other areas during restricted periods. This would apply to recreational fishing boats and sport diving boats as well, although these types of boats are at the island less frequently than commercial fishing boats. Therefore, land use impacts of boost phase intercept testing and training on commercial fishing and recreational fishing and boating activities at San Nicolas Island would be less than significant.

Boost phase intercept events are proposed to occur three times per year; to account for "scrubbed" or canceled operations, safety clearance procedures could occur up to six times per year. The associated safety hazard pattern would encompass portions of both the inner and outer Sea Range. For a single test or training event, range areas within the hazard pattern would include 4A, 4B, 5A, 5B, 6A, and 6B (if the target missile is launched from San Nicolas Island) or Range Area 5B, 5C, 6B, 6C, 7B, and W-537 (if the target missile is launched from outside of the Sea Range). These range areas encompass the western and northern commercial shipping lane approaches, depending on from where the target missile is launched (refer to Figures 2-2a and 3.10-1). According to the HITS database, it is possible that about six vessels might be present in the clearance area prior to NOTMAR issuance under the San Nicolas Island launch scenario, and about four vessels might be present under the offsite launch scenario. Any ships and boats (commercial and non-commercial) would need to be outside the clearance area prior to conducting each boost phase intercept event. Certain fisheries (e.g., drift gill netting for pelagic shark and swordfish) occur in the open ocean environment. However, the majority of commercial fishing vessels and recreational boaters are typically in nearshore areas and would not likely be in the clearance area prior to a test or training event. Temporary relocation or re-routing for safety purposes would not significantly affect land uses. Operations would not be conducted until vessels are clear of the area in accordance with the range clearance procedures previously described. Therefore, land use impacts of boost phase intercept testing and training would be less than significant.

As noted above, the safety hazard pattern associated with boost phase intercept events would encompass non-Territorial Waters within the Sea Range. For the reasons described above, land use impacts would be less than significant.

B - Upper Tier

Potential effects of target launches are the same as those described above for boost phase intercept events (see Section 4.10.4.1-A). Therefore, land use impacts of upper tier testing and training on commercial fishing activities at San Nicolas Island would be less than significant.

Upper tier events are proposed to occur three times per year; to account for "scrubbed" or canceled operations, safety clearance procedures could occur up to six times per year. The safety hazard patterns encompass portions of the outer Sea Range. For a single test or training event, range areas within the clearance area surrounding the safety hazard pattern would include 5A, 5B, 5C, 6A, 6B, 6C, 7A, 7B, 7C, and W-537. W-537 is a Control Area Extension (CAE) (or transit corridor) for commercial aircraft. This corridor can be closed by the FAA at the request of the Navy in order to facilitate activities on the Sea Range (refer to Section 3.11.2.2-B). Since this is a regular procedure for current activities and since proposed upper tier events would be conducted only three times per year, land use impacts on aircraft traffic through W-537 would be less than significant. The clearance area would also encompass the western, northern, and Route 3 commercial shipping lane approaches (refer to Figures 2-2b and 3.10-1). According to the HITS database, it is possible that about six vessels might be present in the Sea Range portion of the clearance area prior to NOTMAR issuance. Information for ship densities off the Sea Range are not available; based on extrapolation from the HITS database, it can be assumed that minimal numbers of ships would be present in the off-range portions of the Sea Range, except possibly in the portion of Route 3 that parallels the southern Sea Range boundary. Any ships and boats (commercial and non-commercial) would need to be outside of the clearance area prior to conducting the event. Certain fisheries (e.g., drift gill netting for pelagic shark and swordfish) occur in the open ocean environment. However, the majority of commercial fishing vessels and recreational boaters are typically in nearshore areas and would not likely be in the clearance area prior to a test or training event. From a land use perspective, commercial shipping densities are low enough that no substantial effects would occur. Operations would not be conducted until vessels are clear of the area in accordance with the range clearance procedures previously described. Therefore, land use impacts of upper tier testing and training would be less than significant.

C - Lower Tier

As discussed for boost phase intercept events, land use impacts of lower tier testing and training launch activities on commercial fishing activities at San Nicolas Island would be less than significant.

Lower tier events are proposed to occur three times per year; to account for "scrubbed" or canceled operations, safety clearance procedures could occur up to six times per year. Potential land use effects associated with lower tier events would be the same as those identified for upper tier testing and training, with the exception of a smaller safety pattern hazard area (refer to Figures 2-2c and 3.10-1). Commercial vessel traffic in the clearance area surrounding the safety hazard pattern (Range Areas 7A and 7B) is extremely low. According to the HITS database, it is possible that about seven vessels might be present in the clearance area prior to NOTMAR issuance. Operations would not be conducted until vessels are clear of the area in accordance with the range clearance procedures previously described. Therefore, land use impacts of lower tier testing and training would be less than significant.

D - Nearshore Intercept

Potential land use impacts from proposed nearshore intercept events were described previously in Section 4.10.3.1. Land use impacts of proposed nearshore intercept testing and training would be less than significant.

E - Collective Impacts of Theater Missile Defense Element

Potential effects of the TMD element on commercial fishing boats, recreational fishing boats, and sport diving boats would be minimal. The exception would be the potential effects on individual commercial fishermen associated with nearshore intercept testing and training events. However, this does not represent a significant land use impact since it would not substantially change current land use. With the exception of nearshore intercept events, none of the other TMD programs would require closure of San Nicolas Island to commercial fishing. Therefore, collective land use impacts of the TMD Element on commercial fishing would be less than significant.

The TMD Element would add a maximum of 17 test and training events to the Sea Range per year, each of which would require clearance of various range areas for safety purposes. Sea Range operations can sometimes be "scrubbed" or canceled on the scheduled day for various operational reasons. In such cases, range clearance procedures have typically already been initiated. Therefore, it can be assumed that the TMD Element would involve clearance of various range areas up to 34 times per year. Collectively over a 1-year period, a total of about 114 vessels might be present in the clearance areas prior to NOTMAR issuance. Operations would not be conducted until vessels are clear of the area in accordance with the range clearance procedures previously described. Therefore, land use impacts of the TMD Element would be less than significant.

For the reasons described above, land use impacts of the TMD Element in non-Territorial Waters would be less than significant.

4.10.4.2 Training Element – Fleet Exercise and Special Warfare Training

A - Fleet Exercise Training

Potential land use impacts from one additional FLEETEX per year are identical to those described in Section 4.10.3.2. Land use impacts would be less than significant.

B - Special Warfare Training

In addition to the ongoing amphibious operations by the U.S. Marine Corps at their current level of activity, the proposed action would incorporate a twofold increase of Special Warfare Training by SEALs (increasing from two to four times per year). The areas of the range required to perform these training events are the currently used nearshore and beach areas of San Nicolas Island. These areas are all located within Territorial Waters. Small boats would use various nearshore waters in order to access the coastal locations at San Nicolas Island. The areas needed for this boat activity would be small in comparison to areas of San Nicolas Island that are currently cleared for safety purposes during target launches for other activities. Also, the areas proposed for special warfare training are currently used for military testing and training purposes, so there would be no change to current land use. Therefore, land use impacts of special warfare training on commercial and recreational boaters would be less than significant.

C - Collective Impacts of Training Element

The Training Element would consist of one additional FLEETEX and two additional special warfare training exercises. These activities are currently conducted on the Sea Range and would not represent a new land use. The additional activities would not significantly affect land use on the Sea Range, San Nicolas Island, or Point Mugu. Therefore, collective land use impacts of the Training Element would be less than significant.

For the reasons described above, impacts from the Training Element on land use in non-Territorial Waters would be less than significant.

4.10.4.3 Facility Modernization Element – Point Mugu and San Nicolas Island

A - Point Mugu Modernizations

The beach launch capability would consist of using either Pad B or Pad C for launching missiles. These existing pads are in an area currently designated for T&E land use (refer to Figure 3.10-5) and have been previously used for such activities. Clearance procedures would be identical to those currently used for launches from the Building 55 Launch Complex (refer to previous discussion in Section 4.10.2.1). Therefore, land use impacts would be less than significant.

B - San Nicolas Island Modernizations

Increased Launch Capabilities

A launch site would be added near the Alpha Launch Complex, an area currently used for many of the target launches at San Nicolas Island. In addition, a vertical launch system approximately 30 feet (9 m) tall would be placed at one of the pads on the west end of the island. This area is currently used for missile and target launches. Clearance procedures would be identical to those used for existing launches from San Nicolas Island (refer to previous discussion in Section 4.10.2.1). Therefore, land use impacts would be less than significant.

Support Facilities

Other support facilities include a new range support building (12,000 square feet [1,100 m^2] construction area) and multiple-purpose instrumentation sites (five at 15,000 square feet [1,400 m^2] each). The minimal amount of construction would not result in significant impacts to land use. Other support facilities would be placed in areas of the island currently used for similar activities. The proposed facilities would support operations consistent with current activities on San Nicolas Island. Therefore, no land use impacts would occur.

4.11 TRAFFIC

4.11.1 Approach to Analysis

The traffic analysis addresses ground, air, and Sea Range vessel traffic. The principal issue is the potential for proposed ground, air, or vessel traffic to affect existing transportation and circulation conditions. Impacts on traffic are assessed with respect to the potential for disruption of transportation patterns and systems, deterioration of existing level of service (LOS) ratings, and changes in existing levels of transportation safety. Impacts may arise from changes in traffic volumes created by additional Sea Range operations.

Factors typically used to assess the significance of impacts on roadway capacity levels include the extent or degree to which implementation of an alternative would increase volume-to-capacity (V/C) ratios and result in changes to current LOS ratings for roadways in the region of influence (ROI). The proposed action and alternatives do not include the addition of permanently based personnel to NAS Point Mugu or San Nicolas Island, and increase of vehicle traffic ashore would not occur.

Factors used to assess the significance of impacts on air traffic include consideration of an alternative's potential to result in: an increase in the number of flights such that they could not be accommodated within established operational procedures and flight patterns; a requirement for an airspace modification; or an increase in air traffic that results in increased collision potential between military and non-participating civilian operations. The proposed action and alternatives do not include airspace modifications and would not change the Navy's existing relationship with federal airways, uncharted visual fight routes, transition areas, and airport-related air traffic operations.

Factors used to assess the significance of impacts on ocean vessel traffic include the extent or degree to which an alternative would seriously disrupt the flow of commercial surface shipping or recreational fishing/boating. A serious disruption occurs when a vessel is unable to proceed to its intended destination due to exclusion from areas on the Sea Range. However, the need to use alternate routes during the time of exclusion does not constitute a serious disruption.

Analysis of potential impacts on traffic includes: 1) identification of baseline conditions for ground, air, and marine traffic in the ROI; 2) examination of the proposed action and its potential effect on the resource; 3) assessment of impacts from projected traffic volumes and circulation patterns on current traffic volumes, LOS ratings, safety concerns, and circulation patterns; and 4) provision of measures to mitigate any identified impacts. A summary matrix of traffic impacts is presented in Table 4.11-1.

4.11.2 No Action Alternative - Current Operations

None of the current test and training activities affects vehicular traffic ashore; current roadway LOS ratings would remain unchanged. Traffic issues associated with the No Action Alternative are limited to air and marine vessel traffic.

Both military and non-military (e.g., commercial and recreational) entities have been sharing use of the airspace comprising, and the ocean surface underlying, the Sea Range for more than 50 years. Both entities have established an operational coexistence consistent with federal, state, and local plans and policies and compatible with each interest's varying objectives. Range clearance procedures on the Sea Range are implemented prior to each operation to ensure that marine vessels and civilian aircraft are outside of the clearance area (refer to Section 3.0.2.1-F). The following subsections detail traffic activity coordination between Sea Range operations and non-participants using this area.

Table 4.11-1. Traffic Impact Summary Matrix

Alternative	Impact Conclusions NEPA (On Land→ Territorial Waters)	 EO 12114 (Non-Territorial Waters)	Mitigation Measures
NO ACTION ALTERNATIVE	No increase in vehicular traffic. Established flight procedures and no change to airspace use. Advance notice system and low levels of marine traffic in affected areas. Less than significant impact.	*Established flight procedures and no change to airspace use. Advance notice system and low levels of marine traffic in affected areas. Less than significant impact.*	None.
MINIMUM COMPONENTS ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	No increase in vehicular traffic. Aircraft sorties increase by less than 1 percent. Less than 4 percent increase in total vessel activity for TMD testing and training. Short duration (2-3 days) of additional training. Less than significant impact.	*Aircraft sorties increase by less than 1 percent. Less than 4 percent increase in total vessel activity for TMD testing and training. Short duration (2-3 days) of additional training. Less than significant impact.*	None.
PREFERRED ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Short-term construction traffic on San Nicolas Island. Less than 2 percent increase in aircraft activity for TMD testing and training. Short duration of additional training (7 days maximum). Established air and marine traffic procedures. Less than significant impact.	*Less than 2 percent increase in aircraft activity for TMD testing and training. Short duration of additional training (2-3 days). Established air and marine traffic procedures. Less than significant impact.*	None.

4.11.2.1 Air-to-Air Operations

Target and missile launches in support of air-to-air operations occur from NAS Point Mugu and from San Nicolas Island. Onshore and offshore areas within and just outside the launch azimuth boundaries (refer to Figures 3.14-3 and 3.14-5) are cleared for safety purposes during each target or missile launch. Onshore clearance involves military personnel, while offshore clearance can involve vessels or aircraft (both recreational and commercial). NAWCWPNS issues NOTAMs and NOTMARs 24 hours in advance of any Navy activities requiring exclusive use of an area. For these reasons, traffic impacts associated with missile and target launches are less than significant.

Air-to-air operations are typically conducted in the outer portion of the Sea Range (Range Areas 4A, 4B, 5A, 5B, 6A, 6B, and 6C). The safety hazard patterns and associated clearance areas typically occur on the outer part of the Sea Range in the same area as the western approach shipping lane (refer to Figure 3.11-1). According to the Historical Temporal Shipping (HITS) database (U.S. Navy 1993), it is possible that about three commercial shipping vessels might be present in the clearance area prior to NOTMAR issuance; recreational vessels, commercial fishing vessels, and tourist boats are not likely to be in this area. Testing activities are not conducted until vessels are clear of the area in accordance with the range clearance procedures previously described. It is important to note that the Sea Range has supported much higher levels of activity in the past with no significant impacts on air or marine vessel traffic. Given the advance notice system and the low level of traffic in affected areas, the impacts of air-to-air operations on traffic are less than significant.

4.11.2.2 Air-to-Surface Operations

Navy vessels transit the inner Sea Range to reach the testing locations; Navy vessel transit, however, does not affect the activities of other marine vessels in the area.

Inert mine shape drops are conducted northeast of Santa Rosa Island in Becher's Bay. The safety areas for these tests typically occur south of where the western approach and the northern approach shipping lanes converge (refer to Figure 3.11-1). This location has a much higher likelihood of having recreational, tourist, and commercial vessels present. However, aircraft that conduct the drop also survey the area prior to conducting the operation to ensure that no vessels are present. Boats are requested to clear the area voluntarily; an operation is not conducted until the area is completely clear. Recovery operations consist of one commercial vessel with divers retrieving concrete mine shapes following the drops. This activity occurs approximately four times per year and does not affect recreational or commercial boat traffic. Therefore, traffic impacts of inert mine shape drop operations are less than significant.

Air-to-surface operations are typically conducted in the outer portions of Range Areas 4A, 4B, and 5B. According to the HITS database, about three commercial shipping vessels might be transiting the clearance area surrounding the safety hazard pattern at any given time; recreational vessels and commercial fishing vessels could also be in this area. Testing activities are not conducted until vessels are clear of the area in accordance with the range clearance procedures previously described. Given the advance notice system, traffic impacts of air-to-surface operations are less than significant.

4.11.2.3 Surface-to-Air Operations

Navy vessels transit the inner Sea Range to reach the testing locations; Navy vessel transit, however, does not affect the activities of other marine vessels in the area.

Less than five surface-to-air missiles (non-Fleet training) were fired during the baseline year. These firings were either from ships afloat on the Sea Range in the vicinity of San Nicolas Island or from the island itself. Surface-to-air operations are typically conducted in the outer portion of the Sea Range (Range Areas 4A, 4B, 5A, 5B, 6A, 6B, and 6C), although some missile/target intercepts occur in Territorial Waters west of San Nicolas Island (Range Area 4A). A large safety hazard pattern is associated with both the missile (typically fired from a cruiser southwest of San Nicolas Island) and the target (fired from San Nicolas Island to the west). However, very few vessels use this area (an average of 0.01 vessels might be transiting the clearance area surrounding this safety hazard pattern at any given time according to the HITS database). Testing activities are not conducted until vessels are clear of the area in accordance with the range clearance procedures previously described. Given the advance notice system and the low level of traffic in affected areas, impacts of surface-to-air operations on traffic are less than significant.

As noted above, surface-to-air intercepts typically occur in non-Territorial Waters. For the reasons described above, impacts on traffic in non-Territorial Waters are less than significant.

4.11.2.4 Surface-to-Surface Operations

Navy vessels transit the inner Sea Range to reach the testing locations; Navy vessel transit, however, does not affect the activities of other marine vessels in the area.

Onshore missile launches require clearance of areas at and around Point Mugu and San Nicolas Island (see previous discussion in Section 4.11.2). Testing activities are not conducted until vessels are clear of the area in accordance with the range clearance procedures previously described. Given the advance notice system and the low level of traffic in affected areas, impacts of surface-to-surface operations on traffic are less than significant.

Surface-to-surface operations are typically conducted in the outer Sea Range (Range Areas W-60, 4A, 4B, 5A, and 5B). The safety areas for these tests typically occur south of the western approach shipping lanes (refer to Figure 3.11-1). According to the HITS database, it is possible that about six vessels might be present in the clearance area surrounding the safety hazard pattern prior to NOTMAR issuance; recreational vessels and commercial fishing vessels are not usually in this area (they are typically closer to San Nicolas Island in this portion of the Sea Range). Testing activities are not conducted until vessels are clear of the area in accordance with the range clearance procedures previously described. Given the advance notice system, traffic impacts of surface-to-surface operations are less than significant.

4.11.2.5 Subsurface-to-Surface Operations

Navy vessels transit the inner Sea Range to reach the testing locations; Navy vessel transit, however, does not affect the activities of other marine vessels in the area.

Subsurface-to-surface operations are typically conducted in the outer Sea Range (Range Areas 4A, 5A, 6A, and 7A). The safety areas for these tests typically occur south of the western approach shipping lanes (refer to Figure 3.11-1). According to the HITS database, about four vessels might be transiting the clearance area surrounding the safety hazard pattern at any given time. Recreational vessels and commercial fishing vessels could potentially be in this portion of the Sea Range. Testing activities are not conducted until vessels are clear of the area in accordance with the range clearance procedures previously described. Given the advance notice system and the fact that the tests typically occur only three times per year, impacts of subsurface-to-surface operations on traffic are less than significant.

4.11.2.6 Ancillary Operations Systems

Ancillary operations systems include radar systems, communications systems, chaff and flare use, and laser systems (used for measurement purposes). These systems are implemented at times and locations deemed appropriate for their use. These systems do not result in conflicts with non-military traffic on the Sea Range. Therefore, traffic impacts of ancillary operations systems are less than significant.

For the reasons described above, the use of ancillary operations systems in non-Territorial Waters has less than significant impacts on traffic.

4.11.2.7 Current Fleet Exercise Training

The FLEETEX is the most complex event which occurs on the Sea Range. The current level of activity for FLEETEXs spans a maximum of up to 6 days per year, each lasting 2 to 3 days. Except for the aircraft sorties and target launches from NAS Point Mugu or San Nicolas Island in direct support of a FLEETEX, virtually all FLEETEX activity occurs outside of Territorial Waters. Typical events occurring within Territorial Waters consist of takeoffs and landings of the range surveillance and target launch aircraft from NAS Point Mugu. Airborne targets launched from either NAS Point Mugu or San Nicolas Island cross over Territorial Waters and through U.S. airspace to the areas on the Sea Range designated for the FLEETEX. Surface craft which are either support boats or targets pass through Territorial Waters to the exercise areas.

Operations are not conducted until vessels are clear of the area in accordance with the range clearance procedures previously described. Given the advance notice system, the use of established range safety procedures that ensure non-participants remain outside the clearance areas (refer to Section 3.0.2.1-F), and the highly controlled nature of FLEETEX activities, traffic impacts associated with FLEETEX activities in Territorial Waters are less than significant.

The safety areas for FLEETEX activities encompass portions of the western and northern approach shipping lanes (refer to Figure 3.11-1). According to the HITS database, it is possible that about six vessels might be present in the clearance area surrounding the safety hazard pattern prior to NOTMAR issuance. A ship delay or re-routing typically occurs no more than one time per trip since the vessel moves through the area to proceed to its destination; it is highly unlikely that the same vessel is affected more than once during a given FLEETEX. Recreational vessels and commercial fishing vessels can potentially be in areas north and northwest San Nicolas Island in this portion of the Sea Range. These vessels have the option of moving to a different area in order to stay away from the clearance area. Operations are not conducted until vessels are clear of the area in accordance with the range clearance procedures previously described. Given the advance notice system and the fact that each FLEETEX is condensed over a 2 to 3 day period, impacts of FLEETEXs on air and ship traffic are less than significant.

4.11.2.8 Littoral Warfare Training

This current training activity typically involves U.S. Marine Corps and SEAL team landings and raids at San Nicolas Island. The training requires the use of small boats (for landing) and helicopters. The aircraft activity takes place within the restricted areas over San Nicolas Island where non-participating aircraft are precluded from entry; there are no impacts on non-participating air traffic on the Sea Range. No major shipping lanes are located in the vicinity of San Nicolas Island. Non-participating boats need to be clear of only a small area in the general vicinity of the current training locations at the island. Ship traffic is not affected. Therefore, traffic impacts are less than significant.

4.11.3 Minimum Components Alternative

This alternative includes impacts identified for the No Action Alternative since the testing, training, and facility modernization activities included in this alternative are proposed in addition to current operations.

4.11.3.1 Theater Missile Defense Element – Nearshore Intercept

Proposed nearshore intercept activities would occur a maximum of eight times per year at San Nicolas Island. To account for potential “scrubbed” or canceled operations, the entire area around the island (i.e., surface restricted areas Alpha, Bravo, and Charlie; refer to Figure 3.14-5) would be cleared of non-participating vessels up to 16 times per year. These test and training events would add 32 aircraft sorties, 50 ship/boat events, 8 missiles, and 8 targets to current Sea Range activity levels. The number of aircraft sorties, missile launches, and target use would represent an increase of less than 1 percent, 2 percent, and 3 percent, respectively, over baseline activity. The number of ships/boats involved in the events would represent an increase of about 6 percent over baseline activity. Ground traffic ashore would not be affected. The safety hazard pattern would primarily be in Range Areas M3 and 4A, as well as small portions of 3A and M5 (refer to Figure 2-2d). Depending on the missile/target geometry, the debris pattern would occur either off the southeast coast or off the west end of the island. In either case, the clearance area surrounding the safety hazard pattern would have to be clear of all non-participating vessels. Standard clearance procedures, including issuance of NOTAMs and NOTMARs prior to each event, would be implemented. Commercial fishing boats, recreational fishing boats, and sport diving boats would be requested to stay outside the clearance area during each event. Very little commercial ship traffic passes through the San Nicolas Island area. Therefore, commercial ship and boat traffic would not be affected. While commercial fishing and recreational boats would be cleared of the safety hazard pattern, the test and training events would occur only eight times per year and the clearance period would be less than 24 hours. Given the advance notice system, the fact that the events would occur only eight times per year, and the low level of commercial ship traffic in the affected area, the impacts of nearshore intercept testing and training on commercial shipping traffic, fishing, and boating would be less than significant.

4.11.3.2 Training Element – Additional FLEETEX

Operations associated with the additional FLEETEX would occur from NAS Point Mugu and from San Nicolas Island. Since the duration of a FLEETEX is only 2 to 3 days, the addition of one exercise would increase activity levels by less than 4 percent of the days available on the Sea Range per year. Aircraft and vessel traffic would also transit Territorial Water areas of the Sea Range. Operations would not be conducted until vessels are clear of the area in accordance with the range clearance procedures previously described. Given the advance notice system and the limited time of additional activities (2 to 3 days per year), the impact of one additional FLEETEX on traffic in Territorial Waters would be less than significant.

For the reasons described above, impacts of one additional FLEETEX on traffic in non-Territorial Waters would be less than significant.

4.11.3.3 Facility Modernization Element – Multiple-Purpose Instrumentation Sites

The facility modernization portion of the Minimum Components Alternative would entail the construction of five multiple-purpose instrumentation sites on San Nicolas Island. There would not be any impacts on air or marine vessel traffic on the Sea Range. Any impact on ground transportation on the island would be confined to the immediate areas of construction and would be temporary and not significant. Therefore, traffic impacts associated with San Nicolas Island modernizations would be less than significant.

4.11.4 Preferred Alternative

This alternative includes impacts identified for the No Action Alternative since the testing, training, and facility modernization activities included in this alternative are proposed in addition to current operations.

4.11.4.1 Theater Missile Defense Element

The proposed TMD events would not affect vehicular traffic ashore and current roadway LOS ratings would remain the same. Traffic issues associated with the TMD Element are limited to air and marine vessel traffic.

<u>A - Boost Phase Intercept</u>

Boost phase intercept events are proposed to occur three times per year; to account for “scrubbed” or canceled operations, safety clearance procedures could occur up to six times per year. These test and training events would add 30 aircraft sorties and 15 ship/boat events annually to current Sea Range activity levels. The number of aircraft sorties and ship/boat events would represent an increase of less than 1 percent and 2 percent, respectively, over baseline activity. The missile/target use would represent a 1 percent increase over baseline activity. Target launches in support of boost phase intercept events could occur from San Nicolas Island. Aircraft and vessel traffic would also transit Territorial Water areas of the Sea Range. Onshore and offshore areas within and just outside the launch azimuth boundaries would be cleared for safety purposes during each target launch. NAWCWPNS issues NOTAMs and NOTMARs 24 hours in advance of any Navy activities requiring exclusive use of an area. Given the advance notice system, the limited time of additional activity (three times per year), and the minor increase in aircraft sorties and vessel activity, traffic impacts associated with boost phase intercept events in Territorial Waters would be less than significant.

The safety hazard patterns associated with boost phase intercept events would encompass portions of both the inner and outer Sea Range. For a single event, range areas within the clearance area surrounding the safety hazard pattern would include 4A, 4B, 5A, 5B, 6A, and 6B (if the target missile is launched from San Nicolas Island) or 5B, 5C, 6B, 6C, 7B, and W-537 (if the target missile is launched from a location outside of the Sea Range). These range areas encompass the western and northern commercial shipping lane approaches, depending on where the target missile is launched. According to the HITS database, it is possible that about six vessels might be present in the clearance area prior to NOTMAR issuance under the San Nicolas Island launch scenario, and about four vessels might be present under the offsite launch scenario. Any ships and boats (commercial and non-commercial) would need to be outside of the area prior to conducting the event. Operations would not be conducted until vessels are cleared of the area in accordance with the range clearance procedures previously described. Given this low level of testing and training and the associated minor increase in aircraft and ship activity, there would be no significant impact on transportation systems. In addition, it is important to note that the Sea Range has operated at higher levels of activity in the past without significant traffic impacts. Given the advance notice system, the fact that the events would occur only three times per year, and the minor increase in aircraft sorties and vessel activity, traffic impacts of boost phase intercept testing and training in the Sea Range would be less than significant.

As noted above, the safety hazard pattern associated with boost phase intercept events would encompass non-Territorial Waters within the Sea Range. For the reasons described above, traffic impacts associated with boost phase intercept events in non-Territorial Waters would be less than significant.

B - Upper Tier

Potential effects of target launches from San Nicolas Island are the same as those described above for boost phase intercept events (see Section 4.14.4.1-A). Therefore, traffic impacts of upper tier testing and training in Territorial Waters would be less than significant.

Upper tier events are proposed to occur three times per year; to account for "scrubbed" or canceled operations, safety clearance procedures could occur up to six times per year. These test and training events would add 12 aircraft sorties and 23 ship/boat events annually to current Sea Range activity levels. There would also be up to two interceptor missiles and one target missile per event. The number of aircraft sorties, ship/boat events, and missile/target use would represent an increase of less than 1 percent, 3 percent, and 2 percent, respectively, over baseline activity. For a single event, range areas within the clearance area surrounding the safety hazard pattern would include 5A, 5B, 5C, 6A, 6B, 6C, 7A, 7B, 7C, and W-537. W-537 is a Control Area Extension (CAE) (or transit corridor) for commercial aircraft. This corridor can be closed by the FAA at the request of the Navy in order to facilitate activities on the Sea Range (refer to Section 3.11.2.2-B). Since this is a regular procedure for current activities and since proposed upper tier testing and training would be conducted only three times per year, traffic impacts on commercial aircraft transportation through W-537 would be less than significant.

The clearance area would also encompass the western, northern, and Route 3 commercial shipping lane approaches (refer to Figure 3.11-1). According to the HITS database, it is possible that about six vessels might be present in the Sea Range portion of the clearance area prior to NOTMAR issuance; information for ship densities off the Sea Range are not available; based on extrapolation from the HITS database, it can be assumed that minimal numbers of ships would be transiting the off-range portions of the Sea Range, except possibly in the portion of Route 3 that parallels the southern Sea Range boundary. Any ships and boats (commercial and non-commercial) would need to be outside of the clearance area prior to conducting the event. From a traffic perspective, commercial shipping densities are low enough that no substantial effects would occur. Operations would not be conducted until vessels are cleared of the area in accordance with the range clearance procedures previously described. Therefore, traffic impacts of upper tier testing and training would be less than significant.

C - Lower Tier

Potential effects of target launches from San Nicolas Island are the same as those described above for boost phase intercept events (see Section 4.14.4.1-A). Therefore, traffic impacts of lower tier testing and training in Territorial Waters would be less than significant.

Lower tier events are proposed to occur three times per year; to account for "scrubbed" or canceled operations, safety clearance procedures could occur up to six times per year. These events would add 15 aircraft sorties and 23 ship/boat events annually to current Sea Range activity levels. Aircraft and missile/target activities would represent a 1 percent increase over baseline activity, and the ship/boat events would represent a 3 percent increase over baseline activity. All lower tier testing and training would occur outside Territorial Waters. The clearance area surrounding the safety hazard pattern is similar to the San Nicolas Island launch scenario of boost phase intercept testing and training although somewhat larger, also encompassing portions of Range Areas 7A and 7B. According to the HITS database, it is possible that about seven vessels might be present in the clearance area prior to NOTMAR issuance. Operations would not be conducted until vessels are cleared of the area in accordance with the range clearance procedures previously described. Given the advance notice system, the fact that the *events would occur only three times per year, and the minor increases in aircraft sorties and marine vessel activity, traffic impacts of lower tier testing and training would be less than significant.*

D - Nearshore Intercept

Potential traffic impacts from proposed nearshore intercept events were described previously in Section 4.11.3.1; impacts would be less than significant.

E - Collective Impacts of Theater Missile Defense Element

Under the Preferred Alternative, the maximum number of large vessels participating in TMD activities per year would be 20, and the maximum number of small support vessels would be 91. These ship/boat events on the Sea Range are very small when compared to the total amount of existing commercial shipping traffic and other boating activity. The total Navy ship/boat activity comprises an estimated 9 percent of large vessel traffic in the Sea Range (refer to Appendix D). The TMD Element would add a maximum of 17 events per year, each of which would require clearance of various range areas for safety purposes. Sea Range operations can sometimes be "scrubbed" or canceled on the scheduled day for various operational reasons. In such cases, range clearance procedures have typically already been initiated. Therefore, it can be assumed that the TMD Element would involve clearance of various range areas up to 34 times per year. Collectively over a 1-year period, a total of about 114 vessels might be present in the clearance areas prior to NOTMAR issuance. Operations would not be conducted until vessels are cleared of the area in accordance with the range clearance procedures previously described. Therefore, traffic impacts of the TMD Element would be less than significant. Ground traffic systems ashore would not be affected by the TMD Element.

For the reasons described above, traffic impacts of the TMD Element in non-Territorial Waters would be less than significant.

4.11.4.2 Training Element – Fleet Exercise and Special Warfare Training

A - Fleet Exercise Training

The proposed increase of one FLEETEX per year was addressed previously in Section 4.11.3.2; traffic impacts would be less than significant.

B - Special Warfare Training

The proposed increase in special warfare training would occur exclusively at San Nicolas Island and would add two exercises per year involving SEAL team landings and raids at the island. There would be no impact on vehicular traffic ashore. No major shipping lanes are located in the vicinity of San Nicolas Island. Non-participating boats would need to be clear of only a small area in the general vicinity of the proposed training locations at the island. Ship and air traffic would not be affected. Therefore, impacts of special warfare training on traffic would be less than significant.

C - Collective Impacts of Training Element

The increase in activity level associated with the Training Element is small when compared to existing levels of activity. Procedures have been in place over the years to minimize potential disruptions to transportation systems in and around the Sea Range. The minor increases in activity could easily be accommodated within the established operating procedures. Therefore, collective impacts of the Training Element on traffic would be less than significant.

For the reasons described above, traffic impacts of the Training Element in non-Territorial Waters would be less than significant.

4.11.4.3 Facility Modernization Element – Point Mugu and San Nicolas Island

A - Point Mugu Modernizations

The use of two previously used launch pads on the base would not affect air or marine vessel traffic. Clearance procedures would be identical to those currently used for launches from the Building 55 Launch Complex. Any impact on ground transportation would be confined to the immediate areas and would consist of a truck driving to the launch site approximately six times per year. There would be no changes to existing LOS ratings for roadways within the ROI. Therefore, traffic impacts associated with NAS Point Mugu modernizations would be less than significant.

B - San Nicolas Island Modernizations

Proposed San Nicolas Island modernizations consist of construction of new launch and support facilities on the island. There would not be any impacts on air or marine vessel traffic on the Sea Range aside from short-term increases necessary for construction purposes. Any impact on ground transportation on the island would be confined to the immediate areas of construction and would be temporary and not significant. Therefore, traffic impacts associated with San Nicolas Island modernizations would be less than significant.

C - Collective Impacts of Facility Modernization Element

Aside from short-term increases of vehicular traffic necessary for construction purposes, there would not be any impacts on air or marine vessel traffic on the Sea Range. Therefore, collective traffic impacts associated with the Facility Modernization Element would be less than significant.

4.12 SOCIOECONOMICS

4.12.1 Approach to Analysis

This socioeconomic analysis addresses the potential for current and proposed activities to noticeably affect (either adversely or beneficially) socioeconomic activities that occur within the boundaries of the Point Mugu Sea Range, NAS Point Mugu, and San Nicolas Island. Potentially affected socioeconomic activities unique to this action include commercial shipping, commercial fishing, sport fishing and diving, and tourism. The region of influence (ROI) for socioeconomic impacts is limited to Ventura County, affected Channel Islands, and users of the open water areas in the Sea Range. Within Ventura County, special attention is given to communities near Point Mugu (e.g., Oxnard and Camarillo).

Primary socioeconomic issues of concern identified include those associated with continued viability of affected commercial fishing and shipping industries, Environmental Justice (e.g., impacts with regard to minority communities and poverty status); the availability and suitability of housing; and issues associated with public service provision. However, implementation of the proposed action would not result in significant land use changes in affected areas (refer to Section 4.10, Land Use); only the intensity and type of testing and training activities would change. Implementation of the proposed action would not involve a direct increase in personnel at NAS Point Mugu, although short-term, temporary personnel increases could occur at San Nicolas Island. This is consistent with staffing fluctuations that normally occur on this island. In addition to direct and indirect beneficial impacts on regional economic activity, such personnel changes can affect the quality and availability of community services and utilities.

Significance of socioeconomic impacts is assessed primarily in terms of direct effects on the local economy. The magnitude of potential impacts can vary greatly depending on the location of a proposed action; for example, implementation of an action that creates 20 full-time employment positions may be unnoticed in an urban area but may have significant impacts in a more rural region. Factors used to assess significance include the extent or degree to which implementation of an alternative would result in substantial shifts in population trends or adversely affect regional spending and earning patterns. A summary matrix of socioeconomic impacts is presented in Table 4.12-1.

4.12.2 No Action Alternative - Current Operations

Navy testing and training activities are currently conducted on the Sea Range. Commercial shipping, commercial fishing, sport fishing/diving, and tourist-related activities occur on and near the Sea Range, primarily in coastal areas near the Channel Islands and along the mainland coast. Temporary range clearance procedures for safety purposes do not adversely affect these economic activities (refer to Section 4.10, Land Use). Therefore, socioeconomic impacts of the No Action Alternative are less than significant.

In offshore areas, temporary range clearance procedures do not adversely affect commercial shipping traffic (refer to Section 4.11, Traffic). Therefore, socioeconomic impacts of the No Action Alternative in non-Territorial Waters are less than significant.

4.12.3 Minimum Components Alternative

This alternative includes impacts identified for the No Action Alternative since the testing, training, and facility modernization activities included in this alternative are proposed in addition to current operations.

Table 4.12-1. Socioeconomic Impact Summary Matrix

Alternative	Impact Conclusions **NEPA** (On Land→ Territorial Waters)	**EO 12114** (Non-Territorial Waters)	Mitigation Measures
No Action Alternative	Current range operations do not adversely affect commercial shipping and fishing, sport fishing, or tourist-related economic activities. Less than significant impact.	*Current range operations do not adversely affect commercial shipping and fishing, sport fishing, or tourist-related economic activities. Less than significant impact.*	None.
Minimum Components Alternative (This alternative includes impacts identified for the No Action Alternative.)	Short-term, adverse effects on individual commercial fishermen during peak periods (about $150,000 maximum total potential revenue loss on a peak day); since some lost revenue could be recaptured for the 2-4 closures/year during peak periods, regional earnings would not be significantly affected and impact would be less than significant. Minority or low income populations would not be disproportionately affected. Children would not be exposed to increased noise levels or disproportionately exposed to safety risks.	*Temporary range clearance procedures would not affect economic activities in offshore waters. Less than significant impact.*	None.
Preferred Alternative (This alternative includes impacts identified for the No Action Alternative.)	Short-term, adverse effects on individual commercial fishermen during peak periods (about $150,000 maximum total potential revenue loss on a peak day); since some lost revenue could be recaptured for the 2-4 closures/year during peak periods, regional earnings would not be significantly affected and impact would be less than significant. Minority or low income populations would not be disproportionately affected. Children would not be exposed to increased noise levels or disproportionately exposed to safety risks.	*Temporary range clearance procedures would not affect economic activities in offshore waters. Less than significant impact.*	None.

4.12.3.1 Theater Missile Defense Element – Nearshore Intercept

A - Commercial Shipping

Proposed nearshore intercept testing and training would not significantly affect commercial shipping traffic (refer to Section 4.11, Traffic), so this form of economic activity would not be disrupted. Impacts on commercial shipping would be less than significant.

B - Commercial Fishing

Proposed nearshore intercept activities would involve eight events per year at San Nicolas Island. To account for potential "scrubbed" or canceled operations, the entire area around the island (i.e., surface restricted areas Alpha, Bravo, and Charlie; refer to Figure 3.14-5) would be cleared of non-participating vessels up to 16 times per year. This would represent a potentially adverse socioeconomic impact on individual commercial fishermen if the closures were to occur during peak fishing periods. While peak fishing periods do not occur daily, they typically occur October through March around San Nicolas Island. About 35 boats are present at San Nicolas Island during the winter fishing season. This number fluctuates, however, and can reach 50 boats during peak periods, such as the opening of lobster season each fall (Ventura County Commercial Fisherman's Association 1998). During peak periods and good weather, a single boat at San Nicolas Island can earn $3,000 or more per day. If a nearshore intercept event were to be conducted during one of these peak days while a maximum number of boats were in the area (50), clearing the entire area surrounding the island for safety purposes could result in a revenue reduction of $150,000. This reduction would temporarily have an adverse socioeconomic effect on individual fishermen affected. Using the assumption that all lost revenue would be permanent and would only affect boats landing at Ventura (this assumption maximizes the potential for impact), the lost revenue would represent 2.6 percent of the total value of 1995 Ventura commercial fish landings; a more likely scenario—distributing the estimated maximum loss across the region—would comprise lost revenues of only 0.3 percent (refer to Table 3.12-1). Further, of the eight proposed nearshore intercept events per year, only one or two (requiring up to four closures) would be likely to occur during peak fishing season, requiring cessation of fishing activities for only 8 hours for each closure day. It would be likely that lost revenue would be temporary and could be recaptured at another time (i.e., a "lost" day would not preclude fisherman from maximizing revenues over the course of the fishing season). In addition, NAWCWPNS personnel have implemented successful communication procedures with commercial fishermen at San Nicolas Island to minimize effects on commercial activities (Ventura County Commercial Fisherman's Association 1997). Therefore, while there could be temporary, adverse impacts on individual commercial fishermen, impacts would be less than significant on the overall economy of Ventura County and to the regional commercial fishing industry.

C - Recreational Activities and Tourism

Clearance procedures for nearshore intercept events would not adversely affect economic activities such as boating, diving, and whale watching (refer to Section 4.10, Land Use). These activities do not regularly occur at San Nicolas Island, but they can increase notably at certain times of the year (such as the opening of lobster season each fall). For sportboats that do bring recreational fishermen and divers to the island, NOTMARs would be provided in advance, which would allow the boats to select an alternate destination without substantially affecting their activities. Impacts on recreational activities would be less than significant.

D - Environmental Justice

No permanent population centers exist within areas encompassed by the Sea Range. Military support facilities at San Nicolas Island are staffed by civilian and Navy personnel on temporary assignments who are not recorded as residents during census counts. Given that there are no low-income communities or minority communities on San Nicolas Island or in the Sea Range, no one would be disproportionately susceptible to adverse socioeconomic or environmental impacts.

As summarized in Section 3.12, the areas immediately surrounding NAS Point Mugu are currently characterized by an ethnically diverse population. Projections indicate that as population grows over the next 50 years, there will be a dramatic shift at both state and county levels; by 2040, Hispanics are anticipated to comprise about 49.7 percent of the state's population and 52.9 percent of the population in Ventura County. Comparatively few households in the county have incomes below the poverty line (refer to Section 3.12). Safety issues for low income populations would not be affected. Noise contours at the airfield would remain essentially the same as for current conditions. The relatively small additional aircraft activity associated with nearshore intercept testing and training would not noticeably affect these contours. For these reasons, nearshore intercept testing and training would not disproportionately affect minority or low income populations in the ROI.

E - Environmental Justice for Children

Three primary areas of concern with regard to Environmental Justice for Children are noise, airfield safety, and hazardous materials and wastes. Because no change in the size or shape of affected noise contours would occur upon implementation of the proposed action, no impact with regard to children's exposure to noise would occur. Also, implementation of the proposed action would not result in a change in the shape or location of safety zones associated with the airfield safety complex at NAS Point Mugu. Therefore, impacts with regard to airfield safety and mishap potential would not be significant and would not have the potential to disproportionately impact affected populations of children. Finally, the proposed action would not result in substantial changes in the storage, transport, use, or disposal of hazardous materials and wastes associated with Navy operations in the vicinity of established population centers. Consequently, areas populated or commonly used by children would not be newly or disproportionately exposed to increased health or safety risks with regard to hazardous materials.

4.12.3.2 Training Element – Additional FLEETEX

The proposed additional FLEETEX would occur during a 2 to 3 day period each year. NOTMARs would be issued in advance to notify mariners of upcoming activities. However, some recreational and commercial fishing vessels could potentially be in areas north and northwest of San Nicolas Island prior to target launches from the island. These vessels would be cleared prior to launch but would have the option of moving to a different part of the island. Therefore, socioeconomic impacts of the additional FLEETEX would be less than significant.

Several offshore areas on the Sea Range would be cleared to facilitate an additional FLEETEX. However, this would not substantially disrupt commercial shipping or aviation activities (refer to Section 4.10, Land Use, and Section 4.11, Traffic); socioeconomic impacts of an additional FLEETEX in non-Territorial Waters would be less than significant.

4.12.3.3 Facility Modernization Element – Multiple-Purpose Instrumentation Sites

Construction of the proposed multiple-purpose instrumentation sites at San Nicolas Island would have the potential to generate temporary employment opportunities and expenditures for materials in the ROI. However, these jobs and purchases would not be long-term in nature and would not contribute noticeably to regional economic activity. Therefore, socioeconomic impacts would be less than significant.

4.12.4 Preferred Alternative

This alternative includes impacts identified for the No Action Alternative since the testing, training, and facility modernization activities included in this alternative are proposed in addition to current operations.

4.12.4.1 Theater Missile Defense Element

A - Commercial Shipping

The Santa Barbara Channel is the most heavily used cargo traffic lane in southern California waters, serving both domestic and transpacific operations. Shipping is dominated by cargo transports, oil tankers, and barges. Oil tankers using the channel voluntarily travel 50 miles offshore to reduce the potential for conflict with nearshore water craft, sport fishing activities, and subsurface obstructions (CCC 1993). The socioeconomic effects associated with boost phase intercept, upper tier, lower tier, and nearshore intercept events would be minimal. None of these components would significantly affect commercial shipping traffic (refer to Section 4.11, Traffic), so this form of economic activity would not be disrupted. Impacts on commercial shipping would be less than significant.

B - Commercial Fishing

The most notable effect on commercial fishing is associated with nearshore intercept activities (see Section 4.12.3.1). Other proposed programs would involve missile and target launches from San Nicolas Island (about six times per year). However, some recreational and commercial fishing vessels could potentially be in areas north and northwest of San Nicolas Island prior to target launches from the island. These vessels would be cleared prior to launch but would have the option of moving to a different part of the island. NAWCWPNS personnel have implemented successful communication procedures with commercial fishermen at San Nicolas Island to minimize effects on commercial activities (Ventura County Commercial Fisherman's Association 1997). Therefore, socioeconomic impacts of the TMD Element on commercial fishing would be less than significant.

C - Recreational Activities and Tourism

TMD activities would require clearance of several range areas in order to safely complete the proposed testing and training events. These clearance procedures would not adversely affect recreational activities such as boating, diving, and whale watching (refer to Section 4.10, Land Use). These activities do not regularly occur at San Nicolas Island. For sportboats that do bring recreational fishermen and divers to the island, NOTMARs would be provided in advance, which would allow the boats to select an alternate destination without substantially affecting their activities. Impacts on recreational activities and tourism would be less than significant.

D - Housing and Employment

Socioeconomic impacts on housing and employment in the ROI would be less than significant. No permanent or long-term changes in personnel levels would be associated with the TMD Element, and its implementation would not impact regional population characteristics or trends. Based on existing vacancy rates and ongoing expansion of the regional housing market, sufficient excess capacity exists to accommodate potential future personnel changes at NAS Point Mugu. However, no personnel changes would occur with the proposed action; therefore, its implementation would not impact the regional housing supply. Implementation of the TMD Element would not require additional personnel at NAS Point Mugu and would not contribute noticeably to regional economic activity. Thus, neither job composition nor regional per capita earnings characteristics or trends in the ROI would be affected.

Since the TMD Element represents activities added to current levels of operations, additional revenue would be generated for and by NAWCWPNS and NAS Point Mugu. These revenue increases would have minor but beneficial socioeconomic impacts in the ROI.

E - Public Services and Utilities

The TMD Element would not result in increases in regional population and, therefore, would not increase the demand for educational facilities. Therefore, school services would not be adversely affected upon implementation of the proposed action. Similarly, no effect on the availability or quality of police and fire protection would occur. The potable water distribution system supplies the entirety of NAS Point Mugu, including the tenant ANG facilities and Laguna Peak. The existing system has a capacity of 5.8 million gallons per day (gpd) (22.0 million liters per day [Lpd]). Average demand is about 1.6 million gpd (6.1 million Lpd) (Southwest Division 1998). Therefore, potable water supply is not a constraining issue with regard to maintenance and operations activities at NAS Point Mugu. Further, since no changes in regional population would occur upon implementation of the proposed action, no increases or decreases in demand for potable water would result. The capacity of the onbase wastewater system as currently configured is 4 million gpd (15 million Lpd). Normal, steady-state load is about 480,000 gpd (1.8 million Lpd), which is about 12 percent of total capacity (Southwest Division 1998). Therefore, issues associated with wastewater treatment and disposal do not comprise constraints to operations at NAS Point Mugu and would not be adversely impacted by implementation of the TMD Element. Solid waste generation from NAS Point Mugu would remain the same since no changes in regional population would occur upon implementation of the proposed action. Further, the Toland Road Landfill can operate for another 30 years at the present waste generation rate (Ventura County 1994). Therefore, issues associated with solid waste generation and disposal do not comprise constraints to operations at NAS Point Mugu and would not be adversely impacted by implementation of the TMD Element. The Edison Company has indicated that it would be capable of providing NAS Point Mugu with an additional 4.5 million kW with no infrastructure-related cost being passed on to the Navy. Consequently, current systems and the potential for future expansion can accommodate reasonably foreseeable demand for electricity at NAS Point Mugu. Therefore, the quantity and availability of natural gas is not a constraining issue at NAS Point Mugu. No impacts on public services or utilities would occur.

F - Environmental Justice and Environmental Justice for Children

Potential impacts regarding Environmental Justice for the TMD Element are similar to those presented earlier for the nearshore intercept component (see Section 4.12.3.1-D and 4.12.3.1-E). Therefore, the TMD Element would not disproportionately affect minority or low income populations in the ROI. The proposed TMD Element would neither result in new nor disproportionate exposure of children to environmental hazards or safety risks.

4.12.4.2 Training Element – Fleet Exercise and Special Warfare Training

Socioeconomic effects of the additional FLEETEX would be similar to the discussion presented earlier for the Minimum Components Alternative (see Section 4.12.3.2). The addition of two additional special warfare training events per year would not require clearance on the Sea Range, and only certain parts of San Nicolas Island would need to be cleared of recreational and commercial fishing vessels. These vessels would be cleared prior to the training activities but would have the option of moving to a different part of the island. Therefore, socioeconomic impacts of the Training Element would also be less than significant.

As discussed in Section 4.12.3.2, an additional FLEETEX would not substantially disrupt commercial shipping or aviation activities. Therefore, impacts on socioeconomic activities in non-Territorial Waters would be less than significant.

4.12.4.3 Facility Modernization Element – Point Mugu and San Nicolas Island

Implementation of the proposed action would have the potential to generate temporary employment opportunities in the ROI. However, these jobs—associated with minor construction projects on San Nicolas Island—would not be long-term in nature and would not contribute noticeably to regional economic activity. In addition, infrastructure at NAS Point Mugu and San Nicolas Island is adequate for the facility modernization proposals. Therefore, socioeconomic impacts of the Facility Modernization Element would be less than significant.

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4.13 HAZARDOUS MATERIALS, HAZARDOUS WASTES, AND NON-HAZARDOUS WASTES

4.13.1 Approach to Analysis

Terminology used in this section has specific definitions important to its use. "Hazardous materials" refers to chemical substances prior to their use. "Used munitions" are those ordnance items that have been expended through firing or detonation. "Hazardous constituents" are the chemical contaminants associated with munitions debris. Since hazardous constituents comprise only a portion of materials entering the Sea Range, this section also addresses the amounts and types of non-hazardous materials used on the Sea Range.

Hazardous constituents are an inherent part of the RDT&E process for high technology missile and target systems which include military munitions (ordnance). Hazardous constituents are used to increase the strength of materials, lighten weight, reduce the incidence of failure, lower life-cycle costs, and prolong life. Hazardous features of these constituents are understood, and safe handling and pollution prevention measures are a routine part of systems programs to minimize and manage their effects throughout the acquisition process. Issues addressed in this EIS/OEIS are the types, amount, and distribution of hazardous constituents that impact the Sea Range, NAS Point Mugu, and San Nicolas Island.

The components that contain hazardous constituents include propellants, batteries, flares, telemetry, igniters, jet fuel, diesel fuel, hydraulic fluid, and explosive warheads. NAS Point Mugu accumulates and manages hazardous wastes (e.g., paints, adhesives, solvents, aerosols, batteries, and cleaning compounds) for maintenance activities. Each of these constituents has the potential to affect human health and the environment through direct contact with individuals, groundwater, surface water, soil, and air.

Military munitions are not considered hazardous wastes under two very important conditions stated in the USEPA Military Munitions Rule (MMR) and the DoD Interim Policy on Military Munitions (1997).[1] Specifically, munitions are not a waste:

a. When they are used for their intended purpose, including training of military personnel and explosive emergency response specialists; research and development activities; and when they are recovered, collected, and destroyed during range clearance events.

b. When they are unused and being repaired, reused, recycled, reclaimed, disassembled, reconfigured, or subjected to other material recovery activities.

These two conditions cover virtually all of the use of guided missiles, ballistic missiles, rockets, and missile targets at Point Mugu. This section of the EIS/OEIS reviews the use of munitions and targets on the Sea Range and includes the results of analysis of their hazardous constituents disposition. Potential impacts on environmental resources are addressed in other sections of this chapter as appropriate.

[1] On February 12, 1997, the USEPA promulgated a rule covering the applicability of hazardous waste rules to military munitions. This rule became effective on August 12, 1997. The rule is found in 40 CFR 266 Subpart M, Hazardous Wastes, and their treatment, storage, and disposal are governed by the Resource Conservation and Recovery Act (RCRA). The Department of Defense Explosive Safety Board (DDESB) has issued interim policy guidance to assist the services in compliance with the USEPA rule on munitions which will comply with RCRA requirements. The specific purpose of the DoD Interim Policy is to interpret the requirements of the USEPA MMR into procedures which will be followed by all DoD components to ensure compliance with the law.

Military munitions, under the conditions described above, are not considered "hazardous wastes" and are exempt from the requirements of RCRA. Aerial targets (drones) that are not rockets or missiles are technically not munitions, but they are also "used for their intended purpose" just like munitions on the Sea Range. Similar to "used munitions," used targets do not fall within the USEPA or Cal/EPA definition of "solid waste."

Hazardous constituents originate in five classes of systems used for test and evaluation and training: missiles, aerial targets, surface targets, ships and boats, and other ordnance. In addition to these categories, there are quantities of non-hazardous constituents, consisting mostly of steel, concrete, and other routine constituents used in inert general purpose bombs and gunfire rounds.

To address potential impacts, the approach to analysis includes characterizing the yearly test and training operations that may contribute hazardous constituents to the Sea Range environment. These include 342 missile flights, 192 targets expenditure, 1,004 ship and boat operations, 441 events with other ordnance, and over 17,000 items of non-hazardous constituents in inert bombs and mine shapes. Since these amounts reflect the maximum number of participants potentially involved in Sea Range operations, the estimates calculated for this EIS/OEIS tend to overestimate hazardous constituent volumes. The weight of hazardous constituents in each missile, target, support boat, and item of ordnance was then identified. These were characterized by type and weight of material to the level of 1 gram. Results were aggregated to the level of 10 grams and displayed by kilogram. The fate and transport of two categories of missiles were calculated: those that were launched with live (explosive) warheads and those launched with inert warheads. (Missiles that were carried aloft on aircraft but were not launched are not counted because they did not contribute hazardous constituents to the Sea Range.) For missiles with live warheads, three additional cases of fate and transport were examined: 1) warheads that exploded when initiated by hitting or passing close to the target; 2) warheads that did not explode in the air near the target, but fuzed on impact with the water (delayed explosion); and 3) warheads that entered the water intact (duds).

The analysis for the Sea Range produced the total weight of hazardous constituents that entered the water by missile, by type of constituent, for current operations. The total amount of hazardous constituents for the proposed action was then distributed across the Sea Range according to the dispersion of missile and target impacts. The density of these constituents per square kilometer was calculated for each range area. The total volume of ordnance and target constituents was also analyzed for the proposed action and alternatives. Finally, an estimate was made of the historic volume of used munitions expended in the Sea Range.

Non-hazardous constituents (e.g., aluminum, titanium, etc.) are also addressed in this section. Non-hazardous constituents are described in terms of the volume of material used in Sea Range testing and training activities.

The approach to analysis for NAS Point Mugu and San Nicolas Island assessed hazardous materials management, use, storage, and disposal practices. These materials included ordnance, pesticides, asbestos, polychlorinated biphenyls (PCBs), lead, and radon. Hazardous waste analysis included a review of types and levels of waste streams and recycling efforts. In each case, the effects of the Minimum Components Alternative and the Preferred Alternative activities were analyzed in comparison to current activities. Potential impacts on installation restoration sites and underground storage tanks (USTs) were also analyzed.

The significance of potential impacts associated with hazardous constituents, hazardous materials, and hazardous wastes is based on the toxicity, distribution, transportation, storage, and disposal of these substances. Factors used to assess significance include the extent or degree to which implementation of an alternative would substantially increase the human health risk or environmental exposure resulting from the storage, use, transportation, deposition, and disposal of hazardous materials and wastes. For NAS Point Mugu, an analysis was made of the ability of the Hazardous Waste Management Program to accommodate the amount of increase.

Current use of the existing instrumentation and support facilities on San Miguel, Santa Rosa, and Santa Cruz islands involves periodic maintenance activities. Various hazardous materials (e.g., fuel) are used to support facility maintenance on these islands. Only the minimum amount of hazardous material is obtained for a task in order to prevent disposing excess material as hazardous waste. Hazardous materials used on these islands are ordered through the NAS Point Mugu Environmental Materials Management Division (EMMD) and shipped to the islands via boat, barge, or aircraft. The small amount of hazardous materials used on the islands does not have a significant impact on hazardous materials management or hazardous waste management because the existing hazardous waste program already includes the maintenance activities associated with these support facilities. Further, none of the alternatives addressed in this EIS/OEIS include new activities at these islands. Implementation of the Minimum Components or Preferred alternatives would not increase the amount of hazardous materials used on these islands. Therefore, there would be no impact on hazardous materials or hazardous waste management.

A summary matrix of hazardous constituents generated by the proposed action and alternatives, shown in total weight per year, is presented in Table 4.13-1. Specific hazardous materials impacts on air quality are addressed in Section 4.2. Impacts on water quality are addressed in Section 4.4. Impacts on fish and marine mammals are covered in Sections 4.6 and 4.7, respectively.

4.13.2 No Action Alternative - Current Operations

4.13.2.1 Air-to-Air Operations

Air-to-air operations include testing and training with missiles that are fired against other aircraft. Targets used include various small unmanned aerial vehicles and drone versions of fighter aircraft that are flown from the ground, without an airborne pilot. Helicopters and boats are used to retrieve the targets which are cleaned and recycled for additional flights.

Table 4.13-2 displays the amount of hazardous constituents used in air-to-air operations as well as all other current activities. Only about 3 percent of air-to-air hazardous constituents fall within Territorial Waters.

Approximately 97 percent of air-to-air hazardous constituents fall within non-Territorial Waters. The weight of over 7,700 pounds (3,500 kg) for air-to-air operations represents about 60 percent of the current operations total. These hazardous constituents include jet fuel (6,585 pounds [2,987 kg]) which accounts for 84 percent of the total hazardous constituents (7,803 pounds [3,543 kg]) that went into the Sea Range from baseline air-to-air operations. The majority of this weight was in the jet fuel in three drone QF-4 targets that were impacted by missiles.

4.13.2.2 Air-to-Surface Operations

In air-to-surface operations, missiles themselves impact the surface of the ocean, either through the floating surface target or direct entry. The majority of targets are either floating or towed on the surface of the water. A small number of land attack missiles (e.g., SLAM) with inert warheads impact a designated target area on the western tip of San Nicolas Island. Table 4.13-2 displays the amount of

Table 4.13-1. Hazardous Constituents Summary Matrix (kg/year)

Alternative	Impact Conclusions[1] NEPA (On Land→ Territorial Waters)	EO 12114 (Non-Territorial Waters)	Total
NO ACTION ALTERNATIVE			
Air-to-Air	89.55	*3,453.87*	3,543.42
Air-to-Surface	51.44	*48.48*	99.92
Surface-to-Air	114.89	*885.85*	1,000.74
Surface-to-Surface	1.33	*102.84*	104.17
Subsurface-to-Surface	0.33	*2.51*	2.84
Ancillary Operations Systems	None	*51.12*	51.12
Current FLEETEX Training	156.21	*935.90*	1,092.11
Special Warfare Training	23.89	*10.24*	34.13
Subtotal No Action Alternative	437.64	*5,490.81*	5,928.45
MINIMUM COMPONENTS ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)			
Nearshore Intercept	716.70	*0.58*	717.28
FLEETEX	147.48	*316.84*	464.32
Multiple-Purpose Instrumentation Sites	Temporary	*None*	None
Subtotal Minimum Components Alternative	864.18	*317.42*	1,181.60
PREFERRED ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)			
Theater Missile Defense Element	746.77	*201.23*	948.00
Training Element - FLEETEX	147.48	*316.84*	464.32
Training Element - Special Warfare	23.89	*10.24*	34.13
Facility Modernization Element	Temporary	*None*	None
Subtotal Preferred Alternative	918.14	*528.31*	1,446.45
TOTAL OF PREFERRED ALTERNATIVE AND NO ACTION ALTERNATIVE (CURRENT OPERATIONS)	1,355.78	*6,019.12*	7,374.90

[1] Impact conclusions are provided in other resource sections as appropriate.

Table 4.13-2. Hazardous Constituents Associated with Baseline Operations (kg/year)

Scenario	Missiles	Aerial Targets Lost	Surface Targets	Ships and Boats	Other Ordnance	Totals
Air-to-Air	119.72	3,410.70	None	13.00	None	3,543.42
Air-to-Surface	94.41	None	2.91	2.60	None	99.92
Surface-to-Air	468.94	524.21	None	7.59	None	1,000.74
Surface-to-Surface	102.50	None	0.62	1.04	None	104.16
Subsurface-to-Surface	2.42	None	None	0.42	None	2.84
Ancillary Operations	None	None	None	None	51.12	51.12
FLEETEXs (2)	473.46	607.53	4.16	6.97	None	1,092.12
Littoral Warfare	None	None	None	34.13	None	34.13
Totals	**1,261.46**	**4,542.44**	**7.69**	**65.75**	**51.12**	**5,928.45**

hazardous constituents used in air-to-surface operations. The subtotal of nearly 220 pounds (100 kg) represents 2 percent of baseline operations. There is non-hazardous metal and concrete in air-to-surface inert general purpose bombs and mine shapes. This amount totaled nearly 70,500 pounds (32,000 kg) in the baseline year.

Approximately 112 pounds (51 kg) of hazardous constituents associated with current air-to-surface operations fall within Territorial Waters.

Approximately 106 pounds (48 kg) of hazardous constituents associated with current air-to-surface operations fall within non-Territorial Waters.

4.13.2.3 Surface-to-Air Operations

Surface ships use surface-to-air missiles to defend themselves and the Fleet. The total of over 2,200 pounds (1,000 kg) of hazardous constituents represents 17 percent of the current operations amount. The hazardous constituents in this type of operation are primarily missile propellant, batteries, and jet fuel in targets. There were no explosives used in these operations in the baseline year.

Approximately 254 pounds (115 kg) of hazardous constituents associated with current surface-to-air operations fall within Territorial Waters.

Approximately 1,953 pounds (886 kg) of hazardous constituents associated with current surface-to-air operations fall within non-Territorial Waters.

4.13.2.4 Surface-to-Surface Operations

There were 229 pounds (104 kg) of hazardous constituents expended in baseline surface-to-surface operations. This number represents 2 percent of the baseline operations total. Hazardous constituents include a small amount of missile propellant and a larger amount of jet fuel since air-breathing missiles are typically used in these operations.

Approximately 2 pounds (1 kg) of hazardous constituents associated with current surface-to-surface operations fall within Territorial Waters.

Approximately 227 pounds (103 kg) of hazardous constituents associated with current surface-to-surface operations fall within non-Territorial Waters.

4.13.2.5 Subsurface-to-Surface Operations

During baseline operations, there was one subsurface launch which produced 7 pounds (3 kg) of hazardous constituents in missile propellant from its solid rocket booster and jet fuel from its air-breathing engine. This represents 0.05 percent of the current operations total.

Approximately 1 pound (less than 1 kg) of hazardous constituents associated with current subsurface-to-surface operations fall within Territorial Waters.

Approximately 7 pounds (3 kg) of hazardous constituents associated with current subsurface-to-surface operations fall within non-Territorial Waters.

4.13.2.6 Ancillary Operations Systems

Ancillary operations systems include items that are expended from aircraft, aerial targets, and surface targets to support test and training operations. They are primarily defensive countermeasures to defeat or confuse hostile missiles. The systems include defensive flares fired from aircraft, ship-launched flares for countermeasures or illumination, and ship-fired chaff. They do not include flares that are an inherent part of a missile or aerial target system.

Sea Range baseline operations included more than 110 pounds (50 kg) of hazardous constituents in ancillary operations systems. All these substances were employed outside Territorial Waters.

4.13.2.7 Current Fleet Exercise Training

FLEETEXs are the most complex of Sea Range operations. In the baseline year, there were two FLEETEXs which launched 68 missiles, 49 airborne targets, and 40 surface targets. In addition, 79 other ships and target retrieval and range support boats participated. The total of 2,147 pounds (974 kg) of hazardous constituents represents 17 percent of current operations. Hazardous constituents included missile propellant (37 percent), jet fuel (37 percent), batteries (21 percent), explosive warhead materials (4 percent), engine oil (1 percent), and missile igniters, wiring, explosive bolts, etc. (collectively less than 1 percent). In addition, there were 8,198 rounds of cannon and surface gun rounds expended and 341 inert bombs and mine shapes dropped. These materials are non-hazardous, but they accounted for 209,089 pounds (94,842 kg) of metal and concrete.

Approximately 344 pounds (156 kg) of hazardous constituents associated with current FLEETEX operations (two exercises per year) fall within Territorial Waters.

Approximately 2,064 pounds (936 kg) of hazardous constituents associated with current FLEETEX operations (two exercises per year) fall within non-Territorial Waters.

4.13.2.8 Littoral Warfare Training

The Navy currently conducts littoral warfare training exercises that include the use of small boats by U.S. Marine Corps and SEAL units. Emissions from these craft include small amounts of hydrocarbons from engine oil and diesel fuel in their transit from off-range to San Nicolas Island. The total amount is 75 pounds (34 kg) of engine oil and diesel fuel per year.

4.13.2.9 Hazardous Waste Management

Hazardous wastes from San Nicolas Island are transported over the Sea Range to Port Hueneme by barge. The Clean Water Act, RCRA, the Ocean Dumping Act, the International Convention for the Prevention of Pollution from Ships, and OPNAVINST 5090.1B, Environmental and Natural Resources Manual, prohibit the use of the Sea Range as a hazardous waste disposal site, and this restriction is strictly enforced.

4.13.2.10 Shipboard Hazardous Waste Management

The Navy requires that, to the maximum extent practicable, ships shall retain hazardous waste aboard ship for shore disposal. If hazardous materials are discharged overboard, this must occur more than 200 NM (370 km) from land. Since all portions of the Sea Range are within 200 NM (370 km) of the California coast, shipboard discharge of hazardous materials is prohibited within the range.

4.13.2.11 Collective Impacts of Current Operations - No Action Alternative

There were more than 13,000 pounds (5,900 kg) of hazardous constituents deposited in the Sea Range during baseline operations.

Nearly 880 pounds (400 kg), or 7 percent, were deposited within Territorial Waters.

Approximately 12,125 pounds (5,500 kg), or 93 percent, were deposited outside Territorial Waters.

4.13.3 Minimum Components Alternative

This alternative includes impacts identified for the No Action Alternative since the testing, training, and facility modernization activities included in this alternative are proposed in addition to current operations.

4.13.3.1 Theater Missile Defense Element – Nearshore Intercept

Nearshore intercept activities consist of surface-to-air missile firings against a low-altitude (less than 1,000 feet [300 m]) aerial target. The missiles would carry inert warheads, and the purpose of the events would be to evaluate launch, guidance, and command and control systems. Hazardous constituents analysis assumed the use of typical missiles and targets in eight events per year. Table 4.13-3 presents the results of the analysis. The large amount of missile constituents results from the high percentage of missile propellant that could still be present when a missile impacts a target. Because the aerial targets are designed to be recovered and reused, it was assumed that only four of eight targets would be lost per year, due to either missile action or parachute failure.

Table 4.13-3. Hazardous Constituents in the Minimum Components Alternative (kg/year)

	Missiles	Aerial Targets Lost	Surface Targets	Ships and Boats	Other Ordnance	Totals
Nearshore Intercepts	653.62	57.84	None	5.82	None	717.28
FLEETEX (1)	173.03	270.87	0.42	3.43	16.57	464.32
Totals	**826.65**	**328.71**	**0.42**	**9.25**	**16.57**	**1,181.60**
Percent of Baseline Operations	66%	7%	5%	14%	32%	20%

Source: Calculations based on U.S. Navy 60 Series Publications (60G-2-2-11-1) and Targets Compendium (BMDO 1997).

4.13.3.2 Training Element – Additional FLEETEX

FLEETEXs are major “event-driven” exercises; that is, they incorporate a series of separate scenarios (air-to-air missile firings, air-to-surface events, surface-to-air firings, surface-to-surface operations, etc.). Whereas most T&E scenarios on the Sea Range use inert warheads, FLEETEXs routinely fire live missiles to enhance realism, check the reliability of full systems, and provide the highest quality training for crews. The Navy proposes to add one FLEETEX per year as part of the Minimum Components Alternative.

Hazardous constituents used in Navy missiles fired in FLEETEXs include: solid propellants; liquid propellants; jet and rocket engine fuels; potassium hydroxide; and small amounts of pyrotechnics, lithium, mercury thallium, black powder, oxidized magnesium, beryllium oxide, and boron potassium nitrate. The propellants and fuels are usually present in large volumes, but they are expended in air upon normal functioning of a missile. Even if a missile does not contain a live warhead, its guidance and propulsion system will function and burn most expendable items. There is a variety of chemicals that reside in missile components of guidance-seeker heads, batteries, gas generators, igniter cartridges, and explosive bolts. Some of these items are also expended (e.g., gas generators), but many remain intact as a missile enters the water.

Aerial targets contain hazardous constituents in the form of jet and rocket engine fuels, thermal and nickel cadmium batteries, flares, solid propellants, coolant bottles, parachute containers, line cutters, self-destruct charges, fuze boosters, safe and arm devices, and hot gas igniters. Each of these missile and target constituents is carefully evaluated and the minimum amount selected in the acquisition process because they provide the best combination of high performance, lightweight, low cost, and safety.

The Minimum Components Alternative addition of one FLEETEX per year would involve the use of 34 missiles, 29 aerial targets, 4 surface targets, 18 other ships and boats, and 85 units of other ordnance. Table 4.13-3 presents the results of analysis of the hazardous constituents involved in the additional FLEETEX. The amount of hazardous constituents associated with one additional FLEETEX is not exactly 50 percent of the two conducted in the baseline year because the small numbers of live and inert warheads necessitated a slightly different distribution. There was also some variation in the number of surface targets. Rather than being just a 50 percent increase, the additional FLEETEX figures were specifically calculated based on the hazardous constituents anticipated to be expended.

Hazardous constituents used in one additional FLEETEX would collectively weigh less than 1,100 pounds (500 kg). FLEETEXs take place over virtually all of the Sea Range, so the distribution of this amount would be widespread. In addition, there would be an increase in the amount of non-hazardous constituents (mostly metal and concrete, used for ballast) in inert bombs and mine shapes. The number of inert bombs and mines shapes for one additional FLEETEX is estimated to be 4,314 with a non-hazardous weight of about 97,000 pounds (44,000 kg). These inert bombs and mine shapes contain no hazardous constituents.

Approximately 324 pounds (147 kg) of hazardous constituents associated with an additional FLEETEX would fall within Territorial Waters per year.

Approximately 699 pounds (317 kg) of hazardous constituents associated with an additional FLEETEX would fall within non-Territorial Waters per year.

Ancillary operations systems (defensive flares fired from aircraft, ship-launched flares for countermeasures or illumination, and ship-fired chaff) associated with the additional FLEETEX would increase by about 37 pounds (17 kg).

4.13.3.3 Facility Modernization Element – Multiple-Purpose Instrumentation Sites

The Minimum Components Alternative includes the proposal to construct five multiple-purpose instrumentation sites on San Nicolas Island. Each site would consist of a concrete pad to position mobile instrumentation during testing and training events. Although construction activities could result in short-term impacts on hazardous materials use, their use would be controlled and would remain in compliance with federal, state, and local requirements and with Navy policy. No new procedures would be required to store or use any construction-related hazardous materials which would be removed at the end of the construction period.

There would be no hazardous materials directly associated with the instrumentation sites; any hazardous materials occurring at these locations would be limited to the mobile instrumentation used temporarily at the facilities. During normal operations, equipment that could be used at the proposed sites includes portable communication vans, portable optics stations, and portable tracking systems. This type of instrumentation does not typically require the use of hazardous materials. Further, all of the equipment would be at the site only during the operations they would support. In the unlikely event that some of the mobile instrumentation required the use of hazardous materials, their use and disposal would be controlled and would remain in compliance with applicable regulations and with base policy. The construction and use of five new multiple-purpose instrumentation sites would not cause a significant impact on hazardous materials management at San Nicolas Island.

4.13.3.4 Collective Impacts of the Minimum Components Alternative

The testing and training operations of the Minimum Components Alternative would add about 2,640 pounds (1,200 kg) of hazardous constituents to the Sea Range per year. This is slightly over 20 percent of the current annual amount.

Approximately 1,905 pounds (864 kg) of hazardous constituents associated with the collective impacts of the Minimum Components Alternative would fall within Territorial Waters per year.

Approximately 699 pounds (317 kg) of hazardous constituents associated with the collective impacts of the Minimum Components Alternative would fall within non-Territorial Waters per year.

4.13.4 Preferred Alternative

This alternative includes impacts identified for the No Action Alternative since the testing, training, and facility modernization activities included in this alternative are proposed in addition to current operations.

4.13.4.1 Theater Missile Defense Element

The total amount of hazardous constituents that would be deposited in the Sea Range during proposed TMD events is 2,090 pounds (948 kg). As a comparison, this is about 16 percent of baseline operations. The majority (80 percent) of TMD hazardous constituents would be missile propellant with some batteries and jet fuel that may remain in aerial targets hit during the nearshore intercepts. However, the amount of constituents in the overall TMD events would be widely dispersed and would be unlikely to cause a significant impact on human health or the environment. (Potential impacts from hazardous constituents on specific resources are addressed within each resource section, as appropriate.)

Approximately 1,647 pounds (747 kg) of hazardous constituents associated with the TMD Element would fall within Territorial Waters per year.

Approximately 443 pounds (201 kg) of hazardous constituents associated with the TMD Element would fall within non-Territorial Waters per year.

<u>A - Boost Phase Intercept</u>

The boost phase interceptor would consist of an aircraft with a laser. For analysis purposes, the boost phase intercept target was assumed to be a missile with 2,130 pounds (966 kg) of liquid propellant, a solid gas generator, and batteries. See Table 4.13-4 for the results of the analysis of the weight of hazardous constituents that would enter the Sea Range if these three events were performed.

B - Upper Tier

Upper tier missiles are long-range missiles whose impact would occur outside the atmosphere. For analysis purposes, the type and amount of hazardous constituents were calculated to include a two-stage rocket with igniter cartridges and batteries. The target was calculated to be the same type of missile as used in the boost phase intercept event. Table 4.13-4 presents the weight of hazardous constituents that would be deposited in the Sea Range for three upper tier test and training events and associated targets.

Table 4.13-4. Hazardous Constituents (in kg) Associated with the Preferred Alternative

Preferred Alternative Component	Primary Range Areas	Missiles	Aerial Targets Lost	Surface Targets	Ships and Boats	Other Ordnance	Totals
Theater Missile Defense							
Boost Phase Intercept (3)	4A, 4B, 5A, 5B	None	67.69	None	3.12	None	70.81
Upper Tier (3)	5A, 5B, 6A, 6B, W-537	84.42	5.08	None	3.12	None	92.62
Lower Tier (3)	6B, 6C, 6D, 7B, 7C, 7D, W-537	39.02	25.15	None	3.12	None	67.29
Nearshore Intercept (8)	M3, M5, 4A	653.62	57.84	None	5.82	None	717.28
TMD Subtotal		**777.05**	**155.76**	**None**	**15.18**	**None**	**948.00**
FLEETEX (1)		173.03	270.87	0.42	3.43	16.57	464.32
Special Warfare (2)		None	None	None	34.13	None	34.13
Total		**950.08**	**426.63**	**0.42**	**52.75**	**16.57**	**1,446.45**
Percent of Baseline Operations		**75%**	**9%**	**5%**	**80%**	**32%**	**24%**

Source: Calculations based on U.S. Navy 60 Series Publications (60G-2-2-11-1) and Targets Compendium (BMDO 1997).

C - Lower Tier

Lower tier missiles are shorter range than upper tier missiles, and their intercept would be conducted after a target reenters the atmosphere. For analysis purposes, the type and amount of hazardous constituents were calculated from a three-stage rocket with igniter cartridges and batteries. The target was calculated to be the same type of missile as used in boost phase intercept testing and training. Table 4.13-4 presents the weight of hazardous constituents that would be deposited in the Sea Range for three lower tier test and training events and associated targets.

D - Nearshore Intercept

These events would be low-altitude (less than 1,000 feet [300 m]) missile engagements against an aerial target. The missiles would carry inert warheads, and the purpose of the event would be to evaluate the launch, guidance, and command and control systems. Table 4.13-4 presents the results of the analysis of hazardous constituents. The reason for the large amount of missile constituents is the high percentage of missile propellant that could be present when the missile impacts the target. Because this impact occurs at very low altitude, it is possible that much of this material could fall into the ocean. Because the aerial targets are designed to be recovered and reused, it was assumed that only four of eight targets would be lost per year, due either to missile action or parachute failure.

4.13.4.2 Training Element - Fleet Exercise and Special Warfare Training

A - Fleet Exercise Training

The Preferred Alternative would add one FLEETEX per year to the baseline of no action activities. The amount of hazardous constituents deposited in the Sea Range from one additional FLEETEX is shown in Table 4.13-4 above, and was described previously in Section 4.13.3.2.

B - Increased Littoral Warfare - Naval Special Warfare Training

The Navy proposes to increase the number of special warfare exercises from two to four per year. These would consist of surface transit in special boats and shore landings with less than 30 personnel per exercise. Hazardous constituents could consist of small amounts of incidental diesel fuel and engine oil from boats used for the special warfare exercises (see Table 4.13-4).

4.13.4.3 Facility Modernization Element - Point Mugu and San Nicolas Island

Potential impacts from proposed facility modernization components are discussed under "B - NAS Point Mugu" and "C - San Nicolas Island" in the following section.

4.13.4.4 Collective Impacts of the Preferred Alternative

There are two types of effects that could occur with the Preferred Alternative. The first is the potential chemical changes that may occur in Sea Range waters as the result of an increased quantity of hazardous constituents. The second is the possible change in the physical condition of the ocean and sea floor with the addition of a quantity of hazardous and non-hazardous constituents.

The total mass of hazardous constituents that could be deposited in the Sea Range under the Preferred Alternative represents an increase of about 3,300 pounds (1,500 kg). This amount, when compared to the baseline, is less than a 25 percent increase. However, the majority of the increase (2,024 pounds [918 kg] or 63 percent; see Table 4.13-1) would be within Territorial Waters. About one-half of the increase (1,581 pounds [717 kg]; see Table 4.13-4) would be due to nearshore intercepts, with another 1,023 pounds (464 kg) being contributed by the additional FLEETEX.

Approximately 37 percent, or an estimated 1,164 pounds (528 kg) of hazardous constituents associated with collective impacts of the Preferred Alternative would fall within non-Territorial Waters per year.

A - Point Mugu Sea Range

The following discussion describes collective impacts of the Preferred Alternative on the entire Sea Range, including both Territorial and non-Territorial Waters.

The component types and total amounts of hazardous constituents that could enter the Sea Range annually as a result of the Preferred Alternative operations is shown in Table 4.13-5. Telemetry devices, igniters, and primers constitute a very small amount (about 0.02 percent) of the total. Although many of these have minor explosive charges, there is a low probability they would fail to function when released

Table 4.13-5. Hazardous Constituents by Component (kg/year)

	Missile Propellant	Batteries	Telemetry Igniters	Jet Fuel	Diesel Fuel	Engine Oil	Hydraulic Fluid	Flares	Chaff	Explosives	Totals	Non-HAZ-MAT Metal
No Action Alternative												
Air-to-Air Scenario	85.50	292.82	14.61	2,986.62	1.25	110.75	48.00	3.87	0.00	0.00	3,543.42	209
Air-to-Surface Scenario	11.61	1.41	0.19	81.20	0.53	4.98	0.00	0.00	0.00	0.00	99.92	31,952
Surface-to-Air Scenario	484.57	272.58	0.15	235.56	0.73	6.86	0.00	0.29	0.00	0.00	1,000.74	None
Surface-to-Surface Scenario	13.86	0.06	0.03	88.56	0.16	1.50	0.00	0.00	0.00	0.00	104.17	269
Subsurface-to-Surface Scenario	1.38	0.00	0.00	1.05	0.04	0.38	0.00	0.00	0.00	0.00	2.84	None
Ancillary Operations	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.52	45.60	0.00	51.12	None
FLEETEX (2)	402.93	257.11	0.54	381.52	1.07	10.06	0.00	2.75	0.00	36.13	1,092.11	95,046
Littoral Warfare (2)	0.00	0.00	0.00	0.00	24.53	9.60	0.00	0.00	0.00	0.00	34.13	None
Subtotal No Action	**999.85**	**823.98**	**15.52**	**3,774.51**	**28.31**	**144.13**	**48.00**	**12.43**	**45.60**	**36.13**	**5,928.45**	**127,476**
Preferred Alternative												
Theater Missile Defense*	780.84	112.93	0.00	39.04	1.46	13.72	0.00	0.00	0.00	0.00	948.00	None
FLEETEX (1)	152.57	122.14	0.19	158.12	0.37	3.48	0.00	5.18	14.00	8.25	464.32	43,962
Special Warfare (2)	0.00	0.00	0.00	0.00	24.53	9.60	0.00	0.00	0.00	0.00	34.13	None
Subtotal Preferred Alternative	**933.41**	**235.07**	**0.19**	**197.16**	**26.36**	**26.80**	**0.00**	**5.18**	**14.00**	**8.25**	**1,446.45**	**43,962**
TOTALS	**1,933.26**	**1,059.05**	**15.71**	**3,971.67**	**54.67**	**170.93**	**48.00**	**17.61**	**59.60**	**44.38**	**7,374.90**	**171,438**
Percent of Total	**26.21%**	**14.36%**	**0.21%**	**53.86%**	**0.74%**	**2.32%**	**0.65%**	**0.24%**	**0.81%**	**0.60%**	**100%**	

*Based on Table 2-1, the appropriate hazardous constituent proportions attributable to Theater Missile Defense interceptor and target vehicles are: Boost Phase Intercept=16.2%, Upper Tier=24.4%, Lower Tier=16.2%, and Nearshore Intercept=43.2%.

Sources: Calculations based on U.S. Navy 60 Series Publications (60G-2-2-11-1), Targets Compendium (BMDO 1997), and NAVSPECWAR 1997.

high in the air. A failed ignition device could fall into the ocean. Records of the DDESB show no known accidents involving a member of the public being injured by an unexploded charge that had been immersed in saltwater (Naval Air Warfare Center Aircraft Division [NAWCAD] 1997).

The distribution of constituents is spread across virtually the entire Sea Range. The hazardous constituents in the Preferred Alternative and the No Action Alternative were analyzed and their distribution estimated based on historical and planned missile impact areas. The results are shown in Figure 4.13-1. There are several points to note. First, there is no historical or projected distribution of hazardous constituents in the three areas of the Sea Range adjacent to Vandenberg AFB (8A, M1, and M2). Second, there are no hazardous constituents estimated for most of the shoreline areas around the northern Channel Islands (W-289N, W-412, 3F, or 3E). Third, six of the range areas would receive less than 44 pounds (20 kg) per year (W1, W2, 5D, 6D, 7D, and M5). Another five range areas would receive 44 to 218 pounds (20 to 99 kg) per year. Most of the hazardous constituents expended in the Sea Range (69 percent) would be concentrated in the six range areas in the middle of the range (4A/B, 5A/B and 6A/B) and away from the shoreline. Two areas (4A and 5B) are projected to receive more than 2,200 pounds (1,000 kg) per year under the Preferred Alternative.

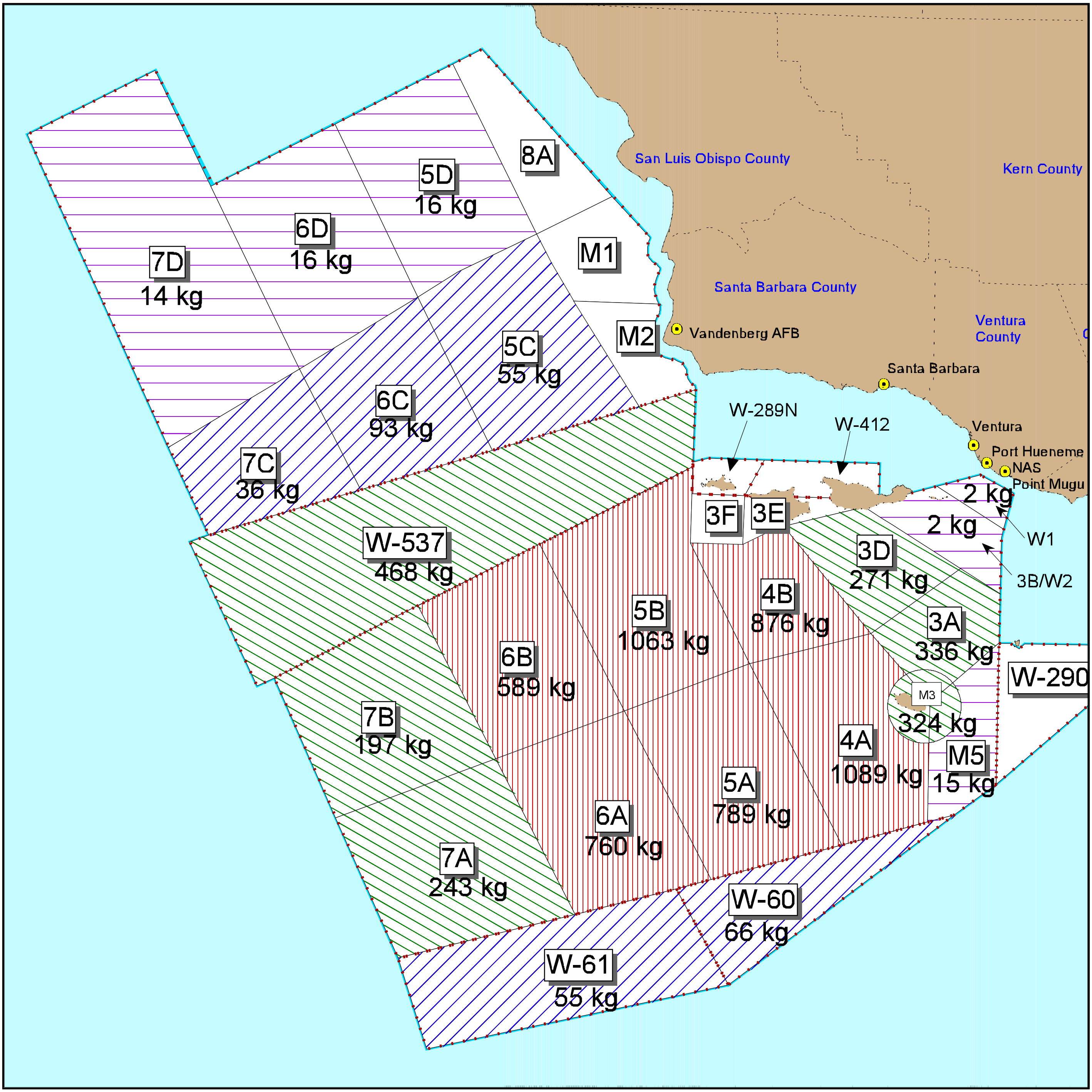
For comparison purposes, the distribution of hazardous constituents in the No Action Alternative was also analyzed, and the results are shown in Figure 4.13-2. Analysis of the comparison shows a smaller amount of hazardous constituents for the No Action Alternative (Current Operations) in almost every range area.

Even though the amount of hazardous constituents in the Preferred Alternative is over 15,400 pounds (7,000 kg), the density in each range area is low (Table 4.13-6). For example, the average density over the entire Sea Range under the No Action Alternative is 0.53 pounds per NM^2 (0.07 kg per km^2), although with the Preferred Alternative it would be 0.66 pounds per NM^2 (0.086 kg per km^2). The median density for those range areas that receive any hazardous constituents under the Preferred Alternative would be only 0.30 pounds per NM^2 (0.04 kg per km^2). Nine range areas would receive 0.08 pounds per km^2 (0.01 kg per km^2) or less per year. Two areas (4A and 4B) would receive relatively high densities (ranging from 2.13 to 2.90 pounds per NM^2 [0.28 to 0.38 kg per km^2]), and one (M3) would receive the greatest (3.43 pounds per NM^2 [0.45 kg per km^2]).

The significance of hazardous constituents and wastes can be determined by examining context and intensity with regard to the Sea Range. The context is best analyzed by reviewing the GIS layouts in Figures 4.13-1 and 4.13-2. The distribution of hazardous constituents is widespread, with small amounts in the areas nearest the coastline and larger amounts in the center of the Sea Range, beyond Territorial Waters. Only near San Nicolas Island is the context of hazardous constituents likely to be a concern. The intensity of the constituents is best shown in the density table (see Table 4.13-6) and in comparison with the No Action Alternative. The table reveals that densities in the Preferred Alternative would range from 0.02 to 3.43 pounds per NM^2 (0.002 to 0.450 kg/km^2) with an overall density of 0.69 pounds/NM^2 (0.09 kg/km^2). Potential impacts on water quality from the deposition of hazardous constituents and wastes are addressed in Section 4.4.

The total volume of hazardous and non-hazardous constituents that would be deposited in the Sea Range is also a consideration. There are no precise records of the volume of materials used in Sea Range test and training activities. However, it is possible to estimate the volume from an analysis of the individual hazardous and non-hazardous constituents in range summaries. As discussed earlier, non-hazardous constituents consist of structural and functional missile components, general purpose training bomb shapes without explosives, and mine shapes. The overall volume of these constituents is shown in Table 4.13-7. The total volume for the No Action Alternative is 5,580 cubic feet (158 m^3) per year. The

Hazardous Constituents Expended in the Point Mugu Sea Range: Preferred Alternative

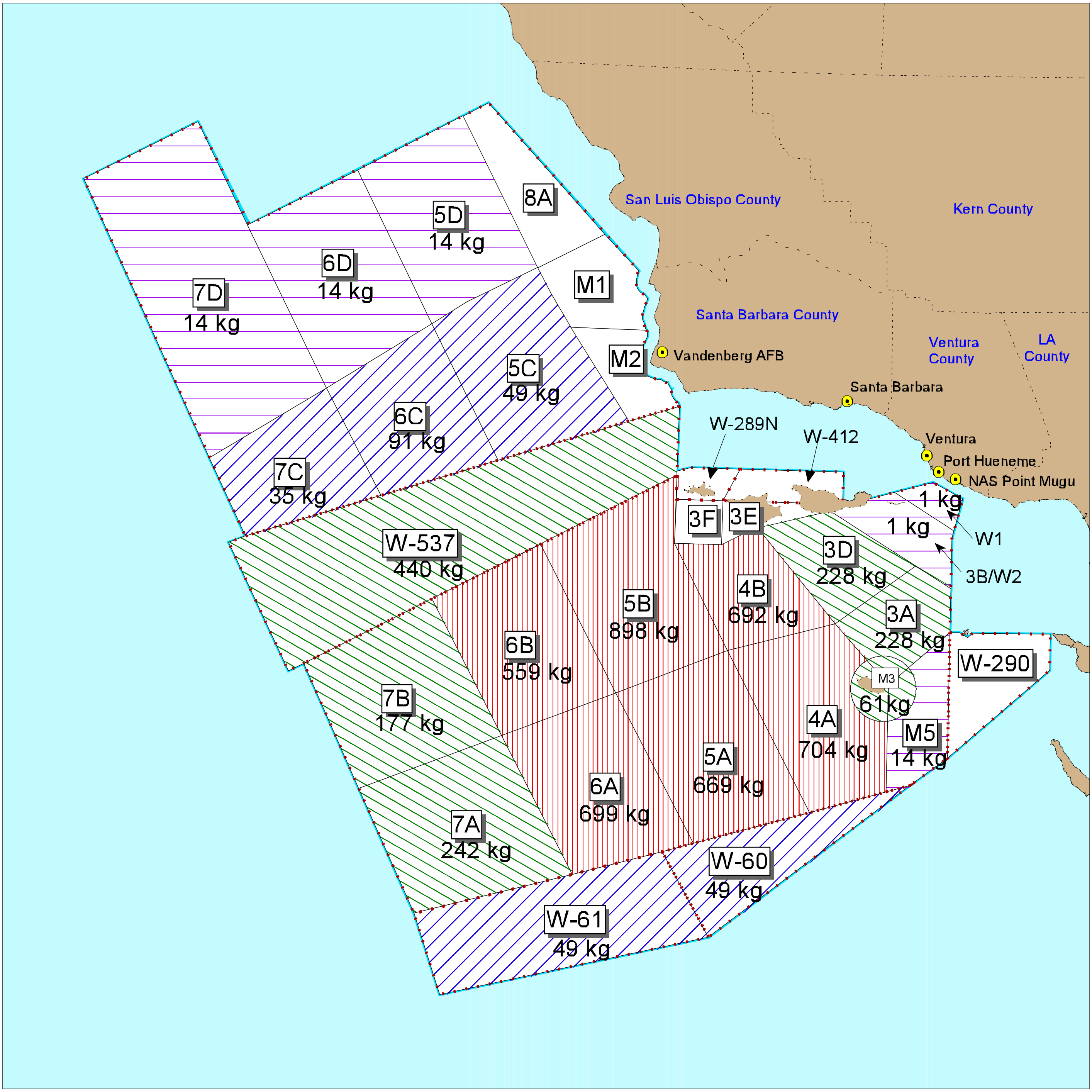


Hazardous Materials Expended
- 0 kg/yr
- 1 - 20 kg/yr
- 20 - 100 kg/yr
- 100 - 500 kg/yr
- 500 - 1100 kg/yr
- Sea Range

Projection: Universal Transverse Mercator
North American Datum 1927
Zone 11
Source: SRS Technologies 1998.

Figure 4.13-1

Hazardous Constituents Expended in the Point Mugu Sea Range: No Action Alternative



Hazardous Materials Expended
- 0 kg/yr
- 1 - 20 kg/yr
- 20 - 100 kg/yr
- 100 - 500 kg/yr
- 500 - 1100 kg/yr

Projection: Universal Transverse Mercator
North American Datum 1927
Zone 11
Source: SRS Technologies 1998.

Figure 4.13-2

5/20/98

Table 4.13-6. Density Distribution of Hazardous Constituents in the Preferred Alternative

Range Area	Hazardous Constituents per Year (kg)	Area (km^2)	Density (kg/km^2)
W1	2	339	0.007
3B/W2	2	1,156	0.002
3A	336	1,512	0.222
3D	271	1,182	0.230
4A	1,089	3,857	0.282
4B	876	2,289	0.383
5A	789	4,429	0.178
5B	1,063	4,648	0.229
5C	55	4,473	0.012
5D	16	4,291	0.004
6A	760	4,235	0.180
6B	589	4,166	0.141
6C	93	3,549	0.026
6D	16	4,634	0.003
7A	243	4,858	0.050
7B	197	4,572	0.043
7C	36	3,045	0.012
7D	14	8,453	0.002
M5	15	1,327	0.011
W-60	66	2,587	0.026
W-61	55	5,060	0.011
W-537/C1176	468	10,866	0.043
M3	324	720	0.450
Totals	**7,375**	**86,249[1]**	**0.086**

[1] The total area (86,249 km^2) does not include the Oceanic Control Boundary west of the Sea Range which is reflected in the total area of airspace encompassed by the Sea Range boundaries (i.e., 93,200 km^2).

Source: SRS Technologies 1998.

Table 4.13-7. Total Volume of Materials Entering the Sea Range (m^3/year)

	Volume
No Action Alternative	
Air-to-Air Scenario	61.00
Air-to-Surface Scenario	16.00
Surface-to-Air Scenario	20.00
Surface-to-Surface Scenario	3.00
Subsurface-to-Surface Scenario	1.00
Ancillary Operations Systems	0.30
FLEETEXs (2)	57.00
Littoral Warfare Training	0.04
No Action Alternative Subtotal	158.34
Preferred Alternative	
Theater Missile Defense	22.00
FLEETEX (1)	26.30
Special Warfare Training (2)	0.04
Preferred Alternative Subtotal	48.34
Total Preferred and No Action Alternatives	**206.68**

Source: SRS Technologies 1998.

Preferred Alternative would add 1,730 cubic feet (48 m^3) to the baseline for a total of 7,310 cubic feet (207 m^3) per year. About one-third of this volume is caused by non-hazardous constituents. There were nearly 10,000 rounds of cannon shells and surface ship gunfire used in training on the Sea Range during baseline operations. In addition, the Fleet dropped over 500 inert practice and general purpose bombs and nearly 50 practice mine shapes. About 40 percent of the mine shapes were recovered. The inert items are made from iron, steel, and concrete to give the shape and handling quality of real weapons, but they contain no explosives and no hazardous constituents or materials. Most of the remainder of the volume consists of non-hazardous constituents (e.g., aluminum, titanium, etc.) in the missiles and targets.

In an attempt to describe the overall volume of material entering the Sea Range in the past decade, an estimate was made based on the number of missiles fired over the 11-year FY85-FY95 period. Missiles were selected as the most appropriate measure of merit because the amount of material deposited in the range, including targets, tends to be proportional to the number of missiles fired. NAWCWPNS Point Mugu is fundamentally a missile range, and other activities are performed in addition to that basic mission. Using the baseline year when 5,620 cubic feet (158 m^3) of materials were calculated to have been deposited in the Sea Range, estimates were made to extrapolate the volume of materials used over the 11-year period. The results are shown in Table 4.13-8. The average appears to be only slightly higher than the baseline year.

Table 4.13-8. Historical Debris Expended in the Point Mugu Sea Range, FY85-FY95 (m^3/year)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	Avg.
Missiles	250	397	371	399	360	232	320	292	334	331	301	326
Ratio of Missiles to Baseline	0.83	1.32	1.23	1.33	1.20	0.77	1.06	0.97	1.11	1.10	1.00	1.08
Debris Volume (m^3)	132	210	196	211	190	123	169	154	177	175	159	173

Source: SRS Technologies 1998.

Estimates for the years before 1985 are speculative. In the early years after the range was formed as the Naval Air Missiles Test Center in 1946, almost all the instrumentation was onshore, and launches were made from Point Mugu. In the 1950s, San Nicolas Island was instrumented with radar, telemetry, surveillance, and communications equipment, and more of the tests were performed at sea, away from the mainland. Although the capabilities of the Sea Range have increased with the introduction of more modern technology, its purpose, mission, and use in the Navy have remained relatively constant. What is not known are the exact numbers of missiles, targets, and other items that historically may have been deposited in the Sea Range.

However, an estimate of the range of debris deposition values is possible based on a historical perspective of the times from 1946 through 1985. These years of operations by the Navy on the Sea Range covered the post-World War II military drawdown, the Korean conflict, and the Vietnam War. It is reasonable to assume that there were both peaks and troughs in the operations on the Sea Range, while the FY85-FY96 time frame is shown to be one of a steady decline in the amount of debris expended during range operations. In the early years of range operations, it is likely that the operations tempo would be less than today's lower level. However, during the Korean and Vietnam conflicts, activity would have been higher than current levels. Since 1946, there have been 25 years which were periods of lower activity (i.e., no armed conflicts) and approximately 14 years in which U.S. forces were engaged in active conflict. Using the FY85-FY95 data as a mid-range of activity, the high value for debris deposition could be greater than 9,000 cubic feet (250 m^3) per year while the low value would be less than 3,500 cubic feet (100 m^3) per year. These estimates provide a weighted average of approximately 5,300 cubic feet (150 m^3) of debris per year for years prior to 1985.

B - NAS Point Mugu

Hazardous Materials Management

Addition of the proposed new operations (TMD, one more FLEETEX, and two more Naval Special Warfare exercises) and facility modernizations (use of two previously used launch pads) would not have a significant impact on hazardous materials management for NAS Point Mugu. The majority of TMD components would originate from bases far outside the Sea Range and would not be supported directly by the organizations and staff of NAS Point Mugu. There would be some additional aerial targets that could be launched from San Nicolas Island; these could transit the main base and be supported by hazardous materials managers there. This could total nine missile targets and four drone targets. This number of 13 targets is slightly more than 4 percent of the current target operations, and the increase is not significant. There would also be an increase in ships, but most of these would originate off range (primarily in the San Diego homeport area). Range support and target retrieval boat operations would increase by approximately 33 percent, resulting in a minor increase of hazardous materials use. The units handling these boats have the capacity to do so, and the increase is a small percentage of the hazardous materials managed at these locations.

The majority of FLEETEX units also originate off range, and only a small increase would be expected in target hazardous materials management. No construction would be required at the main base to support the additional FLEETEX associated with the Preferred Alternative. Small increases in the amount of hazardous materials due to increased operations would result in an added throughput in the Supply Department. However, this increase would be very small and not significant. The Environmental Materials Management Division has a model facility which would be able to accommodate the increased hazardous materials in accordance with existing regulations.

Hazardous Materials Storage. Aircraft and target fuels comprise the largest amount of hazardous materials stored on the base. Probably the most hazardous fuel is the hypergolic liquid used in the AQM-37 target because it contains inhibited red fuming nitric acid and mixed amine fuel. Hypergolic liquid is stored in Buildings 862 and 847. The overall number of targets used in the Preferred Alternative would be expected to increase by 15 percent. However, the number of these types of targets launched would be only expected to increase by 3 targets, a difference of 10 percent. This small increase would not cause a significant impact on hazardous materials storage.

Ordnance Transportation. With the exception of defensive aircraft flares, the majority of ordnance used on the Sea Range does not transit NAS Point Mugu. It originates with Fleet ships and units that enter and depart off range. There would be no significant increase in ordnance transportation.

Hazardous Waste Management

NAS Point Mugu managed 823,763 pounds (373,865 kg) of hazardous waste during baseline operations (NAWS Point Mugu 1998e); most of these were recycled (450,345 pounds [204,389 kg]). Since the majority of the Preferred Alternative operations would occur on the Sea Range, they would not affect NAS Point Mugu directly. Increased operations that could take place on NAS Point Mugu would be aircraft takeoffs and landings as the aircraft provide support for range missions. It is possible to estimate an overall increase in hazardous materials management by analyzing the expected increase in aircraft operations (3.2 percent) over baseline operations. This small increase in range operations would not significantly affect hazardous waste management. There would be no significant operational impacts, and no mitigation would be required.

Installation Restoration Program

The Navy is proposing to use existing launch pads on the southwest side of the base, near the beach, for launching approximately 6 missiles per year. These facilities are over 2,000 feet (610 m) from the nearest Installation Restoration Program (IRP) site (#20). Launch activities would not expose workers to known contaminated sites or impede investigative or remedial efforts on the IRP sites. Therefore, there would be no significant impacts associated with IRP sites.

Storage Tanks

NAS Point Mugu uses USTs and ASTs to store petroleum products and other hazardous substances throughout the base; the principal product stored is JP-8 jet fuel. Current throughput is approximately 900,000 gallons (3.4 million liters) per month. Impacts from the Preferred Alternative are most likely to arise from an increase in the amount of aircraft traffic supported by the base. There would be an approximate 3.6 percent increase in aircraft sorties associated with the Preferred Alternative. Many of these would originate and refuel offbase and would not impact NAS Point Mugu. If the entire 3.6 percent used Point Mugu refueling facilities, it would proportionally increase JP-8 distribution by approximately 32,000 gallons (122,000 liters) per month, with a total throughput of 932,000 gallons (3.54 million liters). Since the combined total would remain less than throughput capacity (1.37 million gallons [5.2 million liters]), impacts to fuel storage and throughput from implementation of the proposed action would be less than significant.

Pesticides

Operations from TMD, increased FLEETEXs, increased Special Warfare exercises, and facility modernization would not alter the use of pesticides on NAS Point Mugu. There would be no impacts from pesticides, and no mitigation would be required.

Asbestos

NAS Point Mugu conducted surveys in 1995 and 1996 to identify asbestos-containing material which might become a potential health and safety concern. The proposed action would not require any new construction at NAS Point Mugu. Any remaining asbestos-containing material encountered during future activities would be properly abated. Therefore, there would be no significant impacts associated with asbestos.

Polychlorinated biphenyls

PCBs are not located at the existing launch sites proposed for future use, and no new PCB-containing equipment would be installed as part of the Preferred Alternative. There would be no impacts associated with PCBs.

Lead

The manufacture and use of lead-based paint is prohibited. There is a small amount of lead in the JATO bottle propellant. Lead azide and lead styphnate are used in several missile components (e.g., warheads, primer-detonators), but the amounts are less than 1 gram per missile, and missiles are tightly sealed and protected from release until used for their intended purpose on the Sea Range. Therefore, there would be no significant impacts from lead, and no mitigation would be required.

Ordnance

Most activities in the Preferred Alternative would increase ordnance use on the Sea Range, but only a few would increase ordnance activities on NAS Point Mugu. Proposed TMD activities would fire an estimated 17 interceptor missiles and 20 target missiles per year. These missiles would be manufactured by commercial firms, delivered to the Navy for testing, and launches would be conducted at other locations in the Pacific. None of these missiles would be launched or transported through NAS Point Mugu. The main effect from TMD activities would be the launch and maintenance of targets, but none of the targets would carry ordnance. An additional FLEETEX would involve 34 missiles, 33 targets, and 85 events of other ordnance. However, the majority of the missiles and other ordnance would originate from Fleet combatant ships (an aircraft carrier, cruisers, and destroyers) and would not pass through NAS Point Mugu. Only a few FLEETEX aircraft (5-10) would stage from the NAS Point Mugu airfield, and these would use the airfield to upload their missiles. This small number of aircraft would pose only a minor amount of work for NAS Point Mugu ordnance personnel and systems. All targets would be processed on Point Mugu and would contain no ordnance. Finally, the two extra Naval Special Warfare exercises would contribute small amounts of oil and diesel fuel, but proposed routes of travel for these craft would be from their home base at Coronado to San Nicolas Island, and return; they would not pass through NAS Point Mugu. Thus, there would be no significant impact due to ordnance and no mitigation would be required.

Radon

Activities associated with the Preferred Alternative would not have any radon effects. Radon hazards have not been identified at any of the Preferred Alternative sites. Therefore, there would be no impact from radon, and no mitigation would be required.

<u>C - San Nicolas Island</u>

Hazardous Materials Management

The Preferred Alternative would increase the amount of hazardous materials used on San Nicolas Island through short-term construction and the tempo of longer-term range operations. Short-term construction activities include a 50,000-pound (23,000-kg) missile launch pad, a new range support building, five new multiple-purpose instrumentation sites, and upgrades to an existing launch pad. These activities would result in short-term impacts on hazardous materials use, but their use would be controlled and would remain in compliance with federal, state, and local requirements and with base policy. No new procedures would be required to store or use the construction-related hazardous materials which would be removed at the end of the construction period.

The largest amount of hazardous materials on the island is in the form of fuel to heat and power the 150-plus buildings. Annually, about 500,000 gallons (1.875 million liters) of JP-5 are shipped, stored, and used. If the Preferred Alternative is implemented and the new buildings were constructed, the requirement for fuel could increase by 3-6 percent. This amount would be within the existing throughput capacity of the island. Thus, the small increase in required throughput would not have a significant impact, and no additional mitigation would be required.

Target transport and launch activities would increase with the Preferred Alternative. The major new target would be missiles used for TMD events. Although there is a large quantity of liquid propellant and oxidizer in such missiles (1,479 pounds [671 kg]), missiles are transported and stored fully fueled and ready for use. The small number (9) of missile launches per year would not cause a significant impact on hazardous materials management.

Hazardous Waste Management

Construction of new facilities may result in temporary generation of small amounts of hazardous waste. There are currently eight satellite accumulation areas and one "less-than-90-day" accumulation area on the island. If these are not adequate to handle construction requirements, other temporary areas may be designated and operated according to RCRA and state regulations. These temporary sites would be removed at the completion of construction. There would be no significant impact on hazardous waste management from construction activities.

Increased range operations activities associated with the Preferred Alternative would occur in the new buildings as well as in current facilities. There were 65,698 pounds (29,800 kg) of hazardous waste shipped from San Nicolas Island during baseline operations (NAWS Point Mugu 1998e). The overall increase in range aircraft operations is expected to be low (3.6 percent), with the increase in San Nicolas Island target launches to be about 33 percent. Since range operations include aircraft, missile, and target flights, the net increase in operations and associated hazardous waste generation would likely be less than 5 percent. This would be within the hazardous waste management capability of San Nicolas Island. Since the hazardous waste management program already addresses these types of activities, and the increase could be accommodated within the existing program, this increase would not result in significant impacts on hazardous waste management.

Installation Restoration Program

Construction and operations at San Nicolas Island associated with the Preferred Alternative would not significantly affect the island's IRP sites. The construction in the closest proximity to an IRP site would be for the proposed multiple-purpose instrumentation buildings on Skyline Drive. This location is over 2 miles from the closest IRP site (#26) to the west and on approximately the same elevation contour. Therefore, none of the increased operations of the Preferred Alternative would have a significant impact on the IRP.

Underground Storage Tanks

None of the Preferred Alternative activities would require the construction of new storage tanks, and none would affect the remediation of current USTs. Therefore, there would be no significant impact to storage tanks.

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4.14 PUBLIC SAFETY

4.14.1 Approach to Analysis

Factors considered in determining whether an alternative would have a significant public safety impact include the extent or degree to which implementation of the alternative would subject a non-participant to increased risk of personal injury. For all test and training events conducted on the Sea Range, there are specific and documented procedures in place to ensure that non-participating personnel are not endangered by Navy actions. NAWCWPNSINST 5100.2, Sea Range Safety, provides specific guidance and requirements for range operators and users. Included in the Range Safety Instruction are procedures for developing Range Safety Approvals and Range Safety Operations Plans (RSOPs). Also covered are the requirements and specifications of Flight Termination Systems (FTSs). Requirements for range surveillance by aircraft prior to operational testing or training events are also provided in the safety instruction.

The major safety issue on the Sea Range is the potential for missile and target debris to strike a non-participating ocean vessel or civilian aircraft. The size of a clearance area (the area surrounding the safety hazard pattern) cleared for each event is a function of the missile and target characteristics. Potential injuries to personnel on the ground could result from high speed penetration or impact trauma. Technical studies have indicated that debris particles with an impact kinetic energy of less than 11 foot-pounds (a unit of force, in this case indicating the force required to raise 11 pounds [5 kg] a distance of 1 foot [0.3 m]) do not pose a hazard to exposed personnel on the ground (Cole and Wolfe 1996). Analysis of each current and proposed test and training operation on the Sea Range involves estimating the area on the ground where particles with energy levels greater than 11 foot-pounds are likely to occur. For aircraft, the same studies estimate that serious damage to aircraft can occur by impact or engine ingestion of debris particles with a diameter greater than 0.4 inches (10 mm) in diameter (Cole and Wolfe 1996). The area which is subject to debris will have aircraft excluded from it for the time of testing. Crossing the Sea Range are five Control Area Extensions (CAEs) which are part of the transpacific air route structure. These airways allow civilian aircraft a direct route through the range. NAWCWPNS has a formal Memorandum of Agreement with the Federal Aviation Administration (FAA) which delineates the conditions which allow CAEs to be closed to civil air traffic. Also addressed in the analysis are electromagnetic radiation (EMR) hazards, laser systems, and chaff use. Ordnance handling and transportation procedures are addressed in Section 4.13, Hazardous Materials, Hazardous Wastes, and Non-Hazardous Wastes.

In addition to current safety procedures in use on the range and at Point Mugu, the accident history for operations on the Sea Range was considered. There have been no accidents involving non-participants on the Sea Range as a result of Navy operations. Extensive safety procedures are implemented when hazardous activities occur at both Point Mugu and San Nicolas Island. Examples of these procedures are the use of "boundary boats" along the shore near Building 55 during the launch of targets over the beach on the Sea Range. These boats ensure that non-participants remain clear of the launch area. On San Nicolas Island, the entire west end of the island is secured and no personnel are allowed in the operations area when the onshore Surface Land Attack Missile (SLAM) target is used. There are numerous EMR sources and emitters at NAS Point Mugu and on San Nicolas Island. When these sources are active and producing EMR, they can potentially cause hazards to personnel, ordnance, and fuel. However, physical mechanisms, monitoring meters, and computer hardware and software are present to prevent unsafe levels of EMR from reaching workers and the public. Extensive plans and procedures are in place to ensure that any risks posed by these EMR sources are minimized. A summary matrix of public safety impacts is presented in Table 4.14-1.

Table 4.14-1. Public Safety Impact Summary Matrix

Alternative	Impact Conclusions NEPA (On Land→ Territorial Waters)	Impact Conclusions EO 12114 (Non-Territorial Waters)	Mitigation Measures
NO ACTION ALTERNATIVE	Range clearance procedures implemented before each event; EMR below safety thresholds for personnel. Less than significant impacts.	*Range clearance procedures implemented before each event. Less than significant impacts.*	None.
MINIMUM COMPONENTS ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	Range clearance procedures implemented before each event. Less than significant impacts.	*Range clearance procedures implemented before each event. Less than significant impacts.*	None.
PREFERRED ALTERNATIVE (This alternative includes impacts identified for the No Action Alternative.)	For upper tier events, the Navy would increase range safety and clearance resources and increase coordination efforts with the FAA and Coast Guard. Less than significant impacts.	*For upper tier events, the Navy would increase range safety and clearance resources and increase coordination efforts with the FAA and Coast Guard. Less than significant impacts.*	None.

4.14.2 No Action Alternative - Current Operations

Both military and non-military (e.g., commercial and recreational) entities have been sharing use of the airspace comprising, and the ocean surface underlying, the Sea Range for more than 50 years. Both entities have established an operational coexistence consistent with federal, state, and local plans and policies and compatible with each interest's varying objectives. Range clearance procedures on the Sea Range are implemented prior to each operation to ensure that marine vessels and civilian aircraft are outside of the clearance area (refer to Section 3.0.2.1-F). The following subsections detail public safety coordination between Sea Range operations and non-participants using this area.

4.14.2.1 Air-to-Air Operations

Target and missile launches in support of air-to-air operations occur from NAS Point Mugu and from San Nicolas Island. Onshore and offshore areas within and just outside the launch azimuth boundaries (refer to Figures 3.14-3 and 3.14-5) are cleared for safety purposes during each target or missile launch. Onshore clearance involves military personnel, while offshore clearance can involve vessels or aircraft (both recreational and commercial). NAWCWPNS issues NOTAMs and NOTMARs 24 hours in advance of any Navy activities requiring exclusive use of an area. A special phone number has also been set up by NAWCWPNS Point Mugu to allow commercial fishermen to be informed in advance of military activities at San Nicolas Island (Ventura County Commercial Fisherman's Association 1997). For these reasons, public safety impacts associated with safety clearance procedures for missile and target launches are less than significant.

Air-to-air operations are typically conducted in the outer portion of the Sea Range (Range Areas 4A, 4B, 5A, 5B, 6A, 6B, and 6C). The safety hazard patterns and associated clearance areas also typically occur on the outer part of the Sea Range. Air-to-air missiles fired on the Sea Range are relatively short-range systems, from under 20 NM (37 km) to approximately 100 NM (185 km). (Such air-to-air missiles are rarely fired on the Sea Range to their maximum capable range.) The clearance areas are kept clear of non-participating aircraft and ships prior to each operation. In addition, the firing geometries for these missile shots usually are configured so that no missiles are fired toward a land mass. The procedures in NAWCWPNSINST 5100.2, Sea Range Safety, are strictly adhered to in order to minimize risks to human life and property. Most air-to-air missiles fired on the Sea Range do not carry live warheads but rather are equipped with telemetry packages to record test data such as intercept parameters, firing conditions, and miss distance. According to the Historical Temporal Shipping (HITS) database, it is possible that about three commercial shipping vessels might be present in the clearance area prior to issuance of the NOTMAR; recreational vessels, commercial fishing vessels, and tourist boats are not likely to be in this area. Testing activities are not conducted until vessels are clear of the area in accordance with the range clearance procedures previously described. Given the advance notice system and the highly controlled nature of these missile firings, public safety impacts of air-to-air operations in non-Territorial Waters are less than significant.

Most objects entering the Sea Range do so at either high subsonic or supersonic airspeeds and typically break apart upon impact. As a result, very little of the missile or test item retains its original configuration, and most of the hazardous and non-hazardous constituents are dispersed in the water column as they settle to the ocean bottom. Dense items sink immediately while volatile liquids or gases either evaporate or go into solution or a suspension state in the seawater. There is a very small probability that a hazardous constituent survives water submersion intact. However, when combined with the water depth on the Sea Range (averaging 1,600 feet [500 m] in the more heavily used areas) and wide areas over which debris is dispersed, it is reasonable to expect that any intact hazardous constituent has no impact on public safety for boaters and recreational or commercial fishermen.

4.14.2.2 Air-to-Surface Operations

Air-to-surface missiles are fired against towed targets on the Sea Range or against targets on San Nicolas Island. These tests are conducted in accordance with standard Sea Range clearance procedures. Inert mine shape drops are conducted near Santa Rosa Island (refer to Figure 3.0-14). However, no live bombs or live mines are dropped on the Sea Range. In addition, aircraft with air-to-surface missiles or other munitions are required to make a clearing pass over their target prior to firing to ensure that the target area is clear of non-participating ships, boats, or aircraft. This includes SLAM testing at San Nicolas Island and inert mine shape drops at Becher's Bay off Santa Rosa Island. There is a high likelihood of recreational or commercial vessels to be located in Becher's Bay at any given time. The aircraft involved in these tests are able to fly slow enough (about 300 knots [560 km per hour]) to ensure that all non-participants are clear of the safety area prior to the drop. Procedures are in place to allow expenditure of missiles or bombs only if the target area is confirmed clear and there is no risk to non-participants. Based on the highly controlled nature of these missile firings and the restrictions on the expenditure of other air-to-surface ordnance, public safety impacts of air-to-surface operations are less than significant.

Air-to-surface intercepts typically occur in outer portions of the Sea Range (e.g., Range Areas 4A, 4B, and 5B). Testing activities are not conducted until vessels are clear of the area in accordance with the range clearance procedures previously described. Public safety impacts from air-to-surface operations in non-Territorial Waters are less than significant.

4.14.2.3 Surface-to-Air Operations

Less than five surface-to-air missiles (non-fleet training) were fired during baseline operations. These firings were either from ships afloat on the Sea Range in the vicinity of San Nicolas Island or from the island itself. With the exception of short-range missile systems fired from San Nicolas Island, surface-to-air operations are typically conducted in the outer portion of the Sea Range (Range Areas 4A, 4B, 5A, 5B, 6A, 6B, and 6C).

Testing activities are not conducted until vessels are clear of the area in accordance with the range clearance procedures previously described. Onshore target launches also require clearance of areas at and around Point Mugu and San Nicolas Island (see previous discussion in Section 4.14.2). Given the advance notice system and the highly controlled nature of missile and target firings, public safety impacts of surface-to-air operations are less than significant.

Surface-to-air operations involve both short-range, close-in ship defense systems and systems capable of long-range intercept of airborne targets. A large safety hazard pattern is associated with both the surface-to-air missile (typically fired from a cruiser or destroyer southwest of San Nicolas Island) and the missile target (fired from San Nicolas Island to the west). However, very few vessels use this area (an average of 0.01 vessels are present in these areas at any given time according to the HITS database). Testing activities are not conducted until vessels are clear of the area in accordance with the range clearance procedures previously described. Given the advance notice system and the highly controlled nature of missile and target firings, public safety impacts of surface-to-air operations in non-Territorial Waters are less than significant.

4.14.2.4 Surface-to-Surface Operations

Onshore target launches associated with surface-to-surface operations require clearance of areas at and around Point Mugu and San Nicolas Island (see previous discussion in Section 4.14.2); public safety impacts are less than significant.

Surface-to-surface operations are typically conducted in the outer Sea Range outside Territorial Waters (Range Areas W-60, 4A, 4B, 5A, and 5B). Missiles and naval guns are fired from surface vessels on the Sea Range. Targets include towed surface targets, powered ship targets, ship hulks, and other specialized targets available on the Sea Range. The Sea Range has procedures in place to clear the flight path of a missile from launch to target impact. For long-range, surface-to-surface missiles, a fighter chase aircraft is flown above and behind the test missile to ensure that the missile does not deviate from its programmed flight path. If the missile's flight path deviation reaches unacceptable limits, the Missile Flight Safety Officer, usually aboard the chase aircraft, can destroy the missile with an onboard FTS. Due to the extensive precautions that the Navy takes when firing these long-range capable missile systems, these operations are not expected to have significant impacts on public safety. The safety areas for these tests typically occur south of the western approach shipping lanes. According to the HITS database, it is possible that about six vessels might be present in the clearance area surrounding the safety hazard pattern prior to NOTMAR issuance; recreational vessels and commercial fishing vessels are not usually in this area (they are typically closer to San Nicolas Island in this portion of the Sea Range). Testing activities are not conducted until vessels are clear of the area in accordance with the range clearance procedures previously described. Given the advance notice system, the use of a chase aircraft and a Missile Flight Safety Officer, and the highly controlled nature of these tests, public safety impacts of surface-to-surface operations in non-Territorial Waters are less than significant.

4.14.2.5 Subsurface-to-Surface Operations

Subsurface-to-surface operations are typically conducted in the outer Sea Range (Range Areas 4A, 5A, 6A, and 7A). The level of subsurface-to-surface missile launch activity on the Sea Range is very low. These operations typically involve underwater launches of subsurface missiles. The procedures cited above for surface-to-surface operations are identical to this scenario. The surface target may be sunk just outside Territorial Waters. The safety areas for these tests typically occur south of the western approach shipping lanes (refer to Figure 3.10-1). According to the HITS database, it is possible that about four vessels might be present in the clearance area surrounding the safety hazard pattern prior to NOTMAR issuance. Recreational vessels and commercial fishing vessels could potentially be in areas north and northwest of San Nicolas Island in this portion of the Sea Range. Testing activities are not conducted until vessels are clear of the area in accordance with the range clearance procedures previously described. Given the advance notice system and the highly controlled nature of these tests, public safety impacts of subsurface-to-surface operations in non-Territorial Waters are less than significant.

4.14.2.6 Ancillary Operations Systems

Radar and other electromagnetic sources can pose hazards to personnel exposed to radiation above specified levels; these levels vary with the frequency and power of the emitting source. To minimize the effects of the use of electromagnetic sources, the Navy follows procedures directed in the Hazards of Electromagnetic Radiation to Personnel (HERP) program. Ordnance and fuels are also susceptible to the hazards of EMR. The hazards to ordnance and fuel from EMR are managed under the Hazards of Electromagnetic Radiation to Ordnance (HERO) and Hazards of Electromagnetic Radiation to Fuel (HERF) programs. During the siting process for any new EMR source, radiation hazard surveys are conducted to assess the potential hazards posed by the EMR source to personnel, ordnance, and fuel. This process establishes hazard areas for personnel, ordnance, and fuel, if required. These hazard areas are depicted by circular arcs on base maps. Periodic surveys are conducted of existing sources to ensure that established hazard arcs are current, that the hazardous areas are plainly marked, and that operators are using the EMR sources in accordance with published procedures in order to protect potentially exposed individuals, ordnance, and fuels. Hazard arcs for ordnance extend beyond the base boundaries at NAS Point Mugu (refer to Figure 3.14-1); however, the Navy imposes strict procedures to preclude the transport of HERO-susceptible ordnance into HERO hazard areas. The general guideline for EMR exposure for individuals from the American National Standards Institute (ANSI) is that exposure be limited to 0.4 watts per kilogram of body weight (ANSI 1982). Another standard used is 10 mW/cm^2 (i.e., a power of 10 mW applied over an area of one square centimeter). These exposure levels provide a safety factor of 10 for most EMR sources. Because of the strict compliance by the Navy to restrict access to EMR hazard areas, the impact of EMR sources at NAS Point Mugu is less than significant.

NAWCWPNS uses a variety of radars at NAS Point Mugu and San Nicolas Island for range instrumentation purposes. Surveillance radars typically operate at peak powers ranging from 250 kW to 1,000 kW (NAWCWPNS Point Mugu 1997b). Metric radars typically operate at peak powers of about 1 to 3 mW and at frequencies of about 5,700 MHz (NAWCWPNS Point Mugu 1996m). These radars are mounted on towers with a look angle horizontal or slightly upward. This minimizes potential risk to personnel in the area. Other EMR-emitters include communication systems such as radio communications and video systems. These devices are situated and operated to minimize hazardous situations. Extensive plans and procedures are in place to ensure that the risks posed by these EMR sources are minimized. The Navy requirements and local NAS Point Mugu procedures are covered by OPNAVINST 5100.23D and NAWSPMINST 5100.1, Chapter 2 (NAWCWPNS Point Mugu 1998f).

Since NAS Point Mugu has established procedures in place to prevent exposure of either Navy personnel or the general public to hazardous EMR, the impact of EMR sources is less than significant.

Chaff use could present a public safety impact if packets were ejected over areas occupied by the general public. However, chaff is typically used on the Sea Range at least 10 NM from shore to minimize potential exposure to the public. Therefore, public safety impacts associated with chaff use are less than significant.

Use of laser systems for detection and guidance commonly occurs on the Sea Range, primarily in association with missile testing activities. Laser safety issues are supervised by the NAWCWPNS Command Safety Office. Laser safety specifications are included in Range Safety Approvals before they can be used on the Sea Range. After laser specifications are received from the range user, an independent laser safety analysis is made by the NAWCWPNS Laser System Safety Officer (NAWCWPNS Point Mugu 1998f). Therefore, public safety impacts associated with laser systems on the Sea Range are less than significant.

For the reasons described above, the use of ancillary operations systems in non-Territorial Waters has less than significant impacts on public safety.

4.14.2.7 Current Fleet Exercise Training

Target and missile launches in support of FLEETEX operations occur from NAS Point Mugu and from San Nicolas Island (see previous discussion in Section 4.14.2). Aircraft and vessel traffic also transit through Territorial Water areas of the Sea Range. Operations are not conducted until vessels are clear of the area in accordance with the range clearance procedures previously described. Given the advance notice system, the use of established range safety procedures that ensure non-participants remain outside the clearance areas, and the highly controlled nature of FLEETEX activities, public safety impacts are less than significant.

In the baseline year, 75 percent of missiles and 87 percent of targets fired on the Sea Range were during FLEETEXs. The remaining missiles and targets were fired in support of test and evaluation programs. Except for aircraft sorties or target launches from NAS Point Mugu or San Nicolas Island in direct support of a FLEETEX, virtually all FLEETEX activity occurs outside of Territorial Waters. The major activities associated with current FLEETEXs are conducted in the outer Sea Range, primarily in Range Areas 4A, 4B, 5A, and 5B. The primary locations for the missile/target intercepts are Range Areas 5A and 5B (outside Territorial Waters). Small surface targets (about 20 feet [6 m] long) may be sunk in Range Area 4A (just outside Territorial Waters). Safety areas for these tests encompass portions of the western and northern approach shipping lanes (refer to Figure 3.10-1). According to the HITS database, it is possible that about six vessels might be present in the clearance area surrounding the safety hazard pattern prior to NOTMAR issuance. Recreational vessels and commercial fishing vessels can potentially be in areas north and northwest of San Nicolas Island in this portion of the Sea Range. These vessels have the option of moving to a different area in order to stay away from the clearance area. Prior to an exercise, comprehensive operations plans and instructions are prepared by staff of the participating Naval command. A major portion of planning documents and instructions covers the safety issues in exercises of this type. Standard Sea Range clearance procedures are used prior to the beginning of an exercise. Operations are not conducted until vessels are clear of the area in accordance with the range clearance procedures previously described. The primary tenet and philosophy of the safety procedures used during FLEETEXs is that any unit in the exercise can report an unsafe condition and all ships and aircraft "Hold Fire" until the situation is corrected. Furthermore, all activity during FLEETEXs is constantly being monitored by the Sea Range Operations Conductors at Point Mugu. They *also can call a "Hold Fire" as a situation warrants. Due to extensive pre-planning, emphasis on safety, and the structured nature of FLEETEXs, these operations do not have a significant impact on public safety in non-Territorial Waters.*

4.14.2.8 Littoral Warfare Training

Littoral warfare training takes place in nearshore waters at San Nicolas Island by the U.S. Marine Corps and Navy Special Warfare forces. The training uses both small boats for landing and helicopters. The aircraft activity generally occurs within the restricted areas over San Nicolas Island where non-participating aircraft are precluded from entry. No live ordnance or munitions are used in this type of training. If appropriate, NOTAMs and NOTMARs are published to inform the public of these activities. Since the activity level of this training is low and occurs in an area where the general public can be excluded, there are no impacts on public safety.

4.14.3 Minimum Components Alternative

This alternative includes impacts identified for the No Action Alternative since the testing, training, and facility modernization activities included in this alternative are proposed in addition to current operations.

4.14.3.1 Theater Missile Defense Element – Nearshore Intercept

Proposed nearshore intercept activities would involve eight events per year at San Nicolas Island. To account for potential "scrubbed" or canceled operations, the entire area around the island (i.e., surface restricted areas Alpha, Bravo, and Charlie; refer to Figure 3.14-5) would be cleared of non-participating vessels up to 16 times per year. These events would add 32 aircraft sorties, 50 ship/boat events, 8 missiles, and 8 targets to current Sea Range activity levels. The number of aircraft sorties, missile launches, and target use would represent an increase of less than 1 percent, 2 percent, and 3 percent, respectively, over baseline activity. The number of ships/boats involved in the test and training events would represent an increase of about 6 percent over baseline activity. Safety hazard patterns for these missiles and targets would be contained entirely within the Sea Range, and standard range clearance procedures would be used to ensure that non-participating aircraft and ships are outside of the clearance area. The clearance area would primarily be in Range Areas M3 and 4A, as well as small portions of 3A and M5 (refer to Figure 2-2d). Depending on the missile/target geometry, the debris pattern would occur either off the southeast coast or off the west end of the island. In either case, all non-participating vessels would have to stay outside of the clearance area. Due to the timing of peak fishing periods, more commercial fishing boats tend to be in this area in the fall and winter (October - March) than in spring or summer (Ventura County Commercial Fisherman's Association 1998). As mentioned above, commercial fishing boats, recreational fishing boats, and sport diving boats would be restricted from the clearance area during each event. Given the advance notice system, established range safety procedures which ensure the clearance area is clear of non-participants, and the fact that the test and training events would occur only eight times per year, public safety impacts of nearshore intercept testing and training would be less than significant.

4.14.3.2 Training Element – Additional FLEETEX

Operations associated with the additional FLEETEX would occur from NAS Point Mugu and from San Nicolas Island. Aircraft and vessel traffic would also transit Territorial Waters of the Sea Range. Since the duration of a FLEETEX is only 2 to 3 days, the addition of one exercise would increase activity levels by less than 4 percent of the days available on the Sea Range per year. Operations would not be conducted until vessels are cleared of the area in accordance with the range clearance procedures previously described. Given the advance notice system, the use of established range safety procedures that ensure non-participants remain outside the clearance areas, and the highly controlled nature of FLEETEX activities, public safety impacts would be less than significant.

For the reasons described above, impacts of one additional FLEETEX in non-Territorial Waters would be less than significant.

4.14.3.3 Facility Modernization Element – Multiple-Purpose Instrumentation Sites

The construction of five multiple-purpose instrumentation sites on San Nicolas Island would increase monitoring capabilities of current and future test and training activities. Potential public safety issues are limited to mobile EMR sources that may be placed on the instrumentation sites. Since the public does not have access to San Nicolas Island, public safety impacts of these EMR systems would be less than significant.

4.14.4 Preferred Alternative

This alternative includes impacts identified for the No Action Alternative since the testing, training, and facility modernization activities included in this alternative are proposed in addition to current operations.

4.14.4.1 Theater Missile Defense Element

A - Boost Phase Intercept

Target launches in support of boost phase intercept events could occur from San Nicolas Island. Aircraft and vessel traffic would also transit Territorial Water areas of the Sea Range. Operations would not be conducted until vessels are cleared of the area in accordance with the range clearance procedures previously described. Given the advance notice system and the use of established range safety procedures that ensure non-participants remain outside the clearance areas, public safety impacts associated with boost phase intercept events would be less than significant.

Boost phase intercept events would add 30 aircraft sorties and 15 ship/boat events annually to current Sea Range activity levels. The number of aircraft sorties and ship/boat events would represent an increase of less than 1 percent and 2 percent, respectively, over baseline activity. The missile/target use would represent a 1 percent increase over baseline activity. The safety hazard patterns would encompass portions of both the inner and outer Sea Range. For a single event, range areas within the clearance area surrounding the safety hazard pattern would include 4A, 4B, 5A, 5B, 6A, and 6B (if the target missile is launched from San Nicolas Island) or 5B, 5C, 6B, 6C, 7B, and W-537 (if the target missile is launched from a location outside of the Sea Range). These range areas encompass the western and northern commercial shipping lane approaches, depending on where the target missile is launched. According to the HITS database, it is possible that about six commercial ships might be present in the clearance area prior to NOTMAR issuance under the San Nicolas Island launch scenario, and about four commercial ships might be present prior to NOTMAR issuance under the offsite launch scenario. Any ships and boats (commercial and non-commercial) would need to be outside of the clearance area prior to conducting the operation. NOTMARs would be issued in advance of each event to reduce the number of vessels in the clearance area. Therefore, the number of ships in the area would be less than these numbers. The Sea Range has established comprehensive laser use procedures to ensure that the laser energy is not directed toward areas where it could cause harm. The use of lasers on the Sea Range is controlled by NAWCWPNS Command Safety. Laser safety specifications must be included in the Range Safety Approval before a laser can be used on the Sea Range. An independent analysis by the Laser System Safety Officer is also conducted prior to laser use on the Sea Range (NAWCWPNS Point Mugu 1996m). During all boost phase intercept engagement scenarios, the laser would be directed at an upward angle from the level of the aircraft, flying at an altitude of about 40,000 feet (12,000 m). This would preclude directing laser energy at people or wildlife (U.S. Air Force 1997a). Standard range clearance procedures would be used to ensure that non-participating aircraft or ships are outside of the clearance area prior to conducting the events. Given the advance notice system, established range safety procedures ensuring that non-participants remain outside the clearance areas, and the fact that the events would occur only three times per year, public safety impacts of boost phase intercept testing and training in the Sea Range would be less than significant.

As noted above, the safety hazard pattern associated with boost phase intercept events would encompass non-Territorial Waters within the Sea Range. For the reasons described above, public safety impacts associated with boost phase intercept events in non-Territorial Waters would be less than significant.

B - Upper Tier

Potential effects of target launches from San Nicolas Island are the same as those described above for boost phase intercept events (see Section 4.14.4.1-A). Therefore, public safety impacts of upper tier testing and training in Territorial Waters would be less than significant.

Upper tier events would add 12 aircraft sorties and 23 ship/boat events annually to current Sea Range activity levels. There would also be up to two interceptor missiles and one target missile per event. The number of aircraft sorties, ship/boat events, and missile/target use would represent an increase of less than 1 percent, 3 percent, and 2 percent, respectively, over baseline activity. The target missile and interceptor missile used for upper tier events have very large safety hazard patterns (refer to Figure 2-2b). For a single event, range areas within the clearance area surrounding the safety hazard pattern would include 5A, 5B, 5C, 6A, 6B, 6C, 7A, 7B, 7C, and W-537. CAEs (or transit corridors) are established to allow civil aircraft safe transit across the Sea Range. These corridors can be closed by the FAA at the request of the Navy in order to facilitate activities on the Sea Range. With implementation of this procedure, public safety impacts of upper tier testing and training on commercial aircraft transportation through the Sea Range in non-Territorial Waters would be less than significant.

The debris area, a small area within the safety hazard pattern of the missile/target intercept, would be easily cleared of non-participants because of its size. The safety hazard pattern (and associated clearance area), however, is substantially larger and would require more extensive clearance procedures. The clearance area would also encompass the western, northern, and Route 3 commercial shipping lane approaches (refer to Figure 3.10-1). According to the HITS database, it is possible that about six vessels might be present in the Sea Range portion of the clearance area prior to NOTMAR issuance. Depending on the firing geometry, these footprints would likely extend off the Sea Range. Information for ship densities off the Sea Range are not available; based on extrapolation from the HITS database, it can be assumed that minimal numbers of ships would be present in the off-range portions of the Sea Range, except possibly in the portion of Route 3 that parallels the southern Sea Range boundary.

Clearance of such large areas by the Navy would require close coordination with the FAA, Coast Guard, shipping concerns, and other ocean users in areas outside of the Sea Range. In the past, such extensive range clearance procedures have been successfully implemented on the Point Mugu Sea Range for various situations. Examples include off-range launches of subsurface-to-surface missiles toward the Kwajalein range in the western Pacific. Although each launch and most of the initial flight occur outside

Sea Range boundaries, extensive areas are cleared for safety purposes. This includes large areas of the lower Sea Range, the area along the entire flight path, and the destination range in the western Pacific. Similar proven clearance procedures would also be applied to proposed upper tier testing and training. Operations would not be conducted until vessels are cleared of the area in accordance with the range clearance procedures previously described. Range surveillance would involve four surveillance aircraft (two up-range and two down-range). Each aircraft can remain on-station for up to 6 hours with one-way transit time of 2 hours. Therefore, these aircraft would begin clearing the clearance area 10 hours before the event and would depart the area 2 hours before the event. Proposed upper tier testing and training would only be conducted once all non-participating vessels either clear the area, alter their speed sufficiently not to enter the clearance area, or are exiting the area at the time of the event. If these safety precautions are not met by the scheduled time of the operation, the event would not be conducted. Consequently, these operations would only be conducted in conditions safe for the public. Therefore, public safety impacts of upper tier testing and training in non-Territorial Waters would be less than significant.

C - Lower Tier

Potential effects of target launches from San Nicolas Island are the same as those described above for boost phase intercept events (see Section 4.14.4.1-A). Therefore, public safety impacts of lower tier testing and training in Territorial Waters would be less than significant.

Lower tier events would add 15 aircraft sorties and 23 ship/boat events annually to current Sea Range activity levels. These aircraft activities would represent a less than 1 percent increase over baseline activity, and the ship/boat events would represent a 3 percent increase over baseline activity. The clearance area surrounding the safety hazard pattern for lower tier testing and training would be similar to the San Nicolas Island launch scenario of boost phase intercept events although somewhat larger, also encompassing portions of Range Areas 7A and 7B. However, commercial vessel traffic in these areas is extremely low. According to the HITS database, it is possible that about seven vessels might be present in the clearance area prior to NOTMAR issuance in Range Areas 7A and 7B. The target missile and interceptor missile clearance areas for these shorter range systems can fit on the Sea Range. Operations would not be conducted until vessels are cleared of the area in accordance with the range clearance procedures previously described. Given the advance notice system, the use of established range safety procedures that ensure non-participants remain outside the clearance areas, and the fact that the events would occur only three times per year, public safety impacts of lower tier testing and training would be less than significant.

D - Nearshore Intercept

Potential public safety impacts from proposed nearshore intercept activities were described previously in Section 4.14.3.1. Public safety impacts of proposed nearshore intercept testing and training would be less than significant.

4.14.4.2 Training Element – Fleet Exercise and Special Warfare Training

A - Fleet Exercise Training

Potential public safety impacts from the proposed increase of one FLEETEX per year were described previously in Section 4.14.3.2. Public safety impacts of the additional FLEETEX would be less than significant.

B - Special Warfare Training

The proposed increase in special warfare training would occur exclusively at San Nicolas Island and would include two additional exercises per year involving SEAL team landings and raids at the island. These activities currently occur twice per year at this location, so the proposed addition of two special warfare training events would not represent a new type of activity. No major shipping lanes are located in the vicinity of San Nicolas Island. Non-participating boats would need to be clear of only a small area in the general vicinity of the proposed training locations at the island. Ship traffic would not be substantially affected. Given the relatively small area involved and its proximity to Navy-owned San Nicolas Island, and the fact that proven safety procedures are currently in place for this type of training, public safety impacts of special warfare training would be less than significant.

4.14.4.3 Facility Modernization Element – Point Mugu and San Nicolas Island

A - Point Mugu Modernizations

The proposed modernizations at NAS Point Mugu would have no impact on public safety. No increases in the number of planned target and missile launches from NAS Point Mugu are proposed, although some surface-to-surface missile launches could occur from Pad B or Pad C (refer to Figure 2-3a). These launch pad sites have been used previously and no additional safety procedures would be required to enable their use. Current safety procedures for launching missiles and targets from NAS Point Mugu would remain in place (see previous discussion in Section 4.14.2). Therefore, there would be no impact on public safety due to the NAS Point Mugu facility modernizations.

B - San Nicolas Island Modernizations

A launch site would be added near the Alpha Launch Complex, which is currently used for many of the San Nicolas Island target launches. In addition, a vertical launch system would be placed at one of the pads on the west end of the island. These areas are currently used for missile and target launches and proven safety procedures are already established for launches from San Nicolas Island. Therefore, safety impacts of the increased launch capabilities would be less than significant

The construction of five multiple-purpose instrumentation sites on San Nicolas Island would increase monitoring capabilities of current and future test and training activities. Potential public safety issues are limited to mobile EMR sources that may be placed on the instrumentation sites. Since the public does not have access to San Nicolas Island, public safety impacts of these EMR systems would be less than significant.

4.14.4.4 Bird-Aircraft Strike Hazards

Bird-aircraft strike hazard (BASH) data indicate that anywhere from 10 to 60 birds have been struck within any given year. Given the recent increase in aircraft activity associated with the E-2 aircraft squadron realignment to NAS Point Mugu (Southwest Division 1998), existing bird strike potential could be as much as 30 percent higher than this (or about 10 to 80 incidents per year). Upon implementation of the Minimum Components Alternative or the Preferred Alternative, proposed aircraft activity within the Sea Range would increase by slightly more than 4 percent (150 sorties per year). Only a portion of these sorties would originate and land at NAS Point Mugu; the total increase represents less than 1 percent of all current aircraft operations at NAS Point Mugu (refer to Table 3.0-1). Based on total projected flying hours, flight patterns, and other aircraft activity, the potential for BASH-related aircraft mishaps would essentially remain unchanged upon implementation of the Minimum Components Alternative or the

Preferred Alternative. The BASH Plan currently implemented by NAS Point Mugu would remain in effect, and no noticeable change in bird-strike frequency would be expected. Therefore, increased BASH potential would have a less than significant impact on public safety.

CHAPTER 5
CUMULATIVE IMPACTS

5.1 INTRODUCTION

The Council on Environmental Quality (CEQ) Regulations (40 Code of Federal Regulations [C.F.R.] §§1500-1508) for Implementing the Procedural Provisions of the National Environmental Policy Act (NEPA) of 1969, as amended (42 United States Code [U.S.C.] § 4321 et seq.) define cumulative effects as:

> "The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions."
> (40 C.F.R. § 1508.7)

The contribution of a proposed action to the overall cumulative impacts in a region of influence (ROI) is of particular concern. A single project may have individually minor impacts; however, when considered together with other projects, the effects may be collectively significant. A cumulative impact is, therefore, the additive effect of all projects in the same geographic area.

In general, effects of a particular action or group of actions must meet all of the following criteria to be considered cumulative impacts:

- Effects of several actions occur in a common locale or ROI (i.e., action can contribute to effects of an action in a different location).
- Effects on a particular resource are similar in nature (i.e., affects the same specific element of a resource).
- Effects are long-term; short-term impacts dissipate over time and cease to contribute to cumulative impacts.

Section 5.2 discusses relevant past, present, and reasonably foreseeable future actions on the Point Mugu Sea Range or in the immediate vicinity of NAS Point Mugu. Specific environmental documentation addressing direct and indirect effects of these actions either has been or will be conducted separately from this EIS/OEIS. A brief summary of the projects considered for cumulative analysis is included in Section 5.2, and a discussion of potential cumulative impacts is provided in Section 5.3.

5.2 CUMULATIVE PROJECTS

5.2.1 Navy Projects

5.2.1.1 VR-55 Reserve Squadron and Mobile Maintenance Facility Relocation to NAS Point Mugu

The Navy recently relocated the VR-55 squadron and Mobile Maintenance Facility (MMF) to NAS Point Mugu from Moffet Field, California. This relocation involved five C-130 aircraft, 66 maintenance vans, and associated personnel (a total of 187 full-time and 185 reserve personnel). VR-55 conducts training flights, logistic support missions, and detachments to remote locations. The MMF provides mobile support units and maintenance for P-3 aircraft. The aircraft were assigned to Hangar 34 after the VXE-6 (Antarctic Development Squadron) disestablished and removed their six C-130s from Point Mugu. The relocated E-2 squadrons have been assigned to this same hangar on an interim basis until proposed renovations for their permanent facility are completed in 2001. The MMF vans were located at a previously vacant location at NAS Point Mugu. Both a Categorical Exclusion and Record of Non-Applicability were issued for this project.

The proposed action examined in this EIS/OEIS primarily involves activities on the Sea Range. No increase of personnel and no construction would occur at NAS Point Mugu. There is only minimal geographic overlap between environmental issues associated with the VR-55 and MMF relocation, and the actions addressed in this EIS/OEIS.

5.2.1.2 Surface Warfare Engineering Facility

The Surface Warfare Engineering Facility (SWEF) is located at the Construction Battalion Center (CBC) Port Hueneme, approximately 4 miles (6.4 kilometers [km]) northwest of Point Mugu. The SWEF is a component of a separate Navy Command, the Port Hueneme Division (PHD) Naval Surface Warfare Center (NSWC). The Navy recently published an Environmental Assessment (EA) and issued a Finding of No Significant Impact (FONSI) on 22 June 2000 addressing current operations and proposed implementation of the Virtual Test Capability at the SWEF.

During tests, the SWEF functions like a "ship on land." It is used for testing shipboard systems to accomplish the following objectives: investigate engineering solutions for existing systems, provide training for military and civilian personnel, and evaluate new self-defense systems without requiring installation aboard ships or equipping a laboratory at sea. Aircraft used by the SWEF to test radar detection and tracking capabilities fly from, to, and/or through the Sea Range and use its range operations and air controllers to assist in directing aircraft. All aircraft operations scheduled and controlled by NAWCWPNS Point Mugu are included within the analysis of the No Action Alternative addressed in this EIS/OEIS.

5.2.1.3 West Coast Basing of the F/A-18E/F Aircraft

This action involves siting 92 F/A-18 aircraft (E/F models), locating 5,145 associated personnel, and providing associated training functions at the receiving installation. In addition to the increased staffing and equipment levels, the proposed action would increase Navy activity and flight operations at the receiving installation. The three installations considered for the west coast base are NAS Lemoore, NAS Point Mugu, and Naval Air Facility (NAF) El Centro. A Draft EIS was prepared assessing the potential impacts associated with the Preferred Alternative (NAS Lemoore) and other alternatives. Subsequent to the Draft EIS, the Navy removed NAS Point Mugu as a potential receiving installation candidate, and a Record of Decision (ROD) was signed selecting NAS Lemoore as the location to receive the F/A-18s.

5.2.1.4 San Clemente Island Range Complex

San Clemente Island is the southernmost of the eight California Channel Islands and is located 43 nautical miles (NM) [80 km] east-southeast of San Nicolas Island. The San Clemente Island Range Complex (SCIRC) consists of San Clemente Island; associated land, air, and sea training ranges; and designated operating areas to the south and west of the island (Figure 5-1). Most of these areas are under the supervision of the Southern California Offshore Range (SCORE). The role of the SCIRC is to support tactical training to improve the combat readiness of Pacific Fleet Air, Surface, and Submarine units by providing instrumented operating areas and associated facilities.

Navy Ranges in the Southern California Bight

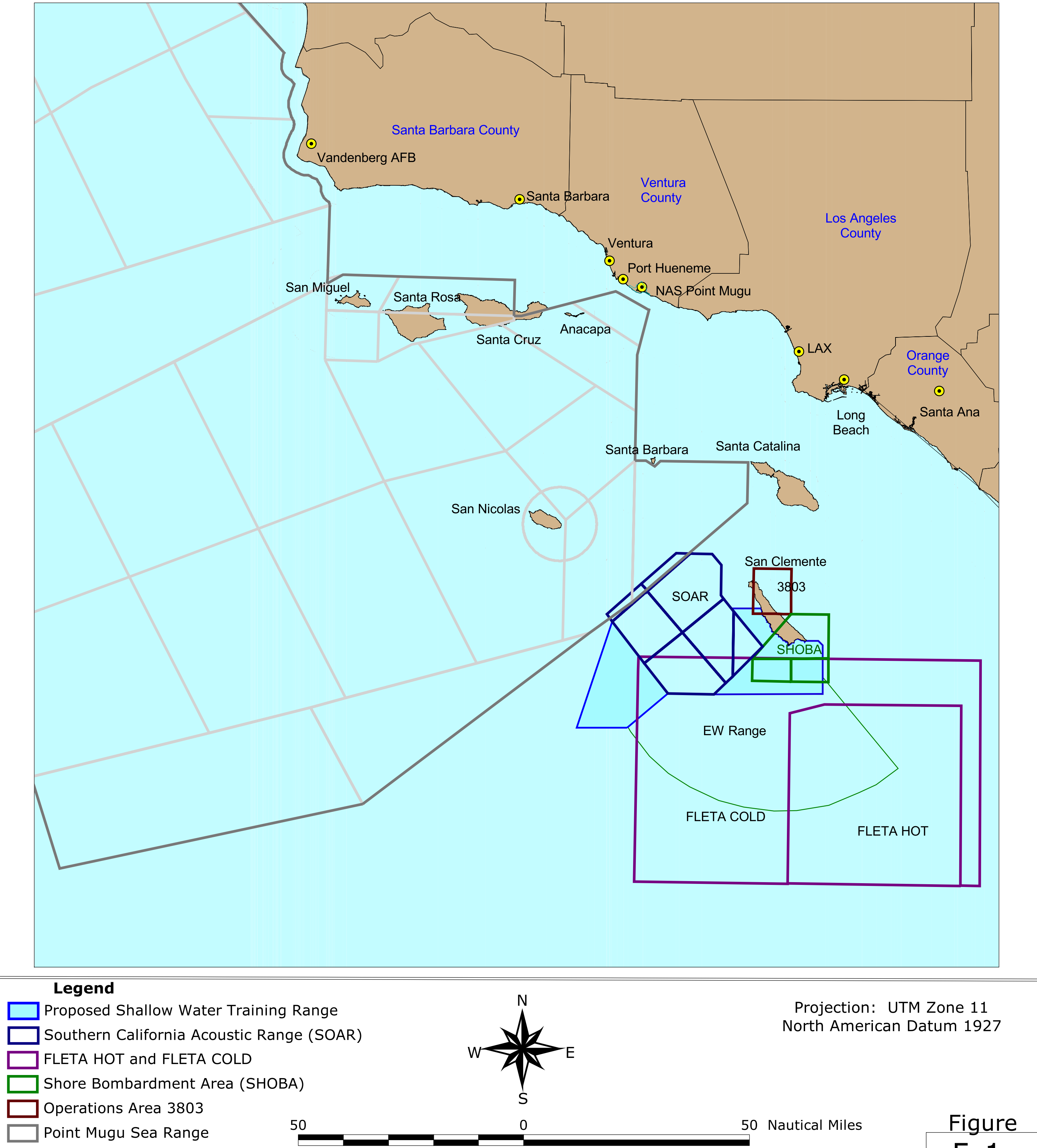

Figure 5-1

This integrated set of SCIRC ranges and operational areas cover approximately 2,620 NM^2 (8,990 km^2) and is located 50 NM (93 km) south of Long Beach. One of the main SCIRC components is the Southern California Anti-Submarine Warfare Range (SOAR), a portion of which overlaps the Point Mugu Sea Range. The purpose of the overlap is to provide increased training space for SOAR participants to use underwater instrumentation installed on the ocean floor. The overlap area is approximately 23 NM [43 km] long by 3 NM [6 km] wide and is the subject of a Memorandum of Agreement that specifies coordination in scheduling and operations between SCORE and the Point Mugu Sea Range. When scheduled, SCORE operations normally use the underwater space and the airspace from sea level up to an altitude of 5,000 feet. The area can be used by NAWCWPNS Point Mugu if needed. The larger operating areas of W-291, FLETA HOT, and FLETA COLD are also used by the Fleet but are not scheduled by SCORE, nor are they part of the SCIRC.

Currently, the operations that take place in the SCIRC include: undersea warfare (anti-submarine and mine countermeasures); mining exercises; missile firing; electronic warfare; shore bombardment; amphibious warfare; Naval Special Warfare; and non-combatant operations. About 2,700 operations are conducted per year. Since the primary purpose of the range complex is Fleet training, there is a wide variety of munitions used. They include about 400 torpedoes, 400 underwater targets, 8,000 sonobuoys, 600 mine shapes, 40-60 missiles with aerial targets, 700 artillery shells, 6,000 naval gun shells, 600 bombs, 40,000 cannon shells, over 1.6 million small arms rounds, and other assorted munitions.

The Navy is currently proposing to enhance the capabilities of the SCIRC to meet current and anticipated Fleet training and readiness needs. The Navy issued a Notice of Intent to prepare an EIS/OEIS on 17 August 1999. Public scoping meetings were held in Los Angeles, Orange, and San Diego counties in September 1999, and the EIS/OEIS is currently being prepared. Specific elements to enhance the SCIRC's capabilities include: instrumenting an existing shallow water area; increasing the number of participating personnel in amphibious operations and expanding the scope of these operations once per year to include a battalion-size landing (up to 1,500 Marines plus equipment); defining land Training Areas and Ranges for the Naval Special Warfare Command; increasing the frequency and intensity of training activities; determining the optimum configuration of land uses; and developing procedures for addressing endangered species, natural resources, and cultural resources that meet statutory obligations in a way that minimizes limitations on the use of SCIRC and sustains natural and cultural resources. If the proposed action is implemented, the number of training and test operations would increase by 500 to about 3,200 per year.

As described above, there is only minimal geographic overlap between the Point Mugu Sea Range and the SCIRC.

5.2.1.5 Tomahawk Testing and Training

NAWCWPNS Point Mugu proposes to use an existing underwater launch site near San Clemente Island and establish and use a new soft-landing missile recovery area at San Nicolas Island in support of continued testing of the Tomahawk Land Attack Missile (TLAM). An EA was previously prepared addressing the continued testing of TLAM within the parameters of established West Coast testing facilities that are currently used by the Tomahawk program. Subsequent to publication of the FONSI, the Navy identified the need to use an underwater launch facility and to establish a land-based missile recovery site in support of Tomahawk weapon system testing and training. The Navy is preparing an Addendum to the EA to address these activities.

An emergency termination area is used when an operational anomaly occurs that does not allow the missile to be flown safely to the designated landing site on the mainland. The proposed San Nicolas

Island recovery area would be used only when the missile is in full control and can be guided to ensure soft impact termination (i.e., parachute recovery). Proposed activities would include soft landing of a Tomahawk missile an average of once per year, associated chase aircraft overflights at the island, temporary closure of some roads on San Nicolas Island, retrieval of the missile, and transport back to the mainland. There is no geographic overlap between the proposed recovery area or underwater launcher and the activities addressed in this EIS/OEIS. None of the proposed facility modernizations would be located within this area.

5.2.1.6 Inert Ordnance Delivery Area at San Nicolas Island

NAWCWPNS Point Mugu has identified the need to establish an inert ordnance delivery area on San Nicolas Island. While the inert ordnance delivery area would typically be used in conjunction with Fleet training exercises (FLEETEXs), the area would also be used during joint task force exercises and for independent training activities. Ordnance used at the inert ordnance delivery area would be limited to MK-76 inert bombs, inert bomb delivery unit (BDU)-33s and -46s, and inert laser guided training rounds which would use a laser targeting system to identify the target(s). Ordnance would be delivered from Navy and Marine Corps fixed-wing aircraft (typically F-14s and F-18s). In addition, some training scenarios would include the use of helicopters (typically HH-60s). The proposed inert ordnance delivery area would be used approximately 10 times per year. There is no geographic overlap between the proposed recovery area or underwater launcher and the activities addressed in this EIS/OEIS. None of the proposed facility modernizations would be located within this area.

5.2.1.7 San Nicolas Island Supply Pier

The U.S. Navy (NAVAIR) has proposed to construct a Supply Pier at San Nicolas Island. Implementation of Military Construction (MILCON) Project P-250 would result in the establishment of a permanent pier structure and ancillary facilities (e.g., utilities, staging area, and administrative offices) at Daytona Beach. The San Nicolas Island Supply Pier would preclude the need for continuation of current barge landing operations at Daytona Beach, resulting in reduced human-marine mammal interaction, improved personnel safety conditions, and more reliable supply services at the island. Although temporary adverse impacts have been identified (e.g., habitat disruption during construction), measures that would reduce impacts to levels below significance thresholds would be implemented and no significant impacts would occur. Cumulatively, resources within the same ROI would be affected; however, proposed actions on San Nicolas Island assessed in this EIS/OEIS would occur at different times and would be geographically separate from activities associated with the proposed Supply Pier. Further, no significant, unmitigable impacts have been identified for either project.

5.2.1.8 E-2C Aircraft Parking Apron Extension at NAS Point Mugu

An EA is being prepared to analyze the potential impacts of a proposed aircraft parking apron extension at NAS Point Mugu. Implementation of the proposed action would provide sufficient parking for 12 E-2C aircraft that would result in increased aircraft longevity, maintenance efficiency, aircraft security, operational and maintenance safety, and combat readiness of the E-2C fleet. The following components are included as part of the proposed action: 1) demolition of existing concrete building slabs, one small concrete block building, and fences; 2) addition of 20,757 square yards (4.3 acres) of concrete to extend the aircraft parking apron; 3) placement of a culvert underneath the apron to replace an existing drainage ditch; 4) relocation of apron-to-taxiway lighting; and 5) installation of catch basins to control storm runoff. Following implementation of the proposed action, 12 E-2C aircraft could be parked in a single location directly in front of Hangar 553. The resulting apron extension would provide sufficient room for parking two rows of six aircraft each without their wings folded. The remaining four

E-2Cs plus an inoperable trainer would continue to be parked within Hangar 553. There is no geographic overlap between the proposed aircraft parking apron extension and activities addressed in this EIS/OEIS. The proposed facility modernization at NAS Point Mugu would not be within this area, and there would be no change to the frequency or type of aircraft operations at the airfield.

5.2.1.9 Range Operations Center Addition, NAS Point Mugu

Construction project P-031 includes a 29,740 square foot (2,763 square meter) two-story addition to the existing Range Operations Center (Building 53). The project also includes correction of structural and seismic deficiencies, removal of trailers, and installation of utilities and site improvements. A Categorical Exclusion Documentation Form (Catex Number 00-53) states that the proposed action has been found not to have a significant effect on the human environment individually or cumulatively (Construction Battalion Center [CBC] Environmental Division 2000).

5.2.2 Air Force Projects

5.2.2.1 Vandenberg Air Force Base Ongoing Operations

Vandenberg Air Force Base (VAFB) occupies approximately 98,400 acres (39,822 ha) on the south-central coast of California, about 50 miles (80 km) northwest of Santa Barbara (refer to Figure 1-2). As headquarters for the 30th Space Wing, the Air Force's primary missions at VAFB are to launch and track satellites in space and test and evaluate strategic intercontinental ballistic missile (ICBM) systems. VAFB activities have the potential to affect other areas due to flight paths and trajectories of test vehicles and launches. Since the launch operations do not occur within the ROI of the proposed action and alternatives addressed in this EIS/OEIS, there would be no cumulative contribution to effects on the Point Mugu Sea Range from VAFB launches.

The 30th Space Wing conducts west coast space and missile launch operations using a variety of launch vehicles, including the Minuteman III, Peacekeeper, Titan II, and Titan IV (for comparison purposes, a launch vehicle typically used at VAFB, the Minuteman III, is approximately 50 feet [15 m] tall, more than 20 feet [6 m] taller than the Vandal target used on the Point Mugu Sea Range). To achieve a polar launch (i.e., which would place the launch vehicle into a polar orbit), a southerly launch trajectory is required. To achieve an equatorial launch, a western launch is required. Since these missiles affect the scheduling of other operations on the Sea Range, NAWCWPNS Point Mugu provides tracking support, back-up command destruct capabilities, and scheduling support for all west-bound launches. The VAFB missiles are normally long-range ballistic missiles whose flight paths pass above airspace typically used for Sea Range operations. Since these missile operations occur in airspace exclusively at high altitudes (above 100,000 feet [30,500 m]) and do not impact the Sea Range, there are no cumulative impacts with current Sea Range operations. In consideration of the proposed accommodation of Theater Missile Defense (TMD) testing and training, since NAWCWPNS Point Mugu has the scheduling authority for both those VAFB launch operations that affect Sea Range airspace within the warning areas and also for the TMD events, operations would always be scheduled to assure no overlap in time or airspace.

5.2.2.2 Proposed Evolved Expendable Launch Vehicle Program, Vandenberg Air Force Base

Currently, VAFB launches a variety of launch vehicles from a number of launch sites. The U.S. Air Force (USAF) is considering participation in the continued development and deployment of Evolved Expendable Launch Vehicle (EELV) systems to replace current Atlas IIA, Delta II, Titan II, and Titan IVB launch systems. An EIS has been prepared to address this proposal. The proposed action would not represent a noticeable change from current and past VAFB activities; proposed EELV launches would be conducted at the same azimuth altitudes as are typical of VAFB operations. The changes are site-specific to the installation itself. Since effects of the EELV program would not occur in the same ROI as the proposed action and alternatives identified in this EIS/OEIS, there would be no cumulative contribution to effects on the Point Mugu Sea Range.

5.2.2.3 F-22 Low-Level Supersonic Over-Water Testing

The USAF proposes to test the F-22's ability to perform low-level flight maneuvers at supersonic speeds and to determine what, if any, maintenance concerns result from testing in an ocean environment. The proposed action is to conduct up to an average of 24 low-level supersonic sorties per year over open ocean areas within the Point Mugu Sea Range and in adjacent airspace off the coast of California. Flight tests would involve use of one F-22 aircraft, an F-15 or F-16 as a chase aircraft, and tanker aircraft for aerial refueling. The USAF prepared an EA to address potential impacts of the proposed action (USAF 2000). A FONSI was signed on 2 February 2000 stating that noise from these activities would not have significant impacts to marine mammals or other animals because noise levels would be within the range of those produced by existing aircraft using the Point Mugu Sea Range. The FONSI also stated that cumulative impacts of this action on the Sea Range would not be significant because the F-22 overflights would not result in a perceptible increase in noise levels on the range.

5.2.3 Other Projects

5.2.3.1 California State University Channel Islands Campus at Camarillo

The California State University (CSU) recently initiated the reuse of the former California State Development Hospital facilities in Camarillo as a new university campus in Ventura County (CSU Channel Islands). The CSU has relocated the Ventura Off-Campus Center from the City of Ventura to the former hospital and plans to eventually develop a 15,000 full-time equivalent student university campus. Currently, the 634-acre site contains approximately 1.6 million total gross square feet (gsf) of developed structures. At full build-out, proposed uses of the site include a public elementary school, day-care center, academic enhancement center, research/office space (340,000 gsf), food service, university support space, and recreational facilities. Student housing within the existing main campus buildings will serve up to 1,000 students, while 900 residential units will be developed within the project site. Reuse of the hospital for the Ventura Off-Campus Center with 1,500 full-time equivalent students began in summer of 1999, with expansion to 3,250 full-time equivalent students expected within 8 years. This initial phase involves the renovation of 12 buildings. It is anticipated that full build-out into a 4-year university serving 15,000 students and approximately 1,500 faculty and staff would occur after 2025.

The proposed action examined in this EIS/OEIS primarily involves activities on the Sea Range. No increase of personnel and no construction would occur at NAS Point Mugu. There is only minimal geographic overlap between environmental issues associated with the CSU and the proposed action addressed in this EIS/OEIS.

5.2.3.2 Construction Projects within the ROI

A variety of construction projects are proposed in Ventura County in the vicinity of NAS Point Mugu, as well as some minor construction projects directly on the base. These include renovation projects, residential projects, mixed use proposals for industrial, institutional, commercial, retail, educational, and residential uses, and one 18-hole public golf course at Camarillo Springs Regional Park. The proposed action primarily involves activities on the Sea Range, well offshore. Proposed construction projects at

NAS Point Mugu would not affect the facilities supporting Sea Range operations. There is only minimal geographic overlap between environmental issues associated with the Ventura County construction projects and the proposed actions addressed in this EIS/OEIS.

5.2.3.3 Hyper-X Research Vehicle Program

The National Aeronautics and Space Administration (NASA) proposed preflight preparation and test flight activities associated with the Hyper-X research vehicle program. The Hyper-X Research Vehicle is planned as a Mach-10 aircraft (i.e., an aircraft that can fly at speeds up to 10 times faster than the speed of sound). It could be used either for global-reach travel or to provide access to space vehicles. The proposed action would involve all facets of the Hyper-X program, including manufacturing, delivery, and wind tunnel testing. The portions of the program proposed for the Sea Range include B-52 taxi and captive carry flight tests, research vehicle booster release and splashdown, research vehicle free flight, and research vehicle splashdown. NASA prepared an EA to address potential impacts of the proposed action (NASA 1999). A FONSI was signed on 13 September 1999 stating that these activities would not individually or cumulatively have significant impacts to the environment in the Point Mugu Sea Range.

5.2.3.4 Shipping Channel Relocation

A proposal has been initiated to relocate the Southern California Shipping Channel 25 miles (40 km) south of its current location. This proposal is one aspect of several emission control strategies identified in Measure (M13) of the 1994 California Ozone State Implementation Plan (1994 SIP) to reduce emissions from ocean-going marine vessels and harbor vessels, not including those used for recreational activities.

The 1994 SIP identified M13 emission reductions as a "federal assignment" with U.S. Environmental Protection Agency (USEPA), International Maritime Organization (IMO), and U.S. Coast Guard as the responsible agencies. The 1994 SIP identified three potential emission reduction measures for M13: 1) IMO standards for new engines; 2) commercial ship traffic control measures, listing both relocating the Southern California Shipping Channel and reducing vessel speed; and 3) new engine standards for the Captive Fleet. The 1994 SIP M13 called for approximately 30 percent emissions reductions from 1990 levels by the year 2010.

Since November 1996, USEPA has periodically held "stakeholder" meetings to attempt to identify control measures by consensus. No formal decisions on these issues have been made. Various critical studies are currently underway analyzing the validity of the emission reduction claim from the proposed relocation and other measures. These studies include the Southern California Ozone Transport Study which is analyzing ozone transport pollution within the Southern California Bight and a Tracer Study which is analyzing emission transport from existing and proposed locations for the shipping channel. Preliminary Navy analysis indicates that a relocated ship channel would at best have a minor emission reduction (at the expense of other downwind onshore areas) and at worst may increase emissions into the South Coast Air Basin. The emission increase would be due in part to the approximately 20 NM (37 km) increase in transit distances created by the relocated channel.

The California Air Resources Board has created a technical working group to specifically analyze the speed reduction measure. Initial analysis indicates such a speed reduction measure would have substantial reductions in pollution. These reductions exceed those claimed in the 1994 SIP for the relocated shipping channel. Given this current status, the proposed relocation of the Southern California Shipping Channel is speculative and, therefore, is not yet reasonably foreseeable.

5.2.3.5 Channel Islands National Marine Sanctuary

Managed by the National Oceanic and Atmospheric Administration (NOAA), the Channel Islands National Marine Sanctuary (CINMS) is located 25 miles (40 km) off the coast of Santa Barbara. It encompasses 1,252 NM^2 (4,294 km^2) surrounding the five northern Channel Islands. Sanctuary boundaries extend from mean high tide to 6 NM (11 km) offshore surrounding Anacapa, Santa Cruz, Santa Rosa, San Miguel, and Santa Barbara islands. The CINMS was established in 1980 in accordance with Title III of the Marine Protection, Research, and Sanctuaries Act of 1972. The main objectives of the Sanctuary are to protect biological, cultural, and historical resources. A management plan for the Sanctuary was completed and went into effect in 1982. This plan is currently being revised and an EIS is being prepared to analyze potential environmental impacts of the revised management plan. The draft EIS and management plan have not yet been published; it is therefore difficult to determine what changes to the Sanctuary may occur and the impacts of such changes upon proposed activities addressed in this EIS/OEIS. Several boundary concepts have been proposed that include significant expansion of the Sanctuary into the Sea Range. None of the proposed activities addressed in this EIS/OEIS would be located within existing CINMS boundaries. However, several of the boundary expansion concepts being considered would encompass proposed activities addressed in this EIS/OEIS. Expansion could have an impact on Sea Range activities, particularly if Sanctuary regulations related to military activities are changed to limit existing or proposed activities.

5.2.3.6 Minerals Management Service Exploratory Drilling

The Minerals Management Service (MMS) has proposed to conduct exploratory drilling in federal waters offshore Santa Barbara County and is preparing an EIS to evaluate the potential environmental impacts of their proposed drilling projects. The projects include sequential drilling of 5 to 8 delineation wells from a single mobile offshore drilling unit on existing leases in federal Outer Continental Shelf waters in the Santa Maria Basin and western Santa Barbara Channel. The purpose of the drilling is to further delineate oil and gas resources on leases or units that have previous commercial discoveries of oil and gas. In addition to addressing potential cumulative impacts from other activities in the area, the EIS will include a discussion of the potential impacts of the buildout of production facilities. All platform proposals would be subject to full environmental review, and the earliest any platform would be installed is 2006. The exploratory drilling Draft EIS is scheduled for completion in summer of 2001.

Although the proposed Santa Barbara Channel exploratory drilling area is located north of the northern Channel Islands and outside Point Mugu Sea Range boundaries, the delineation wells proposed for the Santa Maria Basin are located within the Sea Range, in the vicinity of range areas M1 and M2 (refer to Figure 1-2). It is expected that MMS's Draft EIS will address the potential for cumulative impacts from their proposed drilling activities in combination with Navy Sea Range operations; however, cumulative impacts are unlikely given the very different nature of activities involved. In addition, offshore oil and gas platforms currently exist within Sea Range boundaries and specific safety procedures ensure that non-participants, including oil and gas platforms, are not endangered by Navy activities. Therefore, potential cumulative impacts would be less than significant.

5.2.3.7 Marine Vessel Noise

In addition to the specific projects and activities examined with respect to the potential for cumulative impacts, this chapter includes a discussion of potential impacts on marine mammals resulting from additional ship noise. Since concerns about the potential effects of noise in the ocean have increased in recent years, the following discussion addresses the potential for additive noise effects resulting from additional Navy operations associated with the proposed action.

Navy vessels account for only about 9 percent of the vessel traffic on the Sea Range (refer to Appendix D). The Sea Range is open to commercial and private vessel traffic and is widely used by non-Navy vessels. There is no evidence that occasional ship and boat traffic causes biologically significant disturbance to pinnipeds or dolphins in open water (Richardson et al. 1995a). Harbor porpoises often show local avoidance of vessels, but harbor porpoises are mainly confined to nearshore waters inshore of the northern part of the Sea Range where Navy vessel traffic is infrequent. Dolphins frequently *approach* ships to ride the bow wave. Therefore, cumulative impacts of disturbance from ships and boats on pinnipeds and dolphins would be less than significant.

However, ships in the Sea Range (including those that are part of proposed Navy activities) produce sufficient underwater noise to cause short-term changes in baleen whale and sperm whale behavior, and localized displacement of these whales, if the ships approach the whales. Reactions are most pronounced if the ships are moving rapidly and either directly toward the whales or with variable course and speed (Richardson et al. 1995a). These whales may react to multiple vessels working in the same area at longer distances than they would react to a single vessel (Koski and Johnson 1987; Richardson et al. 1995a). Individually identifiable bowhead whales (a baleen whale species) displaced from a feeding area by vessel disturbance have been observed to return and resume feeding within 1 day (Richardson 1987; Richardson and Malme 1993). Also, baleen and sperm whales often show little reaction to ships or boats if the vessel is moving slowly at constant speed on a constant course. While on the Sea Range, Navy vessels and larger commercial vessels spend only a minority of their time traveling at high speed and/or on variable courses, and do not normally continue to operate at the same location for longer than the time required to transit through that area. Therefore, sperm whales and baleen whales, such as the blue or fin whales that occur west of San Nicolas Island in summer (refer to Section 3.7.2.2), may sometimes be displaced temporarily by approaching vessels, but these whales are not likely to be deterred from any one area for more than 1 to 2 days. The number of baleen or sperm whales that may be affected is highly variable, but any disturbance is temporary and is not considered biologically significant. Therefore, cumulative impacts of disturbance to baleen whales and sperm whales by commercial vessels and Navy ships and boats operating on the Sea Range would be less than significant.

5.3 CUMULATIVE IMPACTS

This section addresses the additive effects of the Preferred Alternative in combination with the projects identified in Section 5.2. No significant impacts have been identified for the Preferred Alternative in this EIS/OEIS. Since environmental analyses for many of these projects are not complete and quantitative data are not available, cumulative impacts have been addressed qualitatively and are described below.

5.3.1 NAS Point Mugu

Specific components of the Preferred Alternative at NAS Point Mugu are geographically separate from the other projects on base (VR-55 Reserve Squadron, Aircraft Apron Extension, and the Range Operations Center Addition). Only one project (VR-55 Reserve Squadron) would involve aircraft operations, but any increase would be negligible with respect to the total number of aircraft operations currently conducted at the airfield. For these reasons, cumulative impacts at NAS Point Mugu would not be significant.

5.3.2 San Nicolas Island

Cumulative projects planned for San Nicolas Island include Tomahawk Testing and Training, Inert Ordnance Delivery, and Supply Pier construction. Activities associated with these projects would be focused on the mesa south of the airfield and at Daytona Beach, all on the eastern portion of the island. Geographic overlap with the Preferred Alternative is minimal because construction activities associated with the Facility Modernization Element would occur on the western portion of the island. Missile and aircraft overflights associated with the Preferred Alternative (Nearshore Intercept) would occur about eight times per year along the northern and southern shorelines of the island, which would partially overlap with planned overflights for the Tomahawk Testing and Training and the Inert Ordnance Delivery. However, Tomahawk Testing and Training would occur an average of only once per year and would not affect the overall noise environment. Overflights associated with Inert Ordnance Delivery would occur about 10 times per year, but these overflights would not occur at low altitudes and are not anticipated to result in noticeable increases to average noise levels at the island. For these reasons, cumulative impacts at San Nicolas Island would not be significant.

5.3.3 Point Mugu Sea Range

There is only minimal geographic overlap between the Point Mugu Sea Range and the SCIRC (a portion of the SOAR overlaps a small portion of the Sea Range). An EIS/OEIS is currently in progress that will address potential environmental impacts at the SCIRC. None of the alternatives addressed in this EIS/OEIS include new activities at San Miguel, Santa Rosa, or Santa Cruz islands, nor would any of the proposed activities occur within CINMS boundaries. None of the other projects identified in Section 5.2 would result in increased ordnance activities on the Sea Range, although some would involve aircraft overflights and some increased vessel activity. Projects involving geographic overlap with the Sea Range include Tomahawk Testing and Training, Inert Ordnance Delivery, VAFB Ongoing Operations, EELV, F-22 Low-Level Supersonic Over-Water Testing, Hyper-X Research Vehicle Program, MMS Exploratory Drilling, and the Shipping Channel Relocation. VAFB Ongoing Operations and EELV occur at very high altitudes and would not contribute to cumulative impacts. The F-22 and Hyper-X activities have received FONSIs stating that they would not individually or cumulatively contribute to impacts on the Sea Range. Overflights associated with Tomahawk Testing and Training and with Inert Ordnance Delivery would occur collectively about 11 times per year in the vicinity of San Nicolas Island. However, these overflights would not occur at low altitudes and are not anticipated to result in noticeable increases to average noise levels at the island. Potential cumulative impacts from MMS's proposal to conduct exploratory drilling would be less than significant due to the differing nature of activities involved and established Sea Range safety procedures. The Shipping Channel Relocation is speculative and, therefore, is not yet reasonably foreseeable. For these reasons, cumulative impacts on the Sea Range would not be significant.

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CHAPTER 6
OTHER CONSIDERATIONS REQUIRED BY NEPA

6.1 POSSIBLE CONFLICTS BETWEEN THE ACTION AND THE OBJECTIVES OF FEDERAL, REGIONAL, STATE , AND LOCAL PLANS, POLICIES, AND CONTROLS

Based on evaluation of the action with respect to consistency with land use guidelines for the area surrounding and including the Naval Air Warfare Center Weapons Division (NAWCWPNS) Point Mugu Sea Range and Naval Air Station (NAS) Point Mugu, the action does not conflict with the objectives of federal, regional, state, and local land use plans, policies, and controls. Table 6-1 provides a summary of environmental compliance for the proposed action.

Table 6-1. Possible Conflicts Between the Action and the Objectives of Federal, State, and Local Land Use Plans, Policies, and Controls

Plans, Policies, and Controls	Responsible Agency	Status of Compliance
National Environmental Policy Act (NEPA) (42 United States Code [U.S.C.] § 4321 et seq.) Department of the Navy Procedures for Implementing NEPA (32 Code of Federal Regulations [C.F.R.] 775)	Navy	This Environmental Impact Statement (EIS)/ Overseas EIS (OEIS) has been prepared in accordance with the Council on Environmental Quality (CEQ) Regulations implementing NEPA and Navy NEPA procedures. The preparation of this EIS/OEIS and the provision for its public review are being conducted in compliance with NEPA.
Executive Order (EO) 12114, Environmental Effects Abroad of Major Federal Actions	Navy	EO 12114 requires environmental consideration for actions that may affect the environment outside U.S. Territorial Waters. This EIS/OEIS satisfies the requirements of EO 12114.
Coastal Zone Management Act (CZMA) (16 C.F.R. § 1451 et seq.) California Coastal Act (14 California Code of Regulations [C.C.R.])	California Coastal Commission	The Navy has determined that the proposed action would be consistent to the maximum extent practicable with the enforceable policies of the California Coastal Act and has completed a Coastal Consistency Determination (CCD) in accordance with the CZMA.
Clean Water Act section 401/402 (§§ 401-402, 33 U.S.C. § 1251 et seq.), section 404 (§ 404, 33 U.S.C. § 1251 et seq.) Rivers and Harbors Act (33 U.S.C. § 401 et seq.)	U.S. Environmental Protection Agency (USEPA) / U.S. Army Corps of Engineers (USACE) USACE	The proposed action would not discharge dredged or fill material. Weapons system test and training components would result in contaminant concentrations within applicable saltwater regulatory standards. Therefore, neither a Section 401, 402, or 404 (b) (1) permit in compliance with the Clean Water Act nor a Section 10 permit in compliance with the River and Harbors Act is required.
Clean Air Act (CAA), as amended (42 U.S.C. § 7401 et seq.)	USEPA	Per CAA regulations, the proposed action would not compromise air quality attainment status in California or conflict with attainment and maintenance goals established in its State Implementation Plan (SIP). Therefore, a CAA conformity determination is not required.
EO 11990, Protection of Wetlands (U.S.C. §§ 1221-1226)	Navy	The proposed action would not have a significant impact on wetlands.

Table 6-1. Possible Conflicts Between the Action and the Objectives of Federal, State, and Local Land Use Plans, Policies, and Controls (continued)

Plans, Policies, and Controls	Responsible Agency	Status of Compliance
Endangered Species Act (16 U.S.C. § 1531)	U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS)	The Navy concluded formal Section 7 consultation with the USFWS in January of 1999 for all activities that may affect federally listed species under USFWS jurisdiction located at NAS Point Mugu. The USFWS issued the No Jeopardy Final Programmatic Biological Opinion in June 2001. The Programmatic BO includes all activities addressed in this EIS/OEIS. The Navy concluded a separate formal Section 7 consultation in December 2000 with the USFWS for all activities with may affect federally listed species under USFWS jurisdiction located at San Nicolas Island. The USFWS issued the No Jeopardy Final Programmatic Biological Opinion in October 2001. The programmatic BO includes all activities addressed in this EIS/OEIS. The Navy initiated informal Section 7 consultation during May of 2001 with NMFS for all activities on the Sea Range addressed in this EIS/OEIS. The consultation concluded in January of 2002 with NMFS concurring with the Navy's conclusion that all current and proposed activities will not adversely affect federally listed species.
Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §§ 1801-1802)	NMFS	The Navy has determined that the proposed action would not adversely affect Essential Fish Habitat; NMFS has concurred with this determination. Therefore, formal consultation with NMFS is not required.
Marine Mammal Protection Act (MMPA) (16 U.S.C. §1431 et seq.)	NMFS	The Navy coordinated with NMFS regarding MMPA permitting issues and applied for and received Incidental Harassment Authorization for launch activities on San Nicolas Island (refer to Appendix E).
EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (Executive Order 12898, 59 Federal Register 7629 [Section 1-101])	Navy	Minority or low-income populations would not be disproportionately affected by the proposed action.
EO 13045, Protection of Children from Environmental Health Risks and Safety Risks (Executive Order 13045, 62 Federal Register 1985)	Navy	The proposed action would not disproportionately expose children to environmental health risks or safety risks.
National Historic Preservation Act (NHPA) (§ 106, 16 U.S.C. 470 et seq.)	Navy	The proposed action would not involve effects on National Register or eligible properties.
EO 13089, Coral Reef Protection (Executive Order 13089, 63 Federal Register 115)	Navy	The proposed action would not affect any coral reef ecosystem.

Table 6-1. Possible Conflicts Between the Action and the Objectives of Federal, State, and Local Land Use Plans, Policies, and Controls (continued)

Plans, Policies, and Controls	Responsible Agency	Status of Compliance
California Coastal National Monument Designation (Presidential Proclamation, January 11, 2000)	Bureau of Land Management (BLM), with management by California Department of Fish and Game	The proclamation designates lands above water in an area on the California coast from mean high tide to a distance of 12 NM in Territorial Waters. San Nicolas Island and the other Channel Islands within the Sea Range are located outside of this designation.
National Marine Sanctuaries Act (16 U.S.C. 1431 et seq.)	National Oceanic and Atmospheric Administration (NOAA)	Aside from aircraft and vessel traffic transiting the area, none of the Navy's proposed activities would take place within the Channel Islands National Marine Sanctuary (CINMS). All Navy Sea Range test and training activities are consistent with CINMS regulations (15 C.F.R. 920.70).
EO 13158, Marine Protected Areas (Executive Order 13158, 65 Federal Register 105)	Navy	"Marine Protected Areas" (MPAs) have not yet been officially designated under EO 13158.
EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds (Executive Order 13186, 66 Federal Register 11)	Navy	The proposed action would not have a measurable negative effect on migratory bird populations.

6.2 ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL OF THE PROPOSED ACTION AND ALTERNATIVES

The proposed action includes Theater Missile Defense, Training, and Facility Modernization elements that would be implemented at the Point Mugu Sea Range, NAS Point Mugu, and San Nicolas Island. Energy required to successfully implement the proposed action would include fossil fuels and electricity needed to power aircraft, missiles, targets, vehicles, vessels, and equipment. Fuels for Navy and contractor vehicles and vessels are currently available and are in adequate supply from Navy-owned sources or from area commercial distributors. Required electricity demands would be supplied by the existing electrical service at NAS Point Mugu and San Nicolas Island or by generators.

Proposed new construction would comply with local and state codes which are designed to promote energy efficiency, water conservation, and the use of renewable energy sources. Facilities to be constructed would be designed with energy-efficient heating and cooling systems.

Direct energy requirements of the proposed action are limited to those necessary to operate vehicles, vessels, and equipment. No superfluous use of energy related to the proposed action has been identified, and proposed energy uses have been minimized to the maximum extent possible without compromising the integrity of the testing, training, and facility modernization activities. Therefore, no additional conservation measures related to direct energy consumption by the proposed action are identified.

6.3 IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT OF RESOURCES

NEPA (42 U.S.C. § 4321 et seq.) requires an analysis of irreversible and irretrievable effects. Resources that are irreversibly or irretrievably committed to a project are those that are used on a long-term or permanent basis. This includes the use of nonrenewable resources such as metal, fuel, and other natural or cultural resources. Human labor is also considered a nonrenewable resource. These resources are nonrenewable or irretrievable because they would be used for the proposed action when they could have been used for other purposes. Another issue that falls under the category of the irreversible and irretrievable commitment of resources is the unavoidable destruction of natural resources, which could limit the range of potential uses of that particular environment.

The proposed action would constitute an irreversible or irretrievable commitment of nonrenewable or depletable resources for the materials and energy expended during implementation of the Theater Missile Defense, Training, and Facility Modernization elements. The proposed testing and training could be accommodated by use of existing equipment and infrastructure at NAS Point Mugu and San Nicolas Island. However, proposed construction and renovation projects are relatively minor and would not significantly affect supplies of nonrenewable or depletable resources.

In addition, the Navy applies an active Pollution Prevention Program to all aspects of its activities. It is Navy policy to conduct its programs to reduce to the maximum extent possible the quantity of toxic chemicals entering the environment. Pollution prevention is not pollution control but a comprehensive set of practices which results in a reduced volume of wastes to be dealt with or transferred to the environment.

Implementation of the proposed action would not result in the destruction of environmental resources such that the range of potential uses of the environment would be limited. The proposed action would not adversely affect the biodiversity or cultural integrity of the Point Mugu Sea Range, Point Mugu, or San Nicolas Island marine, terrestrial, or human environment. Therefore, although the proposed action would require the use of nonrenewable and depletable resources, the Navy would attempt to minimize the irreversible or irretrievable commitment of resources associated with the proposed action.

6.4 RELATIONSHIP BETWEEN SHORT-TERM ENVIRONMENTAL IMPACTS AND LONG-TERM PRODUCTIVITY

NEPA requires an analysis of the relationship between a project's short-term impacts on the environment and the effects that these impacts may have on the maintenance and enhancement of the long-term productivity of the affected environment. Impacts that narrow the range of beneficial uses of the environment are of particular concern. This refers to the possibility that choosing one development option reduces future flexibility in pursuing other options, or that giving over a parcel of land or other resource to a certain use often eliminates the possibility of other uses being performed at that site.

Implementing the Theater Missile Defense, Training, and Facility Modernization elements of the proposed action would involve the additional use of vehicles, vessels, and equipment which are currently used for other purposes. The majority of the activities addressed in this EIS/OEIS would be categorized as long-term. For example, although the use of the target areas may be of short duration, the target areas would receive increased and repeated use. The same is true of the use of the airspace of the Point Mugu Sea Range and the proposed extended use of the facilities at NAS Point Mugu and San Nicolas Island. Short-term construction activities would result in new and renovated facilities.

The proposed Theater Missile Defense, Training, and Facility Modernization elements would result in both short-term environmental effects and long-term productivity. Short-term effects would be primarily related to construction activities and individual testing and training events which would include air emissions, noise, increases in air and vessel traffic, and an increase in the amount of weapons testing and training debris entering the Sea Range. From the long-term perspective, increased use of the Point Mugu

Sea Range, NAS Point Mugu, and San Nicolas Island would increase the productivity of NAWCWPNS Point Mugu. This would meet the established NAWCWPNS Point Mugu mission to conduct state-of-the-art weapons system testing and evaluation and provide a realistic training environment. The proposed action would also meet the long-term goal of allowing the Navy to successfully meet current and future defense requirements. The proposed action would not be expected to result in any impacts that would reduce environmental productivity, permanently narrow the range of beneficial uses of the environment, or pose long-term risks to health, safety or the general welfare of the public.

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CHAPTER 7
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CHAPTER 10
GLOSSARY AND INDEX

10.1 GLOSSARY

Table 10-1 presents definitions of operational terms used to describe current and proposed activities on the Point Mugu Sea Range. Table 10-2 presents a list of factors for converting English and metric units.

Table 10-1. Glossary of Terms

Term	Definition
AEGIS	Total weapons system aboard destroyers and cruisers that includes fire control system, radar, and ordnance (e.g., missiles).
Aircraft operation	A single takeoff, landing, or overhead pattern (a "sortie" would count as two or more aircraft operations).
Ballistic	The unpowered phase of a missile flight, goes into an arc (parabola).
Boost Phase	Powered ascent period of missile flight.
Booster	Short duration rocket booster used to launch a missile or target and get it up to speed before the regular jet engine can sustain flight.
Canceled Operation	An operation in which the scheduled activity is terminated at least 2 hours prior to the launching of the test article.
Captive-carry	Carrying inert missiles equipped with telemetry devices on an airplane during sortie to simulate carrying and firing live ordnance.
Chaff	Thin strips of metallic foil-like material which are dropped from aircraft and ship to confuse or passively jam enemy radar, enabling friendly aircraft to avoid detection.
Completed Operation	An operation that is scheduled and executed on the Sea Range.
Cruise Missile Defense	Defense of a point target (e.g., ship) against cruise missiles.
DC-130	C-130 aircraft specially configured to launch aerial targets.
Drone	Unmanned aerial vehicle.
Event	A surface vessel leaving port, accomplishing its assigned mission (e.g., testing activities or training exercises, and returning to port.
Flares	Flares used on the Sea Range are of two types. Defensive flares are ejected from aircraft in order to confuse heat-seeking missiles. Illumination flares are dropped from aircraft and descend to the surface by parachute, providing surface illumination during the night.
Fleet Exercise (or FLEETEX)	A coordinated, multi-ship exercise designed around particular training events and scenarios. The objective of a FLEETEX is to conduct realistic Fleet operations with minimal operational constraints consistent with the safety of participants and non-participants.
Hazard area	See "safety hazard pattern."
Hulk	A stripped-down, environmentally cleaned, ex-Navy destroyer or other vessel used as a surface target.
Impact area	The predetermined area where a missile will strike the surface (ground or water). This area will always be inside the safety hazard pattern.
Knot	Unit of measurement indicating speed of an aircraft, missile, or ocean vessel in nautical miles per hour.
Launch Operation	An operation involving a vehicle or device (target or missile) which departs from a launch site (e.g., BQM-34 launched from land on San Nicolas Island) or another vehicle (QF-4, F/A-18, F-14, or DC-130).
Littoral Warfare	Naval operations in coastal waters or the littoral area, commonly defined as that from 600 feet deep toward the shore.

Term	Definition
Live fire	Type of test or training using real ordnance or munitions.
Lower Tier	Lower altitude (inside of atmosphere) descent period of missile flight.
Mach	Ratio between speed (aircraft, missile, or target) and sound at a given altitude.
Missile	A projectile weapon that is fired or otherwise propelled toward a target. Missiles can be "live" (carrying ordnance) or "inert" (without ordnance).
Operation	A test or training activity (e.g., test and evaluation of a Phoenix missile versus an AQM-37 target) that is scheduled on the Sea Range. An operation can involve as few as one aircraft or ship. An operation can also involve numerous aircraft or ships in a coordinated testing and training event and still be considered a single operation.
Ordnance	Explosive weapons or munitions.
Platform	Location from which a missile, target, or other test item is launched. A platform can be airborne (aircraft), surface (ship), or subsurface (submarine).
Restricted Area	Special Use Airspace within which aircraft operations are subject to restrictions regarding lateral boundaries, flight altitudes, and hours of operation.
Safety hazard pattern	Surface area that could be endangered by a missile if it does not follow its prescribed flight path.
Scrubbed Operation	An operation removed from the daily schedule within 2 hours of the scheduled launch of a target, missile, or other test article. Supporting aircraft or ships may have launched in advance of the launch of the test article. In this event, those assets would be recalled since the test or event could not be completed successfully.
Sea State	Sea State is a measurement of wind and wave conditions. It is expressed in an International Scale of 0 to 12, with 0 being the calmest conditions and 12 representing the most severe.
SEPTAR	Remotely controlled powered boats for use as surface targets.
Sortie	The complete flight of a single aircraft (i.e., one take-off, one or more "aircraft operations," and a final landing).
Special Use Airspace	Airspace within which specific activities must be confined, or wherein limitations are imposed on aircraft not participating in those activities.
Support Operation	Any effort not specified as a Launch Operation is categorized as a Support Operation.
Target	Item used for test and evaluation of munitions (e.g., missiles, bombs, or rockets). Targets can be surface (e.g., hulks) or airborne (e.g., missiles and QF-4 aircraft).
Telemetry	Electronic data transfer. Telemetry can include video (photo-optical), audio, or other data transmission.
Torpedo	Munitions launched against surface or subsurface targets. Torpedoes can be launched from the air, surface, or subsurface.
Theater Missile Defense (TMD)	An integrated program intended to protect U.S. forces and allies against the threat of short- and medium-range missiles. TMD testing may involve Boost Phase Intercept Testing, Upper Tier Testing, Lower Tier Testing, and Cruise Missile Defense.
Upper Tier	High-altitude (outside of atmosphere) period of missile flight.
Warning Area	Designated airspace for military activities that are in international airspace. When Warning Areas are in use, controlling agencies must issue a notice-to-airmen (NOTAM) to stay clear of the area; however, flights by non-participating aircraft are not prohibited.

Table 10-2. Unit Conversion Matrix for English and Metric Units of Measure

Type of Measure	English Unit	Metric Unit	English → Metric, Multiply by:	Metric → English, Multiply by:
Distance	inches	centimeters	2.54	0.39
	feet	meters	0.30	3.28
	yards	meters	0.91	1.09
	miles	miles/kilometers	1.61	0.62
	nautical miles	kilometers	1.85	0.54
Area	square inches	square centimeters	6.45	0.16
	square feet	square meters	0.09	10.76
	square yards	square meters	0.84	1.20
	square miles	square kilometers	2.59	0.39
	square nautical miles	square kilometers	3.43	0.29
	acres	hectares	0.40	2.47
Volume	cubic inches	cubic centimeters	16.39	0.06
	cubic feet	cubic meters	0.03	35.31
	cubic yards	cubic meters	0.76	1.31
	fluid ounces	milliliters	29.60	0.03
	quarts	liters	1.06	0.94
	gallons	liters	3.80	0.26
	acre-feet	hectare-meter	0.12	8.11
	acre-feet	cubic meters	1233.48	0.00
Mass	ounces	grams	28.35	0.04
	pounds	kilograms	0.45	2.20
	tons	metric tons	0.91	1.10
	tons	kilograms	907.20	0.00
Density (mass/area)	ounces per square foot	grams per square meter	305.49	0.0033
	pounds per square mile	kilograms per square kilometer	0.17	5.76
	pounds per square nautical mile	kilograms per square kilometer	0.13	7.62
(mass/volume)	pounds per cubic foot	kilograms per cubic meter	16.03	0.06
(mass/mass)	ounces per pound	milligrams per kilogram	62,500	0.000016
Temperature	° Fahrenheit	° Celsius	°C = (5/9) x (°F-32)	°F = 1.8 x °C+32
Force	pounds	newtons	4.45	0.22
Pressure	pounds per square foot	newtons per square meter	47.88	0.02
	pounds per square inch	newtons per square meter	6894.76	0.00015

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