U. S. SPACE FORCE

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

Vandenberg Space Force Base

(See INRMP signature pages for plan approval date)

ABOUT THIS PLAN

This installation-specific Environmental Management Plan (EMP) is based on the United States Space Force (USSF)[1] standardized Integrated Natural Resources Management Plan (INRMP) template. This INRMP has been developed in cooperation with applicable stakeholders, which may include Sikes Act cooperating agencies and/or local equivalents, to document how natural resources will be managed. Non-U.S. territories will comply with applicable Final Governing Standards (FGS). Where applicable, external resources, including Air Force Instructions (AFIs); Air Force Manuals (AFMANs), USAF Playbooks; federal, state, local, FGS, Biological Opinions and permit requirements, are referenced.

Certain sections of this INRMP begin with standardized, USAF-wide "common text" language that address USAF and Department of Defense (DoD) policy and federal requirements. This common text language is restricted from editing to ensure that it remains standard throughout all plans. Immediately following the USSF-wide common text sections are installation sections. The installation sections contain installation-specific content to address local and/or installation-specific requirements. Installation sections are unrestricted and are maintained and updated by USAF environmental Installation Support Teams and/or installation (VSFB) personnel.

NOTE: The terms 'Natural Resources Manager' (NRM) *and 'NRM/POC'* (point of contact) *are used throughout this document to refer to the installation person responsible for the natural resources program, regardless of whether this person meets the qualifications within the definition of a natural resources management professional in DoD Instruction 4715.03,* Natural Resources Conservation Program.

Notes: 1. Vandenberg Air Force Base was officially redesignated as Vandenberg Space Force Base in May of 2021. This document and its components are "transitional" in nature; they may include occasional references to the United States Air Force (USAF), Vandenberg Air Force Base (VAFB), Air Force Instructions (AFIs), Air Force Manuals (AFMAN) and other "historic" and current designations.

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DOCUMENT CONTROL

Standardized INRMP Template

In accordance with (IAW) the Air Force Civil Engineer Center (AFCEC) Environmental Directorate Business Rule 08, EMP Review, Update, and Maintenance, this INRMP was formatted following the standardized template dated 10/03/2018.

Installation INRMP

Record of Review—The INRMP is updated no less than annually, or as changes to natural resource management and conservation practices occur, including those driven by changes in applicable regulations. IAW the Sikes Act and AFMAN 32-7003, *Environmental Conservation*, the INRMP must be reviewed for operation and effect no less than every five years. An INRMP is considered compliant with the Sikes Act if it has been approved in writing by the appropriate representative from each cooperating agency within the past five years. Approval of a new or revised INRMP is documented by signature on a signature page signed by the Installation Commander (or designee), and a designated representative of the United States Fish and Wildlife Service (USFWS), state fish and wildlife agency, and National Oceanic and Atmospheric Administration (NOAA) Fisheries when applicable (AFMAN 32-7003).

Annual reviews and updates are accomplished by the installation NRM, and/or a Section Natural Resources Media Manager. The installation shall establish and maintain regular communications with the appropriate federal and state agencies. At a minimum, the installation NRM (with assistance as appropriate from the Section Natural Resources Media Manager) conducts an annual review of the INRMP in coordination with internal stakeholders and local representatives of USFWS, state fish and wildlife agency, and NOAA Fisheries, where applicable, and accomplishes pertinent updates. Installations will document the findings of the annual review in an Annual INRMP Review Summary. By signing the Annual INRMP Review Summary, the collaborating agency representative asserts concurrence with the findings. Any agreed-upon updates are then made to the document; at a minimum, work plans are updated.

Note: During 2018 and 2019, AFCEC engaged the Center for Environmental Management of Military Lands (CEMML) at Colorado State University (CSU) to assist USAF installations with meeting DoD requirements to include climate change assessments in their INRMPs (Agreement No W9128F-16-2-0020-0018). To accomplish this task, a CSU team of climate scientists, ecologists, environmental planners, military land managers, and engineers reviewed the Vandenberg Space Force Base (VSFB) INRMP, generated downscaled temperature and precipitation data for VSFB to develop climate projections under two future emission scenarios, and used tools and models to assess impacts of future climate on the installation's natural resources (CEMML 2019). In 2020, the results of this climate change assessment were integrated with the relevant sections of this INRMP.

INRMP APPROVAL/SIGNATURE PAGES

EXECUTIVE SUMMARY

This INRMP (or Plan) has been prepared to address the requirements of AFMAN 32-7003, 20 April 2020, *Environmental Conservation*, and the Sikes Act Improvement Amendments of 1997 (16 United States Code [USC] 670 [a][1][A]). It provides an adaptive management approach to natural resources issues on VSFB.

In the past, natural resources management has relied on implementation of separate plans addressing different aspects of natural resources management, such as land management, urban forestry, fish and wildlife management, forestry management, outdoor recreation, and range management. Each plan addressed various base resources independently of the others, and there was no integration of management strategies.

Under the Sikes Act, as amended (16 USC 670 et seq.), the Secretary of Defense is directed to ". . . carry out a program to provide for the conservation and rehabilitation of natural resources on military installations." AFMAN 32-7003, Section 3.3, directs that "The INRMP defines natural resources management goals and objectives that are consistent with the military mission, and ensures no net loss in the capability of installation lands to support the military mission." AFMAN 32-7003, Section 3.10, further states, "The INRMP implements ecosystem management on Air Force installations by setting goals for attaining the desired land condition."

This change in approach to natural resources management—from a series of independently conceived and executed management plans to a single integrated document—is reflected in the current INRMP. This Plan updates the original VAFB INRMP prepared in 1997,as well as several other revisions since that date, including major updates in 2011 and 2015.

The purpose of the INRMP is to provide integrated, comprehensive, ecosystem-based resource management strategies and to recommend goals for VSFB's natural resources for a period of five years. As a "living document," the intent of the Plan is to integrate all aspects of natural resource management with the installation's mission, with no net loss to mission capability and readiness. To accommodate changes in the programs at VSFB and in its ecosystems, the INRMP uses an adaptive management approach.

Ecosystem-based management strategies, when combined, provide an optimal opportunity for VSFB ecosystems to flourish. The overall goal—and benefit—of ecosystem management is to minimize intervention in natural, self-regulating habitats to return VSFB to a self-sustaining environment. This has been VSFB's approach to natural resources management for more than 20 years. Implementing this INRMP, therefore, will not entail a significant change in management direction for the installation.

Adaptive management strategies provide an alternative to traditional environmental planning by stressing inventiveness and flexibility in approaching environmental problems. Through interim monitoring, adaptive management provides the information required to assess the effect of management goals on habitat improvement, ecological restoration, and species preservation. Such an approach provides the management strategy to protect ecosystems in the face of change.

This INRMP includes specific actions to be implemented over the next five years. Some actions may require Environmental Assessments and/or Environmental Impact Statements to fulfill National Environmental Policy Act (NEPA) requirements. Actions may also require section 7 consultation with the USFWS or NOAA Fisheries, in accordance with the federal Endangered Species Act (ESA). Implementation of actions identified in this INRMP or those required by another regulatory authority are programmed for funding as directed by the USSF. Implementation of these actions depends on the availability of adequate funding.

The INRMP describes these recurring and projected future actions and also identifies internal processes and policies that support natural resource management objectives to ensure regulatory compliance.

1.0 OVERVIEW AND SCOPE

This Integrated Natural Resource Management Plan (INRMP) was developed to provide for effective management and protection of natural resources. It summarizes the natural resources present on the installation and outlines strategies for adequately managing those resources. Natural resources are valuable assets of the United States Space Force (USSF). They provide the natural infrastructure needed for testing weapons and technology, as well as for training military personnel for deployment. Sound management of natural resources increases the effectiveness of USSF adaptability in all environments. The USSF has stewardship responsibility over the physical lands on which installations are located to ensure that all natural resources are properly conserved, protected, and used in sustainable ways. The primary objective of the USSF natural resources program is to sustain, restore, and modernize natural infrastructure to ensure operational capability and no net loss in the capability of USSF lands to support the installation's military mission. The plan outlines and assigns responsibilities for the management of natural resources, discusses related concerns, and provides program management elements that will help to maintain or improve the natural resources within the context of the installation's mission. The INRMP is intended for use by all installation personnel. The Sikes Act is the legal driver for the INRMP.

1.1. Purpose and Scope

The purpose of this INRMP is to provide strategic direction to ecosystem and natural resources management on Vandenberg Space Force Base (SFB) in accordance with Air Force Manual (AFMAN) 32-7003, *Environmental Conservation*. The long-term goal of the INRMP is to integrate all management activities in a manner that sustains, promotes, and restores the health and integrity of VSFB ecosystems and using an adaptive management approach. Such an approach recognizes the underlying complexities of functioning ecosystems and complies with the intent of AFMAN 32-7003 to ensure ecologically sound stewardship of the nation's natural resources found on USSF lands.

The INRMP is designed to meet the objectives listed below.

Summarize existing management plans and natural resources literature pertaining to VSFB.

Identify and analyze management goals in existing plans.

Integrate the management goals and objectives of the individual plans.

Support base compliance with applicable regulatory requirements.

Support the integration of natural resource stewardship with the USSF mission.

Provide direction for monitoring strategies.

1.2. Management Philosophy

Under Department of Defense Instruction (DoDI) 4715.3 and AFMAN 32-7003, each military installation in the United States under the jurisdiction of the Secretary of Defense must prepare and implement an INRMP unless a determination is made that the absence of significant natural resources makes preparation of such a plan inappropriate. INRMP development involves the participation of installation and higher command personnel and coordination with relevant outside authorities. Natural resources management is to be integrated and should follow the principles and practices of ecosystem management and biodiversity conservation. AFMAN 32-7003 (Section 3.10) and DoDI 4715.3 (Section E6.2) outline the following

ecosystem management principles and guidelines that form the cornerstone of the Department of Defense's (DoD's) ecosystem management policy, as follows.

Maintain and improve the sustainability and native biological diversity of the ecosystem.

Administer with consideration of ecological units and time frames.

Support sustainable human activities.

Develop a vision of ecosystem health.

Develop priorities and reconcile conflicts.

Develop coordinated approaches for working toward ecosystem health.

Use the best science available.

Use benchmarks for monitoring and evaluating outcomes.

Use adaptive management.

Implement through installation plans and programs.

Ecosystems are dynamic in that their characters, extents, and problems change over time. Given this, natural resources management programs must be equally flexible and able to incorporate new information as it becomes available. This approach to natural resources management is called adaptive management, and it is one of the principles on which the natural resources management program at VSFB is based. Interim monitoring provides information required to assess the effect of management techniques on habitat improvement, ecological restoration, and species preservation and allows the management approach to be altered as needed. Such an approach provides the proactive management strategy needed to successfully protect ecosystems in the face of change.

Adaptive management requires a combination of monitoring, evaluation, and research for an entire ecological system so that the combined effects of managerial strategies can be detected, assessed, and improved over time (Holling 1978, Lee and Lawrence 1986). It relies on use of the best available scientific knowledge and treats each management goal as a set of experiments, using performance criteria to assess goal effectiveness. Adaptive management emphasizes the clear specification of performance criteria before management actions are taken. Interim assessment of management actions produces knowledge that enhances learning and allows for the incorporation of new information. Management monitoring and evaluation provide feedback to improve results over time. Planning for adaptive management requires a system-wide effort to ensure the integration and consistency of natural resources goals. At the base level, adaptive management includes prioritizing management strategies and units based on landforms, land use, and habitats.

The adaptive management of natural resources as ecological units can also provide financial benefits. For instance, the cost of propagating oak (*Quercus* spp.) seedlings in overgrazed areas is greater than that of implementing proper management techniques from the start (rotation of grazing areas and fencing of sensitive seedlings in *Quercus agrifolia* (coast live oak) forest and woodland alliance). Ideally, a balanced, natural environment requires minimal manipulation by humans, which is more cost-effective than intensive system management. Therefore, VSFB's overall natural resources policy is one of minimizing intervention in a natural, self-regulating system. The recognition of spatial and temporal scales reflects a larger, more long-term ecosystem management strategy for VSFB.

This INRMP provides management direction through an interdisciplinary approach. It presents an overview of practices that could affect natural resources on base to enhance the understanding of how using one

resource or area of the base can affect others. The INRMP also forms the basis for developing specific projects consistent with VSFB natural resources management objectives.

1.3. Authority

The authority for the INRMP comes from the Sikes Act; DoDI 4715.3, *Environmental Conservation Program* (3 May 1996); Air Force Policy Directive (AFPD) 32-70, *Environmental Quality* (20 July 1994); and AFMAN 32-7003 (20 April 2020).

The Sikes Act requires that an INRMP meets diverse requirements, examples of which follow.

Allow for fish and wildlife management, land management, and wildlife-oriented recreation.

Allow for fish and wildlife habitat enhancement or modifications.

Protect, enhance, and restore wetlands where necessary to support fish, wildlife, and plants.

Integrate and ensure consistency among the various activities conducted under the INRMP.

Allow the public access to the military installation that is necessary or appropriate for sustainable public use of natural resources but is consistent with the needs of fish and wildlife resources and subject to safety and military security.

Enforce applicable natural resource laws.

Result in no net loss in the capability of military installation lands to support the military mission of the installation.

1.4. Integration with Other Plans

This INRMP includes tiered or component plans (Tabs A-O), including but not limited to Tab D—Threatened and Endangered Species, Tab J—Lands and Grounds and Tab L—Bird/Wildlife Aircraft Strike Hazard (BASH). In conjunction with its component plans, this plan mutually supports the Integrated Cultural Resources Management Plan, Integrated Pest Management Plan (partially covered under Tabs G and K) and the Installation Development Plan (IDP, see AFI 32-7062, Comprehensive Planning), among others.

INRMP revisions and concurrence must be coordinated through the installation chain of command and the identified internal stakeholders. External stakeholders, primarily the three key resource management partner agencies (United States Fish and Wildlife Service [USFWS], California Department of Fish and Wildlife [CDFW] and National Oceanic and Atmospheric Administration [NOAA] Fisheries), are provided an opportunity to review significant updates when those updates are in draft form and/or during the annual review process. The 30th Space Delta Installation Management Flight (30 CES/CEI) must ensure that the INRMP and any other plans that may affect natural resources are mutually supportive and not in conflict with each other.

2.0 INSTALLATION PROFILE

Table 1. Installation profile.

Office of Primary Responsibility	The 30th Space Delta, Installation Management Flight (30 CES/CEI) has overall responsibility for implementing the natural resources management program and is the lead organization for monitoring compliance with applicable federal, state, and local regulations.
Natural Resources Manager (NRM)/Point of Contact (POC)	Responsible Organization: 30 CES/CEI Phone: (805) 606-4198
State and/or local regulatory POCs (Include agency name for Sikes Act cooperating agencies)	United States Fish and Wildlife Service, Ventura Office; National Marine Fisheries Service, Long Beach; California Department of Fish and Wildlife (Region 5)
Total acreage managed by installation	99,579
Total acreage of wetlands	Up to 4,967 (*but see* Section 2.3.5)
Total acreage of forested land	Approx. 22,673 (see Section 2.3.2)
Does installation have any Biological Opinions? (If yes, list title and date, and identify where they are maintained)	YES, too many to list. Most significant is the Programmatic Biological Opinion 8-8-13-F49R; December 2015.
Natural Resources Program Applicability (Place a checkmark next to each program that must be implemented at the installation. Document applicability and current management practices in Section 7.0)	☒ Fish and Wildlife Management ☒ Outdoor Recreation and Access to Natural Resources ☒ Conservation Law Enforcement ☒ Management of Threatened, Endangered, and Host Nation-Protected Species ☒ Water Resource Protection ☒ Wetland Protection ☒ Grounds Maintenance ☒ Forest Management ☒ Wildland Fire Management ☒ Agricultural Outleasing ☒ Integrated Pest Management Program ☒ Bird/Wildlife Aircraft Strike Hazard (BASH) ☒ Coastal Zone and Marine Resources Management ☒ Cultural Resources Protection ☒ Public Outreach ☒ Geographic Information Systems (GIS)

2.1. Installation Overview

2.1.1. Location and Area

VSFB is located on the south-central California coast, approximately 275 miles south of San Francisco, 140 miles northwest of Los Angeles, and 55 miles northwest of Santa Barbara. The 99,579-acre base extends along approximately 42 miles of Santa Barbara County coast and varies in width from 5 to 15 miles (Appendix A, Figure 3-1).

Table 2. Installation, geographically separated units, and their locations and area descriptions.

Installation/ Geographically Separated Unit	Main Use/ Mission	Acreage	Addressed in INRMP?	Describe Natural Resource Implications
Vandenberg SFB	Launch, place, and track satellites in near-polar orbit; test and evaluate intercontinental ballistic missile systems; and support aircraft operations in the western range	99,579	INRMP coverage	See Section 2.4.3
Pillar Point Space Force Station (AFS)	Supports the VSFB launch program	55	See Pillar Point AFS INRMP	See Pillar Point AFS INRMP
Anderson Peak Optical Site	Closed. Supported the VSFB launch program	<1	Yes	See Tab O
Santa Ynez Peak Optical Site	Supports the VSFB launch program	<1	Yes	See Tab O
Point Conception	Weather monitoring and other functions	27	Yes	See Tab O
Molokai High Frequency Receiver Site	Closed. Supported the VSFB missile launch program; receiver for communications to Hawaiian area of Western range	363	Yes	See Tab O

2.1.1.1. Off-Base Leased Mission Support Sites

Vandenberg SFB has five Off-Base Leased Mission Support Sites (also referred to as geographically separated units [GSUs]): Pillar Point Space Force Station (AFS), Anderson Peak Optical Site, Santa Ynez Peak Optical Site, Point Conception and Molokai High Frequency Receiver Site. A brief description of each GSU is provided below. Additional information can be found in Tab O.

The Pillar Point AFS supports the VSFB launch program and is on a small ocean peninsula approximately 23 miles south of San Francisco. At an elevation of approximately 165 feet above sea level, Pillar Point AFS provides radar tracking and telemetry reception. Pillar Point AFS has a separate INRMP.

The Anderson Peak Optical Site originally supported the VAFB launch program and is approximately 106 miles north-northwest of VSFB. It is at an elevation of approximately 4,020 feet above sea level. It is no longer in operation, however transfer of the property to the United States Department of Agriculture (USDA) Forest Service has not been completed.

The Santa Ynez Peak Optical Site supports the VSFB launch program and is approximately 42 miles southeast of VSFB at an elevation of 4,133 feet above sea level. The site is operated under a memorandum of understanding (MOU), between the Federal Aviation Administration and the Western Space and Missile Center, with a Special Use Permit from the USDA Forest Service.

Point Conception supports the VSFB mission by hosting a weather station, ocean surface monitoring functions and communications relay stations. It is located approximately four miles south of VSFB's southern boundary. Elevation at this location ranges from sea level to approximately 220 feet. The Space

Force completed acquisition of the land and buildings at Point Conception from the United States Coast Guard (USCG) in late 2020. In late 2018, more than 23,000 acres formerly operated as the Cojo-Jalama Ranches, which adjoins Point Conception at all terrestrial boundaries, was purchased by The Nature Conservancy, and is now operated as the Jack and Laura Dangermond Preserve.

The Molokai High Frequency Receiver Site, on the north-central coast of Molokai, Hawaii, had supported the VSFB launch program and served as a high-frequency receiver for radio communications to the Hawaiian area of the western range. It is no longer in operation (all USSF actions concluded in 2012; however, transfer of the property to the Department of Hawaiian Homelands has not been completed; transfer may be completed in CY 2021). All USSF equipment, tanks, and concrete conduit have been removed and only the buildings remain.

2.1.2. Installation History

The VSFB area has a cultural history dating back at least 11,000 years. There are numerous historical and cultural areas on the base, many of which are eligible for nomination to the National Register of Historic Places.

2.1.2.1. History of the Area

The abundant archaeological information scattered throughout the base is testimony to early occupation by Native American people. The aboriginal inhabitants of the region were the Purisimeño Chumash, an ethnic and linguistic subgroup of the Chumash. The Purisimeño territory extended from Point Conception to the north end of the Santa Maria Valley and from the vicinity of the present-day town of Buellton to the Pacific Ocean. The Chumash and their ancestors lived in this area for more than 9,000 years. They lived in villages but would leave to hunt, fish, and collect plant foods. These activities created archaeological sites that form one of the most complete archaeological records for any of the Chumash subareas.

In 1769, explorers of the Portola Expedition, the first Spanish expedition to traverse the Santa Maria Basin, crossed the area while traveling from San Diego to Monterey. This is the first known contact of the Purisimeño with Europeans. The establishment of La Purisima Mission in 1787 marked the beginning of Spanish occupation in the area. Settlers at the mission ranched and cultivated surrounding lands.

Mission influence waned after secularization of the California missions in 1834. Mission lands were subdivided among various Mexican citizens. The Mexican land grants that were on present-day VSFB included Guadalupe, Casmalia, Todos Santos y San Antonio, Jesus Maria, Purisima Mission, Lompoc, and Punta Concepcion. Almost as soon as the lands were granted, parts of or whole ranchos were sold. In one of these transactions, the Lompoc Valley Land Company acquired the Lompoc and Mission Viejo land grants in the Lompoc Valley. In 1874, this land was auctioned to farmers who wanted to establish a temperance colony (alcohol was forbidden). During this time, the riparian vegetation was cleared and the many tributary channels of the Santa Ynez River were filled in to increase the amount of arable land in the Lompoc Valley.

2.1.2.2. Recent Base History

Point Sal Wharf and Lompoc Landing were constructed during the early development of this portion of the central coast. Livestock ranching and dry farming continued until 1941, when the War Department purchased most of what is now VSFB. The land was used as an Army training facility known as Camp Cooke. When this camp was inactivated after World War II, the land was again used for ranching and farming. The base was reactivated briefly during the Korean War before it was returned to ranching and farming again. In 1957, the USSF acquired the 64,000 acres north of the Santa Ynez River as Cooke AFB.

In 1958, the installation was renamed VSFB, after General Hoyt S. Vandenberg, the service's 2nd Chief of Staff and an early advocate of space and missile operations. The 20,000 acres of Point Arguello Naval Missile Facility were annexed to VSFB in 1964, and in 1966, the Sudden and Scolari Ranches were acquired, bringing the total base area to its present size of 99,579 acres.

2.1.2.3. United States Coast Guard Presence

In 1939, the USCG completed its lifeboat rescue station three miles south of Point Arguello on land purchased from the Sudden Ranch. The remaining buildings are now part of VSFB. The USCG managed the station until 1957 but, because it was never called on for a rescue, the station was declared unnecessary. The USCG also staffed and maintained a 50-acre lighthouse station at Point Arguello. The light and fog signal were automated in 1950, and the LORAN radar station, which replaced the naval radio beacon, was closed in 1980.

2.1.2.4. Chromite Mines

During World War I, when access to high-grade international sources of chromium ore was restricted, chromite was mined on VSFB. These mines are just east of Point Sal Road near Lions Head. Both mines were abandoned when higher grades of ore were again available at the end of the war.

2.1.3. Military Missions

VSFB is headquarters for the 30th Space Delta, the USSF's Space Command unit that operates VSFB and the Western Test Range/Pacific Missile Range (Western Range). VSFB operates as an aerospace center supporting West Coast launches for the USSF, DoD, National Aeronautics and Space Administration, and commercial contractors. The three primary operational missions of VSFB are to launch, place, and track satellites in near-polar orbit; to test and evaluate intercontinental ballistic missile systems; and to support aircraft operations in the western range (which begins at the coastal boundaries of VSFB and extends westward from the California coast to Hawaii and the western Pacific).

Of the primary missions, testing ballistic missiles and launching rockets are the most likely missions to affect the natural resources of VSFB. Because of its location on the extreme west coast of California, satellites launched from the southern part of VSFB do not fly over population centers. The potential problems of rocket and missile launches include fueling difficulties during vehicle preparation, explosion during liftoff, and technical problems requiring destruction of the launch vehicle and its payload. The potential effects of these activities include igniting a range fire; releasing hazardous materials to the air, water, or soil; creating loud noise that may impact humans and wildlife; and scattering debris across a wide area. Depending on the payload of the exploded vehicle, there is also the potential for spreading hazardous material along with the debris of the vehicle itself.

2.1.4. Surrounding Communities

The two regional city centers nearest VSFB are San Luis Obispo to the north and Santa Barbara to the southeast. Both of these cities are the seat of their respective county governments and home to a major university and were founded around a mission settlement. VSFB is within Santa Barbara County, and San Luis Obispo County contains VSFB's nearest coastal neighbors in what is commonly referred to as the Five Cities Area: the cities of Arroyo Grande, Grover Beach, and Pismo Beach, and the towns of Avila Beach and Oceano.

The city of Lompoc, six miles east of the base boundary, is VSFB's closest incorporated residential neighbor. Lompoc was founded as a temperance colony in 1874. Today, Lompoc and the surrounding

communities of Mesa Oaks, Mission Hills, and Vandenberg Village are home to approximately 43,000 people. In addition to Lompoc, the city of Santa Maria and surrounding communities of Casmalia and Guadalupe were the most important early American settlements in the region. These three communities and the town of Orcutt are north of VSFB. Although it is farther away from VSFB, the Santa Ynez Valley is still tied to the economy of the base. This area includes Ballard, Los Olivos, Santa Ynez, and Solvang, whose agricultural histories are similar to those of Lompoc, Buellton, and Santa Maria.

2.1.5. Local and Regional Natural Areas

The western boundary of VSFB is 42 miles of undeveloped Pacific Ocean coastline. Most of the coastline south of the base is composed of coastal bluffs and sandy beaches, similar to those found at VSFB. There are rocky outcrops at Point Sal north of VSFB. Dune structures and long, sandy beaches can be seen north of VSFB at Guadalupe Dunes, south of the Santa Maria River in Santa Barbara County, and Oceano to Nipomo Dunes north of the Santa Maria River in San Luis Obispo County.

Other natural areas near VSFB that are monitored and managed include Rancho Guadalupe County Park, owned by Santa Barbara County and managed by the Center for Natural Lands Management, and the Guadalupe-Nipomo Dunes National Wildlife Refuge, owned and managed by the USFWS. The Nature Conservancy purchased approximately 24,000 acres of land from the former Cojo-Jalama Ranches and formed the Jack and Laura Dangermond Preserve, which abuts VSFB at the southern and southeastern boundaries. The active management policies at these sites contrast with management of the nearby coast; Oceano Dunes is a state vehicular recreation area, and the coast south of VSFB is devoted to other forms of recreation, including surfing, fishing, diving, and other sporting activities.

2.2. Physical Environment

Climate, land use, water, and topography all contribute to the development of particular habitat types. The physical environment of VSFB is an important factor in determining the type of natural resources found on base. The topography of VSFB is varied, including hills, mountains, terraces, floodplains, mesas, canyons, and rocky headlands. VSFB also contains a number of on-base watersheds and impoundments, including the Santa Ynez River, Shuman Creek, San Antonio Lagoon, Barka Slough, and Punchbowl Lake.

The descriptions that follow were excerpted from the IDP for VSFB (VSFB 2020). Climatological data included in these descriptions were obtained from the 30th Space Delta Weather Squadron.

2.2.1. Climate

Vandenberg SFB is in a dry subtropical climate zone that experiences semi-wet winters, dry summers, and mild temperatures throughout the year. As a result of its proximity to the Pacific Ocean, VSFB also is affected by coastal weather, including ocean winds, fog and cloudiness, and marine inversions.

From November through April, it is relatively wet and cool, whereas it is dry and warm from May through October. Temperatures throughout the area are generally mild, ranging from 21 °F to 104 °F (-6.1 °C to 40 °C), with an annual average of 57 °F (13.9 °C). About 92 percent of the annual total rainfall occurs during the winter months of November–April and is produced primarily by frontal systems transiting the area. The rainy season is characterized by a recurring sequence of one or two rainy days followed by about five partly cloudy, dry days. Little rainfall occurs from May to October, and the average annual precipitation is 13–16 inches. Winter storms bring general cloudiness to the area, but the average annual number of cloudy days is only 80 in most of the area. Winds are usually light to moderate, coming primarily from the northwest on the northern portion of VSFB and from the north to northeast on the southern portion.

Three types of inversion affect the region: radiation, marine, and subsidence. The radiational (or nocturnal) inversions form year-round over interior regions on cloudless nights as heat radiates from the earth and cools the air near the ground. During the half year of summer, marine inversions set up fog and, at VSFB, low stratus clouds are typical. This results from relatively warm, moist air moving over very cold ocean water. The resulting marine layer is moved onshore by prevailing northwesterly flow.

2.2.1.1. Climate Change Projections

CSU CEMML generated site-specific climate projections for VSFB under two future carbon-emission scenarios: Representative Concentration Pathway (RCP) 4.5 (moderate emission levels) and RCP 8.5 (high emission levels). The researchers then used these projections to assess potential impacts of future climate on natural resources at the base. Climate models used historical daily climate data recorded from 1980 through 2009 to represent average historical (i.e., baseline) conditions and generate the climate projections. The historical daily climate data represent the 30-year historical reference point used by the Intergovernmental Panel on Climate Change (IPCC) to define climate change scenarios. Future climate conditions for VSFB, assessed under both RCP 4.5 and RCP 8.5, were projected to produce decadal time series of daily climate values for 2026–2035 and 2046–2055, represented hereafter as 2030 and 2050, respectively (see Methods Appendix in CEMML 2019).

The CSU CEMML assessment was based on publicly available data and data provided by the Space Force Civil Engineer Center (AFCEC) (CEMML 2019). The climate projections were based on recent global climate model simulations developed for the IPCC Fifth Assessment Report, the IPCC Coupled Model Intercomparison Project Phase 5, and the U.S. National Center for Atmospheric Research Community Climate System Model (Hibbard et al. 2007; Moss et al. 2008, 2010; Gent and Danabasoglu 2011; Hurrell et al. 2013).

2.2.1.2. Climate Model Results

Climate projections for VSFB (Table 3) indicate that minimum and maximum temperatures will increase over time under the two emission scenarios (RCP 4.5 and RCP 8.5). For the decade centered around 2030, both scenarios project a similar degree of increase in average annual temperature (TAVE) from 0.9 °F to 1.4 °F (0.5–0.8 °C) over the historical average. The two emission scenarios show greater warming by 2050, with the RCP 4.5 expressing a warming of approximately 1.9 °F (1.1 °C) and RCP 8.5 expressing a warming of 3.3 °F (1.8 °C).

Annual average precipitation (PRECIP) varies between emission scenarios and over time due to larger interconnected ocean-atmosphere dynamics associated with the National Center for Atmospheric Research Community Climate System Model. For 2030, the RCP 4.5 scenario projects a small increase in PRECIP of 3% and RCP 8.5 shows a decrease of 13%. For 2050, RCP 4.5 projects a PRECIP decrease of 10% from historical average and RCP 8.5 shows an increase of 5% over the historical average. Importantly, each scenario includes seasonal changes in precipitation, with increases concentrated in a few months, and precipitation decreasing or remaining the same in other months (see Climate Appendix in CEMML 2019).

Table 3. Summary of climate data.

Variable	Historical	RCP 4.5		RCP 8.5	
		2030	2050	2030	2050
PRECIP (inches)	14.8	15.2	13.3	12.9	15.6
TMIN (°F)	46.5	48.1	48.3	47.4	49.9
TMAX (°F)	69.7	70.8	71.8	70.7	72.9
TAVE (°F)	58.1	59.5	60	59	61.4
GDD (°F)	3799	4109	4274	4020	4605
HOTDAYS	2.2	1.3	3.7	3.0	5.5
WETDAYS	0.2	0.0	0.2	0.1	0.4
Notes: TAVE °F=annual average temperature; TMAX °F=annual average maximum temperature; TMIN °F=annual average minimum temperatures; PRECIP (inches)=annual average precipitation; GDD °F=average annual accumulated growing degree days with a base temperature of 50 °F; HOTDAYS (average # of days per year)=average number of hot days exceeding 90 °F; WETDAYS (average # of days per year)=annual number of days with precipitation exceeding 2 inches in a day.					

2.2.2. Landforms

VSFB includes a 42-mile section of coastline in the southwestern part of the Santa Maria basin. The base is bounded by the Casmalia Hills to the north and the Santa Ynez Mountains and Sudden Flats to the south. Between these two ranges are the broad and generally flat areas of the San Antonio Terrace, Burton Mesa, and Lompoc Terrace, on which most of the VSFB mission occurs.

The surface topography at VSFB is varied; the highest topographic relief is in the south. The generally moderate slopes of the Casmalia Hills to the north rise to over 1,300 feet and, to the south, the much steeper canyon slopes of Tranquillon Mountain represent a dramatic backdrop to the southern coastal flats. General topology is shown in Appendix A, Figure 4-1.

2.2.3. Geology and Soils

Vandenberg SFB is a geologically complex area that includes the transition zone between the Southern Coast Range and Western Transverse Range Geomorphic Provinces of California. The major geomorphic features of VSFB include the Casmalia Hills, San Antonio Terrace, Barka Slough, Purisima Hills, Burton Mesa, Lompoc Valley, Lompoc Terrace, Santa Ynez Mountains, and Sudden Flats. The geological features of VSFB have been an important factor in the development of the diversity of natural habitats.

Marine sedimentary rocks of Late Mesozoic age (140–70 million years before the present) and Cenozoic age (70 million years to the present) underlie VSFB (Dibblee 1950). Extensive folding and faulting throughout the VSFB area has created four structural regions: the Santa Ynez Range, the Lompoc lowland, the Los Alamos syncline, and the San Rafael Mountain uplift (Reynolds, Smith, and Hill, Inc., 1985).

Dominant soil types on VSFB include those listed below (Shipman 1981; Appendix A, Figure 4-2).

The **Tangair-Narlon association** is on nearly level to strongly sloping terrain. Poorly drained and moderately well drained sands and loamy sands, located primarily on terraces, characterize this soil type.

The **Marina-Oceano association** comprises drained sands on mesas and dunes.

The **Chamise-Arnold-Crow Hill association** is characterized by well drained and somewhat excessively drained sand to clay loams on high terraces and uplands.

The **Concepcion-Botella association** occurs on nearly level to steep terrain. Well drained loamy sands, fine sandy loams, and silty clay loams on terraces and small valleys characterize this soil type.

The **Sorrento-Mocho Camarillo association** occurs in nearly level to moderately sloping terrain, such as floodplains and alluvial fans. The soil is well drained to somewhat poorly drained, and it ranges from sandy loams to silty clay loams.

The **Shedd-Santa Lucia-Diablo association** is a well-drained, shaley clay loam, accompanied by silty clays on uplands, found in strongly sloping to very steep topography.

The **Los Osos-San Andreas-Tierra association** ranges from fine sandy loams to sandy loams with clay loams in upland areas. These are well drained to moderately well drained soils, found in strongly sloping to very steep terrain.

A significant portion of south VSFB totaling nearly 25,000 acres, including much of the former Sudden Ranch property, has not been soil-mapped to standards compatible with the National Cooperative Soil Survey (NCSS). The Space Force is working with soil scientists affiliated with the Natural Resources Conservation Service (NRCS) to initiate surveys of that area in late 2021 or early 2022.

2.2.4.Hydrology

The major freshwater resources of VSFB include six streams, comprising two major and four minor drainages (Appendix A, Figure 4-3). The major drainages are San Antonio Creek and the Santa Ynez River. The minor drainages are Shuman, Cañada Honda, Bear, and Jalama Creeks.

The freshwater resources can be divided into four geographic areas. The northern area comprises Shuman Canyon and several seasonal stream drainages. The north-central area includes the San Antonio Creek drainage, the Santa Ynez River drainage north of the river, and several smaller drainages. This area is heavily influenced by human activity because it contains the main cantonment area of the base and private agricultural lands outside of the base. The Santa Ynez Lagoon covers 58 acres in the southwestern corner of this area. The south-central area includes the southern part of the Santa Ynez River drainage, Cañada Honda, and several small, seasonal stream drainages. The southern area consists primarily of Sudden Ranch and contains small streams and two permanent ponds (Engineering Science, Inc., and Sea World Research Institute 1988).

The San Antonio Creek watershed has a drainage area of 154 square miles. The upper reaches of San Antonio Creek (i.e., upstream of Barka Slough) have intermittent flows that generally result from runoff of winter rains (November through April). The lower reaches of San Antonio Creek (i.e., downstream of Barka Slough) are perennial and are fed by surfacing groundwater in Barka Slough. This slough is a central dividing point in the San Antonio watershed. It is formed by underground continuous bedrock between the Purisima and Casmalia Hills, just west (or downstream) of the slough. This bedrock forms a barrier to underground flow down the watershed through unconsolidated deposits (Conoco, Inc., 1985; URS Corporation [URS] 1987).

In the lower San Antonio Creek basin, creek water flows west-northwest to the ocean. There are marshlands along part of its course. The creek ends in a small lagoon, which breaks through the dunes to the sea only during large storms, at which time it is subject to tidal inundation (URS 1987; United States Department of the Interior [USDI] 1981).

The Santa Ynez River flows west along the northern base of the Santa Ynez Mountains from the vicinity of the Murietta Divide, near the Ventura-Santa Barbara county line, to the coastline north of Surf Railroad Station. The river watershed has a total drainage area of about 900 square miles and ranges in elevation from sea level to about 6,800 feet. Less than five percent of this area is within VSFB. Flow in the Santa

Ynez River varies seasonally in response to precipitation and runoff. From June through November, the river flow is typically less than seven cubic feet per second, including effluent from a sewage treatment plant at Lompoc. Most of the minor watercourses in the basin, however, flow only during or shortly after storms (Union Oil Company 1985, URS 1987).

The flow of the Santa Ynez River has been regulated since 1920 by Gibraltar Reservoir, since 1930 by Jameson Lake, and since 1952 from Lake Cachuma. Water is diverted out of the Santa Ynez Basin from these three reservoirs for municipal use in the Santa Barbara area. In addition, water is pumped for irrigation from wells along the river. There is a 100-year floodplain next to the Santa Ynez River.

There are numerous ponds and water-holding depressions on VSFB. Man-made lakes on VSFB include Lake Canyon Lakes, Punchbowl Lake, and MOD III Lake. These lakes support populations of redear sunfish (*Lepomis microlophus*) and largemouth bass (*Micropterus salmoides*). Other lakes and ponds within the boundaries of the installation include Lompoc-Casmalia Pond, Mitchell Pond, Lower Canyon Lake, ABRES-A Lake, and El Rancho Pond.

Vandenberg SFB is in Santa Barbara County, where groundwater supplies about 77% of domestic, commercial, industrial, and agricultural water. It is also the last line of defense against periodic droughts that occur in the county. Historical records and tree ring analysis indicate that local droughts lasting several years or longer have occurred two to four times per century over the last 460 years (Turner 1992).

To better understand the supply and limitations of each groundwater basin and aquifer, local, state, and federal agencies regularly monitor water quantity and quality. This information about groundwater resources is essential for a thorough understanding of aquifer conditions. This knowledge can help to avoid overusing aquifers, which can lead not only to their depletion, but also seawater intrusion, diminished storage capacity, lower water quality, and/or land subsidence within a basin.

These potential consequences depend on aquifer characteristics. In areas with low recharge rates, excessive pumping might render portions of an aquifer unusable indefinitely. Lowering the water tables might increase pumping "lifts," which could make pumping economically unfeasible for some uses. In contrast, with proper management, lowering the groundwater basins can sometimes make them more effective by reducing rejected recharge. Because the consequence of long-term groundwater overuse can include permanent aquifer impairment, careful evaluation of long-term use records and groundwater response is essential to successful groundwater management. In Santa Barbara County, groundwater basins generally change significantly over a period of years, or in some cases decades. In larger basins, trends in groundwater level and quality are recognizable only by examining data the length of rainfall cycles. Some factors likely to affect basin conditions, such as imported supplemental water, basin management plans, and climatic influences, may change from year to year (Gibbs 2006).

The County Public Works Department and the United States Geological Survey (USGS) will continue a cooperative water resources monitoring program, which measures groundwater depth and quality and surface water flow and quality to evaluate water resources throughout the county. Groundwater observations published in 2005 (Gibbs 2006) revealed little change to significant conclusions reached in previous annual reports. Well measurements indicate that in the Cuyama Valley, the downward groundwater level trend continues. In the Eastern Santa Maria Basin, levels have dropped off dramatically. In the Western Santa Maria Basin, near Guadalupe, levels appear to have peaked in the due to water moving through the basin from the extremely wet 1990s and 2001, and were declining by 2005. In the San Antonio Valley, most well levels are declining. In the Santa Ynez and Lompoc Basins, water levels have remained stable or have declined only slightly. Work on groundwater management plans continue (Gibbs 2006).

2.2.4.1. Modeling Stream Channel Flooding

Researchers at CSU CEMML modeled stream channel overflow (or flooding) associated with climate projections for the San Antonio Creek and the Santa Ynez River. Flood modeling was conducted using local watershed characteristics and design storms generated from projected precipitation data based on RCP 4.5 and 8.5 emission scenarios for the 2030 and 2050 time periods. The models did not consider flooding of independent surface water bodies, stormwater systems, or surface ponding, nor do the projected design storms represent extreme weather events (e.g., hurricanes, extraordinary storm fronts). For comparison, historical precipitation data were used to calculate a baseline storm event for the year 2000.

Inundation projections were influenced by four variable inputs: (1) variation in total precipitation between design storms, (2) variation between the daily distribution of precipitation over the three-day period, (3) land cover change over the watershed area used in hydrologic modeling, and (4) land cover change within the installation used in hydraulic modeling. Projected storm precipitation for each scenario is summarized in Table 4 and Table 5. Inundation for each scenario and the relative change from baseline conditions are summarized in Table 6 and Table 7. The spatial extent of projected flooding for Santa Ynez and San Antonio basins is also depicted in a series of maps included in the Hydrology Appendix of the CEMML (2019) climate change report.

San Antonio Creek Basin Results

The baseline design storm calculated for San Antonio Creek basin was estimated to produce 4.31 inches of precipitation over the three-day period (Table 4). Stream channel overflow associated with the baseline design storm was estimated to inundate approximately 1725 acres at VSFB (Table 5).

Under the RCP 4.5 emission scenario, inundation along San Antonio Creek at VSFB is projected to decrease by 11% in 2030 and by 12% in 2050. Under the RCP 8.5 emission scenario, inundation is projected to decrease slightly in 2030 and increase slightly in 2050 (Table 5).

Table 4. Design storm precipitation, San Antonio Creek basin.

Design Storm		**Baseline**	**RCP 4.5**		**RCP 8.5**	
		2000	**2030**	**2050**	**2030**	**2050**
Precipitation (inches)	Day 1	1.34	0.89	1.11	0.77	0.95
	Day 2	2.06	1.41	1.64	1.65	2.10
	Day 3	0.91	0.92	0.72	0.73	1.18
	Total	4.31	3.22	3.47	3.15	4.23
Percent change from baseline (%)			-25	-19	-27	-2

Table 5. Design storm precipitation, Santa Ynez River basin.

Design Storm		**Baseline**	**RCP 4.5**		**RCP 8.5**	
		2000	**2030**	**2050**	**2030**	**2050**
Precipitation (inches)	Day 1	2.02	1.87	1.85	1.29	2.28
	Day 2	2.91	2.75	3.28	2.89	3.56
	Day 3	1.43	1.87	1.44	1.90	1.77
	Total	6.36	6.49	6.57	6.08	7.61
Percent change from baseline (%)			2	3	-4	20

Table 6. Projected inundation along San Antonio Creek basin.

	Baseline	RCP 4.5		RCP 8.5	
	2000	2030	2050	2030	2050
Projected inundation (acres)	1725	1541	1517	1671	1802
Change in inundation area from baseline (acres)		-184	-208	-54	77
Percent change from baseline (%)		-11	-12	-3	4

Santa Ynez River Basin Results. The baseline design storm calculated for Santa Ynez River basin was estimated to produce 6.36 inches of precipitation (Table 6), inundating approximately 1333 acres at VSFB (Table 7).

Under the RCP 4.5 emission scenario, inundation is projected to decrease by 15% in 2030 and then increase by 10% in 2050. Under the RCP 8.5 emission scenario, inundation is projected to decrease by 5% in 2030 and return to baseline levels in 2050 (Table 7).

Table 7. Projected inundation along Santa Ynez River Basin.

	Baseline	RCP 4.5		RCP 8.5	
	2000	2030	2050	2030	2050
Projected inundation (acres)	1333	1127	1472	1272	1333
Change in inundation area from baseline (acres)		-206	139	-61	0
Percent change from baseline (%)		-15	10	-5	0

2.2.4.2. Coastal Zone Modeling

Researchers used a DoD, site-specific scenario database to assess exposure to sea level rise (SLR) and storm surges (SSs) at VSFB. Details on the development and use of this database are described in Hall et al. (2016). Extreme water-level scenarios were based on regional frequency-analysis estimates of 20-year and 100-year SSs. Coastal flooding projections were modeled for RCP 4.5 and RCP 8.5 emission scenarios in 2035 and 2065 in accordance with the DoD scenario database. SLR inundation estimates the new permanent coastline for each scenario and timeframe; SS inundation estimates short-term flooding associated with an extreme water-level event that is expected to recede after the storm.

SLR and SS effects were observed at the mouth of the Santa Ynez River (Table 8). SLR is projected to reduce installation area by between 245.6 acres (RCP 4.5 in 2035) and 262.4 acres (RCP 8.5 in 2065). Projections for a 20-year SS, which have a 5% probability of occurring any given year, estimate possible inundation of between 636.9 acres for the RCP 4.5 scenario in 2035 to 690.2 acres for the RCP 8.5 scenario in 2065. Projections for a 100-year SS, which have a 1% probability of occurring any given year, estimate possible inundation up to 717.4 acres (0.72% of the installation area) for the RCP 8.5 scenario in 2065. The spatial extent of projected SLR and SS inundation are shown in the Hydrology Appendix of the CEMML (2019) climate change report.

Table 8. Projected SLR and SS inundation for each of the climate scenarios.

Climate Scenario		2035		2065	
		Projected inundation (acres)	Percent of installation area inundated (%)	Projected inundation (acres)	Percent of installation area inundated (%)
RCP 4.5	SLR	245.6	0.25	246.4	0.25
	20-yr SS	636.9	0.64	636.9	0.64
	100-yr SS	690.2	0.69	663.9	0.67
RCP 8.5	SLR	254.4	0.26	262.4	0.26
	20-yr SS	663.9	0.67	690.2	0.69
	100-yr SS	690.2	0.69	717.4	0.72
SLR=sea level rise; SS=storm surge.					

2.3. Ecosystems and the Biotic Environment

Vandenberg SFB contains diverse biological resources of considerable significance. Its location in the transitional geographic zone, between central and southern coastal California, has resulted in the formation of numerous unique biological habitats. Within this region, populations of many plant and animal species overlap at the southern or northern limits of their distributions. Moreover, the base has been relatively undisturbed by the urban, industrial, agricultural, and recreational pressures that have affected the distribution and abundance of native habitats in many other parts of coastal California.

The preservation of biodiversity and conservation of biological resources at VSFB are important issues for on-base natural resources planning. The native habitats of VSFB require long-term protection, both because of their unique nature and because they are a refuge for many threatened and endangered plant and animal species. The disturbance and subsequent loss of habitats affects population size and stability of sensitive species. Impacts from human development and processes, such as cattle grazing and agricultural activities, may have impacted native upland and wetland habitats. Exotic plant and animal species often invade native habitats and replace native species. Large areas of the base have been impacted by nonnative plant species (such as iceplant (Family: Aizoaceae], veldt grass [*Ehrharta* spp.], European beachgrass [*Ammophila arenaria*], and pampas grass [*Cortaderia* spp.]) and pest animal species (including North American beaver [*Castor canadensis*], feral pig [*Sus scrofa scrofa* × *S. s. domestica*], American bullfrogs [*Lithobates catesbeianus*], and a variety of nonnative fish species). The control or eradication of invasive exotics and the protection of native habitats and sensitive species are major issues of management concern on VSFB, and are fully detailed in tabs G and K.

Plant species nomenclature for historical vegetation follows Abrams and Ferris (1940), Hickman (1993), Munz (1974), Munz and Keck (1968), and Smith (1976); nomenclature for current vegetative cover, and for the remainder of the document, follows the alliances in the Manual of California Vegetation (MCV) (California Native Plant Society 2020). All wildlife and plant species named in this section are listed with common names only. Scientific names for all species may be found in Appendix B, Table B-5.

2.3.1. Ecosystem Classification

Vandenberg SFB is located within the Humid Temperate Domain, Mediterranean Division, California Coastal Chaparral Forest and Shrub Province (Bailey 2014). Ecosystems in this domain are subject to seasonal fluctuations in precipitation and temperature. Other climate variables typical of this domain include high levels of humidity, mild winters, and ample rainfall, especially during summer months when severe thunderstorms are frequent (Bailey 2014).

There are approximately 14 major ecotypes on VSFB. Those that follow defined vegetation types include: Bishop pine (*Pinus muricata*) forest, tanbark oak (*Notholithocarpus densiflorus*) forest, oak woodland, riparian woodland, wetlands, central coast maritime chaparral, coastal scrub, coastal strand, coastal salt marsh, freshwater marsh, and grasslands. Other habitats include saltwater and freshwater habitats, coastal bluffs and rocky headlands, and ruderal areas. These ecotypes are described further in Section 5.3.

2.3.2. Vegetation

2.3.2.1. Historical Vegetative Cover

Vegetation mapping within VSFB has been accomplished through several projects (Coulombe and Cooper 1976; Provancha 1988; Schmalzer et al. 1988). Although there is basic agreement with respect to the major vegetation categories, there are inconsistencies in their definitions and, sometimes, large discrepancies in their estimated acreages.

Studies conducted in 1960 on vegetation types in the southern part of the base (Gaines 1960; Gaines and Norsworthy 1960) were followed in the mid-1970s by the first basewide biological surveys carried out by researchers from San Diego State University (Coulombe and Cooper 1976; Coulombe and Mahrdt 1976). They initially defined 26 vegetation types based on species composition and physiognomy (Appendix B, Table B-2) and provided descriptions of the major categories.

Schmalzer et al. (1988) revised and studied these vegetation types in more detail, identifying 14 vegetation types (Appendix A, Figure 5-1), 12 of which were previously described by Coulombe and Cooper (1976). Most current environmental documents for VSFB refer to the vegetation classification scheme developed in these reports. Coulombe and Cooper (1976) produced a generalized vegetation map from aerial photography showing the distribution of 12 main vegetation types (they did not map coastal bluff scrub).

Eliassen (1999) completed a vegetation map of north VSFB using 1:12,000 color infrared imagery from June 1990 (Appendix A, Figure 5-2). This map is much more detailed than the 1988 map and uses a vegetation classification more closely based on the Holland system (1986) used throughout California. Thirty communities and land use types are recognized on north VSFB, including vernal pools and areas of nonnative plants not detailed in previous mapping efforts. Due to time constraints and a lack of clear photos, south Vandenberg was not included in this study.

The US Forest Service conducted a Vegetation Type Map Survey of California from 1927 to 1941. G. F. Burks compiled maps for the VSFB area in 1941 from field surveys conducted in 1930 and 1931. The vegetation types mapped for VSFB cover the USGS quadrangles for Guadalupe and Lompoc at a scale of 1:62,500. Plant associations were observed in field surveys from such vantage points as ridges and peaks and from boundaries sketched on maps using topographic features as a controlling factor. Each plant association was identified by a dominant species, which was defined as a species constituting 20 percent or more of crown cover occupied by its type element (conifers, broad-leaved trees, shrubs, or herbs). The type element was dominant if it formed 20 percent or more of total vegetation cover. Areas with less than 20 percent cover were identified as barren. The type elements were made up of a group of subtypes or plant

associations. Historical vegetation maps indicate that the dominant vegetation types at VSFB in the 1930s were grassland, sagebrush, chamise chaparral, woodland, and woodland-grass subtype. Cultivated and urban areas also were mapped. Although this map was not digitized into GIS due to lack of topographic orientation on the original, it provided valuable information on historical plant coverages at the base.

In 1960, vegetation was mapped and described for the Point Arguello Naval Missile Facility, which now forms much of south VSFB (Gaines and Norsworthy 1960). Numerous plant communities of the area were grouped into 24 major vegetative associations, which were described and quantified by representative sampling plots (Appendix B, Table B-1). A second report provided a list of species used in designating the plant communities, the composition of the plant communities, and a series of maps derived from overlays of the plant communities identified from aerial photography flown in February and March 1959 (Gaines 1960).

Few other documents are available that describe historical distributions of vegetation at VSFB. One study, however, investigated the distribution of central coast maritime chaparral, a form of California maritime chaparral found on the central coast, but localized mostly at VSFB and in areas surrounding the base (Odion et al. 1992). Its historical cover has been quantified in the report, which summarizes that there were an estimated 27,300 acres of maritime chaparral within the current VSFB boundary before the 1800s.

Effective management and protection of habitats requires the formulation of consistent classification and accurate mapping; therefore, the vegetation classification that will ultimately be used for the base needs to be reconciled.

2.3.2.2. Current Vegetative Cover

A basewide floral inventory in 1996 found diverse plant resources within VSFB (Holland and Keil 1996). More than 850 plant species from more than 400 genera belonging to 96 plant families were found. Researchers from San Diego State University carried out the most comprehensive study of fauna on-base in the mid-1970s (Coulombe and Cooper 1976, Coulombe and Mahrdt 1976). Vertebrate species observed on VSFB and in the adjacent nearshore marine environment included 53 species of mammals, 315 species of birds (115 of which have been known to breed on VSFB), 17 species of reptiles, and 10 species of amphibians. In 2009, Wildscape Restoration created Vegetation Classification Notes (Wildscape 2009), which in addition to accompanying GIS resources are used to classify vegetation basewide. A summary of featured plant and animal species by habitat type on VSFB is presented in Appendix B, Table B-3. A list of wildlife species that regularly occur on VSFB is provided in Tab A—Fish and Wildlife Management Plan.

Brief descriptions of the main vegetation types found within VSFB are provided below, and additional information can be found in Tab A—Fish and Wildlife Management Plan. The MCV is the standard vegetation classification system for state and federal agencies within California; therefore, vegetation types are provided below in MCV format, which uses both scientific and common names (California Native Plant Society 2020).

Pinus muricata (Bishop Pine) – *Pinus radiata* (Monterey Pine) *Woodland Alliance*

Bishop Pine – Monterey Pine Woodland

Bishop pine, the dominant plant in this alliance, generally occurs as scattered individuals and in patches and small stands within chaparral, in areas where there is enough precipitation or fog condensation to supplement soil moisture. Bishop pine seedlings were planted on the base in 1980, 1990, and 1995. This

stand is of great ecological interest because it is the southernmost stand on mainland North America (Zedler 1977).

Dense bishop pine woodland is the most important habitat for the western gray squirrel (*Sciurus griseus*) on VSFB (Zedler 1977). This woodland type also provides habitat for the federally endangered plant, Lompoc yerba santa (*Eriodictyon capitatum*). On VSFB, there are 454 acres of this habitat.

Status

Pitch canker (*Fusarium circinatum)*, a fungal disease introduced to California in the 1980s, has become established in the native Monterey pine populations in Monterey and San Luis Obispo Counties. A 1995 USDA Forest Service survey discovered pines with pitch canker in Ryon Park in Lompoc. At present, there is no treatment for this disease other than removal of the diseased trees.

Management

Thinning and interplanting would not be done because these procedures would destroy the scientific interest of the native stands.

No special precautions would be taken for wildfire protection. Because the fire ecology of bishop pine woodland is not entirely understood, management techniques would be carefully monitored.

Any bishop pine trees planted on-base will be from native stock. Such plantings have been carried out at the base in the past but, at this time, the USDA Forest Service has recommended against future plantings of bishop pines until a reliable method of producing disease-free seedlings can be found. Other planting methods would be explored to develop further groves.

Any work in bishop pine woodland areas is cleared through 30 CES/CEA (now CEI).

30 CES/CEIEA monitors the health of the bishop pine woodland.

Future development and construction would be planned to avoid disturbing these areas.

Notholithocarpus densiflorus (Tanoak) *Forest Alliance*

Tanoak Forest

Tanoak is often found as an understory plant or a co-dominant species in mixed evergreen forests in California, but rarely does it occur as a single canopy dominant as on VSFB. It occurs only in moist steep canyons and on peaks, where fog drip adds to precipitation during the otherwise dry summers. Due to their occurrence in foggy areas, a large number of mosses and fungi are associated with tanoaks. The dominant understory species in this forest is California huckleberry (*Vaccinium ovatum*), accompanied by western sword fern (*Polystichum munitum*). On VSFB, tanoak forest occurs mainly on the highest ridges and peaks, particularly Tranquillon and Oak Mountains, where it inhabits approximately 64 acres.

Status

The tanoak forest on VSFB is stable. Fire impacts tanoak forests. Tankoaks usually recover after fire or cutting with subsequent growth from basal resprouts; however, older trees may be killed or damaged by fire to the extent that they become susceptible to attack by insects and fungi.

Management

Future construction in tanoak forest sites would avoid disturbing intact stands, since the total extent of this community is limited, and fog drip restricted forests of this nature are of scientific interest.

Any removal of tanoak trees would be limited as much as possible to prevent potential erosion impacts on steep slopes. Tree cutting should keep base intact to keep tanoak viable for basal resprouting.

Fire is not required for the maintenance of tanoaks and so would not be included in prescribed burn programs; fire would be avoided and suppressed in these stands. Because the fire ecology of tanoak forests is not entirely understood, fire management techniques would be carefully monitored.

Coast Live Oak Woodland and Forest

Coast live oak (*Quercus agrifolia* var. *agrifolia*) is widely distributed along the coast of California. On VSFB, coast live oak associations vary from open stands with scattered trees (savannas) to dense forest-like stands with a continuous canopy (woodlands). Annual grasses, primarily nonnatives, such as bromes (*Bromus* spp.) and wild oats (*Avena fauta*), and western poison oak (*Toxicodendron diversilobum*), are the most common understory plant species. Hoffmann's sanicle (*Sanicula hoffmannii*) is an endemic species associated with coast live oak woodlands. On VSFB, this woodland occurs mostly in the interior portions of north VSFB and occupies 4,354 acres.

Status

Early European settlers introduced nonnative annual grasses with cattle, and these grasses have replaced native perennial grasses, once commonly associated with oaks. Along with competition from annual grasses, damage to acorns and oak seedlings from cattle, feral pigs, and fire, or from overall disruption of the normal oak life cycle, may account for the failure of oak seedlings to become established.

Management

Avoid development and construction in coast live oak woodlands and forests to minimize disturbances to oak trees.

Encourage habitat enhancement measures, particularly regeneration of oak trees in woodlands outside of construction zones.

Restore altered coast live oak woodlands and forests to their predisturbance condition. Employ measures specific to oak woodlands, such as replanting oaks at the optimal replacement rate,

Protect seedlings with cylinders of wire mesh, and using snow fencing to protect root zones, or use other equally effective methods.

Replace coast live oak woodland and forest plant species removed during construction with local native plants.

Removal of coast live oak or other oak trees should be avoided. If any oak tree greater than 6-inches in diameter (dbh) is removed an oak mitigation plan for replacement shall be developed with 5 years of maintenance. Coordinate plan with CEIEA. Replacement shall consist of 5 gallon size (minimum) trees obtained from locally occurring saplings or seed stock of 10 for every 6-inch diameter or greater oak tree to be removed or significantly disturbed. Replacement trees will be cared for, maintained, and well established (healthy) for a period of 5 years.

Incorporate exclusion fences in grazing pastures to prevent cattle from grazing in coast live oak woodlands and forests. This policy would continue for existing fenced areas and would be implemented for unprotected coast live oak woodlands and forests.

Control exotic plant species, including early removal, to increase viable seedling numbers.

Riparian Woodland

Riparian woodlands occur along river courses, streambeds, and areas where the water table lies close to the surface of the ground. Riparian systems are important due to their high biological productivity and value for providing food and cover for wildlife, particularly birds. In the coastal region of Santa Barbara County, most of the remaining relatively undisturbed riparian areas occur on VSFB. Riparian areas at VSFB are represented by the *Salix lasiolepis* (arroyo willow) shrubland alliance and *Acer negundo* (box-elder) forest and woodland alliance. Refer to Tab B for more detail.

Special-status species that occur in riparian woodlands are listed in Appendix B, Table B-3.

***Salix lasiolepis* Shrubland Alliance** is a riparian alliance commonly known as arroyo willow thicket. On VSFB, this alliance is dominated by arroyo willow, both as a canopy and an understory species. Other species include western poison oak, gooseberry (*Ribes divaricatum*), Schott's sedge (*Carex schottii*), and California blackberry (*Rubus ursinus*). Arroyo willow thickets cover large areas on VSFB along the San Antonio Creek and the Santa Ynez River and, to a lesser degree, in the larger canyons, such as along Shuman Creek, Bear Creek, and Cañada Honda Creek. This vegetation type has been mapped and measured variously to inhabit 2,200 acres (Coulombe and Cooper 1976) to 3,500 acres (Provancha 1988).

***Acer negundo* Forest and Woodland Alliance** is a riparian alliance commonly known as box-elder forest and woodland. Its occurrence is restricted on VSFB. Until the September 2000 Harris Fire, which burned 431 acres of surface vegetation at Barka Slough, the largest area of box-elder forest and woodland was found in the slough next to the channel, surrounded byarroyo willow thicket. At VSFB, the total area found to be covered by box-elder forests and woodlands was estimated to be 440 acres VSFB(Coulombe and Cooper 1976), with 70 acres in Barka Slough (Dial and Pisapia 1980). The areas of box-elder forest and woodland at Barka Slough that was burned in September 2000 is now reemerging.

Status

Key threats to arroyo willow thickets and box-elder forests and woodlands are exotic species, groundwater overdraft, and off-base agriculture.

Management

Maintain cattle fencing around all arroyo willow thicket and box-elder forest and woodland areas to prevent the adverse effects of grazing on riparian vegetation.

Implement periodic monitoring of the condition of Barka Slough as a wetland habitat. A monitoring plan to document habitat recovery and utilization by wildlife following the September 2000 Harris Fire was implemented from 2004 to 2005.

Protect arroyo willow thickets and box-elder forests and woodlands to the maximum extent practicable, including avoidance of damage to root zones. Encourage habitat enhancement in the form of regeneration of riparian vegetation.

Where willows need to be trimmed or where construction occurs next to riparian habitat, emphasis would be placed on conducting these activities outside of the nesting season of riparian species, particularly the endangered southwestern willow flycatcher (*Empidonax traillii extimus*) and other neotropical migratory birds. For management purposes, the nesting season for neotropical migrants and other birds protected under the Migratory Bird Treaty Act is defined by VSFB as 15 February to 15 August. For some species, such as the California thrasher (*Toxostoma redivivum*), and in certain areas, such as those used by nesting herons and raptors, longer "no work" windows may be necessary.

Restore altered arroyo willow thickets and box-elder forests and woodlands to predisturbance conditions. Include measures specific to riparian woodlands, such as planting cuttings at the optimal replacement rate, protecting seedlings with cylinders of wire mesh, and using snow-fencing or other methods to protect root zones. Use locally native species to replace riparian vegetation removed during construction.

Replace permanent impacts at least 1:1 ratio depending on regulatory requirements and in coordination with Vandenberg Natural Resources Management.

Arctostaphylos Chaparral

Chamise chaparral is a dense, evergreen, fire-adapted form of shrubby vegetation native to California's coastal areas and common chamise (*Adenostoma fasciculatum*) is the dominant species in this shrubland alliance. It provides valuable wildlife habitat and is important in providing vegetative cover that controls erosion, especially on steep slopes and ridges. Central coast maritime chaparral, which includes Burton Mesa chaparral, is restricted mostly to VSFB and its vicinity (Odion et al. 1992). On VSFB, chamise chaparral is variable and widespread, occurring on parts of the Burton Mesa, San Antonio Terrace, Lompoc Terrace, canyon slopes on south VSFB, and some of the slopes of the lower Santa Ynez Mountains. Its area has been reduced considerably over the years, and now it inhabits approximately 13,061 acres (Schmalzer and Hinkle 1987; Appendix A, Figure 5-3). Dominant plants include manzanitas (*Arctostaphylos* spp.), Santa Cruz Island oak (*Quercus parvula* var. *parvula*), California lilacs (*Ceanothus* spp.), and common chamise. Many regionally endemic species are found in chamise chaparral on VSFB, particularly in the Burton Mesa chaparral, which is distinguished by the presence of sand mesa manzanita (*Arctostaphylos rudis*), La Purisima manzanita (*Arctostaphylos purissima*), Lompoc ceanothus (*Ceanothus cuneatus* var. *fascicularis*), and Santa Barbara ceanothus (*Ceanothus impressus* var. *impressus*). Burton Mesa chaparral is very rare and regionally declining plant community, and much of the remaining acreage occurs on VSFB.

Burton Mesa chaparral, a component of maritime chaparral with endemic species, is considered a sensitive habitat with limited distribution, and it has seasonally important wildlife use. The primary plant species in Burton Mesa chaparral are ranked 1B.1 by CNDDB and found primarily on VSFB and nearby in Santa Barbara County along the CA coastal region. Additionally, this chaparral on VSFB provides habitat for two federally listed plant species. Dominant species known only in this region and their known distribution are found in the following list:

Arctostaphyllos purissima = Point Sal to Gaviota
Arctostaphylos rudis = Arroyo Grande to South VSFB
Arctpstaphylos tomentosa ssp. *eastwoodiana* = Point Sal to Honda Canyon and Harris Grade

The two dominant plant species of Burton Mesa chaparral *Arctostaphylos* (*A purissima, A rudis*) comprise a Natural Community alliance ranked by California Department of Fish and Wildlife as G1/S1 (G1 = Critically imperiled which is at very high risk of extinction or elimination due to restricted range, very few populations or occurrences, very steep declines, or other factors; S1 = Critically imperiled; at very high risk of extirpation in the jurisdiction due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors).

Status

Wildland fuel management is required for reducing fuel and fire hazards to create more favorable habitat for wildlife and to ensure the continued existence of fire-adapted plant species. Research has shown that burning in chaparral can lead to invasions of exotic plant species, particularly members of the Aizoaceae family, commonly known as iceplant. Controlled burn programs must take this factor into account

(D'Antonio et al. 1993, Zedler and Scheid 1988). Invasions of iceplant, veldt grass (*Erharta calycina*), and jubata grass considerably degrade chaparral. Their seed dispersal (in the droppings of deer and rabbits), germination, and growth are facilitated by a variety of disturbances.

Management

Construction or development should avoid intact stands of chamise chaparral and Burton Mesa chaparral. Replace and enhance impacts at 2:1 restored:impacted acres to provide implementable mitigation for projects to increase incentive to not develop chaparral areas.

Use existing roads, fuel breaks, and natural barriers as firebreaks for controlled burning to reduce the potential for soil erosion and disturbance to the natural chamise chaparral community.

The natural fire intervals for areas within VSFB are unknown. They are almost certainly much longer than the 20- to 30-year interval that now prevails as a result of controlled burning and human-induced wildfires. Therefore, some areas of pristine vegetation would be protected from fire and would be chosen based on the absence of weedy exotics, their location away from facilities or residences, and the low probability of future development. These would not be scheduled for controlled burning. The goal is to ensure that some vegetation is maintained in mature condition, providing areas that could be compared to burned sites and maintaining populations of species that may require or be favored by long fire intervals. Substantial areas of Burton Mesa chaparral, in particular, would be protected from fire or burned very infrequently. To allow for variation in ages of vegetation patches, the areas of chamise chaparral included in the controlled burn program would not be burned at the same interval. Refer to Tab M for additional information.

More information is needed regarding the processes of invasion of exotics and regeneration of native species following fire. The prescribed burning measures that minimize the invasion of exotic plants, such as iceplant, veldt grass, and pampas grass, need to be determined. Controlled burning would be limited to areas where the seed source of iceplant, veldt grass, or pampas grass is not significant; alternatively, eradication of these species would precede prescribed burning.

Seed bank studies for different ages of chamise chaparral patches would be conducted. An understanding of input, longevity, and losses of seeds during the fire cycle would facilitate management strategies.

Little is known about wildlife responses to the controlled burning program, including those species of special interest. Further research is needed in this area.

Vegetation and fire history data would be maintained and updated on the base GIS. It may be possible to link these data layers with predictive models of fire behavior both for controlled burns and for wildfires.

Within five years after controlled burns in chamise chaparral, a periodic program of removal of exotic plants should be instituted.

Coastal Scrub Alliances

The coastal scrub alliances represent extensive vegetation cover on VSFB and provide habitat for a number of wildlife species. Special-status species that occur in coastal scrub alliances are listed in Appendix B, Table B-3. Coastal scrub alliances at VSFB are represented by:

1) the *Artemisia californica* (California sagebrush) – *Salvia mellifera* (black sage) shrubland alliance,
2) the *Lupinus chamissonis* (Chamisso's lupine) – *Ericameria ericoides* (California goldenbrush) shrubland alliance, and
3) the *Coreopsis gigantean* (giant coreopsis) shrubland alliance.

***Artemisia californica – Salvia mellifera* Shrubland Alliance**, commonly known as California sagebrush – black sage scrub, is a diverse community. It is dominated by California sagebrush, which occurs on dry slopes and soils near the coast to the interior foothills. Associated shrub species include seacliff buckwheat

(*Eriogonum parvifolium*), black sage, deerweed (*Acmispon glaber*), and western poison oak. Many perennial and annual herbs also occur in this community. Purple sage (*Salvia leucophylla*) is found primarily in southern VSFB on the lower slopes of Tranquillon Peak. Smaller patches also occur on the south-facing slopes of northern VSFB near Point Sal.

On VSFB, this shrubland alliance occurs at the southern distributional limits of the northern California sagebrush – black sage scrub, and at the northern limits of the Venturan California sagebrush – black sage scrub. The overlap in species assemblages contributes to high species richness and occurs in southern VSFB near Cañada Honda Creek and Bear Creek and in northeastern VSFB. It inhabits between 25,000 acres (Coulombe and Cooper 1976) and 32,000 acres (Provancha 1988).

***Lupinus chamissonis* (Chamisso's lupine) – *Ericameria ericoides* (California goldenbrush) Shrubland Alliance**, commonly known as Chamisso's lupine – California goldenbrush scrub, occurs between Bodega Bay and Point Conception in coastal California. It occurs on sandy backdunes stabilized by vegetation cover, behind foredunes, and in transitional dune areas. This alliance may be represented best on VSFB because elsewhere this habitat has undergone extensive degradation and loss. This alliance has relatively dense and continuous plant cover; it is composed of scattered shrubs, subshrubs, and herbs; and it is dominated by California goldenbush, California sagebrush, and Chamisso's lupine. In the stabilized sand dunes, unique dune swale or slack wetlands occur, providing habitat for many plant and animal species. Important endemic plants in this community include San Luis Obispo monardella (*Monardella undulata* ssp. *undulata*), Blochman's leafy daisy (*Erigeron blochmaniae*), and black-flowered figwort (*Scrophularia atrata*). Chamisso's lupine – California goldenbrush scrub occurs along most of the VSFB coastline. On southern VSFB, it occurs as a relatively narrow strip, extending a few hundred yards inland and grading into California sagebrush – black sage scrub or grassland. On northern VSFB, it occurs along a wider section of the coast, extending several miles inland on the San Antonio Terrace. Chamisso's lupine – California goldenbrush scrub covers 8,192 acres (Schmalzer and Hinkle 1987).

***Leptosyne giganteum* Shrubland Alliance**, commonly known as giant coreopsis scrub, inhabits 160 acres on cliffs and bluffs immediately near the coast on rocky and very shallow, poorly developed soils. It is exposed to nearly constant winds and salt spray, as well as to coastal fog drip. Plant species found in this community include giant coreopsis, California saltbush (*Atriplex californica*), seaside woolly sunflower (*Eriophyllum staechadifolium*), *Dudleya* spp., and coastal goldenbush (*Isocoma menziesii*).

Status

Giant coreopsis scrub is not rare on VSFB, but proper management of grazing and fire is necessary. In areas that are overgrazed, these communities may be replaced by nonnative grassland. If previously grazed areas are later protected from grazing, many of the vigorous shrub species may return; however, some of the associated annual herbs may never regenerate (Coulombe and Cooper 1976).

The fire ecology of giant coreopsis scrub warrants further study. In the past, fire management of this alliance has been similar to that for chamise chaparral; however, the two vegetation types may have different optimal fire frequencies and require different management prescriptions. Additional research is needed so that more alliance-specific schedules and fuel management plans can be developed for VSFB.

Past attempts to stabilize dune surfaces by planting introduced grasses and other species resulted in their proliferation to the extent that they are a serious threat to the development and survival of native plants, which, in turn is a threat to native wildlife habitats. These invasive exotics include veldt grass, European beachgrass, narrow-leaved iceplant (*Conicosia pugioniformis*), and other members of the iceplant family.

Many endemic species occur within giant coreopsis scrub and the wetland habitats in the dune swales. Wind erosion affects disturbed areas or areas where native vegetation cover is removed.

Management

Limit grazing to preserve the *Coreopsis giganteum* shrubland alliance and prevent their conversion to grassland.

For slope repair or large project areas dominated by dense relatively pristine shrubland for all 3 alliances, mitigation at a 1:1 ratio by Construction/Project proponent shall be incorporated into the project.Control the spread of exotic plant species by implementing, to the greatest extent feasible, a long-term weed-eradication program.

Minimize physical disturbances to soils and vegetation.

Continue studies of candidate plant species found in coastal dune/Chamisso's lupine – California goldenbrush scrub.

Continue to prohibit use of off-road vehicles (ORVs) in Chamisso's lupine – California goldenbrush scrub.

Preserve giant coreopsis scrub for endemic plant and animal species by avoiding future development and disturbances and by limiting the removal of vegetation to prevent erosion.

Abronia latifolia (Coastal Sand Verbena) – Ambrosia chamissonis (Beach Burr Sage) Dune Grassland Alliance Coastal Sand Verbena – Beach Burr Sage Grassland

***Abronia latifolia* (Coastal Sand Verbena) – *Ambrosia chamissonis* (Beach Burr Sage) Dune Grassland Alliance** is a combination of beach and active dunes characterized by sparse low-growing species, such as coastal sand verbena, beach bur-sage, and maritime sea-rocket (*Cakile maritima*). The cover of coastal sand verbena – beach burr sage grassland on VSFB is estimated to range from 760 acres (Provancha 1988) to 1,660 acres (Coulombe and Cooper 1976) and occurs along the coast in the central and northern part of the base.

This alliance provides habitat for a number of special-status plants and animals, primarily in the active dunes. Special-status species that occur in coastal strand areas are listed in Appendix B, Table B-3.

Status

This plant community is restricted to parts of the shoreline. It is actively managed, as it provides habitat for a number of sensitive species. A major threat to native wildlife and plants in this community is the presence of exotic plant species, such as European beachgrass and members of the iceplant family, which continue to invade coastal areas, thereby inhibiting the growth of or displacing native species and threatening the western snowy plover (*Charadrius alexandrinus nivosus*) and the California least tern (*Sternula antillarum browni*) habitat.

Management

Continue to enforce protection measures for western snowy plover and least tern habitat, including restricting beach access by signs, fences, and the use of specific trails. Additional information is provided in Tab D—Threatened and Endangered Species Management Plan.

Develop and implement a weed control program to prevent the spread of invasive species and enhance wildlife habitat without compromising the breeding activities and survival of special-status wildlife species. Additional information is provided in Tab K—Invasive Plant Species Management Plan.

Continue to prohibit ORV use in dune areas to minimize human disturbance and trampling.

Sarcocornia pacifica (Common Pickleweed) *Herbaceous Alliance*

Pickleweed Mats

Pickleweed mats in coastal California are generally small and occur on flat plains of low elevation, such as river mouths and bays, where seawater is in the water table and surfaces are periodically flooded by tides. The marsh at the mouth of the Santa Ynez River (172 acres) is the only representative of this alliance on VSFB and the only pickleweed mat in northern Santa Barbara County. The eastern edge of the pickleweed mats intergrades with Olney's three-square bulrush (*Schoenoplectus americanus*) – southern bulrush (*C. californicus*) marsh associated with the Santa Ynez River.

Plant diversity is relatively low, with common pickleweed and alkali heath (*Frankenia salina*) being the dominant species. Although no special-status plant species occur in this marsh, it is used by many wildlife species, including marine birds, shorebirds, and fish. Special-status species that inhabit pickleweed mat are listed in Appendix B, Table B-3.

Status

The pickleweed mat at VSFB is unique because of its restricted distribution, both regionally and locally.

Management

Future development will avoid impacting this rare ecosystem type.

The ecology and hydrology of the Santa Ynez River estuary will be studied in more detail because of the importance of wildlife species that inhabit it. The effects of artificially restructuring the estuary for habitat management are not well understood.

Olney's Three-Square Bulrush – Southern Bulrush Marsh

Olney's three-square bulrush – southern bulrush marsh is a heterogeneous freshwater marsh alliance dominated by perennial herbs that occur in areas with water at or near the surface for the entire year. Dominant species include Olney's three-square bulrush, southern bulrush, broad-leaved cattail (*Typha latifolia*), giant bur-reed (*Sparganium eurycarpum* var. *eurycarpum*), hoary nettle (*Urtica dioica* ssp. *holosericea*), and a number of other rushes (*Juncus* spp.) and sedges (*Carex* spp.). On VSFB, the largest freshwater marsh occurs in Barka Slough and is estimated to be 140 acres (Dial and Pisapia 1980). Smaller instances are found in the dune swale wetlands or slacks on San Antonio Terrace, but these areas are too small to register on vegetation maps. Coulombe and Cooper (1976) identified 350 acres of freshwater marsh on VSFB.

Historically, the extent of this alliance on VSFB was much greater, particularly at Barka Slough. Much of this marsh appears to be in transition; willows (*Salix* spp.) and nettles are increasingly invading areas where bulrushes and cattails (*Typha* spp.) previously dominated. This succession has been attributed to the overdraft of groundwater from the San Antonio Basin, by both VSFB and off-base agricultural interests, and as a result of drought during the past two decades. State water became available to the base in January 1997. Presently, water is drawn only six weeks out of the year during annual maintenance of the state water system; however, the expected reduction in the overdraft of groundwater from the San Antonio Basin is not evident due to continued agricultural overdraft from off-base users. Loss of the Olney's three-square bulrush – southern bulrush marsh alliance is a significant issue because it provides habitat for many plant and animal species. Although once it was among the richest bird habitats in the county, by the mid-1990s Barka Slough supported only a fraction of the bird population that it did a decade earlier (Holmgren and Collins 1995). The Barka Slough monitoring program implemented in 2004-2005 included assessing the

relative abundance of these species within Barka Slough; however, funding for this project was discontinued.

Special-status species that occur in Olney's three-square bulrush – southern bulrush marsh are listed in Appendix B, Table B-3.

Status

The survival of the freshwater marsh and the entire Barka Slough ecosystem is unlikely overdraft of the San Antonio Aquifer is reversed (Schmalzer et al. 1988). A 1995 study (Holland 1995) indicated that implementation of a restoration program for Barka Slough would be feasible only if uses of surface and groundwater within the basin were curtailed to restore water levels to pre-1980 conditions.

Management

The condition of Barka Slough as a wetland habitat should be monitored periodically. A monitoring plan to document habitat recovery and use by wildlife following the September 2000 Harris Fire was implemented in 2004–2005 but was discontinued. The plan includes baseline surveys for wildlife and plant species, including special status species, and the establishment of protocols for future surveys to assess changes in habitats and their use by wildlife species.

Needle Grass – Melic Grass Grassland

Small, isolated occurrences of native perennial grasses, such as needle grass, june grass (*Koeleria macrantha*), beardless wild-rye (*Elymus triticoides*), glaucous wild-rye (*Elymus glaucus* ssp. *glaucus*), and little California melica (*Melica imperfecta*), occur at VSFB, primarily on terraces with fine clay soils; however, their extent is not well documented. Nonnative grasslands, on the other hand, occupy a large area, dominated by introduced annual grasses, such as bromes, wild oats (*Avena* spp.), hare barley (*Hordeum murinum* ssp. *leporinum*), various ryegrass (*Elymus* spp.) species, and fescues (*Vulpia* spp.), as well as introduced herbs, such as filarees (*Erodium* spp.), mustards (*Brassica* spp.), and California burclover (*Medicago polymorpha*). Needle grass – melic grass grasslands are the resource base for grazing leases on VSFB and cover approximately 19,324 acres. Additional information regarding grasslands is provided in Tab B—Grazing Management Plan.

Special-status species that occur in grasslands are listed in Appendix B, Table B-3.

Status

Nonnative grasslands have replaced most native needle grass – melic grass grasslands on VSFB, and today few areas of native perennial grasses remain on VSFB. To the extent possible, future development should avoid impacting native needle grass – melic grass grasslands.

Management

Survey to document and map the extent of native grasses on-base.

If possible, manage grazing to improve stands of native grasses.

Manage needle grass – melic grass grasslands to support sensitive plant and wildlife species, such as the western burrowing owl (*Athene cunicularia hypugea*).

Coastal Bluffs and Rocky Headlands

Coastal bluffs and rocky headlands provide important roosting and nesting habitat for a number of seabirds. Seabird nest sites are designated as environmentally sensitive habitat (ESH) by Santa Barbara County and

are protected under the Local Coastal Plan and California Coastal Act. Nesting birds found in these habitats are pigeon guillemot (*Cepphus columba*), pelagic cormorant (*Phalacrocorax pelagicus*), western gull (*Larus occidentalis*), black oystercatcher (*Haematopus bachmani*), rhinoceros auklet (*Cerorhinca monocerata*), and Brandt's cormorant (*Phalacrocorax penicillatus*). These species nest from February through August, and the most important nesting sites on VSFB are at Point Pedernales, Destroyer Rock, Point Arguello, Rocky Point, and Purisima Point.

Special-status species that occur on coastal bluffs and rocky headland areas are listed in Appendix B, Table B-3.

Management

Avoid construction in the vicinity of known seabird and peregrine falcon nesting sites. To the extent feasible, minimize all disturbances during the nesting season from March through August (mid-February through mid-August for peregrine falcons).

2.3.2.3. Future Vegetation Cover

Researchers evaluated ecosystem vulnerability to climate change at VSFB using the Habitat Climate Change Vulnerability Index (HCCVI) framework developed by Comer et.al. (2012). This index uses analysis of climate change sensitivity and ecological resilience for each ecosystem type within a given ecoregion. Results from the analysis indicate that several types of vegetation cover will be susceptible to climate change at VSFB.

Grassland alliances were classified as highly vulnerable under both emission scenarios due to warmer temperatures and shifts in precipitation patterns. Flooding also negatively impacts grassland alliances; any predicted increases in inundation under scenarios RCP 4.5 and RCP 8.5 would lead to losses in the current grass cover at VSFB. Coastal scrub alliances as well as forest and woodland alliances were classified as moderately vulnerable under high emission scenarios, but highly vulnerable under moderate emission scenarios.

There is a temperature below which the equilibrium state of the forest and woodland alliances appears constant, but above which the equilibrium forest and woodland cover declines steadily. This threshold represents a point where some degree of forest and woodland loss is inevitable. As the threshold is exceeded, there is a gradual increase in the committed die-back, with changes that are more progressive than sudden. Forest vegetation may experience some degree of die-back before impacts are observed. For example, if climate were stabilized at 2050, a significant die-back could still occur over the next 100-200 years (Lyra et al., 2017).

The chamise chaparral shrubland alliance is also expected to change under future climate conditions. This alliance is not defined as vulnerable using the parameters of this analysis, as the projected temperature and precipitation changes alone are not predicted to drive a significant change in the chaparral ecosystem (Reynier et al. 2017). However, the expected increases in fire frequency and, to a lesser degree, fire intensity, combined with the continued spread of invasive grasses, are expected to transform a significant portion of the shrub-dominated chamise chaparral into an alliance dominated by non-native, annual grasses. Variable intensity fire has historically been an integral process to chamise chaparral alliances, and chaparral has adaptations that help it succeed in these conditions, including facultative and obligate seeding and re-sprouting (Estes 2013). The introduction of invasive grasses promotes a cycle of more frequent fires, creating disturbed areas susceptible to further invasion and inhibiting successful shrub regeneration (Reynier et al. 2017).

In addition to the shifts in specific ecosystem types, rising temperatures will enhance soil decomposition. Together with reductions in rainfall, this may reduce plant productivity over large areas and in across different ecosystem types.

2.3.2.4. Turf and Landscaped Areas

The main cantonment (urbanized) area of VSFB consists of residential, industrial, community service, administrative, and recreational use areas grouped to form the core of the base. This area contains various turf and landscaping improvements, including family housing lawns, golf course fairways and greens, and other small landscaped areas maintained by service contract under the direction of the Base Civil Engineer. The administrative, athletic, and housing areas each contain landscaping also maintained by the Base Civil Engineer. Many introduced species are used for landscaping in the improved areas, including varieties of coniferous and broadleaf trees that line roadways, lawn grasses, shrubs and vines, and colorful flowering plants used for ground cover or accents.

Eucalyptus and Monterey Pine Windbreaks

The shelterbelts of VSFB consist of introduced trees (eucalyptus [*Eucalyptu*s spp.] and Monterey pine), chosen primarily for their rapid rate of growth and the protection from wind that they provide. They have minimal ecological value and could be made available for wood products. Most trees within these windbreaks are mature, ranging from an estimated 30 to 100 years in age. These species have been estimated variably to occupy approximately 300 acres (Coulombe and Cooper 1976) to 800 acres (Provancha 1988). However, before any wood is cut, groves of introduced trees must be assessed for potential significant monarch butterfly (*Danaus plexippus*) roosting sites and for nests of raptors, great blue herons (*Ardea herodias*), and all other species protected by the Migratory Bird Treaty Act.

2.3.3.Fish and Wildlife

Saltwater Habitats

These habitats include ocean and nearshore marine areas, as well as coastal saltwater lagoons. Inshore saltwater game fish include various species of surfperch (Gadidae), rockfish (*Sebastes* spp.), cod (Gadidae), and bass. Along the coastline, important marine invertebrates are California spiny lobster (*Panulirus interruptus*), rock crab (*Cancer* spp.), and four species of abalone (black, green, red, and white [(*Haliotis cracherodii*, *H. fulgens*, *H. rufescens*, and *H. sorenseni*, respectively]). Coastal lagoons at the mouth of the Santa Ynez River and San Antonio Creek are particularly important as bird habitats. Coulombe and Cooper (1976) observed 44 species of birds in these lagoons.

Special-status species that occur in saltwater habitats are listed in Appendix B, Table B-3.

In the nearshore kelp beds, off the rocky coastline near Purisima Point, there is a small breeding colony of the federally threatened southern sea otter (*Enhydra lutris nereis*). Since approximately 2011, southern sea otter adults and pups off the coastline near Sudden Flats on south VSFB have become the predominant population in the near coastal waters of the installation. This population has increased substantially from 2-5 otters in initial observations to 35-60 otters in 2020.

Freshwater Habitats

These habitats include rivers and creeks, Punchbowl Lake, and several other small ponds on VSFB. Freshwater fish species found in these habitats include the game fish, redear sunfish, and largemouth bass, as well as numerous other fish species.

Special-status species that occur in freshwater habitats are listed in Appendix B, Table B-3.

Marine Mammals

Marine mammals found on VSFB are the Pacific harbor seal (*Phoca vitulina richardii)*, California sea lion (*Zalophus californianus*), and the northern elephant seal (*Mirounga angustirostris*). California sea lions haul out seasonally at Point Sal, near the northern boundary of VSFB, and South Rocky Point on south VSFB. Pacific harbor seals haul out at Purisima Point and just south of Purisima Point (referred to as the Spur Road haul-out site) on north VSFB, and from the area of the boat dock at the Vandenberg Harbor northwest to South Rocky Point on south VSFB. Pacific harbor seals and elephant seals are the only pinniped species that presently breed on VSFB; their peak breeding period extends from January through June. The South Rocky Point haul-out area is the main pupping and breeding site. Increasing numbers of Steller sea lions (*Eumetopias jubatus*) have been observed since approximately 2012; however, only rarely are more than five animals observed during any survey. Along with the seals and sea lions, cetaceans, including dolphins, porpoises and whales, also inhabit or migrate through the waters off the coast of VSFB. See additional details in Tab A— Fish and Wildlife Management Plan.

Marine mammal haul-out areas are designated as ESH by Santa Barbara County and are protected under the Local Coastal Plan, California Coastal Act, and Marine Mammal Protection Act.

2.3.3.1. Climate Impacts on Fish and Wildlife

Fish and wildlife could be affected by anticipated temperature increases and shifting precipitation at VSFB based on climate change projections. Inundation in the Santa Ynez and San Antonio Creek basins are projected to decrease under several scenarios, which could reduce habitat availability for fish. Alternatively, long-term scenarios show the possibility of increased inundation within the Santa Ynez basin, which could increase fish habitat availability. A number of birds rely on arroyo willow thickets and box-elder forests and woodlands along the Santa Ynez River and could also be impacted by changes in the inundation area. Extreme rain events associated with the storm model projections could negatively impact birds by imposing flood damage on riparian woodland alliances.

Wildlife that relies on lentic habitats may also be negatively impacted by climate change. While annual rainfall averages are not likely to change drastically in the short or long term, models project shifts in seasonality, with periods of intense rain followed by long periods with less precipitation. Many amphibians, fish, crustaceans, and turtles rely on lentic habitats for all life cycle stages. They could suffer under prolonged periods of drought even if annual rainfall increases. Additionally, as water temperatures rise in lentic systems, dissolved oxygen content decreases, impairing water quality particularly for larval amphibians and aquatic macroinvertebrates. Increasing water temperature will also increase the chances of algal blooms occurring, further depleting dissolved oxygen content and degrading habitat quality (Paerl et al. 2011).

Increases in temperature and shifting precipitation also have the potential to impact wildlife by altering vegetation at VSFB (see Section 2.3.2.3). Changing vegetation communities could negatively impact specialist species of wildlife that historically depended on specific native plants (Dukes and Mooney 1999). In turn, such changes could create new niches easily filled by invasive wildlife species, as newly arriving invasive species are often able to outcompete native species that are already experiencing reduced fitness (Hellmann et al. 2008).

Rising temperatures could also increase potential for foodborne diseases and incidences of infectious diseases that are transmittable to humans. This includes diseases carried by foxes, rodents and arthropods such as rabies and West Nile virus (Githeko et al. 2000).

2.3.4. Threatened and Endangered Species and Species of Concern

Federal and state threatened and endangered plant, fish, and wildlife species that occur or that could occur at VSFB are listed in Appendix B, Table B-4a and Table B-4b. Although the ESA does not protect species listed as threatened or endangered at the state level, AFMAN 32-7003 directs USSF installations to provide similar protections to state-listed species where practicable and where such protection is not in direct conflict with the military mission. Detailed management information on all special status species is included in Tab D—Threatened and Endangered Species Management Plan. The INRMP is a guidance document and programs and actions described herein may require section 7 consultation with the USFWS or the NOAA Fisheries in accordance with the ESA.

2.3.4.1. Plants

Five federally endangered plant species occur on VSFB. In addition, one state endangered and two state threatened species occur, and one federally endangered species occurred in the past.

Beach layia *(Layia carnosa)* (federally endangered, state endangered). Two populations are present on VSFB, in coastal dune habitat on both north and south VSFB.

Gambel's water cress (Nasturtium gambelii) (federally endangered, state threatened). Only one population is known on VSFB.

Lompoc yerba santa (federally endangered, state rare). VSFB has two of the four known locations for this species and includes the location with the greatest number of known genetically different individuals.

Gaviota tarplant (Deinandra increscens ssp. villosa) (federally endangered, state endangered). At least one small population occurs on VSFB.

Vandenberg monkeyflower (Diplacus vandenbergensis) (Federal candidate for listing). Occurs on VSFB.

Seaside bird's-beak (Cordylanthus rigidus ssp. littoralis) (state endangered). This species occurs in small numbers at several locations on VSFB.

Surf thistle (Cirsium rhothophilum) (state threatened). This species occurs in the foredunes near the mouth of San Antonio Creek.

Beach spectaclepod (Dithyrea maritima) (state threatened). The occurrence of this species is sporadic in coastal strand and foredune communities.

La Graciosa thistle (Cirsium scariosum var. loncholepis) (federally endangered; state threatened). The last confirmed observation of this species near VSFB was in 1958 (Smith 1976).

2.3.4.2. Fish and Wildlife

Federally and state threatened and endangered fish and wildlife species that occur on VSFB are listed in Appendix B, Table B-4b and are described below.

Vernal pool fairy shrimp (Branchinecta lynchi) (federally threatened). This species was documented on VSFB in 2004. Surveys were completed to document all locations where it occurs. Vernal pool fairy shrimp were documented in vernal pools on both north and south VSFB.

Unarmored threespine stickleback (Gasterosteus aculeatus williamsoni) (federally endangered, state endangered, California fully protected species). This species is native to San Antonio Creek; in 1994, an attempt to transplant a population in Cañada Honda Creek was unsuccessful. Unarmored threespine stickleback and tidewater goby (*Eucyclogobius newberryi*) monitoring and management programs are integrated where the two species co-occur in San Antonio Creek. Measures developed for the conservation of these species must also consider the threatened California red-legged frog (*Rana draytonii*), which co-occurs with one or both species in many stream reaches.

Tidewater goby (federally endangered). This species occurs in all of the major creeks on VSFB (San Antonio, Cañada Honda, and Shuman), in the Santa Ynez River, and in both the Santa Ynez and San Antonio Lagoons. Tidewater goby and unarmored threespine sticklebackmonitoring and management programs are integrated where the two species co-occur. Measures developed for the conservation of these species must also consider the threatened California red-legged frog, which co-occurs with one or both species in many stream reaches.

Steelhead (also known as Coastal Rainbow Trout) (*Oncorhynchus mykiss irideus*) (federally endangered). This species occurs in the Santa Ynez River. With the exception of the Santa Ynez River and Jalama Creek, streams on VSFB provide poor to marginal habitat for steelhead.

California red-legged frog (federally threatened). This species occurs in nearly all permanent streams and ponds on VSFB.

Western snowy plover (federally threatened). This species nests and overwinters on the foredunes along the coast of VSFB, from near Point Sal to Purisima Point, and along beaches north and south of the Santa Ynez River mouth.

California least tern (federally endangered, state endangered, California fully protected species). This species nests from mid-April through August in colonies at locations along the coastal strand of north VSFB's coastline. Since 1998, least terns have nested only at the primary colony site at Purisima Point.

Southwestern willow flycatcher (federally endangered, state endangered). This species has been observed during the nesting season (May to August) in only three locations on VSFB, all of them in arroyo willow thickets along the Santa Ynez River, within three miles of the river mouth. There has been no successful breeding of this species documented on VSFB since 2003.

Southern sea otter (federally threatened, California fully protected species). A small, resident breeding colony of this species has inhabited the kelp beds near Purisima Point since 1991 (Roest 1995). A second, larger resident breeding colony has been present along the kelp beds near Sudden Flats area of south VSFB since 2001.

Black abalone (Haliotis cracherodii) (federally endangered). This species was once harvested at VSFB but a moratorium on fishing is currently in effect due to its listing as federally endangered. The VSFB coastline is designated Critical Habitat for this species.

White abalone (Haliotis sorenseni) (federally endangered). Found in very low density at the coastal habitat of the newly acquired Point Conception GSU.

2.3.4.3. Other Species of Management Concern

Several other animal species that occur on VSFB are not listed as either threatened or endangered, but are otherwise protected by federal laws (i.e., Migratory Bird Treaty Act, Bald and Golden Eagle Protection Act, and Marine Mammal Protection Act) or are species of special concern either at the federal level (birds

of conservation concern) or at the state level (Appendix B, Table B-4b). Consideration of these species in management actions on VSFB, to protect viable populations, can help preclude the need for their listing under the ESA. The Threatened and Endangered Species Management Plan (Tab D) addresses management issues associated with these species. Other species of management concern are listed below.

Bald eagle (Haliaeetus leucocephalus) (federally delisted, state endangered, California fully protected species). This species is occasionally observed flying over VSFB.

American Peregrine falcon (Falco peregrinus anatum) (federally delisted, state delisted, California fully protected species). Several nesting pairs of peregrine falcons inhabit the rocky cliffs of VSFB.

Belding's savannah sparrow (Passerculus sandwichensis beldingi) (state endangered). The presence of this subspecies has not been confirmed and recent indications are that it does not occur on the installation. Based on this species' habitat preferences, it is possible that it would occur in the salt marsh vegetation of the Santa Ynez River estuary.

California brown pelican (Pelecanus occidentalis californicus) (federally delisted, state delisted, California fully protected species). This species roosts on the rocky cliffs and coastal bluffs of VSFB; offshore kelp beds also provide excellent feeding areas.

2.3.4.4. Climate Impacts on Threatened and Endangered Species

Habitat change and disruption to food availability are two major climate-related threats to threatened and endangered species at VSFB (CEMML 2019). Habitat requirements may change for some species if they are able to employ behavioral adaptations in response to changing conditions. Prey populations and/or forage abundance are likely to be affected by changes in temperature and precipitation. Seasonal cues for prey or forage emergence may also change, resulting in a mismatch between food availability and food needs. Populations of some threatened and endangered species are further imperiled by life stages that are sensitive to temperature and precipitation changes projected in the climate scenarios. For example, stream channel overflow and changes in precipitation could alter riparian alliances important for threatened and endangered species such as the southwestern willow flycatcher. Information on managing for threatened and endangered species considering these changes can be found in section 7.4.1.

2.3.5. Wetlands and Floodplains

Wetland alliances, such as pickleweed mats and marshes, play many valuable, if not crucial, ecological and economic roles, and the importance of protecting them with appropriate stewardship cannot be overstated. Ecologically, they provide important seasonal to year-round foraging, drinking, spawning, nursing, resting, and sheltering habitats for myriad animal and plant species. Economically, they attenuate and absorb floodwater runoff, serve as natural water-treatment centers (Miller 1994), help to maintain water levels in aquifers, supply municipal water and irrigation water for agriculture, and are often the foci of recreational pursuits. Although they represent only about five percent (5,110 acres) of the VSFB landscape (Paterson 1995), they include a wide variety of types, ranging from rivers and intermittent streams to freshwater ponds, vernal pools, dune swales, and estuaries that support a rich diversity of organisms far out of proportion to the extent of these habitats.

The diversity of species supported by wetland alliances at VSFB includes a number of species protected under the federal Endangered Species Act (ESA) of 1973 (United States Fish and Wildlife Service [USFWS] 2020) and the California lists of Threatened and Endangered Plants and Animals of Special Concern (California Department of Fish and Wildlife 2020a, 2020b). The listed species include three federally endangered fish, including the unarmored threespine stickleback, tidewater goby, and steelhead;

and a California species of high concern, the arroyo chub (*Gila orcutti*) (California Department of Fish and Wildlife 2020a). VSFB riparian habitats and/or wetlands also provide nesting habitat for the federally endangered southwestern willow flycatcher, foraging habitat for a breeding population of the federally endangered California least tern, and nesting and foraging habitat for a First-Priority California Species of Concern—tricolored blackbird (*Agelaius tricolor*). The wetlands also support substantial populations of the federally threatened California red-legged frog and vernal pool fairy shrimp, as well as a small population of federally endangered Gambel's water cress.

In the 200-year time span since the American Revolution, 22 states had lost 50 percent or more of their wetlands, with California leading the way at 91 percent (Dahl 1990); the scope or damage to and loss of wetlands in the United States ranges somewhere around 53% in the lower 48 states alone. Habitat loss, disturbance, and contamination due to agricultural uses, urbanization, military uses, and other activities are the main factors influencing the healthy function and habitat availability of wetlands. Minimization of factors that degrade or significantly alter wetlands is crucial for protecting these "keystone" ecosystems.

2.3.5.1. Wetlands Mapping for Vandenberg SFB

In compliance with AFMAN 32-7003, *Environmental Conservation*, and Executive Order (EO) 11988, *Floodplain Management*, VSFB has delineated its wetlands in all areas of the base and its floodplain boundaries in all areas of the base that poses a flood risk. This is the first step in managing floodplain use to minimize the impacts of floods on human safety, health, and welfare and to preserve the natural and beneficial values of floodplains and associated wetlands. Wetlands inventories conducted on the base have followed the USFWS hierarchical wetland classification system developed by Cowardin et al. (1979). This system generally is used to identify, map, and assess acreages of various types of wetlands when regional inventories of wetlands are conducted. The jurisdictional delineation of wetlands following the United States Army Corps of Engineers' (USACE 1987) wetlands delineation criteria serves to identify wetland versus non-wetland areas by identifying boundaries between these areas rather than describing the types of wetlands present. Jurisdictional delineation is part of the regulatory and permitting process for compliance under Section 404 of the Clean Water Act; therefore, it is not applicable to conducting base-wide wetlands inventories. USACE delineation methods are applied specifically on a case-by-case basis to assess the extent of impacts on wetlands that may occur on the base. Three major wetlands mapping projects have been carried out at VSFB, as described below.

The USFWS wetlands mapping project was completed in June 1989 as part of the National Wetlands Inventory and was based on color infrared aerial photography taken at a scale of 1:40,000. Field reviews were carried out in selected areas so that ground conditions and photographic signatures of wetlands could be correlated. The USFWS wetlands classification system was used (Cowardin et al. 1979) and 81 different wetland types were defined. The products of this mapping project included draft 1:12,000-scale maps with labeled wetland attributes and final 1:24,000-scale maps without labeled attributes. Final digital data were forwarded to the National Wetlands Inventory and integrated into the Wetlands Analytical Mapping System. A total of 2,922 acres of wetlands were classified, or about 3% of the base's area (USFWS 1995).

The California Polytechnic State University wetlands mapping project was based on the analysis of 1990 color infrared photography. Wetlands were classified using the USFWS wetlands classification system (Cowardin et al. 1979) and 23 different wetland types were identified, described, and mapped. The effort identified a total of 5,025 acres of wetlands, or 5.1 percent of the base's area (Paterson 1995).

The U.S. Army Engineer Research and Development Center (ERDC) planning-level mapping of aquatic resources project was completed in 2018 for the entire base area. The goal of the project was to identify (at a watershed or planning scale) areas that have the potential to meet the definition of jurisdictional waters

of the United States for future planning efforts. The study involved extensive analysis of remote sensing products and data, as well as field sampling to corroborate results. Due to the scale of the analyses, the authors used a hybrid classification method that modified the California natural community classification by Holland (1986) and another by Keeler-Wolf (1998). The study identified and classified 474 miles of streams and 4,967 acres of potential wetlands in 9 different community classes or map units. The wetland vegetation communities delineated were Arroyo Willow Woodland at 55.2% of the total area (2,743 acres), Emergent 3.7% (186 acres), Juncus Stand 0.9% (43 acres), Poison Hemlock Stand 0.6% (30 acres), Saltwater Marsh 3.3% (163 acres), Vernal Pool 28.5% (1,414 acres), Mixed Wetland 1.8% (88 acres), Mixed Wetland/Upland 3% (149 acres), and Unvegetated 3.0% (147 acres).

There are significant discrepancies in the results from these projects. The identification of wetland types, the number of wetland types, and the assessment of total acreage of each wetland type identified vary considerably. The ultimate wetlands classification used for the base and the resulting wetland classes need to be consolidated; subsequently, their acreages need to be evaluated. The combined coverages are shown in Appendix A, Figure 5-4.

2.3.5.2. Wetland and Riparian Habitat Types at Vandenberg SFB

In accordance with AFMAN 32-7003, *Environmental Conservation*, this section describes the range of wetland habitats on base, details existing wetland regulations, discusses the current management practices and considerations, and provides goals and objectives for the future stewardship of this important resource. Management details are provided in Tab B—Wetlands and Riparian Habitat Management Plan.

Riverine Systems—Perennial Flows

Perennial flow riverine systems make up significant portions of the Santa Ynez River, San Antonio, Cañada Honda, Jalama, and Shuman Creeks. They also are found as small sections of minor streams near Point Sal in the north and in the Santa Ynez Mountains on Sudden Ranch in the south. Because of the nearly continuous flow of water available in perennial streams, they are vital to federally endangered fish and amphibians. Extensive palustrine forest and emergent wetland communities are found adjacent to perennial streams. These areas support a diversity of associated riparian habitat and wildlife species that rely on the wetlands, hydrophilic vegetation, and the rivers themselves for survival. The sections below describe the perennially flowing riverine systems at VSFB.

Santa Ynez River—The Santa Ynez River, one of the largest rivers in California's Central Coast, flows west along the northern base of the Santa Ynez Mountains from the vicinity of the Marietta Divide, near the Ventura-Santa Barbara county line, to the coastline north of Surf Railroad Station. The river watershed has a total drainage area of about 900 square miles and ranges in elevation from sea level to about 6,800 feet. Less than five percent of this area lies within VSFB (Engineering Science, Inc. and Sea World Research Institute 1988). Flow in the Santa Ynez River varies seasonally in response to precipitation and runoff. From June through November, the river flow is typically less than seven cubic feet per second, including effluent from a sewage treatment plant at Lompoc. The Santa Ynez River generally runs throughout the year, but dries up locally during periods of prolonged drought (Union Oil Company 1985, URS 1987).

Shuman Creek—Shuman Creek is located approximately five miles south of Point Sal and approximately three miles south of the northern VSFB boundary. It is nine miles long and has a drainage area of about 21 square miles. Though it has a large mouth, there is no defined lagoon associated with this creek. It drains the Casmalia Hills to the north and east and the San Antonio Terrace to the south. For most of its length, Shuman Creek is a narrow, shallow stream with a moderate current. During the summer, it makes little contact with the ocean, despite the fact that the ocean is located 65 feet west of the mouth. Coastal dunes

border the mouth of the creek, which empties directly into the ocean during winter months. Steep banks border the creek within a relatively wide watershed, known as Shuman Canyon, that runs parallel with Point Sal Road and the Southern Pacific Railroad right-of-way. The water course extends for 4.4 miles inside of VSFB and for a considerable distance beyond the base boundary (Mahrdt et al. 1976).

San Antonio Creek—The San Antonio Creek watershed has a drainage area of 154 square miles. The upper reaches of San Antonio Creek (i.e., upstream of Barka Slough) have intermittent flows, generally as runoff from the winter rains (November through April). The lower reaches of San Antonio Creek (i.e., downstream of Barka Slough) are perennial and are fed by surfacing groundwater in Barka Slough. This slough is a central dividing point in the San Antonio watershed. It is formed by underground, continuous bedrock between the Purisima and Casmalia Hills, just west (or downstream) of the slough. This bedrock forms a barrier to underground flow down the watershed through the unconsolidated deposits (Conoco 1985, URS 1987).

In the lower San Antonio Creek basin, water from the creek flows west-northwest to the ocean. Marshlands are located along part of its course. The creek ends in a small lagoon in the sand dunes and breaks through the dunes to the ocean only during large storms, at which time it is subject to tidal inundation (URS 1987).

Cañada Honda Creek—Cañada Honda Creek (hereafter Honda Creek) is a perennial stream about 9 miles long with a drainage basin of about 12 square miles that supports riparian vegetation and a very small area of estuarine habitat at the mouth of the creek. Honda creek is located 6 miles south of the Santa Ynez River and 2.5 miles north of Point Arguello. The Southern Pacific Railroad and Coast Road traverse the lower end of the creek. The creek is inaccessible, for the most part, due to the steep cliffs and densely vegetated riparian woodland. It is the steepest stream that flows through VSFB and it has a relatively fast current. There is no clearly definable lagoon, although small amounts of salt and freshwater marsh exist near the mouth of the creek, which lies within a shallow cove separated from the ocean by a flat, sandy beach. Well vegetated, steep dunes characterize the north side of the cove, whereas the south side is characterized by sheer cliffs and rocky beach (Mahrdt et al. 1976).

Jalama Creek—Jalama Creek is eight miles in length and drains 24 square miles of the Santa Ynez Mountains. The creek mouth is located at the southern boundary of VSFB, approximately five miles north of Point Conception. In general, the topography of the creek consists of moderately steep, well vegetated hillsides, and barren cliffs (Mahrdt et al. 1976).

Riverine Systems—Intermittent Flows

Intermittent stream systems contain flowing water for only part of the year, and most of the tributary streams that flow into the Santa Ynez River flow intermittently. When the water is not flowing, surface water may be absent, although isolated pools of varying size may persist through the drier months. These remnant refuge pools provide critical habitat for a variety of plants and wildlife. At VSFB, the majority of intermittent flow systems occur along Sudden Ranch and the region north of Lions Head; Bear Creek is considered the largest of these streams. Numerous minor drainages bisect these hilly environments flowing from headwaters at the coastal slopes to the ocean.

Palustrine Systems— Emergent Marshes and Forested Riparian

As much as 95–97% of riparian communities have been eliminated from floodplain areas of southern California by development (Faber et al.1989). Diversions of water flow, overdrafting of groundwater, and infestations of invasive exotic plants have degraded much of the remaining habitat.

Fortunately much of the emergent marsh and forested riparian habitat of VSFB remains intact. Coulombe and Cooper (1976) identified a total of 350 acres of freshwater marsh and 2,640 acres of forested riparian

habitat; however, a later study estimated as much as 3,500 acres of riparian forest land on VSFB (Provancha 1988). Estimates from more recent studies fall in between those estimates, depending on how the vegetation and other measure of wetland presence or absence is classified (e.g., the 2018 ERDC survey; Mersel et al. 2018). These wetland habitats are widespread on base and can be found along every major drainage and in a large number of pocket wetlands, both natural and man-made.

Barka Slough—Barka Slough, one of the largest wetlands in Santa Barbara County, comprises approximately 480 acres of freshwater marsh and riparian woodland habitat that support a variety of regionally significant wildlife. This impounded section of San Antonio Creek is sustained by a subsurface groundwater barrier between the Purisima and Casmalia Hills that forces groundwater in the alluvium to the surface, where it backs up for approximately 2.5 miles to create Barka Slough (Dial and Pisapia 1980, Muir 1964, Conoco 1985, URS 1987).

Palustrine Systems—Seeps and Springs

Seep and spring wetlands form from seasonal or perennial groundwater discharge (Sada et al. 2001). They differ from riparian wetlands by lacking well-defined channels that extend throughout the wetland. Seeps generally do not have surface flow whereas springs typically have flow for part of the year (Ferren et al. 1996). On VSFB, seeps and springs are widely distributed but not well known. These wetlands are small and often ephemeral and can be overlooked easily.

The floral diversity of seeps and springs provides potential cover for resting, nesting, and feeding for many different organisms, especially birds (Sada et al. 2001). Many springs in western North America are isolated from other wetlands and periodically dry out. This lack of connectivity restricts dispersal of many macroinvertebrates and fishes and has resulted in many unique and endemic species occupying isolated spring wetlands (Williamson and Harrison 2002).

Palustrine Systems—Vernal Pools and Seasonal Wetlands

In California, as much as 90 percent of vernal pool habitat has been destroyed by land conversion to agriculture and development (USFWS 1990). Vernal pools are identified as shallow depressions, usually underlain by a subsurface layer that impedes drainage, that become seasonally inundated for limited periods of time following rain events. During the wet season, these seasonal wetlands are dominated by facultative and non-persistent obligate wetland vegetation (USACE 1987). After the cessation of rain, water levels drop in these pools that often completely dry by summer. After desiccation, these pools may become dominated by annual upland herbs and grasses, making the pools difficult to detect.

Vernal pools are widespread on VSFB but occupy a minimal portion of the base as a whole. Estimates for vernal pool cover on VSFB are variable, ranging from approximately 10 acres (USFWS 1995) to 64 acres (Paterson 1995) to 114 acres (Provancha 1988), and the 2018 survey identified 1,414 acres of potential vernal pools (Mersel et al. 2018). Due to the ephemeral nature of vernal pools, their small size, and the difficulties associated with identifying pools outside of the wet season, this habitat type has been poorly documented.

On VSFB, the majority of vernal pools and seasonal wetlands occur on the Burton Mesa near 13th and 35th Streets. Although the vernal pools and seasonal wetlands at VSFB are not extensive, they provide important habitat for birds and other vertebrate species, as well as many invertebrates (insects and crustaceans). In particular, they are important on VSFB for providing habitat for the vernal pool fairy shrimp, a federally threatened species, and the western spadefoot (*Spea hammondii*), an amphibian listed as a California Species of Concern.

Palustrine Systems—Dune Swale Wetlands

Dune swale or dune slack wetlands are low-lying areas between the crests of coastal dunes where the water table is near the surface (Grootjans et al. 2001). On VSFB, dune swale wetlands are confined to the coastal dune scrub community along a section of the coast north of San Antonio Creek on the San Antonio Terrace. Dune swale wetland flora is highly variable, depending on duration and amount of soil saturation (Holland and Keil 1996) and, as a result, dune swale wetlands are also important wildlife areas.

Palustrine Systems—Artificial Ponds and Migratory Waterfowl Overwintering Areas

At VSFB, there are many different palustrine ponds, both natural and man-made (none meet the classification criteria for lacustrine wetland) belonging to the open water, emergent, scrub-shrub, and forested classes.

Ponds—On VSFB, there are several natural and artificial ponds. Many of these water bodies, larger in size than vernal pools, could be classified as vernal lakes but sharing many features of lacustrine systems and freshwater marshes in terms of flora. Water regimes range from permanent to seasonal.

Artificial ponds were created through purposeful modification of habitats or through unintentional modification via road, embankment construction, and others. Those created or used for recreation are Pine Lakes, Punchbowl Lake, and Mod III Pond. These have been stocked with fish for recreation in the past and now support populations of exotic fish.

Other lakes and ponds on VSFB include, Lompoc-Casmalia Pond, Mitchell Pond, Lower Canyon Lake, ABRES-A Lake and El Rancho Pond. These water bodies range from permanent to semi-permanent with some drying completely during low rain years. ABRES-A Lake is part of IRP Site 13.

Lake Canyon Lakes—The Lake Canyon lake complex is composed of three lakes. Located downstream from Areas 2 and 3 of Installation Restoration Program (IRP) Site 20. It supports introduced populations of sport fish, and provides habitat for native waterfowl and aquatic species.

Punchbowl Pond—Punchbowl Lake is used for recreational fishing and supports a nonnative fauna similar to that of the Lake Canyon lakes. In addition, the emergent vegetation along the northeastern shore of the pond provides habitat for one of the only breeding populations of tricolored blackbird, a California Species of Special Concern. This pool is situated downslope of the VSFB Saddle Cloud stables.

MOD III Pond—MOD III Pond is a recreational lake subjected to stocking with sport fish in the past, but also supports native and non-native amphibians. MOD III Pond is part of the IRP Site 15 cluster.

Natural Resource Management Area—This area was originally a VSFB sewage treatment plant with ponds heavily used by migratory waterfowl as a stopover site. When the facility was no longer needed, the ponds were not maintained. In the early 1990s, conservation work revived the ponds, but soon after they were unable to be maintained at a depth needed for ponding in the summer and fall. Recreational improvements to the area also declined, with site abandonment occurring around 2006, although there has been some interest in developing areas near the Santa Ynez River floodplain.

Estuarine Systems

Estuarine wetlands are coastal embayments that have at least occasional access to the ocean and, therefore, saltwater enters them during high tides; at least occasionally, ocean water is diluted by freshwater runoff from adjacent land. Estuarine intertidal wetlands are found primarily in the Santa Ynez coastal salt marsh and a small area near the mouth of Honda Creek. Additional relatively minor and unique estuaries occur at the mouth of Jalama, San Antonio, and Shuman Creeks. These estuarine systems were divided into three main categories to recognize their unique topographical, hydrological, and biological features: river mouth

estuaries, canyon mouth estuaries, and coastal dune estuaries, all of which are described and discussed separately below with management considerations.

Estuarine Systems—River Mouth Estuaries

River mouth estuaries occur at the mouths of large rivers that generally have some perennial flow producing nearly permanently brackish conditions in the estuary, referred to as a salt marsh. Salt marshes in coastal California are generally small and are found at river mouths and bays. They occur on flat plains of low elevation where seawater is present in the water table. In recent decades, salt marshes and other coastal in California, development has drastically reduced the extent of wetlands.

The Santa Ynez River Salt Marsh—This salt marsh is the only one of its kind occurring on VSFB and is the only large coastal salt marsh in northern Santa Barbara County. This marsh (and estuary) is one of the best preserved estuaries remaining in southern California, with the potential to provide substantial, high-quality rearing habitat for steelhead. The mouth of the river is closed off from the ocean much of the year, preventing regular tidal fluctuation. The eastern edge of the salt marsh intergrades with freshwater marshes associated with the Santa Ynez River; to the north is annual grassland, and to the south is coastal dune scrub.

Estuarine Systems—Canyon Mouth Estuaries

A series of relatively small watersheds on VSFB drain into the ocean through incised canyons or arroyos. At the mouth of these canyons small estuaries are formed that vary in size, salinity, and biota, depending on frequency of tidal flushing, evaporation, and perennial freshwater flow. Freshwater runoff tends to drop dramatically during the dry seasons of summer and fall, resulting in loss of water in these estuaries through evaporation and relatively high salinity. During large flow events, sand impoundments at the mouth of these creeks are washed away, allowing tidal influence and dramatic shifts in salinity in these estuaries. Examples of canyon mouth estuaries on VSFB include Cañada Honda and Jalama Creek. Examples of canyon mouth estuaries on VSFB include Cañada Honda and Jalama Creek.

Cañada Honda Estuary—The Cañada Honda Estuary is small estuary approximately six miles south of the Santa Ynez River mouth, just west of the Coast Road crossing at Cañada Honda. A large sand impoundment blocks the estuary from the ocean during the majority of the year, limiting tidal influence and likely resulting in relatively low salinity. Deep pools under the railroad trestles constitute the majority of the estuary.

Jalama Creek Estuary—Jalama Creek is located along the southern border of VSFB and is not subject to impacts from past, present, or projected USSF actions. The Santa Barbara County Jalama Beach Park borders the estuary along its southern boundary. Sensitive species exist in the area.

Estuarine Systems—Coastal Dune Estuaries

Coastal dune estuaries are relatively small and seasonally impounded by sand bars. In addition to variable perennial runoff, coastal dunes contain significant amounts of freshwater that replenish these estuaries. The water, therefore, is slightly brackish and generally stable most of the year (Ferren et al. 1996). On VSFB, two coastal dune estuaries, the San Antonio Creek Estuary and Shuman Creek Estuary, are found on either side of the San Antonio Dunes Terrace. Nearby dune ponds may have been part of these estuaries historically, but subsequently they have separated by changes in creek flow or dune topography.

San Antonio Creek Estuary—The San Antonio Creek Estuary, sometimes referred to as the San Antonio Lagoon, is approximately 7.4 miles north of the Santa Ynez River mouth. During large storms, the San Antonio Creek breaches the dunes that normally block it from the ocean, subsequently tidal influence occurs, causing dramatic shifts in salinity (URS 1987, USDI 1981). Aquifer overdraft has led to drawdown

of water in Barka Slough and San Antonio Creek. This drawdown, plus any impacts from unmanaged agriculture and grazing, will directly affect habitat quality.

Shuman Creek Estuary—The Shuman Creek Estuary, or lagoon, is approximately 10.6 miles north of the Santa Ynez River mouth. A sand bar blocks the estuary from the ocean for most of the year. Large flow events breach the sand bar during rainy periods. Subsequent tidal surges cause dramatic shifts in salinity in the estuary. As with the San Antonio Estuary, excessive ground and surface water use (over drafting) has affected the Shuman Creek Estuary, decreasing available habitat for sensitive species and degrading riparian habitat.

2.4. Mission Impacts on Natural Resources

2.4.1.Natural Resource Constraints to Mission and Mission Planning

Natural resource constraints to future planning and missions at VSFB are the result of a combination of legal factors (e.g., federal and state environmental laws and regulations) and physical factors (e.g., topography) and help to shape the framework for prioritizing management goals and objectives. Natural resources constraints include identified wetlands and threatened/endangered species habitats (First Class Constraints), special-status/candidate species habitats (Second Class Constraints), and floodplains, steep slopes, and highly erodable soils (Third Class Constraints).

The natural resources constraints map (Appendix A, Figure 6-3) is a generalized guide to delineating areas on VSFB, where natural resources constraints may be a factor in the development of future plans. Incorporation of natural resources concerns in these areas early in the planning process is particularly important to avoid conflicts that could impact mission accomplishment. Although the constraints map could suggest a high potential for significant impacts on USSF missions and projects, procedures established on VSFB to integrate environmental issues early in program planning have historically minimized conflicts between resource protection and mission accomplishment.

These projects and procedures may include the following:

continue support of pollution prevention and waste management activities;

evaluate identified hazardous waste sites using ecological standards/criteria, as well as public health standards/criteria;

develop a database of hazardous waste originators with respect to sensitive species, habitats, and resources;

develop and implement a solid waste management plan;

develop a materials recovery facility;

develop a composting/greenwaste program;

design and implement a cleanup program for former debris and the landfill area;

reduce erosion impacts around the landfill;

continue operation of prevention of significant deterioration stations to ensure minimal impact on ambient conditions;

evaluate the potential effects of potential construction of electrical wind turbines and wind turbine farms on natural resources;

minimize AICUZ and launch noise impacts on wildlife to the maximum extent feasible; and

maintain current restrictions on flight altitude levels.

2.4.2.Land Use

Vandenberg SFB is composed of 99,579 acres. Improved lands, the area covered by buildings, helipads, runways, driveways, roads, recreation areas, and slabs, represent 33,180 acres (Appendix A, Figure 6-1). Semi-improved lands cover a total of 21,230 acres (USSF 1992). Most improved lands are within the cantonment area; the remainder of improved and semi-improved areas are scattered throughout the base. In the IDP (VSFB 2020), land is categorized as improved, semi-improved, and unimproved. The planning office is also responsible for overseeing the completion of comprehensive GIS map overlays for VSFB, which are used to provide specific definitions for grounds categories.

Vandenberg SFB is in a rich natural environment on the south-central coast of California. This region of California is particularly rich in habitat diversity because of its position in a transition zone between central and southern California's habitat and climate. This unique transitional habitat zone extends from Point Sal in the north to Point Conception in the south. Local geography also plays a role in VSFB's ecological diversity. The east-west trending Transverse Range provides extreme contrasts on northern and southern slopes. Northern slopes are moist and cool compared with the southern slopes, which are hotter and drier. These temperature extremes encourage species with northern and southern affinities to exist close to one another. VSFB is especially important because it provides the largest single management unit of these unique natural resources.

Riparian woodland and forest alliances have been much reduced in Santa Barbara County this century and now exist in disjunct and degraded stands along streams and rivers and in foothill canyons. The most extensive areas are along the Santa Maria River (particularly west of Guadalupe), San Antonio Creek (mostly on VSFB), and the Santa Ynez River (on and off VSFB) (Lehman 1994). The Barka Slough area of San Antonio Creek (in eastern VSFB) and several sections of the Santa Ynez River west of Buellton and Lompoc have particularly rich growth.

The Santa Ynez River is affected by agricultural reclamation and grazing in the Lompoc and Santa Ynez Valleys and by restricted water flows controlled by the Bradbury Dam approximately 45 miles upstream of the base. Approximately five miles of the Santa Ynez River adjoins VSFB property. This section of coastal estuary is an important natural resource under base management.

The Santa Ynez marsh and riparian woodland complex is one of the largest wetlands of this type remaining in the region (NOAA 1993). Many species of fish and resident and migratory birds use the estuary. The pickleweed mats at the mouth of the Santa Ynez River grades to freshwater Olney's three-square bulrush – southern bulrush marsh and riparian woodland and forest alliances upstream. Riparian woodland is found in much of the stream course east of the base, except for paved areas near Lompoc. This riparian corridor was substantially reduced in many areas due to conversion to agriculture.

Chamise chaparral is probably the most widespread plant community in Santa Barbara County. Burton Mesa chaparral is a rare form of mixed chaparral found both on and off the base. This plant community is noted for being composed primarily of regionally unique plant species.

The State of California acquired the Burton Mesa Ecological Reserve because of the high value of its environmentally sensitive resources, particularly the rich botanical diversity of the property's Burton Mesa chaparral. This property supports one of the last significant natural stands of maritime chaparral in central California. In 1988, the original extent of Burton Mesa chaparral was estimated to be over 22,000 acres, which was reduced to 14,550 acres in 1938 and further reduced to less than 8,645 acres in 1988. Additional habitat has been lost due to the spread of exotic plant species. It is not known how many acres of Burton

Mesa chaparral remain, but more than 3,000 acres is on the Burton Mesa Ecological Reserve (Gevirtz et al. 2007).

A Land Management Plan was prepared for the Burton Mesa Ecological Reserve in 2005 (Condor Environmental Planning Services, Inc. 2007) that articulates goals and specific action items that are intended to

Engage the local community in the reserve;

Protect the resources on the reserve;

Restore native ecological communities in those portions of the reserve that have been altered by humans;

Continue to learn more about this unique ecosystem through an effective system of monitoring and research; and

Use and continuously update the GIS database that has been developed for the reserve.

Over the past 200 years, grassland alliances have been substantially altered throughout California, including Santa Barbara County. Changes in this habitat have been brought about by such human activities as burning, overgrazing, fire suppression, agriculture, urban expansion, and the introduction of nonnative plant species. Perennial native bunch grasses have been replaced by introduced annual species, and many other grasslands have disappeared altogether. VSFB is one of the remaining coastal areas still supporting large expanses of grassland.

Although VSFB's coastline is similar to that in the central coast region of California, it has special regional importance. It is the largest stretch of central California coastline managed by a single entity.

The USSF is particularly proud of VSFB’s largely undisturbed setting and is a conscientious steward of a primarily intact regional habitat supporting many threatened and endangered species. The USSF has established working relationships with the USFWS, CDFW, The Nature Conservancy, and several other nongovernmental organizations to promote the preservation of flora and fauna at VSFB.

2.4.3. Current Major Mission Impacts on Natural Resources

Although broad compatibility exists between the space-based missions conducted at VSFB and the requirements of successful natural resources management, impacts are still associated with USSF activities.

Regulatory consultations with the USFWS and NOAA Fisheries have been completed for all current mission programs that have any known or potential impacts on species listed under the ESA, or that are protected under the Marine Mammal Protection Act. A Programmatic Biological Opinions issued by the USFWS and Letters of Authorization issued by NOAA Fisheries, specify monitoring or appropriate mitigation measures to ensure species protection, while assuring year-round capability of launch and other mission-essential programs.

The military missions conducted at VSFB potentially have both long-term and short-term effects on natural resources. Long-term impacts arise during construction of new facilities and usually involve habitat loss and degradation. Potential short-term impacts from launches associated with USSF missions are hazardous materials releases, wastewater discharges, noise, and impacts associated with fallout and vapor.

2.4.3.1. Long-term Impacts

Construction

Long-term impacts at VSFB typically occur during the construction of a new facility. The potential effects of new construction are assessed prior to facility construction in environmental documents required under NEPA. Base policy ensures natural resources managers and environmental planners approve appropriate mitigation measures before facility construction. In addition, a process has been established on VSFB that ensures input on natural resources issues is provided during the earliest stages of project planning.

Infrastructure Maintenance and Improvements

Infrastructure maintenance and improvement projects, such as installation and maintenance of culverts, utilities, and water lines, have the potential to impact threatened and endangered species and disturb habitat. Impacts on natural resources can be minimized or avoided in most of these instances through the AF Form 813, *Request for Environmental Analysis*, work request processes, and the EIAP. General guidelines to avoid impacts on resources include placing utilities and water lines within existing disturbed areas (e.g., road shoulders) as much as possible, and maintaining close coordination between 30 CES and base biologists to ensure that culvert and drainage construction and maintenance projects avoid adverse impacts on threatened and endangered aquatic species, such as the California red-legged frog and the unarmored threespine stickleback.

Borrow Pits

Operation of VSFB requires a network of roads, parking lots, administrative buildings, residential housing, utilities and other facilities. New construction and maintenance of existing facilities and roads frequently requires the use of soil gathered from distant "borrow pits." Borrow pits are required to provide structural fill for building foundations, slope stabilization, failed subgrade soils on roads and parking lots, erosion damage, landslide repairs, and repair of water and sewer lines.

Vandenberg SFB has nineteen existing borrow pits, twelve of which are currently active; and most were initially placed in the 1960's, prior to the authorization of the ESA. While it is possible to purchase and transport soil to the base from other sites, this would simply result in relocating the potential effects to the environment and sensitive species to that off-site location. Additionally, purchasing soil from off-site can be cost-prohibitive, and even more so if transportation costs are considered: The cost to import borrow material from off base sources ranges from $65 to $90 per cubic yard depending on the type of structural fill required. Additionally, importing borrow material would likely increase the likelihood of introducing non-native species to VSFB.

Borrow pits are considered "semi-improved areas." Weed removal, revegetation and other potential management actions are discussed in Appendix C as well as Tabs J and K.

Air and Water Pollution

Air pollutant emissions from the exhaust plume of a rocket launch could cause localized effects on terrestrial and aquatic biota from exposure to initially high concentrations of pollutants. Such effects have not been documented during monitoring of launches in the past, with the exception of testing for acid deposition, which has been demonstrated to be minimal and rare. Monitoring is performed for most rocket launches in proximity to aquatic habitats or habitat for sensitive species.

Hazardous Waste

Proper handling and management of hazardous waste is critical to maintaining the quality of natural resources at VSFB. Improperly managed hazardous waste could introduce chemicals with the potential to impact human health, welfare, and the environment. Facilities and operations generating hazardous waste include power plants, missile launch facilities, space launch complexes (SLCs), medical facilities, laboratories, gas stations, research and testing operations, propellant and fueling operations, and industrial/maintenance shops. Missile launch and research test facilities are within the sensitive Shuman Creek watershed and in sensitive dune habitat on San Antonio Terrace. SLCs occur on north VSFB near the breeding grounds of California least terns and western snowy plovers and within watersheds on south VSFB.

Hazardous waste management at VSFB is controlled and tracked by the Hazardous Waste Management Plan, Waste Analysis Plan, Wastewater Management Plan, and various emergency response plans. The compliance element of 30 CES/CEI provides oversight for the implementation of these plans.

The amount of hazardous waste generated annually at VSFB is large enough to require that the base be designated a hazardous waste facility under the Resource Conservation and Recovery Act (RCRA). The California Environmental Protection Agency's Department of Toxic Substances Control (DTSC) provides regulatory oversight of hazardous waste issues at VSFB. Hazardous waste operations at the base are authorized by DTSC under the RCRA Part B permit.

Pollution Prevention and Waste Minimization

The Hazardous Waste Management Plan, the Wastewater Management Plan, Hazardous Materials Emergency Response Plan, the Integrated Solid Waste Management Plan, and other associated waste minimization directives and plans form the basis for reducing pollution at VSFB. These plans are applicable to all entities conducting activities on VSFB and its remote sites that generate air emissions, hazardous and solid wastes, and wastewater. Most support operations are positioned around the cantonment area, which is close to the center of the northern half of the base (e.g., HAZMART; the Collection and Accumulation Point and the Transportation, Storage, and Disposal Facility; the former base landfill and its associated groundwater reclamation system; and the SLC-2 Launch Water Reclamation System). Other pollution prevention operations, such as the Industrial Wastewater Treatment Plant, are on southern VSFB.

Installation Restoration Program

The Environmental Restoration Program (ERP) is an Space Force initiative to identify and remediate contamination from past activities as necessary to protect human health and the environment. The ERP includes the Installation Restoration Program (IRP) and the Military Munitions Response Program (MMRP). IRP is responsible to identify, characterize, and restore problems arising from past releases of hazardous substances and petroleum products into the environment. The MMRP specifically addresses unexploded ordnance (UXO), discarded military munitions, and munition response sites (MRS) which include former ranges and similar sites. Groundwater, surface water, soil, shallow soil vapor, and sediment at identified sites are addressed with these programs. IRP and MMRP sites are remediated and or managed with land use controls (LUCs) through the Federal Facilities Site Remediation Agreement, a working agreement among the USSF, the Central Coast Regional Water Quality Control Board, and DTSC.

Evaluation of the IRP sites includes assessing the constituents of hazardous substances and potential impacts on ecological systems and the environment. The evaluation process includes an assessment of risk to sensitive receptors in the environment. Before new construction or demolition begins, the Base dig permit

process identifies IRP sites and potential hazardous materials. The ERP will inform the proponent if the new activities or operations are consistent with the site closure requirements and/or LUCs.

Effects of Hazardous Materials Releases on Natural Resources

Mission impacts on natural resources at VSFB have been assessed, including documenting past hazardous materials releases and their effect on the food web and ecological functioning of habitats. Ecological risks have been assessed for sites outside of the cantonment area and remediation or corrective action is ongoing at several IRP sites.

Impacts from Water Discharge During Launches

Launch activities at VSFB generate deluge and wash down waters during a launch. This water is categorized as nonhazardous industrial wastewater and is captured then treated at the Industrial Wastewater Treatment Plant next to SLC-6 on south VSFB. The USSF, under a pollution prevention initiative, operates a water treatment unit on SLC-2 in order to reduce the cost of transportation, treatment, and disposal of those launch waters at the treatment plant. Hydrazine-contaminated wastewaters are treated through an ultraviolet/ozone unit, and once hydrazine is at non-detectable levels, the wastewaters are discharged into evaporation ponds. Non-hydrazine-contaminated wastewaters are discharged directly into the evaporation ponds. The wastewaters in these evaporation ponds contain metals and volatile organic compounds. Under normal circumstances, no significant impacts occur to terrestrial or freshwater biota as a result of water discharges, as industrial wastewater is evaporated or discharged in accordance with a conditional exemption under the State General Permit for Low Threat Discharges. Spill containment areas within launch complex boundaries and management practices prevent any spilled propellant from reaching surface and coastal waters. However, should there be a wastewater system failure, there could be potential impacts on terrestrial and marine biota (Engineering Science, Inc., and Sea World Research Institute 1988). In addition, the occurrence of a launch- or accident-related ground cloud could generate short-term, localized depositional effects.

2.4.3.2. Short-term Impacts

Short-term impacts on natural resources at VSFB are typically related to temporary mission activities, which do not permanently alter the natural environment. Repeated short-term impacts have the potential for cumulative impacts with possible long-term consequences.

Noise Impacts

The noise generated during launches could impact humans and animals at VSFB. In addition, all launch vehicles exceed the speed of sound and thus generate a sonic boom. Depending on the vehicle's trajectory and the meteorological conditions at the time of launch, these booms can impinge on the Northern Channel Islands, off the coast of Santa Barbara County. Re-entry of rocket components by SpaceX and perhaps other future launch proponents can result in a sonic boom impacting the mainland. Both types of noise are temporary, with launch noise lasting up to several minutes and a sonic boom lasting less than a second. The amplitude of the launch noise is dependent on the thrust of the vehicle and the proximity of the receptor (wildlife species or human) to the launch site. Wildlife exposed to launch noise may exhibit behavioral or physiological responses. The degree of the response depends on the amplitude, duration, and frequency of the noise, the hearing sensitivity of the wildlife species, and how frequently the launch noise is generated. Close to the launch site (within half a mile), the noise generated by a launch vehicle could cause changes in hearing sensitivity and could provoke strong behavioral reactions in wildlife. However, most wildlife

species of concern at VSFB are sufficiently far from launch sites that most impacts are expected to be only temporary and minimal.

To better understand the impacts of launch noise and sonic booms on wildlife, launch noise from eight different launch vehicles was measured for nearly 50 individual launches from VSFB (SRS Technologies 2001). In addition, sonic booms were measured on San Miguel Island (SMI), the westernmost of the Northern Channel Islands during nearly 30 launches.

It is difficult to compare different types of noise (transient, impulsive, continuous) as they are perceived differently and have different impacts on hearing. To gain a better feel for the metrics describing launch noise and sonic booms, several reasonable comparisons can be made. An F-16 overflight can be compared to launch noise, as they are of similar duration, although the over-flight noise has more broadband frequency content than the launch. The closest comparison that can be made for sonic booms is nearby thunder.

Birds. The effects of noise and other human disturbance have been studied extensively for colonial nesting birds, including marine birds (Awbrey et al. 1980; Black et al. 1984; Burger 1981; Ellison and Cleary 1978; Kury and Gochfeld 1975). The possible impacts of disturbance include abandonment of breeding sites, egg breakage by panicked adults, physical damage to the eggs due to noise, crushing due to collapse of burrows, or heating and cooling from exposure during periods of nest abandonment. However, these impacts are difficult to document (Cogger and Zegarra 1980; Heinemann and LeBrocq 1965; Schreiber and Schreiber 1980). Losses have been observed when opportunistic predators attack eggs, chicks, or adults of another species as the adults fly from their nests in response to a disturbance. In July of 1997, the launch of a Delta II rocket was suspected of causing the abandonment of four or five California least tern nests, leading to the loss of seven to nine eggs. The Delta II launch complex (SLC-2) is approximately half a mile from the California least tern nesting site. At this distance, noise levels are high and visual disturbance is considerable. However, no western snowy plovers have abandoned their nests due to Delta II launches, even though western snowy plovers nest near the least terns in similar proximity to the SLC-2 launch site. This suggests that different species may respond differently to disturbance even under the same conditions (i.e., type, location, frequency, intensity, and duration).

The hearing ability of gulls has been determined (Counter 1985) and can serve as a reasonable model for the hearing of other marine birds, such as the California brown pelican and the California least tern. The sensitivity of gull hearing is best in the region from 1 to 3 kilohertz and declines rapidly below 1 kilohertz. As the sound energy of launch noise is mostly below 100 Hertz, damage to birds' hearing from launch noise is unlikely (Collins 1988).

The response of pelicans to loud noise is not predicted to be significantly different from any of the other bird species studied (Cooper and Jehl 1980). California brown pelicans are expected to be briefly disturbed by exposure to loud noises, but, since launches are infrequent and exposure to the noise is of short duration, this disruption is not anticipated to affect breeding or individual success. Short-term flushing from roosts is the only observed response of pelicans to launch noise.

Peregrine falcons have been found to fly from nest sites in response to loud noises, with no harm to eggs or young (Cooper and Jehl 1980) or change in nesting success, adult mortality, territory use, or opportunistic predation (Ellis et al. 1991). Adverse effects on the survival or reproductive success of peregrine falcons as a result of launch vehicles have not been documented.

Marine Mammals. Pacific harbor seals are the marine mammals most likely to be impacted on VSFB as a result of launch noise. These animals haul out on sandy beaches and rocky ledges for a variety of reasons, including sleep, predator avoidance, thermoregulation, and pupping. The total population of Pacific harbor

seals inhabiting the VSFB coastline was estimated at 1,300 (Hanan and Beeson 1993), with up to 450 seals hauled out at any one time (Thorson et al. 2000); these numbers have decreased significantly since approximately 2010, as Northern elephant seal and California sea lion populations have both increased. Approximately 30 miles offshore, larger populations of pinnipeds haul out along the coastline of SMI, the westernmost of the Northern Channel Islands. The Point Bennett area of SMI is one of the most important pinniped areas on the west coast. Depending on the time of year, several thousand California sea lions and northern elephant seals, Pacific harbor seals and several hundred northern fur seals (*Callorhinus ursinus*) inhabit the area. During the breeding season for sea lions and elephant seals, the numbers can increase to over 10,000 animals for each species. Although launch noise is barely audible on SMI, sonic booms generated during the supersonic flight of launch vehicles have the capability of impacting the four pinniped species known to haul out in this area.

Under the Marine Mammal Protection Act, the 30th Space Wing at VAFB was issued a five-year rule for incidental harassment of small numbers of marine mammals (*Federal Register*: 10 April 2019, Volume 84, Number 69) and a tiered Letter of Authorization (LOA) by NOAA Fisheries. The LOA was reauthorized on 10 April 2019. Renewal of the five-year permits and LOAs is routinely managed by CEI.

Under the MMPA, there is a requirement to conduct research to determine if there are temporary or cumulative impacts on Pacific harbor seals and other pinniped species at VSFB. A scientific research program started in 1997 to determine the long-term cumulative impacts of space vehicle launches on haul-out behavior, population dynamics and hearing acuity of Pacific harbor seals at VAFB and on haul-out behavior of pinnipeds on SMI was completed in 2012. The Scientific Research Permit issued to authorize this work is now expired, and the Space Force currently has no intention (or requirement) to renew it.

Based on data from the biological launch monitoring, the Pacific harbor seal population (including pups) at VAFB increased and was doing as well or better than other Pacific harbor seal populations in California through approximately 2010. This may have been due to prime haul-out areas, space available for expansion, limited amount of human-caused disturbances (anglers, tourists, watercraft), and infrequent launch disturbances. Haul-out behavior appeared to be only temporarily affected by launch operations, and seals continued to return to the same haul-out sites. There were no long-term behavioral effects to Pacific harbor seals observed as a result of the launches. However, since approximately 2010, Pacific harbor seal numbers have decreased as Northern elephant seal and California sea lion numbers have increased significantly, with NES now known to breed and pup on south VSFB since 2017. There is no indication that the decrease in Pacific harbor seal numbers is in any way related to Space Force activities; all is thought to result from interspecific competition.

Impacts on Pacific harbor seal hearing from launch noise were determined “unlikely” by hearing sensitivity tests performed on at least eleven seals exposed to Titan IV and Delta IV launches, the largest vehicles launched from VAFB in recent years. In addition, hearing data on Pacific harbor seals (Kastak and Schusterman 1999, Mohl 1968, Terhune 1991, Terhune and Turnbull 1995) have shown that in-air hearing in seals is compromised compared to their under-water hearing. This decreased in-air sensitivity, especially at frequencies where launch noise and sonic booms are strongly concentrated, likely greatly reduces the amplitude of the noise they hear from the launches.

On SMI, the loudest sonic boom recorded from a launch vehicle from VAFB had a peak overpressure of 8.9 pounds per square foot (psf) at Crook Point, the southernmost tip of SMI, where very few pinnipeds haul out. Most space launch related sonic booms, however, typically do not exceed 2 or 3 psf. In the area of Point Bennett, the California sea lions seem to have the strongest reactions of the pinnipeds. For the Athena II Ikonos-1 launch, a sonic boom with a peak overpressure of 1 psf caused 232 of the 1,400 sea

lions hauled out to startle and enter the water. However, after 95 minutes the beach appeared to have returned to the same level of activity as before the launch. For the Athena II Ikonos-2, producing a boom with a peak overpressure of 1 psf, only 12 pups out of the 600 sea lions hauled out actually entered the water and, once in the water, the pups began playing and did not return to the beach for several hours. On 7 November 1991, a 1.3 psf boom from a Titan IV impacted SMI and approximately 25 percent of the sea lions responded with a heads up alert, but within 30 seconds all the sea lions returned to their original resting position. In all reported cases for sonic booms on SMI, elephant seals and northern fur seals have very little response, with some of the hauled-out animals responding with a heads up display but very quickly returning to normal activities.

Southern sea otters inhabit the nearshore waters along the coastline of north and south VSFB, using those areas for foraging, resting, and breeding. Monitoring sea otters at Purisima Point for more than six launches did not detect changes in the number of otters as a result of the launches; however, startle response and other behavioral reactions to launches that are considered "harassment" were noted. The launch vehicles with the greatest potential to disturb sea otters in the future are primarily from the proposed Small Rockets initiative and any future launches from SLC-6. More recently, the otter populations have largely relocated to the Sudden Flats region, possibly in response to predators such as sharks.

Terrestrial Mammals. Terrestrial mammals of concern at VSFB include several species of bats. Impacts on these species from launch noise are possible in the event that they are close to a launch complex during a vehicle launch. However, the short duration and infrequent intervals of launch events are likely to result in only temporary and minimal impacts. Studies have shown that the effect of intermittent noise from aircraft overflights on small terrestrial mammal demography is likely to be small and difficult to detect, if it occurs at all (McClenaghan and Bowles 1995). Studies on the hearing sensitivity of a variety of bats (Dalland 1965; MacDonald 1984; Popper and Fay 1995) have shown that they have excellent hearing in the higher frequency ranges (above 20 kilohertz [kHz]) but are very insensitive to lower frequencies where launch noise has most of its energy. Therefore, impacts on these mammals are expected to be minimal to nonexistent.

Aircraft Noise Impacts and AICUZ

The VSFB Air Installation Compatible Use Zone (AICUZ) Study covers the impacts of aircraft noise and potential accidents. The AICUZ Study is a refinement of the Greenbelt program, which established a clear zone around the airfield to improve air safety and reduce noise impacts from the airfield. No construction or development is allowed within the clear zone. The AICUZ Study also covers a wider planning area outside of the clear zone/greenbelt, called the noise zone and the accident potential zone, defined by potential adverse noise and safety impacts. Limited development is recommended within these two areas. In addition to recommending land use policies that protect surrounding communities from flight hazards, the study outlines methods for carefully monitoring and controlling noise levels and exposure times of the affected populations. The USSF's goal is to minimize the effects of its operations by reducing aircraft noise levels and accident hazards and making land use recommendations to benefit nearby ecological and human communities.

Airfield Operations

Vandenberg SFB does not maintain an active flying mission. Unlike most USAF installations, the airfield is not the dominant land use on-base. Approximately 120 fixed-wing aircraft flights are scheduled and about 6,000 take-offs and landings occur per year. Pilots fly outside of a 1,000-foot bubble around pinniped rookeries and maintain a 1,900-foot slant range over the Purisima Point area during the California least tern

and western snowy plover breeding seasons, except when performing a life-or-death rescue mission, when responding to a security incident, or during an aircraft emergency.

Helicopter Flight Operations

Helicopter Flight operations decreased significantly in 2007 with the relocation of the 576th Helicopter Squadron.

Flight Tests

Airplane testing frequencies are highly variable. The number of flights could range from zero to 50 flights per year. However, an average of 10 flights per year, which include 50 passes per year, is a reasonable estimate. The maximum testing frequency could reach three flights in any one week, also with four to five passes per flight.

Fallout and Vapor Impacts

Emissions from the exhaust plume of a rocket launch could cause short-term and localized effects on terrestrial and aquatic biota from exposure to initially high concentrations of air pollutants. However, such effects on biota have not been observed during VSFB launches.

There is a slight possibility of a catastrophic accident during a launch. A launch vehicle could explode or could be detonated intentionally (Versar, Inc. 1991). Most of the propellants would probably be consumed in the explosion and fireball (USAF 1989a). The fireball generated by an explosion would cause the cloud containing any uncombusted propellants to rise (USAF 1989b), minimizing any potential ground-level impacts on terrestrial wildlife. If an explosion were to occur while the launch vehicle was still on the launch pad, then most animals within several hundred feet of the blast would be killed. The ensuing fire could kill additional animals in habitats near the launch site.

Launch systems carry the possibility for an early inflight termination and subsequent activation of the vehicle destruct system. Launch success rate at VAFB between 1960 and 2000 was approximately 94 percent. Of the failed launches that underwent an early inflight termination (6 percent), approximately one-fourth occurred within 60 seconds of launch. There is little potential of significant impact on terrestrial wildlife from such launch anomalies. However, in the unlikely event of an inflight failure coupled with a failure of the vehicle destruct system, some of the liquid propellants from the launch vehicle might enter the ocean. Localized short-term impacts on water quality and marine biota would result from such an unlikely launch anomaly (Engineering Science, Inc., and Sea World Research Institute 1988; Versar, Inc. 1991).

In the event of a catastrophic accident where there is no imminent danger to humans and where sensitive natural resources are present, coordination among various organizations on VSFB would ensure that impacts on the resources were minimized. For example, during the 2001 western snowy plover breeding season, a missile launch from north VAFB was aborted due to a malfunction. Vandenberg AFB Security Forces' Fish and Wildlife wardens coordinated with 30 CES/CEI to ensure that potential impacts on breeding western snowy plovers were minimized during efforts to recover debris that had washed up on the beaches.

Debris Fallout on Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1996, established a new requirement to describe and identify Essential Fish Habitat (EFH) in each fishery management plan. EFH is defined as "those waters and substrate necessary to fish for

spawning, breeding, feeding, or growth to maturity." Only species managed under a federal fishery management plan are covered. The Magnuson-Stevens Act requires all federal agencies to consult with NOAA Fisheries on all actions, or proposed actions, permitted, funded, or undertaken by the agency, that may adversely affect EFH. "Adversely affect" means any impact that reduces the quality or quantity of EFH.

There are 206 species managed by the South Atlantic Fishery Management Council and the Pacific Fishery Management Council that could be affected by space vehicle launches from VSFB. Potential impacts on EFH could affect managed species or their habitat due to direct toxicity from fuel components. During normal launch sequences, rockets use nearly all available fuel and jettison fuel tanks, as they are no longer needed in the orbital ascent. During an aborted launch sequence, debris may be scattered in the region surrounding the launch site, as well as downrange areas over the ocean. The rocket location, direction, and speed at the time of explosion, as well as the current wind conditions, largely determine a debris footprint from a launch abort. Potential adverse effects from aborted launches on the EFH of managed species could result from unspent fuel from debris falling out over EFH areas, potentially creating a toxic condition in the waters, where managed species and their habitat could be adversely affected by the toxicity of the fuel components. This type of impact would be in the vicinity of the fuel fragments on the ocean floor, and depending on the size of fuel fragments, the effects could be minimal or long lasting.

2.4.4.Potential Future Mission Impacts on Natural Resources

2.4.4.1. Launch Programs

The USSF 30th Space Delta Ten-Year Workload Forecast projects the activity of launch programs. Scheduled launches are characterized as directed, planned, or proposed, defined as follows.

Directed—A program for which a Program Management Directive or other authoritative document has been issued or active support of a program for which the obligation of the resources is authorized in accordance with established priorities;

Planned—A program based on authoritative documentation that has been accepted and assigned to a field command for planning and programming purposes short of actual resource obligation; and

Proposed—A program based on preliminary information and identified for long-term planning only.

The impacts of future launch programs would be comparable to those described for ongoing activities.

The following sections describe the projected future levels of operation.

2.4.4.2. Ballistic Missile Launches

Active ballistic missile programs on VSFB include Minuteman III and National Missile Defense missiles; the Ground Based Strategic Deterrent program, a proposed replacement program for Minuteman III is in the planning process for VSFB.

2.4.4.3. Space Launches

Active space launch programs on VSFB include the planned launches of Delta, Firefly, New Glenn, Vulcan and Falcon rockets, among others. A maximum of 70 space launches per year through 2025 are projected for planning purposes.

2.4.4.4. Climate Impacts on Mission and Mission Planning

Vandenberg SFB's mission of launching missiles and satellites, as well as providing air and space surveillance in the Western Range, does not require specific habitat or vegetation types. The primary issues in terms of climate change impacts are (1) altered hydrology and the subsequent impact on the flood regime of large streams and rivers on the installation, and (2) sea level rise.

Numerous buildings, roads, and other structures could be vulnerable to flooding under the climate change scenarios (see maps in Hydrology Appendix of CEMML 2019). However, these structures were also found to be highly vulnerable under current conditions, indicating little to no increased risk of flooding due to climate change. The majority of infrastructure at the installation was built on land high enough to avoid flooding even under extreme conditions. Similarly, the infrastructure that was built close to the Santa Ynez River and San Antonio Creek will be inundated even under present high flow conditions.

Wildland fires in the vicinity of VSFB are expected to increase under both climate change scenarios (Section 7.9.1). This could potentially damage equipment and prevent personnel access to mission critical infrastructure. An increase in fire occurrence or magnitude could also have secondary effects on the mission, such as habitat shifts leading to an increased regulatory environment.

Climate change could impact the mission at VSFB through the following potemtial future effects.

Increases in temperature and wind velocity leading to unsafe environmental conditions for the launch of current and planned weapons and equipment, resulting in increased maintenance requirements, requirements for new equipment, or decreased launch capacity (DoD 2014)

Increased dust generation effecting equipment and visibility (DoD 2014)

Increased wind velocities damaging vital mission infrastructure (Sydeman et al. 2014)

Increased drought potential (Glick et al. 2011)

Potential loss of future training areas due to sea level rise and ecosystem changes

Possible increase in regulatory environment due to reduced threatened and endangered species and other native species populations

In addition to these direct effects, climate change has the potential to disrupt the acquisition and transportation of materials required for the maintenance, construction, and storage of the equipment required for these systems (DoD 2014).

2.4.5.Natural Resources Needed to Support the Military Mission

The air-based nature of VSFB missions, combined with base security needs and the use of highly explosive fuels for rocket and missile launching, requires that a significant area of the base be kept as undeveloped open space to serve as a clear zone for base security, explosive safety, and the protection of population and work centers from fallout debris in the event of an aborted launch. The military requirement for expansive areas of undeveloped open space is compatible with natural resources management at VSFB. Large amounts of undeveloped open space provide a relatively undisturbed natural environment for the rich and diverse habitats and populations found on-base.

The primary structures used in space and missile launches are near the coast at VSFB. Most space launch complexes are on south VSFB, except for SLC-2 and SLC-576-E, which are near Purisima Point on north VSFB. All missile launch facilities and the airfield are on north VSFB. Helicopter pads, radar tracking stations, and telemetry relay stations are scattered throughout the base, as are additional buildings,

equipment, and infrastructure required to support these activities. Appendix A, Figure 6-2 shows the location of space launch complexes on VSFB.

3.0 ENVIRONMENTAL MANAGEMENT SYSTEM

The USSF environmental program adheres to the Environmental Management System (EMS) framework and it's Plan, Do, Check, Act cycle for ensuring mission success. Executive Order (EO) 13693, *Planning for Federal Sustainability in the Next Decade*, U.S. Department of Defense Instruction (DoDI) 4715.17, *Environmental Management Systems*, AFI 32-7001, *Environmental Management*, and international standard, ISO 14001:2004, provide guidance on how environmental programs should be established, implemented, and maintained to operate under the EMS framework.

The natural resources program employs EMS-based processes to achieve compliance with all legal obligations and current policy drivers, effectively managing associated risks, and instilling a culture of continuous improvement. The INRMP serves as an administrative operational control that defines compliance-related activities and processes.

4.0 GENERAL ROLES AND RESPONSIBILITIES

General roles and responsibilities that are necessary to implement and support the natural resources program are listed in Table 9. Specific natural resources management-related roles and responsibilities are described in appropriate sections of this plan.

Table 9. Installation roles and responsibilities.

Office/Organization/Job Title (Listing is not in order of hierarchical responsibility)	**Responsible Organization**
Installation Commander	30 SW/CC
AFCEC Natural Resources Media Manager/SME/Subject Matter Specialist (SMS)	AFCEC/CZOW Edwards ISS
Installation Natural Resources Manager/POC	30 CES/CEIEA
Installation Security Forces	30 SW/SFS
Installation Unit Environmental Coordinators (UECs); see AFI 32-7001 for role description	30 CES/CEIEC
Installation Wildland Fire Program Manager	30 CES/CEF
Pest Manager	30 CES/CEOES
Range Operating Agency	2 ROPS
Conservation Law Enforcement Officer (CLEO)	30 SFS/S3SW
National Environmental Policy Act (NEPA)/Environmental Impact Analysis Process (EIAP) Manager	30 CES/CEIE
NOAA Fisheries	West Coast Region, Long Beach, CA
California Department of Fish and Wildlife	South Coast Region 5, San Diego CA
U.S. Fish and Wildlife Service	Region 8, Ventura FWO, Ventura, CA

5.0 TRAINING

USSF installation natural resource managers/points of contact (NRMs/POCs) and other natural resources support personnel require specific education, training and work experience to adequately perform their jobs. Section 107 of the Sikes Act requires that professionally trained personnel perform the tasks necessary to update and carry out certain actions required within this INRMP. Specific training and certification may be necessary to maintain a level of competence in relevant areas as installation needs change, or to fulfill a permitting requirement.

Installation Supplement—Training

NRMs at VSFB must take the course DoD Natural Resources Compliance, endorsed by the DoD Interservice Environmental Education Review Board and offered for all DoD Components by the Naval Civil Engineer Corps Officers School (CECOS). Other applicable environmental management courses are offered by the Air Force Institute of Technology (http://www.afit.edu), the National Conservation Training Center managed by the USFWS (http://www.training.fws.gov), and the Bureau of Land Management Training Center (http://training.fws.gov)

Natural resource management personnel shall be encouraged to attain professional registration, certification, or licensing for their related fields, and may be allowed to attend appropriate national, regional, and state conferences and training courses

All individuals who will be enforcing fish, wildlife, and natural resources laws on USSF lands must receive specialized, professional training on the enforcement of fish, wildlife, and natural resources in compliance with the Sikes Act. This training may be obtained by successfully completing the Land Management Police Training course at the Federal Law Enforcement Training Center (http://www.fletc.gov/)

Individuals participating in the capture and handling of sick, injured, or nuisance wildlife should receive appropriate training.

Personnel supporting the BASH program should receive flight line drivers training, training in identification of bird species occurring on airfields, and specialized training in the use of firearms and pyrotechnics as appropriate for their expected level of involvement

The DoD supported publication Conserving Biodiversity on Military Lands—A Handbook for Natural Resources Managers (http://dodbiodiversity.org) provides guidance, case studies, and other information regarding the management of natural resources on DoD installations

Natural resources management training is provided to ensure that installation personnel, cooperators, contractors, and visitors are aware of their role in the program and the importance of their participation to its success. Training records are maintained IAW the Recordkeeping and Reporting section of this plan. Below are key natural resources management-related training requirements and programs:

6.0 RECORDKEEPING AND REPORTING

6.1. Recordkeeping

Installation Management Flight records management protocols are conducted IAW AFI 33-322, Records Management Program (RMP) and includes recordkeeping and document compliance monitoring under strict Air Force Records Information Management System (AFRIMS) protocols. This AFI requires all Air Force (AF) activities to comprehensively manage all defined forms of documentation in full compliance with legal accountability and retention requirements, with emphasis placed upon Records Retention and records system maintenance, AFRIMS compliance, upgrades to, and compliance with, the Records Disposition Schedule (RDS). Implementation of the RMP includes the operation and oversite of multiple verifiable documentation management processes associated with the following media programs; Hazardous Waste, Explosive Ordinance Disposal, Solid Waste programs, Air Quality, Storage Tanks, Water Quality programs, and Cultural and Natural Resources programs. The RMP maintains and ensures a fully developed and effective records management program using a standardized filing system methodology for filing, storing, retrieving, and ultimately disposing of records according to published and approved records disposition schedules.

6.2. Reporting

The installation NRM is responsible for responding to natural resources-related data calls and reporting requirements. The NRM and supporting AFCEC Media Manager and Subject Matter Specialists should refer to the Environmental Reporting Playbook for guidance on execution of data gathering, quality control/quality assurance, and report development.

7.0 NATURAL RESOURCES PROGRAM MANAGEMENT

This section describes the current status of the installation's natural resources management program and program areas of interest. Current management practices, including common day-to-day management practices and ongoing special initiatives, are described for each applicable program area used to manage existing resources. Program elements in this outline that do not exist on the installation are identified as not applicable and include a justification, as necessary.

A balanced natural environment requires minimal manipulation and is the most cost-effective natural resources management method. The primary strategies to implement these goals are to protect, conserve, enhance, and manage the flora and fauna of VSFB. The Natural Resources Management Program on VSFB includes habitat protection, threatened and endangered species protection, exotic species control, and management of hunting and fishing. The regulatory requirements for natural resources management encompass a wide range of regulations, including AFIs, federal legislation, and state requirements (Appendix B, Table B-6).

The EIAP ensures proper coordination and planning of on-base projects. As required by AFI 32-7061, the preparation and submission of a work request form or AF Form 813 triggers the EIAP process. The 30 CES/CEI staff review work requests for each proposed project to determine what level of environmental analysis and documentation is required and project plans and EIAP documentation to ensure compliance with the ESA and other natural resources regulations. Staff review all projects on VSFB to ensure that all environmental impacts are identified and considered early in the project planning process and that appropriate mitigations are developed.

Installation Supplement –Natural Resources Program Management

Fish and wildlife management on VSFB began in 1957. In 1963, VAFB entered into its first cooperative agreement with the USFWS and CDFG (now CDFW). In 1988, The Nature Conservancy (TNC) also became an ecological management partner by entering into a cooperative management agreement with VSFB designed to assess information and management needs encountered by both parties in the stewardship of their neighboring lands. The relationship with TNC continues today with their recent purchase of adjacent lands now identified as the Jack and Laura Dangermond Preserve.

The Directorate of Environmental Management was formed in 1985 in part to manage a comprehensive natural resources program at VSFB. Problem areas before 1985 included overgrazing, absence of fire in over-mature stands of chaparral, inadequate game harvests, invasion of exotic plant species, and lack of natural resources data on important species occurring on-base. These problems were largely the result of loosely written leases (in the case of overgrazing) and a lack of sufficient qualified personnel to monitor species. The result, in some areas, was degradation of natural communities, decreased forage production, decreased wildlife populations, and accelerated erosion.

Cooperative Agreements

Cooperative agreements with outside agencies and organizations assist VSFB in maintaining regulatory compliance and provide for agency input in the stewardship of natural resources on VSFB. Cooperative agreements with universities and nonprofit organizations help VSFB accomplish specific projects. Current cooperative agreements in place are listed along with additional information in Tab N.

7.1. Fish and Wildlife Management

Applicability Statement

This section applies to all USSF installations that maintain an INRMP. VSFB is required to implement this element.

Program Overview/Current Management Practices

Guidelines are implemented on VSFB that allow the completion of base missions, while providing conservation, protection, and responsible management strategies for fish and wildlife resources on-base. Fish and wildlife management issues include resource demand, hunting and fishing, habitat improvement, public access, fee structures, wildlife pest problems, and human-wildlife interaction concerns. Specific management objectives are included in the Fish and Wildlife Management Plan (Tab A), Outdoor Recreation Management Plan (Tab H), and Integrated Pest Management Plan (Tab G).

7.1.1. Hunting, Fishing, and Wildlife Viewing

Hunting and fishing are conducted through the Fish and Wildlife Cooperative Agreement, in coordination with the USFWS and CDFW. Hunting and fishing are important recreation activities for active duty, reservists, retired military, DoD civilian personnel on VSFB, Chumash Tribal Members, and US Penitentiary, Lompoc employees. A small number of local civilians also fish on the base using the civilian fishing pass system.

Hunting plays an important role in limiting animal populations to the carrying capacity of their habitats and in reducing the populations of destructive species and nonnative species, such as feral pigs.

Fishing is likewise important as a means of limiting nonnative fish populations to the carrying capacity of their habitats. However, ocean fishing is generally not permitted within the Vandenberg State Marine Reserve, and freshwater fishing is not permitted in Jalama Creek or the Santa Ynez River or lagoon areas due to the presence of endangered steelhead. Nonnative fish are removed from all but man-made ponds and lakes on-base to protect native fish as well as California red-legged frogs and other sensitive aquatic animal species.

Natural areas provide entertainment and education for bird and other wildlife watchers, as well as scenic locations for picnicking, hiking, and camping. There are wildlife viewing opportunities in various locations and habitats on VSFB, including a county park at the Santa Ynez River Estuary, Barka Slough and nearby San Antonio Creek, and some coastal beach and dune areas.

All access is regulated to accommodate recreational use without exposing those using the areas to hazards associated with missile launches, compromising the security requirements of military operations, or permitting take of listed species. Hunting, fishing, and wildlife viewing areas on VSFB are depicted in Appendix A, Figures 7-1A and 7-1B and detailed in 30 SWI 32-7001. Access and authorizations for fishing, hunting, and wildlife viewing are the responsibility of 30 SFS/S3SW.

7.1.2. Wildlife Pest Programs

Species identified as wildlife pests on VSFB include feral pig, North American beaver, California ground squirrel (*Otospermophilus beecheyi*), and bark beetle (*Dendroctonus* spp.). Information regarding these species is provided in Tab G—Integrated Pest Management Plan.

7.1.3.Human-Wildlife Interaction Concerns

Human-wildlife interaction concerns refer to situations where the presence or activities of wildlife could be hazardous or inconvenient to human activities and where human presence could have detrimental impacts on wildlife. The following are examples of human-wildlife interaction concerns at VSFB:

Deer-vehicle strikes—Vehicles traveling at high speeds may strike deer (*Odocoileus* spp.) that stray onto unfenced major roadways. In particularly high-risk areas, lower speed limits during darkness reduce the risk of deer-vehicle strikes.

Nesting birds—The federal Migratory Bird Treaty Act and the State of California Fish and Game Code protect all native wild bird species, their eggs, and nests from "take," including harassment resulting in abandonment of nests or death of eggs or young. There are many nonlethal solutions to nuisances associated with seasonal bird nesting. 30 CES/CEI Natural Resources personnel provide assistance in such situations. Before facilities are demolished or modified, they are evaluated for nesting birds.

Bats—The State of California Fish and Game Code protects all bat species. Bats are beneficial in insect control, but they can be carriers of rabies, although the incidence of this deadly disease in bats is very low. 30 CES/CEI Natural Resources personnel, in coordination with the 30th Medical Group and 30 SFS/S3SW personnel, developed protocols for addressing bat-human conflicts. From September through April, passive exclusion methods are implemented to exclude bats from roosts in buildings in order to alleviate the potential for human contact or mission conflicts. From May through August, young are present in nursery roosts, and exclusion activities are not conducted.

Feral pigs—Feral pigs in California are hybrids of European wild boar and domestic swine. They have sharp tusks and are known to charge aggressively, showing little fear toward humans. The behavior of feral pigs is a potential hazard to people working or enjoying recreation in areas frequented by these animals.

California ground squirrel is a species requiring population control on VSFB. The number of ground squirrels has increased significantly within certain areas of VSFB due, in part, to grazing and landscape management practices (mowing). These practices decrease field cover, which enables squirrels to easily detect predators. Studies have shown that ground squirrel populations decline in fields with increased cover and forage. Past management control practices for the ground squirrel have included rodenticides, live trappings, construction of raptor perches, and increased grass heights. Ground squirrel control is necessary where squirrels or their fleas may come in contact with humans, as bubonic plague is a human health risk in this region. However, ground squirrels are not controlled in uninhabited natural areas as they are important prey for many native predators, and their burrows provide important habitat for the western burrowing owl, a state species of special concern.

Striped skunks (*Mephitis mephitis*) and common raccoons (*Procyon lotor*) are frequently reported pests in the cantonment area and occasionally at remote facilities. These animals have the potential to carry rabies and other diseases of concern to human health. In most cases, these animals become a problem because they are attracted to pet food or garbage left outdoors or in an open garage. Removal of food sources and exclusion of the species from hiding places usually resolves the problem. Where raccoons and skunks persist and must be removed, the base pest control contractor may conduct removal in accordance with the Integrated Pest Management Plan. Where human health and safety is at risk, or if the animal appears ill, 30 SFS/S3SW personnel assist with removal. In addition, it is important to maintain healthy populations of predators, such as coyotes (*Canis latrans*), that provide natural population controls.

7.1.4.State Wildlife Action Plan

In 2000, Congress enacted the State Wildlife Grants Program to support state programs that broadly benefit wildlife and habitats but particularly "species of greatest conservation need." CDFW directed the

development of the State Wildlife Action Plan for California, titled *California Wildlife: Conservation Challenges*, which directs the state to answer the following primary questions.

What are the species and habitats of greatest conservation need?

What are the major stressors affecting California's native wildlife and habitats?

What are the actions needed to restore and conserve California's wildlife, thereby reducing the likelihood that more species will approach the condition of threatened or endangered status?

California's diverse topography and climate have given rise to a remarkable diversity of habitats and a correspondingly diverse array of both plant and animal species. Wildlife provides significant economic benefits to the state through recreation, tourism, and commercial harvest. Many of the places where wildlife thrive are often the same as those valued for recreation and other human activities. By learning what threatens the state's wildlife and the steps that can be taken to reduce those threats, California's residents have the opportunity to become more active stewards of this precious resource.

In the State Wildlife Action Plan, conservation actions were considered for each region of California based on the stressors and circumstances in each. Statewide conservation actions are those that are important across most or all regions. VSFB is committed through this INRMP, as well as through the tripartite Sikes Act MOU, to work with the CDFW to consider and implement actions discussed in the State Wildlife Action Plan to the maximum extent feasible.

7.1.5. Climate Impacts on Fish and Wildlife Management

Changes to flooding patterns related to climate change could impact fish and wildlife at VSFB. Based on vulnerabilities of organisms relying on aquatic habitats, protections should focus on preserving aquatic habitats such as wetlands, riparian habitats, vernal pools and lentic habitats. If inundation levels change rapidly, it may become necessary to implement programs to restore riparian vegetation. As water temperatures rise in lentic systems, dissolved oxygen content will decrease resulting in decreased habitat quality, particularly for larval amphibians and aquatic macroinvertebrates. Warmer water temperatures will also raise the chances of algal blooms occurring, further depleting dissolved oxygen content and habitat suitability (Paerl et al. 2011). Managers may consider efforts to remove invasive aquatic plants and algae from ponds and plant shade trees around water sources to prevent excessive heating (Poff et al., 2002).

Fish and wildlife management will also need to respond to the possible increase in frequency and intensity of wildland fires. When wildland fires are burning, wildlife such as deer will seek refuge. Refuges will experience higher concentrations of deer, which could lead to increased deer-vehicle strikes. Increased fire frequency and intensity will also cause native species to become stressed as their historic habitats become diminished. Such conditions could create open niches for invasive species (e.g., feral pigs).

Hunting could become an increasingly important wildlife management strategy for suppressing feral pigs and other invasive wildlife populations. Other pest species including the North American beaver, California ground squirrel and bark beetle are likely to continue to thrive at VSFB and will need to be continually monitored and managed.

Warmer temperatures and heavier precipitation also favor vectors for diseases such as mosquitoes and ticks (Süss et al., 2008). By minimizing stagnant water in and around the cantonment area, managers can help to reduce mosquito related infections. Tick populations in urban settings can be minimized by keeping lawns mowed and by preventing overabundances of hosts such as deer and rodents.

7.2. Outdoor Recreation and Public Access to Natural Resources

Applicability Statement

This section applies to all USSF installations that maintain an INRMP. VSFB is required to implement this element.

Program Overview/Current Management Practices

Vandenberg SFB contains a variety of outdoor recreation opportunities, including camping, picnicking, wildlife viewing, hunting, and fishing. A sustainable outdoor recreation program includes the management, conservation, and use of natural and outdoor recreation resources that is practical and consistent with the military mission and provides the greatest possible public benefit.

Mission priorities, safety, and security limit public access to recreation on VSFB. In addition, outdoor recreation on VSFB makes use of available natural resources for recreation, while safeguarding public health, safety, and environmental qualities. Natural and recreational resources are managed to provide the greatest possible benefit, while protecting natural areas. VSFB provides recreation opportunities for nearly 15,000 active duty, retired, and dependent personnel and for more than 3,000 civilian workers.

Open space recreation facilities on-base include a 216-acre saddle club, access to 4.8 miles of beach (between October 1 and February 28), and reduced access during the western snowy plover breeding season (March 1 to September 30) (0.5 mile at Surf Station, 0.5 mile at Minuteman Beach, and 0.25 mile at Wall Beach). Although the Marshallia Ranch golf course is currently closed, a proposal to expand and reopen it is currently under consideration. Also available are football/baseball/softball fields, tennis courts, running tracks, picnic areas, a driving range, paintball course and bicycle paths. Additional information regarding the outdoor recreation facilities on VSFB is provided in the Outdoor Recreation Management Plan (Tab H).

7.2.1. Climate Impacts on Outdoor Recreation and Public Access to Natural Resources

Climate change is not expected to have significant impacts on outdoor recreation and public access to natural areas at VSFB. Managers may need to increase monitoring of fish and game populations to ensure they are capable of supporting hunting and fishing under changing environmental conditions. This is particularly true for freshwater fish populations, which are likely to be constrained by periods of drought and lower inundation under some climate scenarios (though flooding increases under other scenarios). Beach activities, such as beach combing, may become limited as sea levels rise. Other outdoor recreational activities such as camping, picnicking, wildlife viewing, and outdoor sports should not be significantly affected by future climate conditions. However, managers should be aware of risks to outdoor recreation related to climate change, including hotter maximum temperatures and increased prevalence of disease vectors such as ticks and mosquitos.

7.3. Conservation Law Enforcement

Applicability Statement

This section applies to all USSF installations that maintain an INRMP. Vandenberg SFB is required to implement this element.

Program Overview/Current Management Practices

The VSFB Fish and Wildlife Management Program was first established in 1957. The Rod and Gun Club, a private recreation organization on VSFB, was the first to establish a natural resources enforcement program on the base in the 1960s to protect game stocks by ensuring adherence to CDFG laws and regulations. The program was established through a Fish and Wildlife Cooperative Agreement among VAFB, the USFWS, and CDFG in 1963. The first natural resources enforcement program with professionally trained staff was organized under the 30th Space Wing Security Forces Squadron (30 SFS) in 1997.

A comprehensive natural resources program at VSFB began in 1985 with the establishment of the Directorate of Environmental Management. Areas of deficiency identified before 1985 included overgrazing, absence of fire in overmature stands of chaparral, inadequate game harvests (e.g., feral pigs), invasion of exotic plant species (e.g., jubatagrass [*Cortaderia jubata*], iceplant, and eucalyptus), and lack of natural resources data on important species occurring on-base. These deficiencies were largely the result of loosely written land outleasing (in the case of overgrazing) and a lack of qualified personnel to monitor species occurring on VSFB. The result, in some areas, was degradation of natural habitat, accelerated erosion, decrease in forage production, and reduced wildlife populations.

The Fish and Wildlife Management Program includes habitat protection, threatened and endangered species protection, nonnative species control, and management of hunting and fishing on-base. The 30 SFS/S3SW enforces this program following the policies, responsibilities, and procedures established in the 30 SWI 32-7001, *Conservation, Management and Enforcement*.

The Conservation Law Enforcement Program incorporates all provisions of 30 SWI 32-7001, which includes land use enforcement for natural (Class II) and special interest (Class III) areas on-base. Natural areas are undeveloped areas used for dispersed recreation, such as hunting, fishing, bird watching, hiking, and sightseeing. Special interest areas contain valuable ecological, archaeological, botanical, geological, historical, biological, or other features requiring protection (AFMAN 32-7003) and are closed to hunting and fishing.

In addition to land use-related enforcement, the 30 SFS/S3SW is responsible for the following:

Enforcing rules and regulations mandated by USFWS Biological Opinions for mission-related activities on-base;

Enforcing Cooperative Agreements and MOUs for the protection of natural and cultural resources; and

Ensuring compliance with all applicable state and federal laws and regulations.

Additional information about base enforcement can be found in Tab I—Conservation Law Enforcement Management Plan.

7.4. Management of Threatened and Endangered Species, Species of Concern and Habitats

Applicability Statement

This section applies to USSF installations that have threatened and endangered species on USSF property. Vandenberg SFB is required to implement this element.

Program Overview/Current Management Practices

A major overarching goal for managing sensitive species on VSFB is to preserve, protect, and enhance populations and their habitats. To achieve this goal, VSFB applies the following measures in threatened and endangered species management.

Avoid adverse direct and indirect impacts on and disturbances to species and their habitats. Where impacts are unavoidable, they should be minimized as much as possible and mitigated where warranted.

Since all populations of rare species that could exist on VSFB may not be known, basewide surveys should be performed to document new populations.

Because rare species populations are dynamic and their ecology is not always completely understood, existing known populations should be monitored as needed based on species' requirements and recovery efforts.

Proposed actions by VSFB that may affect federally threatened or endangered species or their critical habitat are subject to formal consultation, in accordance with section 7 of the ESA, unless it is determined through informal consultation that the proposed action is not likely to adversely affect any listed species or critical habitat. There is no designated Critical Habitat on VSFB, although the immediately adjacent coastal waters are designated CH for several marine species, and critical habitat for California red-legged frog and Vandenberg monkeyflower are immediately adjacent to VFSB. The GSU at Point Conception is designated Critical Habitat for Gaviota tarplant. Protective measures and monitoring of all threatened and endangered species occurs during implementation of projects within their habitats.

Tab D—Threatened and Endangered Species Management Plan includes specific management actions at VSFB that are directed toward protecting listed species. The Threatened and Endangered Species Management Plan also summarizes current biological opinions and their terms and conditions.

7.4.1. Climate Impacts on Threatened and Endangered Species Management

Management actions needed to protect Threatened and Endangered species under a changing climate depend on the speed at which the climate changes, the nature of the climatic changes, and the ability of the species to respond to those changes. Our understanding of species' response to changing climate is not yet sufficient for predicting how most individual species will respond. In addition, the response of sub-populations of a single species may vary, as species can exhibit adaptive responses to environmental conditions. For example, behavioral changes, such as host-plant or food source switching, have already been observed (Iwamura et al. 2013, Ozgul et al. 2010). Other populations have exhibited physical adaptations over time, such as changes in body size associated with longer growing seasons. Genetic variation within a species has been associated with exposure to changing environmental conditions in the past, but populations may not be able to undergo selection for preferred traits if environmental conditions change too rapidly (Hoffmann and Sgrò 2011).

Many current Threatened and Endangered species management activities are appropriate for increasing resilience or facilitating adaptation to climate change. An ecosystem approach that prioritizes functional diversity, habitat maintenance, habitat variability, and habitat connectivity can help support the genetic diversity that may be important for adaptation and/or migration to more favorable habitats. However, when

approaching the uncertainty that is inherent with managing species under changing environmental conditions, additional analysis and planning is required.

Historic patterns used for management decisions are likely to be insufficient for future management challenges (Bierbaum et al. 2013). Research into actionable science used for biodiversity conservation in changing conditions has developed several key principles. Proactive approaches that anticipate change can help extend the period over which species can adapt to changing climate and avoid catastrophic declines associated with stochastic events that act on an already stressed ecosystem.

7.5. Water Resource Protection

Applicability Statement

This section applies to USSF installations that have water resources. Vandenberg SFB is required to implement this element.

Program Overview/Current Management Practices

Watershed protection and the preservation of water quality are important to the health and function of natural resources on VSFB. The primary causes of degraded water quality generally include disease-causing agents found in untreated sewage, oxygen demanding wastes, water-soluble inorganic chemicals, inorganic plant nutrients, organic chemicals, erosion sediments, and thermal pollution. Degraded water quality may cause ecosystems to become vulnerable to other adverse environmental factors.

Water quality impacts associated with activities on VSFB include pollution related to domestic wastewater, industrial wastewater, stormwater, pesticide and fertilizer use, organic chemical use, and erosion. Not all of these water quality threats are directly related to activities occurring on-base. Off-base activities are not within VSFB's control, but healthy aquatic systems are more resilient to upstream impacts than those already degraded by erosion and other forms of pollution.

Vandenberg SFB uses many methods to control potential impacts on water resources, including regulating land use, air pollution, pesticide and fertilizer use, wastewater discharges, and stormwater discharges. Effective control of water quality on-base requires the integration of watershed planning and management. The RWQCB oversees VSFB in programs addressing indirect and direct impacts on water quality. These programs include indirect impacts on water quality from hazardous waste disposal, underground storage tanks, and landfill operations. VSFB's wastewater management plan, industrial wastewater management plan, stormwater pollution prevention plan, and stormwater management plan provide direction for controlling direct impacts on local water quality.

7.6. Wetland Protection

Applicability Statement

This section applies to USSF installations that have existing wetlands on USSF property. Vandenberg SFB is required to implement this element.

Program Overview/Current Management Practices

Approximately five percent of VSFB lands are wetlands (5,110 acres). Vandenberg SFB contains a variety of relatively undisturbed wetlands, ranging from estuaries and rivers to freshwater marshes and intermittent streams. Major wetland areas on-base include Barka Slough, the Santa Ynez River, and the Santa Ynez River estuary (see Section 2.3.5 and Tab B–Wetlands and Riparian Habitats Management Plan).

Vernal pools are among the least understood habitats on VSFB and require further study and mapping. Since many of the pools on-base occur near roadsides, they are subject to disturbances from roadside maintenance and from grass cutting for fire prevention. Additional information regarding the management of wetlands is provided within Tab B—Wetlands and Riparian Habitats Management Plan.

7.6.1. Climate Impacts on Wetland Protection

Drought has the potential to negatively impact many species (including several Threatened and Endangered species) that live in wetlands at VSFB. Despite the increase in annual precipitation under several scenarios, climate projections show the potential for drought conditions to increase in certain months, especially by 2050 under both the RCP 4.5 and RCP 8.5 emissions scenarios. Reductions in wetland area and/or function could lead to detrimental effects on vulnerable species and lead to increases in already substantial natural resource management efforts regarding wetland areas.

7.7. Grounds Maintenance

Applicability Statement

This section applies to USSF installations that perform ground maintenance activities that could impact natural resources. Vandenberg SFB is required to implement this element.

Program Overview/Current Management Practices

Grounds maintenance on VSFB includes native landscaping strategies, pest/insect and disease control, tree windbreak monitoring, nonpoint source pollution control, urban forestry maintenance, and the management of green waste. Proper grounds maintenance is a critical issue for natural resources protection. The Lands and Grounds Maintenance Management Plan (Tab J) provides an overview of grounds maintenance issues on VSFB.

Effective grounds maintenance is important in the management of natural resources on VSFB because it helps to promote the health and development of native plant and animal species. The use of regionally native plants offers the advantages of natural adaptation to the climatic and geologic environments. In addition, the use of native plants can promote regional identity and enhance wildlife habitat and biodiversity. Invasive nonnative plant species can stress an ecosystem by out-competing and replacing native plant species and subsequently destroying habitat for the native wildlife. Currently, there are four grounds maintenance plans for VSFB: the Lands and Grounds Maintenance Management Plan, the Forestry and Urban Forestry Management Plan, the Base Facilities Excellence Plan, and the Base Landscaping Guidelines. Each plan contains recommendations for the type of landscaping that the base will have. The Base Landscaping Guidelines promote the use of native plants.

7.8. Forest Management

Applicability Statement

This section applies to USSF installations that maintain forested land on USSF property. Vandenberg SFB is required to implement this element.

Program Overview/Current Management Practices

On military lands, successful urban forest management must accommodate and support the military mission, while providing environmental benefits and improving the quality of life for base personnel and residents. In 1997, Harland Bartholomew and Associates prepared an Urban Forestry Management Plan for

VSFB. This plan included a comprehensive inventory of all trees in the cantonment area to establish baseline urban forest resources. At that time, the inventory included 7,035 trees that were categorized by type, location, size, quality, and safety. All trees and tree masses were mapped, and corresponding spatial and categorical data were entered into a GIS database. From this baseline information, Harland Bartholomew and Associates formulated goals and objectives for the urban forest on VSFB. An implementation plan defining maintenance and planting requirements was also included in the finalized plan.

Information regarding forest management on VSFB is provided within Tab F—Forestry and Urban Forestry Management Plan.

7.9. Wildland Fire Management

Applicability Statement

This section applies to USSF installations with unimproved lands that present a wildfire hazard and/or installations that utilize prescribed burns as a land management tool. VSFB is required to implement this element.

Program Overview/Current Management Practices

Tab M—Wildland Fire Management Plan (WFMP) describes the fire management activities conducted at VSFB. The WFMP meets the requirements of AFMAN 32-7003, Section 3P, *Wildland Fire Management*; National Fire Protection Association Standard 1051, *Standard for Wildland Fire Fighter Professional Qualifications*; NFPA Standard 1143, *Standard for Wildland Fire Management*; NFPA 1144, *Standard for Protection of Life and Property from Wildfire*; and AFI 32-2001, *Fire Emergency Services Program*. Section 3P of AFMAN 32-7003 requires USAF installations with burnable acreage and installations that use prescribed burns as a land management tool to develop and implement a WFMP; according to AFMAN 32-7003, WFMPs must be incorporated into or be consistent with the installation's INRMP. The WFMP is a fundamental strategic document that guides the full range of fire management-related activities. It provides a framework for managing wildland fire and prescribed fire and hazardous fuel reduction, as tools to safely accomplish the resource protection and management objectives of VSFB, as described in INRMP.

7.9.1. Climate Impacts on Wildland Fire Management

Vandenberg's climate is expected to be only slightly warmer by 2030, with monthly maximum temperatures ranging from 0.3 to 3.2 °F warmer than historic averages. By 2050, monthly maximum temperature is expected to be higher, but temperature increases of more than 4 °F are only expected in the RCP 8.5 2050 scenario.

Across all scenarios, there is a trend toward a much drier January and March, separated by a much wetter February. April is also projected to be considerably drier. Deducing potential fire impacts is difficult with projections of as much as 90% more precipitation in February surrounded by months in which precipitation is likely to decrease by as much as 44%. Further complicating the matter is the fact that the warmest temperatures during this period of the year are projected by the RCP 8.5 2050 scenario, which also estimates a slightly wetter January and February relative to historic averages (and only a slightly drier March). These conflicting results suggest that the effects on fire will be strongly related to the climate change scenario that ultimately is realized.

Should the moist February weather projected under all but the RCP 8.5 2050 scenario not materialize, the resulting winters would be extremely dry. Even with the moist February, it is likely that there will be more fires from January through April given the substantial reductions in precipitation overall during this period.

If February precipitation occurs in one or two heavy precipitation events, it may produce more runoff than moisture in the soil. Should the February precipitation be manifested in numerous events over the course of the month, vegetation would likely respond with increased biomass production. The resulting increased fuel load would then be exposed to a much drier March, with precipitation from 10 to 40% lower than historic norms. This would likely increase fire frequency in March. The increased fuel load would also cause more intense fires throughout the year, exacerbating fuel loading throughout the installation over time.

There is no consistent trend in projected vegetation conversion in the MC2 Dynamic Global Vegetation Models, though all scenarios project a change from the status quo (CEMML 2019). Chaparral may be converted to non-native, annual grasslands through a series of repeated fires resulting from increased fire frequency related to drought and invasive species spread. This shift would promote a cycle of more frequent fires which maintain grasslands at the expense of chaparral. If chaparral converts to grassland, future fires may be of lower intensity due to lower fuel loads and a less flammable fuel matrix. Regardless of predicted fire intensity, however, grasslands will support rates of spread to make fire control difficult. A factor in the year to year management of this scenario is the annual variability in precipitation, which will cause variability in grassland fuel loads (as it does currently).

To summarize the considerations discussed in this section, we expect a greater number of wildland fires at VSFB due to decreased precipitation, primarily in January and March. Vegetation conversion from chaparral to annual grasses may be realized where repeated fires occur, removing the chaparral and replacing it with non-native grasslands. In these areas, fire intensity may decrease due to considerably lower fuel loads, but fire spread rates would remain high. Should the conversion to grasslands fail to occur, fire behavior can be expected to increase in intensity due to drier conditions during fire season.

7.10. Agricultural Outleasing

Applicability Statement

This section applies to USSF installations that lease eligible land for agricultural purposes. Vandenberg SFB is required to implement this element.

Program Overview/Current Management Practices

Proper management of the agricultural outleasing program for VSFB is a major factor in maintaining the quality of natural resources on-base. Past agricultural practices have contributed to the destruction of sensitive habitats and disturbance of threatened, endangered, and candidate species. The Grazing Management Plan (Tab E2) describes the grazing management practices at VSFB. Management strategies have been focused on assessing the status of suitable and available areas for agricultural activities, properly interfacing with the Natural Resources Conservation Service and The Nature Conservancy, and implementing rotational grazing practices and grazing monitoring programs.

Tab E1—Cropland Management Plan discusses the main components of the agricultural outleasing program on VSFB. At present, the Federal Correctional Center at Lompoc is the only authorized organization conducting both crop production and grazing.

7.11. Integrated Pest Management Program

Applicability Statement

This section applies to USSF installations that perform pest management activities in support of natural resources management (e.g., invasive species, forest pests, etc.). Vandenberg SFB is required to implement this element.

Program Overview/Current Management Practices

Invasive nonnative species are major threats to native flora and fauna. The most problematic and widespread species on VSFB are iceplant, veldt grass, European beachgrass, and pampas grass. Other invasive species that are of concern include narrow-leafed iceplant (*Conicosia pugioniformis*) and crystalline iceplant (*Mesembryanthemum crystallinum*). The habitats most threatened by these species are coastal dune communities and chaparral. Riparian and wetland habitats also are vulnerable to invasion by German ivy (*Delairea odorata*), tamarisk (*Tamarix* spp.), and giant reed (*Arundo donax*). Non-native fauna species on VSFB that are considered highest risk include feral hogs, American bullfrogs, European starlings (*Sturnus vulgaris*) and common ravens (*Corvus corax*). Information regarding these species and the efforts to control them on VSFB is provided in Tab G—Integrated Pest Management Program and Tab K—Invasive Plant Species Management Plan.

7.12. Coastal Zone and Marine Resources Management

Applicability Statement

This section applies to USSF installations that are located along coasts and/or within coastal management zones. Vandenberg SFB is required to implement this element.

Program Overview/Current Management Practices

Vandenberg SFB has 42 miles of coastline, consisting of a variety of natural communities, including coastal dunes and coastal dune scrubland, coastal salt marshes, coastal bluffs, and rocky coastlines and beaches (Appendix A, Figure 7-2). Disturbances to some of these areas have been due to past cattle grazing, ORV use, and past military-related development. Several of these natural communities contain endangered and other special status plant species or are used as habitat or roosting sites for threatened, endangered, and other special status animal species. Management of these areas is important to maintain their health and that of the species within them. Coastal issues affecting VSFB include requirements for coastal consistency determinations, protection of marine animals, special management areas for threatened and endangered species, public and military recreation access, and the Vandenberg State Marine Reserve. The Coastal and Riparian Habitats Management Plan (Tab C) contains additional information regarding these resources.

7.12.1. Special Management Areas

There are numerous special management areas on VSFB for coastal species that have been discussed elsewhere in this INRMP, such as western snowy plover habitat, California least tern habitat, southern sea otter rafting areas, and marine mammal haul-outs. In addition, several natural areas are considered sensitive or unique because of their rarity or drastic rate of decline in acreage, either statewide or nationwide, and their importance to the native plant species they support. These areas require special management consideration to preserve their integrity and the diversity of natural systems on the base as a whole. The areas are as follows:

Seabird Nest Sites—Seabird nest sites are designated as ESH by Santa Barbara County and are protected under its Local Coastal Plan and the Migratory Bird Treaty Act. Nesting occurs from April through August on rock cliffs and offshore rocks. Primary nesting locations are Point Pedernales and Destroyer Rock (pigeon guillemot), Point Arguello (pelagic cormorant, western gull, black oystercatcher, pigeon guillemot, rhinoceros auklet, Brandt's cormorant) and Rocky Point (black oystercatcher, pigeon guillemot, Brandt's cormorant). Purisima Point supports nesting pelagic cormorants, pigeon guillemots, and western gulls. Ashy storm-petrels (*Hydrobates homochroa*) were discovered in the Point Pedernales area, but nesting at VSFB was not confirmed in a project that concluded in 2013.

Marine Ecological Reserve—The Vandenberg Ecological Reserve, created under the Marine Resources Protection Act was superseded by the Vandenberg State Marine Reseeve (see below).

Vandenberg State Marine Reserve—The Vandenberg State Marine Reserve (VSMR) was created by the CDFG (now CDFW) in 2007. The designation of this reserve does not allow fishing or collection of other resources (biotic or abiotic), with limited exceptions; refer to Tab H for additional details.

Public access to the VSMR is restricted because it is within the security zone of VSFB. Thus, access to the reserve from the landward side by anyone, including VSFB personnel, is subject to clearance from the 30 CES/CEIEA. In addition, these waters are closed to navigation during space vehicle launches. Thus, mariners are encouraged to contact VSFB before departing from nearby ports (Winlund 1990). Fishing vessels may transit through but not stop or fish within the VSMR.

7.12.2. Climate Impacts on Coastal Zone and Marine Resources Management

Based on the vulnerabilities projected due to flooding, the following set of adaptation strategies have been curated for consideration (Table 10). Suggested adaptation projects are rated by their difficulty to implement and their relative efficacy. Ease of implementation is ranked from 1 to 3, with 1 being most difficult to implement and 3 being the easiest to implement. Efficacy is ranked from 1 to 3, 1 being the least effective and 3 being the most effective. The ecological impacts related to adopting each of these projects is stated to be positive if no negative impacts are expected. If these projects are expected to have negative ecological impacts, they are rated one (being minimal negative impact) through three (being extensive negative impact).

Table 10. Summary of suggested adaptation strategies based on SLR/SS projections.

Strategy	Implementation	Efficacy	Ecological impacts	Ecological resources
Artificial Breakwaters	1	3	Positive	Harris 2009
Bulkheads	2	3	1	Hester et al. 2006
Erosion Monitoring	1	2	Positive	NOAA 2018
Living Shorelines	1	2	Positive	NOAA Living Shorelines
Riprap	2	2	1	Gittman et al. 2016

7.13. Cultural Resources Protection

Applicability Statement

This section applies to USSF installations that have cultural resources that may be impacted by natural resource management activities. Vandenberg SFB is required to implement this element.

Program Overview/Current Management Practices

The 30 CES/CEI Natural Resources staff work closely with 30 CES/CEI Cultural Resources staff archaeologists to ensure that cultural resources concerns are addressed during the implementation of natural resource programs and activities. Natural resource issues of concern to cultural resource protection are incorporated into the VSFB Integrated Cultural Resource Management Plan, which is independent of this INRMP. Examples of ongoing cultural/natural resource coordination issues are as follows:

California least tern and western snowy plover protection requires placement of signs and fencing. Early coordination between biologists and archaeologists ensures that cultural resources are not adversely affected. In some cases, fencing to protect listed species can also be designed and placed so as to also enhance protection of archaeological sites. Native American monitors are involved where appropriate to further ensure protection of sensitive cultural sites.

Vandenberg SFB extended hunting and fishing privileges to Chumash Tribal members and coordinates locations for gathering natural materials that are important to Chumash culture and traditions.

Natural and Cultural Resources staff coordinate on the management of Swordfish Cave, an extremely important site to the Chumash and also a significant and sensitive pallid bat (*Antrozous pallidus*) roosting area.

Natural and Cultural Resources staff coordinate on restoration projects for historic buildings on VSFB that may affect nesting birds and bats.

7.14. Public Outreach

Applicability Statement

This section applies to all USSF installations that maintain an INRMP. Vandenberg SFB is required to implement this element.

Program Overview/Current Management Practices

7.14.1. Prepared Talks

Prepared talks may be given at the request of various groups, such as schools, Boy and Girl Scouts, civic organizations, professional societies, and other federal agencies involved in natural resources. In many cases, topics can be chosen to explain specific management programs that are bolstered by public understanding and support. General presentations about the VSFB Natural Resources Program can create a favorable perception that the USSF effectively manages our public lands and protects our natural resources.

7.15. Bird/Wildlife Aircraft Strike Hazard (BASH)

Applicability Statement

This section applies to USSF installations that maintain a BASH program to prevent and reduce wildlife-related hazards to aircraft operations. Vandenberg SFB is required to implement this element.

Program Overview/Current Management Practices

Aircraft may strike birds flying over the airfield or in aircraft approach and departure routes. Such bird-aircraft strikes could cause significant damage and casualties because the high speed of the aircraft greatly increases the force of the impact. Lesser numbers of other bird species may also fly over the runway and approach zones daily or seasonally. Although the Marshallia Ranch golf course has been closed for several years, a proposal to re-open and expand it is under consideration, One potential component could be a 7-

acre pond, which is expected to attract waterfowl, and it is of significant concern due its location. Waterfowl transiting between the golf course and the Santa Ynez River estuary would be expected to fly at low altitude over the active runway.

Other Wildlife-Aircraft Strike Hazard

The airfield at VSFB is surrounded by excellent mule deer (*Odocoileus hemionus*) habitat. An electric exclusion fence was installed around the airfield to reduce deer strike incidents, however in general, this fence is ineffective and needs to be replaced with a more appropriate fence. Information regarding the management of bird/wildlife-aircraft strike hazard issues is provided in the Bird/Wildlife Air Strike Hazard (BASH) Plan (Tab L).

7.15.1. Newspapers and Related Media

The VSFB newspaper, *Space Country Times*, is an efficient means to inform the local community about natural resources. The base newspaper can be used to explain and publicize programs. 30 CES/CEI will provide articles on various natural resources issues as staffing allows. The Public Affairs Office will coordinate requests from outside newspapers and other media for information on the VSFB Natural Resources Program.

7.15.2. Internet

The Internet offers many opportunities for public outreach, such as distributing photographs, research results, and program highlights, and for announcing the availability of NEPA documents for public review.

7.15.3. Special Events

Vandenberg SFB occasionally hosts special events to highlight environmental awareness. These special events, such as Earth Day and America Recycles Day, provide VSFB with the opportunity to promote its natural resources program. 30 CES/CEI and other organizations on-base may also participate in similar events in the surrounding communities. National Public Lands Day is another example of an outreach event to highlight environmental awareness, although for security reasons, the most recent National Public Lands Day events have been available only to the base population.

7.16. Climate Change Vulnerabilities

Applicability Statement

This section applies to USSF installations that have identified climate change risks, vulnerabilities, and adaptation strategies using authoritative region-specific climate science, climate projections, and existing tools. Vandenberg SFB is required to implement this element.

Program Overview/Current Management Practices

Vulnerability in this case refers to the degree to which an installation and its natural resources are susceptible to the impacts of climate change. Vandenberg SFB is expected to experience a warmer climate in the coming decades, with moderate changes in precipitation projected in different modeling scenarios (See Section 2.2.1). Under these conditions, the installation may be susceptible to the following issues.

More **frequent drought conditions** due to monthly reductions in precipitation (Section 2.2.1)

Permanent inundation from sea level rise, projected to reduce installation area by between 245.6 acres and 262.4 acres (Section 2.2.4.2)

Short-term flooding from storm surges at the mouth of the Santa Ynez River, projected to inundate 636.9-717.4 acres of the installation (Section 2.2.4.2)

Threats to the mission, including loss of training areas and more frequent equipment and infrastructure maintenance needs (Section 2.4.4.4)

Changes to vegetation, including a possible reduction of vegetation cover, caused by warmer temperatures, flooding, and changes in the wildfire regime. Grassland/prairie, wetlands/floodplain, and chaparral are some of the most susceptible ecosystems (Section 2.3.2.3)

Reductions in wildlife habitat due to shifts in seasonal precipitation, changes in vegetation, reduced water quality in lentic systems, and expansion of invasive species (Section 7.1.5)

Need for additional monitoring of fish populations and both native and invasive wildlife populations (Section 7.1.5)

Potential **reduction of outdoor recreational opportunities** on the beach due to sea level rise (Section 7.2.1)

Increased frequency and intensity of **wildland fires,** depending on the extent of changes in climate (Section 7.9.1)

The best available science was used to develop the models from which the downscaled projections and related climate vulnerability assessments were derived. However, there are gaps in data about the complex feedbacks in this system, which add some uncertainty to the projections. The projections provided in this document are therefore intended to demonstrate the range of conditions to which managers may have to adapt (CEMML, 2019).

7.17. Geographic Information Systems (GIS)

Applicability Statement

This section applies to all USSF installations that maintain an INRMP, since all geospatial information must be maintained within the USSF GeoBase system. Vandenberg SFB is required to implement this element.

Program Overview/Current Management Practices

The VSFB GIS is the computer-based tool used for mapping and analyzing geographic features on VSFB. GIS technology integrates common database operations, such as queries and statistical analysis, with the unique visualization and geographic analysis benefits offered by maps. Base Planning (30 CES/CENM) is the supporting section for all land use planning activities on VSFB. The natural resources maps contained within the INRMP are GIS-based and cover a wide range of information about the geology, habitats, vegetation types, wildlife, range management, and other natural resources on-base.

Interface with 30th Space Delta Base Planning

The 30 CES is the proponent and executor of the IDP, while 30 CES/CENM oversees the review process and revises the IDP. The IDP incorporates natural resources management strategies and the maps provided in this INRMP.

8.0 MANAGEMENT GOALS AND OBJECTIVES

The installation establishes long term, expansive goals and supporting objectives to manage and protect natural resources while supporting the military mission. Goals express a vision for a desired condition for the installation's natural resources and are the primary focal points for INRMP implementation. Objectives indicate a management initiative or strategy for specific long or medium range outcomes and are supported by projects. Projects are specific actions that can be accomplished, usually within a single year. Also, in cases where off-installation land uses may jeopardize USSF missions, this section may list specific goals and objectives aimed at eliminating, reducing or mitigating the effects of encroachment on military missions. These natural resources management goals for the future have been formulated by the preparers of the INRMP from an assessment of the natural resources, current condition of those resources, mission requirements, and management issues previously identified. Below are the integrated goals for the entire natural resources program.

The installation goals and objectives are displayed in the 'Installation Supplement' section below in a format that facilitates an integrated approach to natural resource management. By using this approach, measurable objectives can be used to assess the attainment of goals. Individual work tasks support INRMP objectives. The projects are key elements of the annual work plans and are programmed into the conservation budget, as applicable.

Installation Supplement – Management Goals and Objectives

Management goals and objectives for the following management plans are located in Appendix C.

Fish and Wildlife Management Plan

Wetlands and Riparian Habitats Management Plan

Coastal Resources Management Plan

Threatened and Endangered Species Management Plan

Cropland Management Plan and Grazing Management Plan

Forestry and Urban Forestry Management Plan

Integrated Pest Management Plan

Outdoor Recreation Management Plan

Conservation Law Enforcement Management Plan

Lands and Grounds Maintenance Management Plan

Invasive Plant Species Management Plan

BASH Plan

Wildland Fire Management Plan

Cooperative Agreements

Off-Base Leased Mission Support Sites

8.1. Funding

In Appendix C, management goals and objectives are shown in tabular form. The projects that implement these goals and objectives are programmed according to AFCEC guidance using standard titles and the relevant legal drivers (PB28 codes). Each unique combination of standard title and legal driver has an

associated EQ Score, which determine its relative funding priority by Air Force Common Output Level Standards (AF COLS) level. The combination of standard titles and AFCOLS levels replaces the previous nomenclature of project classes 0, 1, 2 and 3. The four AF COLS levels are as follows.

AF COLS 4: (Maintain Compliance) Risk-based mission that complies with statutory legal requirements (EQ Scores 24–21)

AF COLS 3: (Sustain Compliance) Risk-based mission that complies with statutory legal requirements, and Executive Order/Department of Defense/Space Force guidance (EQ Scores 20–16)

AF COLS 2: (Prevents Non-Compliance) Comply with statutory legal requirements and Executive Order/Department of Defense/Space Force guidance (EQ Scores 15–0)

AF COLS 1: (Enhance the Environment) Fully effective and efficient mission capability. Complies with statutory legal requirements, and Executive Order/Department of Defense/Space Force guidance (EQ Score 8)

The application of AF COLS levels to standard titles is subject to change, so the programming guide on eDASH should be consulted for definitive information.

9.0 INRMP IMPLEMENTATION, UPDATE, AND REVISION PROCESS

9.1. Natural Resources Management Staffing and Implementation

Installation Commander

The 30th Space Delta Installation Commander (30 SW/CC) is responsible for the daily operation of and mission accomplishment at VSFB. The 30 SW/CC has authority to approve the INRMP, to ensure funding and staffing for INRMP implementation, and to control access to and use of installation natural resources. The Secretary of a military department may enter into cooperative agreements with states, local governments, nongovernmental organizations, and individuals to maintain and improve natural resources on, or to benefit natural and historic research on, Department of Defense (DoD) installations. The 30 SD/CV chairs the Environmental, Safety, and Occupational Health Council (ESOHC).

Environmental Compliance Assessment System

Vandenberg SFB utilizes a comprehensive compliance assessment program, the Environmental Inspection System (EIS), in accordance with AFI 32-7001. The EIS is intended to be a continuous process to help determine compliance with current environmental regulations through rolling yearly evaluations. An overall EIS evaluation considers 13 major environmental compliance areas including natural resource aspects, such as ESA and other issues.

The EIS is a tool designed to assist Space Force installations and organizations as they assess their compliance with various applicable federal, state, local, and Space Force environmental requirements. Aside from noting potential program noncompliance, EIS reporting systems identify deficiencies, improvements and strengths findings, which demonstrate a standard of excellence or an achievement considered best in class. The EIS assessment is conducted annually by an internal team.

Mission Support Group Commander

The Mission Support Group Commander (30 MSG/CC) has oversight for both the 30th Space Delta Civil Engineer Squadron (30 CES) and the 30th Space Delta Security Forces Squadron (30 SFS), in addition to the Force Support, Contracting, and Logistics Readiness squadrons. The 30 MSG/CC approves specific recreation activities on VSFB. The 30th Space Delta Conservation Law Enforcement Program's (30 SFS/S3SW) Fish and Wildlife personnel patrol coastal areas on-base, enforce the limited access regulations to key wildlife areas, and enforce fish and wildlife rules and regulations, in accordance with 30th Space Wing Instruction (30 SWI) 32-7001, *Conservation, Management and Enforcement*.

Base Civil Engineer

The 30th Space Delta Base Civil Engineer (Base Civil Engineer) oversees the 30th Space Delta Installation Management Flight (30 CES/CEI).

Installation Management Flight

The 30 CES/CEI manages environmental planning, conservation, compliance and pollution prevention functions. Natural resources management at VSFB is the responsibility of the Natural Resources Section (30 CES/CEIEA) within the Conservation Element of 30 CES/CEIE. The Conservation Element also includes cultural resources management functions.

The 30 CES/CEIEA is responsible for conservation and management of threatened and endangered species, fish and wildlife, grazing and cropland, as well as research, pest and land management, and certain outdoor

recreation activities, such as hunting and fishing. In addition, the 30 CES/CEIEA coordinates project planning and implementation with other organizations on-base and reviews project plans and Environmental Impact Analysis Process (EIAP) documentation to ensure compliance with applicable natural resources regulations. The 30 CES/CEIEA staffers are the USSF's technical experts who consult with the USFWS and NOAA Fisheries and coordinate with the California Department of Fish and Wildlife (CDFW) and other regulatory agencies as required. The 30 CES/CEIEA staff are responsible for training and educating VSFB personnel involved in mission requirements affecting the presence and management of natural resources on the base. They also provide technical support to the Public Affairs Office in educating on- and off-base personnel on natural resource issues of interest to the community.

9.2. Monitoring INRMP Implementation

Implementation strategies for the following management plans are located in Appendix C.

Fish and Wildlife Management Plan

Wetlands and Riparian Habitats Management Plan

Coastal Resources Management Plan

Threatened and Endangered Species Management Plan

Cropland Management Plan and Grazing Management Plan

Forestry and Urban Forestry Management Plan

Integrated Pest Management Plan

Outdoor Recreation Management Plan

Conservation Law Enforcement Management Plan

Lands and Grounds Maintenance Management Plan

Invasive Plant Species Management Plan

Bird/Wildlife Air Strike Hazard (BASH) Plan

Wildland Fire Management Plan

Cooperative Agreements

Off-Base Leased Mission Support Sites

9.3. Annual INRMP Review and Update Requirements

The INRMP is a living document and has been compiled in a modular format so that data and maps can be replaced with updates. In addition, the proper maintenance of updated data in the plan, on an annual or as-needed basis, is recommended to ensure the living nature of the document. This will be accomplished through the exchange and input of information into the base GIS data system.

The INRMP must be revised and approved by the appropriate higher command headquarters, USFWS, NOAA Fisheries, and CDFW at least every five years, or more frequently if warranted by significant changes to the installation's mission requirements or its natural resources.

Also, the INRMP is to be reviewed annually with the cooperation of the USFWS, NOAA Fisheries, and CDFW. Annual reviews will ensure that the most current information on all conservation issues is available, that budgeting and implementation are on schedule, and that projects and activities for the upcoming year are identified and included. Although the Sikes Act specifies only that a formal review be completed no

less than every five years, DoD policy requires installations to review INRMPs annually in cooperation with the other parties to the INRMP. Annual reviews facilitate adaptive management by providing an opportunity for the parties to review the goals and objectives of the plan and to establish a realistic schedule for undertaking the proposed actions.

10.0 ANNUAL WORK PLANS

The INRMP Annual Work Plans are included in this section. These projects are listed by fiscal year, including the current year and four succeeding years. For each project and activity, a specific timeframe for implementation is provided (as applicable), as well as the appropriate funding source, and priority for implementation. The work plans provide all the necessary information for building a budget within the USSF framework. Priorities are defined as follows:

High—The INRMP signatories assert that if the project is not funded the INRMP is not being implemented and the Space Force is non-compliant with the Sikes Act; or that it is specifically tied to an INRMP goal and objective and is part of a "Benefit of the Species" determination necessary for ESA Sec 4(a)(3)(B)(i) critical habitat exemption.

Medium—Project supports a specific INRMP goal and objective, and is deemed by INRMP signatories to be important for preventing non-compliance with a specific requirement within a natural resources law or by EO 13112 on Invasive Species. However, the INRMP signatories would not contend that the INRMP is not be implemented if not accomplished within the programmed year due to other priorities.

Low—Project supports a specific INRMP goal and objective, enhances conservation resources or the integrity of the installation mission, and/or support long-term compliance with specific requirements within natural resources law; but is not directly tied to specific compliance within the proposed year of execution.

11.0 REFERENCES

Note: The References section contains many historic references to Vandenberg Air Force Base (or VAFB), which was the correct title of the installation at the time of publication.

11.1. Standard References (Applicable to all USSF installations)

- AFMAN 32-7003, *Environmental Conservation*
- Sikes Act
- eDASH Natural Resources Program Page
- Natural Resources Playbook – a Internal USSF reference available at https://cs1.eis.af.mil/sites/ceportal/CEPlaybooks/NRM2/Pages/

11.2. Installation References

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12.0 ACRONYMS

12.1. Standard Acronyms (Applicable to all USSF installations)

- eDASH Acronym Library
- Natural Resources Playbook – Acronym Section
- U.S. EPA Terms & Acronyms

12.2. Installation Acronyms

30 CES	30th Space Delta Civil Engineer Squadron
30 CES/CEI	30th Space Delta Installation Management Flight (formerly known as 30 CES/CEA)
30 CES/CEIEA	30th Space Delta Installation Management Flight, Natural Resources Section (formerly known as 30 CES/CEANC)
30 CES/CENPL	30th Space Delta Base Planning
30 MSG/CC	30th Space Delta Mission Support Commander
30 SFS	30th Space Delta Security Forces Squadron
30 SFS/S3SW	30th Space Delta Conservation Law Enforcement Program
30 SD/CC	30th Space Delta Installation Commander
30 SWI	30th Space Wing Instruction
AF	United States Space Force
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AF COLS	Air Force Common Output Level Standards
AFI	Air Force Instruction
AFMAN	Air Force Manual
AFPD	Air Force Policy Directive
AFS	Air Force Station
AICUZ	Air Installation Compatible Use Zone
BASH	Bird/Wildlife Air Strike Hazard
Cal Poly	California Polytechnic State University
CDFW	California Department of Fish and Wildlife (formerly California Department of Fish and Game [CDFG])
CEMML	Center for Environmental Management of Military Lands
CNDDB	California Natural Diversity Database
CSU	Colorado State University
DoD	Department of Defense
DoDI	Department of Defense Instruction
DTSC	Department of Toxic Substances Control
EFH	Essential Fish Habitat
EIAP	Environmental Impact Analysis Process
EMP	Environmental Management Plan
EMS	Environmental Management System
ESA	Endangered Species Act
ESH	Environmentally Sensitive Habitat
ESOHC	Environmental, Safety, and Occupational Health Council
FGS	Final Governing Standards
GDD	Growing Degree Days
GIS	Geographic Information System
GSU	Geographically Separated Unit
IAW	In Accordance With

IDP	Installation Development Plan
INRMP	Integrated Natural Resources Management Plan
IPCC	Intergovernmental Panel on Climate Change
IPCC-CMIPP5	IPCC Coupled Model Intercomparison Project Phase 5
ISI-MIP	Inter-sectoral Impact Model Intercomparison Project
IRP	Installation Restoration Program
kHz	kilohertz
LOA	Letter of Authorization
MC2	Dynamic Global Vegetation Model
MCV	Manual of California Vegetation
MOU	Memorandum of Understanding
NCI	Northern Channel Islands
NCSS	National Cooperative Soil Survey
NEPA	National Environmental Policy Act
NOAA Fisheries	National Oceanic and Atmospheric Administration's Fisheries (also known as the National Marine Fisheries Service)
NRCS	Natural Resources Conservation Service
NRM	Natural Resources Manager
ORV	Off-road Vehicle
POC	Point(s) of Contact
PRECIP	Annual Average Precipitation
psf	pound(s) per square foot
RCP	Representative Concentration Pathway
RCRA	Resource Conservation and Recovery Act
SFB	Space Force Base
SLC	Space Launch Complex
SLR	Sea Level Rise
SMI	San Miguel Island
SS	Storm Surge
US	United States
USACE	United States Army Corps of Engineers
USSF	United States Space Force
USC	United States Code
USCG	United States Coast Guard
USDA Forest Service	United States Department of Agriculture, Forest Service
USFWS	United States Fish and Wildlife Service
VAFB	Vandenberg Air Force Base (generally in historic context)
VSFB	Vandenberg Space Force Base
WFMP	Wildland Fire Management Plan

13.0 DEFINITIONS

13.1. Standard Definitions (Applicable to all USSF installations)

- Natural Resources Playbook – Definitions Section

13.2. Installation Definitions

14.0 APPENDICES

14.1. Standard Appendices

Annotated Summary of Key Legislation Related to Design and Implementation of the INRMP.

Federal Public Laws and Executive Orders	
National Defense Authorization Act of 1989, Public Law (P.L.) 101-189; Volunteer Partnership Cost-Share Program	Amends two Acts and establishes volunteer and partnership programs for natural and cultural resources management on DoD lands.
Defense Appropriations Act of 1991, P.L. 101-511; Legacy Resource Management Program	Establishes the "Legacy Resource Management Program" for natural and cultural resources. Program emphasis is on inventory and stewardship responsibilities of biological, geophysical, cultural, and historic resources on DoD lands, including restoration of degraded or altered habitats.
EO 11514, Protection and Enhancement of Environmental Quality	Federal agencies shall initiate measures needed to direct their policies, plans, and programs to meet national environmental goals. They shall monitor, evaluate, and control agency activities to protect and enhance the quality of the environment.
EO 11593, Protection and Enhancement of the Cultural Environment	All Federal agencies are required to locate, identify, and record all cultural resources. Cultural resources include sites of archaeological, historical, or architectural significance.
EO 11987, Exotic Organisms	Agencies shall restrict the introduction of exotic species into the natural ecosystems on lands and waters which they administer.
EO 11988, Floodplain Management	Requires adherence to all federal wetland and floodplain protection regulations; provides direction regarding actions of federal agencies in floodplains; requires permits from state, territory, and federal review agencies for any construction within a 100-year floodplain; requires restoration and preservation of the natural and beneficial values served by floodplains when government agencies are carrying out their responsibilities for acquiring, managing, and disposing of federal lands and facilities; and promotes the use of mitigation banking and the development of a floodplain boundary determination.
EO 11989, Off-Road vehicles on Public Lands	Installations permitting off-road vehicles to designate and mark specific areas/trails to minimize damage and conflicts, publish information including maps, and monitor the effects of their use. Installations may close areas if adverse effects on natural, cultural, or historic resources are observed.
EO 11990, Protection of Wetlands	Requires Federal agencies to avoid undertaking or providing assistance for new construction in wetlands unless there is no practicable alternative, and all practicable measures to minimize harm to wetlands have been implemented and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities; and (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.
EO 12088, Federal Compliance With Pollution Control Standards	This EO delegates responsibility to the head of each executive agency for ensuring all necessary actions are taken for the prevention, control, and abatement of environmental pollution. This order gives the U.S. Environmental Protection Agency (US EPA) authority to conduct reviews and inspections to monitor Federal facility compliance with pollution control standards.

Federal Public Laws and Executive Orders	
EO 12898, Environmental Justice	This EO requires certain federal agencies, including the DoD, to the greatest extent practicable permitted by law, to make environmental justice part of their missions by identifying and addressing disproportionately high and adverse health or environmental effects on minority and low-income populations.
EO 13112, Exotic and Invasive Species	To prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause.
EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds	The U.S. Fish and Wildlife Service (USFWS) has the responsibility to administer, oversee, and enforce the conservation provisions of the Migratory Bird Treaty Act, which includes responsibility for population management (e.g., monitoring), habitat protection (e.g., acquisition, enhancement, and modification), international coordination, and regulations development and enforcement.
United States Code	
Animal Damage Control Act (7 U.S.C. § 426-426b, 47 Stat. 1468)	Provides authority to the Secretary of Agriculture for investigation and control of mammalian predators, rodents, and birds. DoD installations may enter into cooperative agreements to conduct animal control projects.
Bald and Golden Eagle Protection Act of 1940, as amended; 16 U.S.C. 668-668c	This law provides for the protection of the bald eagle (the national emblem) and the golden eagle (*Aquila chrysaetos*) by prohibiting, except under certain specified conditions, the taking, possession and commerce of such birds. The 1972 amendments increased penalties for violating provisions of the Act or regulations issued pursuant thereto and strengthened other enforcement measures. Rewards are provided for information leading to arrest and conviction for violation of the Act.
Clean Air Act, (42 U.S.C. § 7401–7671q, July 14, 1955, as amended)	This Act, as amended, is known as the Clean Air Act of 1970. The amendments made in 1970 established the core of the clean air program. The primary objective is to establish Federal standards for air pollutants. It is designed to improve air quality in areas of the country which do not meet Federal standards and to prevent significant deterioration in areas where air quality exceeds those standards.
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (Superfund) (26 U.S.C. § 4611–4682, P.L. 96-510, 94 Stat. 2797), as amended	Authorizes and administers a program to assess damage, respond to releases of hazardous substances, fund cleanup, establish clean-up standards, assign liability, and other efforts to address environmental contaminants. Installation Restoration Program guides cleanups at DoD installations.
Endangered Species Act (ESA) of 1973, as amended; P.L. 93-205, 16 U.S.C. § 1531 et seq.	Protects threatened, endangered, and candidate species of fish, wildlife, and plants and their designated critical habitats. Under this law, no Federal action is allowed to jeopardize the continued existence of an endangered or threatened species. The ESA requires consultation with the USFWS and the NOAA Fisheries (National Marine Fisheries Service) and the preparation of a biological evaluation or a biological assessment may be required when such species are present in an area affected by government activities.
Federal Aid in Wildlife Restoration Act of 1937 (16 U.S.C. § 669–669i; 50 Stat. 917) (Pittman-Robertson Act)	Provides Federal aid to states and territories for management and restoration of wildlife. Fund derives from sports tax on arms and ammunition. Projects include acquisition of wildlife habitat, wildlife research surveys, development of access facilities, and hunter education.
Federal Environmental Pesticide Act of 1972	Requires installations to ensure pesticides are used only in accordance with their label registrations and restricted-use pesticides are applied only by certified applicators.

Federal Public Laws and Executive Orders	
Federal Land Use Policy and Management Act, 43 U.S.C. § 1701–1782	Requires management of public lands to protect the quality of scientific, scenic, historical, ecological, environmental, and archaeological resources and values; as well as to preserve and protect certain lands in their natural condition for fish and wildlife habitat. This Act also requires consideration of commodity production such as timbering.
Federal Noxious Weed Act of 1974, 7 U.S.C. § 2801–2814	The Act provides for the control and management of non-indigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health.
Federal Water Pollution Control Act (Clean Water Act [CWA]), 33 U.S.C. §1251–1387	The CWA is a comprehensive statute aimed at restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. Primary authority for the implementation and enforcement rests with the US EPA.
Fish and Wildlife Conservation Act (16 U.S.C. § 2901–2911; 94 Stat. 1322, PL 96-366)	Installations encouraged to use their authority to conserve and promote conservation of nongame fish and wildlife in their habitats.
Fish and Wildlife Coordination Act (16 U.S.C. § 661 et seq.)	Directs installations to consult with the USFWS, or state or territorial agencies to ascertain means to protect fish and wildlife resources related to actions resulting in the control or structural modification of any natural stream or body of water. Includes provisions for mitigation and reporting.
Lacey Act of 1900 (16 U.S.C. § 701, 702, 32 Stat. 187, 32 Stat. 285)	Prohibits the importation of wild animals or birds or parts thereof, taken, possessed, or exported in violation of the laws of the country or territory of origin. Provides enforcement and penalties for violation of wildlife related Acts or regulations.
Leases: Non-excess Property of Military Departments, 10 U.S.C. § 2667, as amended	Authorizes DoD to lease to commercial enterprises Federal land not currently needed for public use. Covers agricultural outleasing program.
Migratory Bird Treaty Act 16 U.S.C. § 703–712	The Act implements various treaties for the protection of migratory birds. Under the Act, taking, killing, or possessing migratory birds is unlawful without a valid permit.
National Environmental Policy Act of 1969 (NEPA), as amended; P.L. 91-190, 42 U.S.C. § 4321 et seq.	Requires Federal agencies to utilize a systematic approach when assessing environmental impacts of government activities. Establishes the use of environmental impact statements. NEPA proposes an interdisciplinary approach in a decision-making process designed to identify unacceptable or unnecessary impacts on the environment. The Council of Environmental Quality (CEQ) created Regulations for Implementing the National Environmental Policy Act [40 Code of Federal Regulations (CFR) Parts 1500– 1508], which provide regulations applicable to and binding on all Federal agencies for implementing the procedural provisions of NEPA, as amended.
National Historic Preservation Act, 16 U.S.C. § 470 et seq.	Requires Federal agencies to take account of the effect of any federally assisted undertaking or licensing on any district, site, building, structure, or object included in or eligible for inclusion in the National Register of Historic Places (NRHP). Provides for the nomination, identification (through listing on the NRHP), and protection of historical and cultural properties of significance.
National Trails Systems Act (16 U.S.C. § 1241–1249)	Provides for the establishment of recreation and scenic trails.
National Wildlife Refuge Acts	Provides for establishment of National Wildlife Refuges through purchase, land transfer, donation, cooperative agreements, and other means.
National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. § 668dd–668ee)	Provides guidelines and instructions for the administration of Wildlife Refuges and other conservation areas.

Federal Public Laws and Executive Orders	
Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. § 3001–13; 104 Stat. 3042), as amended	Established requirements for the treatment of Native American human remains and sacred or cultural objects found on Federal lands. Includes requirements on inventory, and notification.
Plant Protection Act of 1999 (7 U.S.C. §§ 7701–7786)	Authorizes the USDA to issue regulations to prevent introductions or dissemination of plant pests and noxious weeds into the U.S. Consolidates related responsibilities previously scattered in multiple statutes, including the Plant Quarantine Act, the Federal Plant Pest Act, and the Federal Noxious Weed Act of 1974.
Rivers and Harbors Act of 1899 (33 U.S.C. § 401 et seq.)	Makes it unlawful for the USSF to conduct any work or activity in navigable waters of the United States without a Federal Permit. Installations should coordinate with the U.S. Army Corps of Engineers (USACE) to obtain permits for the discharge of refuse affecting navigable waters under National Pollutant Discharge Elimination System (NPDES) and should coordinate with the USFWS to review effects on fish and wildlife of work and activities to be undertaken as permitted by the USACE.
Sale of certain interests in land, 10 U.S.C. § 2665	Authorizes sale of forest products and reimbursement of the costs of management of forest resources.
Soil and Water Conservation Act (16 U.S.C. § 2001, P.L. 95-193)	Installations shall coordinate with the Secretary of Agriculture to appraise, on a continual basis, soil/water-related resources. Installations will develop and update a program for furthering the conservation, protection, and enhancement of these resources consistent with other Federal and local programs.
Sikes Act (16 U.S.C. § 670a–670l, 74 Stat. 1052), as amended	Provides for the cooperation of DoD, the Departments of the Interior (USFWS), and the State Fish and Game Department in planning, developing, and maintaining fish and wildlife resources on a military installation. Requires development of an Integrated Natural Resources Management Plan and public access to natural resources, and allows collection of nominal hunting and fishing fees. NOTE: AFMAN 32-7003 sec 3.9. Staffing. As defined in DoDI 4715.03, use professionally trained natural resources management personnel with a degree in the natural sciences to develop and implement the installation INRMP. (T-0). 3.9.1. Outsourcing Natural Resources Management. As stipulated in the Sikes Act, 16 U.S.C. § 670 et. seq., the Office of Management and Budget Circular No. A-76, Performance of Commercial Activities, August 4, 1983 (Revised May 29, 2003) does not apply to the development, implementation and enforcement of INRMPs. Activities that require the exercise of discretion in making decisions regarding the management and disposition of government owned natural resources are inherently governmental. When it is not practicable to utilize DoD personnel to perform inherently governmental natural resources management duties, obtain these services from federal agencies having responsibilities for the conservation and management of natural resources.
DoD Policy, Directives, and Instructions	
DoD Instruction 4150.07. *DoD Pest Management Program*, 29 May 2008	Implements policy, assigns responsibilities, and prescribes procedures for the DoD Integrated Pest Management Program.
DoD Instruction 4715.1, Environmental Security	Establishes policy for protecting, preserving, and (when required) restoring and enhancing the quality of the environment. This instruction also ensures environmental factors are integrated into DoD decision-making processes that could impact the environment, and are given appropriate consideration along with other relevant factors.

DoD Policy, Directives, and Instructions	
DoD Instruction (DODI) 4715.03, Natural Resources Conservation Program	Implements policy, assigns responsibility, and prescribes procedures under DoDI 4715.1 for the integrated management of natural and cultural resources on property under DoD control.
OSD Policy Memorandum, 17 May 2005—Implementation of Sikes Act Improvement Amendments: Supplemental Guidance Concerning Leased Lands	Provides supplemental guidance for implementing the requirements of the Sikes Act in a consistent manner throughout DoD. The guidance covers lands occupied by tenants or lessees or being used by others pursuant to a permit, license, right of way, or any other form of permission. INRMPs must address the resource management on all lands for which the subject installation has real property accountability, including leased lands. Installation commanders may require tenants to accept responsibility for performing appropriate natural resource management actions as a condition of their occupancy or use, but this does not preclude the requirement to address the natural resource management needs of these lands in the installation INRMP.
OSD Policy Memorandum, 1 November 2004—Implementation of Sikes Act Improvement Act Amendments: Supplemental Guidance Concerning INRMP Reviews	Emphasizes implementing and improving the overall INRMP coordination process. Provides policy on scope of INRMP review, and public comment on INRMP review.
OSD Policy Memorandum, 10 October 2002—Implementation of Sikes Act Improvement Act: Updated Guidance	Provides guidance for implementing the requirements of the Sikes Act in a consistent manner throughout DoD and replaces the 21 September 1998 guidance Implementation of the Sikes Act Improvement Amendments. Emphasizes implementing and improving the overall INRMP coordination process and focuses on coordinating with stakeholders, reporting requirements and metrics, budgeting for INRMP projects, using the INRMP as a substitute for critical habitat designation, supporting military training and testing needs, and facilitating the INRMP review process.
USSF Instructions and Directives	
32 CFR Part 989, as amended, and AFI 32-7061, Environmental Impact Analysis Process	Provides guidance and responsibilities in the EIAP for implementing INRMPs. Implementation of an INRMP constitutes a major federal action and therefore is subject to evaluation through an Environmental Assessment or an Environmental Impact Statement.
AFI 32-7062, Space Force Comprehensive Planning	Provides guidance and responsibilities related to the USSF comprehensive planning process on all USSF-controlled lands.
AFMAN 32-7003, Environmental Conservation	Replaces AFI 32-7064. Implements AFPD 32-70, *Environmental Quality*; DODI 4715.03, *Natural Resources Conservation Program*; and DODI 7310.5, *Accounting for Sale of Forest Products*, and explains how to manage natural resources on USSF properties in compliance with federal, state, territorial, and local standards. Also implements AFPD 32-70, *Environmental Considerations in Space Force Programs and Activities*, and DoDI 4710.1, *Archaeological and Historic Resources Management*; and explains how to manage cultural resources on USSF property in compliance with federal, state, territorial, and local standards.
AFPD 32-70, Environmental Quality	Outlines the USSF mission to achieve and maintain environmental quality on all USSF lands by cleaning up environmental damage resulting from past activities, meeting all environmental standards applicable to present operations, planning its future activities to minimize environmental impacts, managing responsibly the irreplaceable natural and cultural resources it holds in public trust and eliminating pollution from its activities wherever possible. AFPD 32-70 also establishes policies to carry out these objectives.
Policy Memo for Implementation of Sikes Act	Outlines the USSF interpretation and explanation of the Sikes Act and Improvement Act of 1997.

USSF Instructions and Directives	
Improvement Amendments, HQ USSF Environmental Office (USSF/ILEV) on January 29, 1999	

14.2. Installation Appendices

Appendix A. INRMP Figures

Appendix B. INRMP TablesTable B-1. Historical major vegetative alliances on Vandenberg SFB .

Forest and Woodland Alliances • *Quercus agrifolia Forest and Woodland Alliance / Coast Live Oak Woodland and Forest* • *Notholithocarpus densiflorus Forest Alliance / Tanoak Forest* • *Salix lasiolepis Shrubland Alliance / Arroyo Willow Thickets* • *Eucalyptus spp. Ruderal Forest Alliance / Ruderal Eucalyptus Grove* • *Hesperocyparis macrocarpa Woodland Special Stands – Monterey Cypress Stands* • *Pinus muricata – Pinus radiata Woodland Alliance / Bishop Pine – Monterey Pine Woodland* • **Soft-Leaved Shrub Associations** • *Coreopsis gigantean Shrubland Alliance / Giant Coreopsis Scrub* • *Artemisia californica – Salvia mellifera Shrubland Alliance / California Sagebrush – Black Sage Scrub* • *Lupinus chamissonis – Ericameria ericoides Shrubland Alliance / Chamisso's Lupine – California Goldenbrush Scrub* • *Lotus scoparius Shrubland Alliance / Deerweed Scrub* • *Mixed Dune Association (diverse, with herbaceous annuals and perennials, subshrubs, and shrubs)* • *Mixed North-Facing Association (characterized by the absence of strong dominants)* • *Baccharis pilularis Scrub Alliance / Coyotebrush Scrub*	**Hard-Leaved Shrub Associations** • *Santa Cruz Island Oak-Chamise-Manzanita-Mountain Lilac Association* • *Arctostapylos (canescens, manzanita, stanfordiana) Shrubland Alliance / Hoary, Common, and Standford Manzanita Chaparral* • *Ceanothus thyrsiflorus Scrub Alliance / Blueblossom Scrub* • *Rhamnus californica Shrubland Alliance / Coffeeberry Shrubland* • *Golden Wattle Association* • **Herbaceous Associations** • *Grasses and Shrubs Association* • *Nassella spp. – Melica Spp. Herbaceous Alliance / Needle Grass – Melic Grass Grassland* • *Leymus condensatus Coastal Grassland Alliance / Giant Wildrye Coastal Grassland* • *Leymus mollis Herbaceous Alliance / Sea Lyme Grass Patches* • *Forb Association*

Table B-2. Current major vegetative alliances on Vandenberg SFB.

Forest, Woodland, Savanna • *Pinus muricata – Pinus radiata Woodland Alliance / Bishop Pine – Monterey Pine Woodland* • *Notholithocarpus densiflorus Forest Alliance – Tanoak Forest Quercus agrifolia Forest and Woodland Alliance / Coast Live Oak Woodland and Forest* • *Salix lasiolepis Shrubland Alliance / Arroyo Willow Thickets* • *Acer negundo Forest and Woodland Alliance / Box-elder Forest and Woodland* **Scrub and Chaparral** • *Adenostoma fasciculatum Shrubland Alliance / Chamise Chaparral* • *Artemisia califonica – Salvia mellifera Shrubland Alliance / California Sagebrush – Black Sage Scrub* • *Lupinus chamissonis – Ericameria ericoides Shrubland Alliance / Chamisso's Lupine – California Goldenbrush Scrub* • *Coreopsis gigantean Shrubland Alliance / Giant Coreopsis Scrub* • *Wet Soil Scrub* • *Huckleberry Scrub*	**Coastal Types** • *Abronia latifolia – Ambrosia chamissonis Dune Grassland Alliance / Coastal Sand Verbena – Beach Burr Sage Grassland* • *Sarcocornia pacifica Herbaceous Alliance / Pickleweed Mats* **Grasslands, Marshes, Ruderal** • *Schoenoplectus americanus – Schoenoplectus californicus Marsh Alliance / Olney's Three-square Bulrush – Southern Bulrush MarshNassella spp. – Melica spp. Herbaceous Alliance / Needle Grass – Melic Grass Grassland* • *Grassland-Annual* • *Miscellaneous Native Herbs/Forbs* • **Ruderal Vegetation Cultivated Vegetation** • *Planted Trees* • *Agricultural Plantings* • *Non-Agricultural Plantings*

Table B-3. Significant plant and animal species, by vegetation alliance or habitat type on Vandenberg SFB. For species' scientific names, please refer to Table B-4a, Table B-4b, and Table B-5..

Alliance or Habitat Type	Featured Species*	
Nassella spp. – *Melica* spp. Herbaceous Alliance (19,324 acres)	Cooper's hawk [S] Ferruginous Hawk [S] Northern harrier [S] Merlin [S] Mountain plover [S] Western burrowing owl [S]	California horned lark [S] Tricolored blackbird [S] Lawrence's goldfinch [S] California legless lizard [S] Blainsville's horned lizard [S]
Artemisia californica – Salvia mellifera Shrubland Alliance 28,(300-35,900 acres)	Northern harrier [S] Loggerhead shrike [S] California horned lark [S] Black-chinned sparrow [S] Lawrence's goldfinch [S] Blainsville's horned lizard [S]	California legless lizard [S] Crisp monardella [S] Mule deer [SI] Western burrowing owl [S] Bell's sage sparrow [S]
Abronia latifolia – Ambrosia chamissonis Dune Grassland Alliance / Coastal Sand Verbena (1,660 acres) *Lupinus chamissonis – Ericameria ericoides Shrubland Alliance (8,192 acres)* *Coreopsis gigantean Shrubland Alliance (160 acres)*	Northern harrier [S] Osprey [S] Merlin [S] Western snowy plover [FT] Whimbrel [S] Long-billed curlew [S] Marbled godwit [S] California least tern [FE/SE] California horned lark [S]	Black-chinned sparrow [S] Blainsville's horned lizard [S] California legless lizard [S] Beach layia [FE/SE] Surf thistle [S/ST] Beach spectaclepod [S/ST] Crisp monardella [S] San Luis Obispo monardella [S] Black-flowered figwort [S]
Adenostoma fasciculatum Shrubland Alliance (13,061 acres) Burton Mesa Component	Loggerhead shrike [S] Bell's sage sparrow [S] Sand mesa manzanita [S] Seaside bird's-beak [S/SE]	Mule deer [SI] Blainsville's horned lizard [S] California legless lizard [S] Vandenberg monkeyflower [FC]
Eucalyptus spp. Ruderal Forest Alliance	Monarch butterfly [S]	
Quercus agrifolia Forest and Woodland Alliance (4,354 acres)	Sharp-shinned hawk [S] Golden eagle [FP] Lawrence's goldfinch [S]	Coast live oak [S] Mule deer [SI] California legless lizard [S]
Salix lasiolepis Shrubland Alliance *(2,200–3,500 acres)* *Acer negundo Forest and Woodland Alliance* *(440 acres)* *Barka Slough*	White-faced ibis [S] Cooper's hawk [S] Merlin [S] Little willow flycatcher [SE] Southwestern willow flycatcher [FE/SE] Yellow warbler [S] Yellow breasted chat [S]	Tricolored blackbird [S] Lawrence's goldfinch [S] Tidewater goby [FE] California red-legged frog [FT] Southwestern pond turtle [S] Blainsville's horned lizard [S] California legless lizard [S]
Permanent Ponds	Least bittern [S] White-faced ibis [S] Osprey [S]	California red-legged frog [FT] Southwestern pond turtle [S]

Schoenoplectus americanus – Schoenoplectus californicus Marsh Alliance (350 acres) *Ephemeral Ponds/Vernal Pools*	Vernal pool fairy shrimp [FT]	Western spadefoot [S]

Pinus muricata – Pinus radiata Woodland Alliance (454 acres)	Lawrence's goldfinch [S] Bishop pine [S] Mule deer [SI]	Cooper's hawk [S] Sharp-shinned hawk [S]
Sarcocornia pacifica Herbaceous Alliance / Pickleweed Mats (172 acres)	Belding's savannah sparrow [SE]	
Rocky Headlands/Coastal Bluffs	Pacific harbor seal [MP] Ashy storm-petrel [S] California brown pelican [FD/SD] Black abalone [FE]	American peregrine falcon [SE] Black oystercatcher [FP] Rhinoceros auklet[S]
Notholithocarpus densiflorus Forest Alliance (64 acres)	Tanbark oak [S]	
Freshwater Lakes Punchbowl Lake (13.6 acres) Pine Canyon Lakes (18.1 acres)	Tricolored blackbird [S] Redear sunfish [SI] Southwestern pond turtle [S] Least bittern [S]	White-faced ibis [S] Largemouth bass [SI] Northern harrier [S]
Freshwater Streams San Antonio Creek (11.2 miles) Honda Creek (8.4 miles) Shuman Creek (1.35 miles) Santa Ynez River (5.45 miles) Jalama Creek (0.67 miles)	Arroyo chub [S] Unarmored threespine stickleback [FE/SE] Southwestern pond turtle [S] Tidewater goby [FE] Steelhead [FE]	Least bittern [S] White-faced ibis [S] Northern harrier [S] Yellow warbler [S]
Saltwater Areas Santa Ynez Lagoon (58 acres) San Antonio Lagoon (1.5 acres)	Golden Eagle [S] Tidewater goby [FE]	Osprey [S]

* Featured Species Codes: FE=Federal Endangered; FP=Federally Protected; FC=Federal Listing Candidate; FT=Federal Threatened; MP=Protected under the Marine Mammal Protection Act; SE=State Endangered; ST=State Threatened; S=Species of Special Concern (federal/state/regional); SI=Other species of special management interest (e.g., game species). Sources: California Natural Diversity Database (2021), USFWS (2020).

Table B-4a. Special Status Species (plants) on Vandenberg SFB.

Species Common Name and *Scientific Name*	Status*	Occurrence on Vandenberg SFB	Habitat	Blooming Period
PLANTS				
Vandenberg monkeyflower *Diplacus vandenbergensis*	FE	Observed	Burton mesa chaparral on VSFB.	Apr–Jun
La Graciosa thistle *Cirsium scariosum var. loncholepis*	FE / ST	Historical occurrence	Coastal dune swale wetlands, coastal salt marsh (brackish). No present locations on VSFB.	Jun–Aug
Surf thistle *Cirsium rhothophilum*	ST	Observed	Coastal dunes.	Apr–Jun
Seaside bird's-beak *Cordylanthus rigidus ssp. littoralis*	SE	Observed	Coastal dunes, chaparral. Primarily found in chaparral on VSFB.	May–Sep
Beach spectaclepod *Dithyrea maritima*	ST	Observed	Coastal dunes.	Apr–May
Lompoc yerba santa *Eriodictyon capitatum*	FE / SR	Observed	Chaparral. Three locations on VSFB.	May–Aug
Gaviota tarplant *Deinandra increscens ssp. villosa*	FE / SE	Observed	Coastal bluffs, coastal scrub. Various locations on VSFB.	May–Aug
Beach layia *Layia carnosa*	FE / SE	Observed	Coastal dunes. Two locations on VSFB.	May–Jul
Gambel's water cress *Nasturtium gambelii*	FE / ST	Observed	Freshwater marsh. One location on VSFB.	Apr–Jun

*Species Status Codes: FE=Federally Endangered; FT=Federally Threatened; SE=California Endangered; ST=California Threatened; SR=California Rare.
Sources: California Natural Diversity Database (2021), USFWS (2020).

Table B-4b. Special Status Species (wildlife) on Vandenberg SFB.

Species Common Name and *Scientific Name*	Status*	Occurrence on Vandenberg SFB	Seasonal Occurrence	Habitat	Breeding Season (Vandenberg SFB Breeders Only)	Comments
INSECTS						
Monarch butterfly *Danaus plexippus*	SLC	Observed	Migrant, fall, winter	Monterey pine and Eucalyptus groves		
El Segundo blue butterfly *Euphilotes battoides allyni*	FE	No, see comments	Year-round	Scrub habitat with seacliff buckwheat (*Eriogonum parvifolium*)	Breed mid June-Sep. Larvae Jul–Oct Pupae year-round	March 2020, VSFB does not host "the listed taxon"
CRUSTACEANS						
Vernal pool fairy shrimp *Branchinecta lynchi*	FT	Observed	Year-round	Vernal pools		Found in 80% of vernal pools in cantonment area in 2005
FISHES						
Unarmored threespine stickleback *Gasterosteus aculeatus williamsoni*	FE / SE	Observed	Year-round	Perennial streams	Year-round; peak in Mar	San Antonio Creek and Honda Creek only
Tidewater goby *Eucyclogobius newberryi*	FE	Observed	Year-round	Perennial streams, primarily coastal	Late Apr–early May	
Steelhead *Oncorhynchus mykiss irideus*	FE	Observed	Winter, spring	Perennial streams with connection to ocean	Spawn Dec–May; peak Dec–Jan	Santa Ynez River; potential Honda and Jalama Creeks
Arroyo chub *Gila orcutti*	CSC	Observed	Year-round	Streams and lakes		Introduced
GASTROPODS						
Black abalone *Haliotis cracherodii*	FE	Observed	Year-round	Coastal waters and rocky shorelines		
White abalone *Haliotis sorenseni*	FE	Observed*, see comments	Year-round	Coastal waters and rocky shorelines		Only at GSU Point Conception
AMPHIBIANS						
California tiger salamander *Ambystoma californiense*	FE / ST	Potential	Year-round	Utilizes a variety of burrows in grassland, oak woodland, and coastal scrub. Requires long-lasting vernal pools for breeding.	Undetermined	Confirmed localities near VSFB, but recent surveys have not found species on VSFB.

Table B-4b. Special Status Species (wildlife) on Vandenberg SFB.

Species Common Name and *Scientific Name*	Status*	Occurrence on Vandenberg SFB	Seasonal Occurrence	Habitat	Breeding Season (Vandenberg SFB Breeders Only)	Comments
California red-legged frog *Rana draytonii*	FT / CSC	Observed	Year-round	Perennial ponds and streams	Feb–mid Apr	Nearly all permanent lakes, streams and ponds on VSFB
Western spadefoot *Spea hammondii*	CSC	Observed	Year-round	Grassland, vernal pools in or near loose sandy or loamy soils	Late Jan–Mar	Dormant underground in sandy soils during dry season
REPTILES						
Southwestern pond turtle *Actinemys pallida*	CSC	Observed	Year-round	Perennial lakes, ponds, streams; eggs laid in upland areas 16-400 meters from water	Can occur year-round; peak May–Jun	Hatchlings overwinter in nest; move to aquatic sites March-April
Blainville's [=coast] horned lizard[3] *Phrynosoma blainvillii*	CSC	Observed	Year-round	Scrub, chaparral, and grassland with open shrub canopy and loose sandy or loamy soils	Apr–Aug	
California legless lizard *Anniella pulchra*	CSC	Observed	Year-round	Sparsely vegetated coastal scrub and chaparral with loose sandy or loamy soils	May–June mating, Sep–Oct birth	
Two-striped garter snake *Thamnophis hammondii*	CSC	Observed	Year-round	Permanent and intermittent rivers and creeks in a variety of habitats	Mar–Apr mating, Aug–Nov birth	
BIRDS						
Common loon (nesting) *Gavia immer*	CSC	Observed	Migrant fall, spring, overwinter, winter	Nearshore waters, estuary, artificial ponds	None	
Ashy storm-petrel (rookery site) *Hydrobates homochroa*	CSC / BCC	Observed	Potential breeder	Rock outcrops, coastal bluffs	Feb–Oct	
California brown pelican *Pelecanus occidentalis californicus*	FD / SD	Observed	Present year-round	Nearshore waters, coastal bluffs, rock outcrops		Delisted 2009

Table B-4b. Special Status Species (wildlife) on Vandenberg SFB.

Species Common Name and *Scientific Name*	Status*	Occurrence on Vandenberg SFB	Seasonal Occurrence	Habitat	Breeding Season (Vandenberg SFB Breeders Only)	Comments
Least bittern (nesting) *Ixobrychus exilis*	CSC / BCC	Observed	Migrant, potential breeder	Freshwater marsh, ponds, lakes with emergent vegetation	Late Mar–Jul	Punchbowl Lake
Ferruginous hawk (wintering) *Buteo regalis*	CSC / BCC	Observed	Migrant, winter	Open country, grassland, agricultural lands		
Northern harrier (nesting) *Circus hudsonius*	CSC	Observed	Year-round, breeder	Open grassland, coastal sage scrub, marshes, agricultural areas	Mar–Jul	
Golden eagle *Aquila chrysaetos*	FP2 / CP / BCC	Observed	Year-round	Cliffs, large trees in open areas	Jan–Aug	
Bald eagle *Haliaeetus leucocephalus*	FD / SE / BCC	Observed	Migrant, winter	Large lakes and wetlands		
American peregrine falcon *Falco peregrinus anatum*	FD1 / SD / BCC	Observed	Year-round, breeder	Nests on cliffs, forage over all open habitats	Mid Feb–Jul	
White-tailed kite *Elanus leucurus*	CP	Observed	Year-round, breeder	Open grassland, sparse woodlands, coastal scrub	Feb–Aug	Requires oaks, dense willow, elderberry, or pine to breed
Western snowy plover *Charadrius nivosus*	FT / CSC / BCC	Observed	Breeder, migrant, winter	Coastal sandy beaches, dunes	Mar–Sep	Vandenberg AFB supported >20% of California population in 2004
Mountain plover *Charadrius montanus*	CSC / BCC	Observed	Migrant, winter	Semi-arid plains, grassland, plateaus		
Black oystercatcher (wintering) *Haematopus bachmani*	BCC	Observed	Year-round, breeder	Rock outcrops	Apr–Aug	
Long-billed curlew *Numenius americanus*	BCC	Observed	Year-round	Beaches and coastal dunes		
California least tern *Sternula antillarum browni*	FE / SE / CSC	Observed	Migrant, breeder	Sand dunes near water	Mid Apr–Aug	Purisima Point
Black skimmer *Rynchops niger*	CSC / BCC	Observed	Year-round, rare visitor	Nearshore waters	None	Santa Ynez River mouth
Marbled murrelet *Brachyramphus marmoratus*	FT / SE	Observed	Rare, summer - winter	Nearshore waters	None	Purisima Point, Point Sal

Table B-4b. Special Status Species (wildlife) on Vandenberg SFB.

Species Common Name and *Scientific Name*	**Status***	**Occurrence on Vandenberg SFB**	**Seasonal Occurrence**	**Habitat**	**Breeding Season (Vandenberg SFB Breeders Only)**	**Comments**
Western burrowing owl (burrow sites) *Athene cunicularia hypugea*	CSC / BCC	Observed	Potential breeder, migrant, winter	Open, dry grassland	Apr–Jun	
Long-eared owl (nesting) *Asio otus*	CSC	Observed	Potential breeder, migrant, winter	Riparian woodland	Undetermined	Potential breeder in vicinity of Grant Road
Short-eared owl (nesting) *Asio flammeus*	CSC	Observed	Migrant, fall, winter	Coastal grassland and marshland	Undetermined	Santa Ynez River mouth; not observed since 1989
Vaux's swift (nesting) *Chaetura vauxi*	CSC	Observed	Migrant	Nests in large hollow trees		
Costa's hummingbird (nesting) *Calypte costae*	BCC / CSC	Observed	Migrant	Riparian woodland	Feb–Jul	Shuman Creek, San Antonio Creek, Santa Ynez River, and Honda Creek
Allen's hummingbird (nesting) *Selasphorus sasin*	BCC	Observed	Migrant, breeder	Open or partly wooded areas	Feb–Jul	
Nuttall's woodpecker (nesting) *Dryobates nuttallii*	BCC	Observed	Year-round, breeder	Oak and riparian woodland	Mar–Jul	
Olive-sided flycatcher (nesting) *Contopus cooperi*	CSC / BCC	Observed	Migrant, breeder	Oak and riparian woodland	May–Aug	
Little willow flycatcher (nesting) *Empidonax traillii brewsteri*	SE / BCC	Expected	Migrant	Willow thickets and brushy swamps		
Southwestern willow flycatcher *Empidonax traillii extimus*	FE / SE / SCS	Observed	Migrant, breeder	Undisturbed willow riparian	Mid May–Jul	Observed at Santa Ynez River, potential habitat elsewhere
Loggerhead shrike *Lanius ludovicianus*	CSC / BCC	Observed	Year-round	Semi-open country with posts, wire, trees, scrub	Mar–Aug	
Purple martin (nesting) *Progne subis*	CSC	Observed	Potential breeder, migrant, spring	Nests in crevices in trees and rocks in woodland habitats	Undetermined	Barka Slough 2004; crevice nester displaced by starlings
Oak titmouse (nesting) *Baeolophus inornatus*	BCC	Observed	Year-round, breeder	Oak woodlands	Mar–Jul	

Table B-4b. Special Status Species (wildlife) on Vandenberg SFB.

Species Common Name and *Scientific Name*	Status*	Occurrence on Vandenberg SFB	Seasonal Occurrence	Habitat	Breeding Season (Vandenberg SFB Breeders Only)	Comments
Bank swallow (nesting) *Riparia riparia*	ST	Observed	Potential breeder, migrant, spring	Coastal bluffs	Undetermined	San Antonio Creek, Santa Ynez River
Yellow warbler (nesting) *Setophaga petechia*	CSC / BCC	Observed	Migrant, breeder	Willow riparian woodland	Mar–Jul	
Yellow breasted chat (nesting) *Icteria virens*	CSC	Observed	Migrant, breeder	Dense willow riparian thicket woodland	Mar–Jul	
Grasshopper sparrow (nesting) *Ammodramus savannarum*	CSC	Observed	Migrant, breeder	Grassland, open scrub	Mar–Jul	
Bell's sage sparrow *Artemisiospiza belli belli*	BCC	Observed	Year-round, breeder	Open chaparral	Mar–Jul	On VSFB, closely associated with successional habitat
Belding's savannah sparrow *Passerculus sandwichensis beldingi*	SE	Expected	Year-round	Saltmarsh vegetation and coastal grassland	Apr–Jul	Santa Ynez River estuary, subspecies not confirmed
Black-chinned sparrow (nesting) *Spizella atrogularis*	BCC	Observed	Migrant, breeder	Chaparral	Apr–Jul	
Tricolored blackbird *Agelaius tricolor*	CSC / BCC	Observed	Year-round, breeder	Dense tule stands, fields, and pastures	Mar–Jul	
MAMMALSmanzanita						
Southern sea otter *Enhydra lutris nereis*	FT/CP	Observed	Year-round, breeder, transient	Nearshore waters, off rocky coastline kelp beds	Year-round, peak Dec-Mar	Resident breeding colony near Purisima Point; colony on south VSFB observed since 2002, transients occasionally elsewhere
Pacific harbor seal *Phoca vitulina richardii*	Protected[1]	Observed	Year-round, breeder, transient	Coastal waters and rocky shorelines	Feb–May	
Northern elephant seal *Mirounga angustirostris*	Protected[1]	Observed	Year-round, transient	Coastal waters, sandy beaches, rocky shorelines	Jan-Mar	Documented breeding
California sea lion *Zalophus californianus*	Protected[1]	Observed	Year-round, transient	Coastal waters, sandy beaches, rocky shorelines	None	
Northern fur seal *Callorhinus ursinus*	Protected[1]	Observed	Year-round, transient	Coastal waters, sandy beaches, rocky shorelines	None	

Table B-4b. Special Status Species (wildlife) on Vandenberg SFB.

Species Common Name and *Scientific Name*	Status*	Occurrence on Vandenberg SFB	Seasonal Occurrence	Habitat	Breeding Season (Vandenberg SFB Breeders Only)	Comments
Townsend's big-eared bat *Corynorhinus townsendii*	CSC	Observed	Year-round, potential breeder	Rocky outcrops, man-made structures	Mate Nov–Feb Young May–Aug	Upper Honda Canyon, Swordfish Cave, Shuman Creek
Pallid bat *Antrozous pallidus*	CSC	Observed	Year-round, breeder	Rocky outcrops, arid caves, man-made structures	Mate in Fall Young May–Aug	Upper Honda Canyon, Swordfish Cave, 13th Street and Santa Ynez River
Western mastiff bat *Eumops perotis californicus*	CSC	Expected	Year-round, potential breeder	Caves, abandoned structures, attics, trees	Mate in Fall Young Mar–Aug	
San Diego desert woodrat *Neotoma lepida intermedia*	CSC	Observed	Year-round, breeder	Coastal sage scrub, prickly pear cactus	Late Winter, Spring	
American badger *Taxidea taxus*	CSC	Observed	Year-round, breeder	Open grasslands	Mate in late summer or early fall Young Mar–Apr	

[1] Remains as a State Endangered Species. Launch monitoring requirements in place prior to delisting remain in effect.
[2] Bald and Gold Eagle Protection Act
[3] Blainville's horned lizard (Crother 2017) and coast horned lizard (Species of Special Concern list from CA.gov) are synonymous.
*Species Status Codes: FC=Federal Candidate for Listing; FE=Federally Endangered; FT=Federally Threatened; FD=Federally Delisted Species; BCC=Federal Bird of Conservation Concern; FP=Federally protected (Bald and Golden Eagle Protection Act, Marine Mammal Protection Act); SD=State Delisted Species; SE=California Endangered; ST=California Threatened; SR=California Rare; CSC=California Species of Concern; CFP=California fully protected; SLC=Species of Local Concern
Sources: California Natural Diversity Database (2021); USFWS (2008, 2020).

Table B-5. All species list for Vandenberg SFB.

Common Name	Scientific Name
Terrestrial Mammals	
Virginia opossum	*Didelphis virginiana*
Ornate shrew	*Sorex ornatus*
Trowbridge's shrew	*Sorex trowbridgii*
Broad-footed mole	*Scapanus latimanus*
Coyote	*Canis latrans*
Northern gray fox	*Urocyon cinereoargenteus*
Bobcat	*Lynx rufus*
Puma	*Puma concolor*
Striped skunk	*Mephitis mephitis*
Long-tailed weasel	*Mustela frenata*
American badger	*Taxidea taxus*
Northern raccoon	*Procyon lotor*
American black bear	*Ursus americanus*
Feral pig	*Sus scrofa sxrofa x S. s. domestica*
Mule deer	*Odocoileus hemionus*
Western gray squirrel	*Sciurus griseus*
California ground squirrel	*Otospermophilus beecheyi*
North American beaver	*Castor canadensis*
Botta's pocket gopher	*Thomomys bottae*
Agile kangaroo rat	*Dipodomys agilis*
Heermann's kangaroo rat	*Dipodomys heermanni*
California pocket mouse	*Chaetodipus californicus*
California vole	*Microtus californicus*
Dusky-footed woodrat	*Neotoma fuscipes*
San Diego Desert woodrat	*Neotoma lepida intermedia*
Brush deermouse	*Peromyscus boylii*
California deermouse	*Peromyscus californicus*
Eastern deermouse	*Peromyscus maniculatus*
Pinyon deermouse	*Peromyscus truei*
Western harvest mouse	*Reithrodontomys megalotis*
Black-tailed jackrabbit	*Lepus californicus*
Desert cottontail	*Sylvilagus audubonii*
Brush rabbit	*Sylvilagus bachmani*
Western mastiff bat	*Eumops perotis californicus*
Brazilian free-tailed bat	*Tadarida brasiliensis*
Pallid bat	*Antrozous pallidus*
Townsend's big-eared bat	*Corynorhinus townsendii*

Table B-5. All species list for Vandenberg SFB.

Common Name	Scientific Name
Big brown bat	*Eptesicus fuscus*
Silver-haired bat	*Lasionycteris noctivagans*
Eastern red bat	*Lasiurus borealis*
Northern hoary bat	*Lasiurus cinereus*
California myotis	*Myotis californicus*
Yuma myotis	*Myotis yumanensis*
Marine Mammals	
Southern sea otter	*Enhydra lutris nereis*
Northern fur seal	*Callorhinus ursinus*
California sea lion	*Zalophus californianus*
Northern elephant seal	*Mirounga angustirostris*
Pacific harbor seal	*Phoca vitulina richardii*
Common minke whale	*Balaenoptera acutorostrata*
Blue whale	*Balaenoptera musculus*
Fin whale	*Balaenoptera physalus*
Humpback whale	*Megaptera novaeangliae*
Gray whale	*Eschrichtius robustus*
Common dolphin	*Delphinus delphis*
Risso's dolphin	*Grampus griseus*
Pacific white-sided dolphin	*Sagmatias obliquidens*
Northern right-whale dolphin	*Lissodelphis borealis*
Killer whale	*Orcinus orca*
Striped dolphin	*Stenella coeruleoalba*
Common bottlenose dolphin	*Tursiops truncatus*
Harbor porpoise	*Phocoena phocoena*
Dall's porpoise	*Phocoenoides dalli*
Sperm whale	*Physeter macrocephalus*
Inshore Saltwater Game Fish	
Diamond turbot	*Pleuronichthys guttulatus*
California grunion	*Leuresthes tenuis*
Jacksmelt	*Atherinopsis californiensis*
White croaker	*Genyonemus lineatus*
Yellowfin croaker	*Umbrina roncador*
Barred surfperch	*Amphistichus argenteus*
Calico surfperch	*Amphistichus koelzi*
Redtail surfperch	*Amphistichus rhodoterus*
Walleye surfperch	*Hyperprosopon argenteum*
Black perch	*Embiotoca jacksoni*

Table B-5. All species list for Vandenberg SFB.

Common Name	Scientific Name
Opaleye	*Girella nigricans*
Kelp rockfish	*Sebastes atrovirens*
Grass rockfish	*Sebastes rastrelliger*
Cabezon	*Scorpaenichthys marmoratus*
Lingcod	*Ophiodon elongatus*
Kelp bass	*Paralabrax clathratus*
Freshwater Fish	
Starry flounder	*Platichthys stellatus*
Unarmored threespine stickleback	*Gasterosteus aculeatus williamsoni*
Channel catfish	*Ictalurus punctatus*
Western mosquitofish	*Gambusia affinis*
Pacific staghorn sculpin	*Leptocottus armatus*
Tidewater goby	*Eucyclogobius newberryi*
Steelhead	*Oncorhynchus mykiss*
Largemouth bass	*Micropterus salmoides*
Bluegill	*Lepomis macrochirus*
Redear sunfish	*Lepomis microlophus*
Green sunfish	*Lepomis cyanellus*
Black crappie	*Pomoxis nigromaculatus*
Sacramento perch	*Archoplites interruptus*
Common carp	*Cyprinus carpio*
Fathead minnow	*Pimephales promelas*
Arroyo chub	*Gila orcutti*
Important Marine Invertebrates	
California spiny lobster	*Panulirus interruptus*
Rock crab	*Cancer* sp.
Red abalone	*Haliotis rufescens*
Green abalone	*Haliotis fulgens*
Black abalone	*Haliotis cracherodii*
Amphibians	
California newt	*Taricha torosa*
Ensatina	*Ensatina eschscholtzii*
Arboreal salamander	*Aneides lugubris*
California tiger salamander	*Ambystoma californiense*
Black-bellied slender salamander [1]	*Batrachoseps nigriventris*
Western spadefoot	*Spea hammondii*
Western toad	*Bufo boreas*
Pacific treefrog	*Pseudacris regilla*

Table B-5. All species list for Vandenberg SFB.

Common Name	Scientific Name
California red-legged frog	*Rana draytonii*
American bullfrog	*Lithobates catesbeianus*
Reptiles	
Southwestern pond turtle	*Actinemys pallida*
Pond slider	*Trachemys scripta*
Western fence lizard	*Sceloporus occidentalis*
Common side-blotched lizard	*Uta stansburiana*
Blainville's [=coast] horned lizard	*Phrynosoma blainvillii*
Western skink	*Plestiodon skiltonianus*
Southern alligator lizard	*Elgaria multicarinata*
California legless lizard	*Anniella pulchra*
Ring-necked snake	*Diadophis punctatus*
Western yellow-bellied racer	*Coluber constrictor mormon*
California striped racer	*Masticophis [=Coluber] lateralis lateralis*
Gopher snake	*Pituophis catenifer*
Common kingsnake	*Lampropeltis californiae*
Common garter snake	*Thamnophis sirtalis*
Coast garter snake	*Thamnophis elegans terrestris*
Two-striped garter snake	*Thamnophis hammondii*
Southern Pacific Rattlesnake	*Crotalus oreganus*
Birds	
Red-throated loon	*Gavia stellata*
Pacific loon	*Gavia pacifica*
Common loon	*Gavia immer*
Pied-billed grebe[2]	*Podilymbus podiceps*
Horned grebe	*Podiceps auritus*
Eared grebe	*Podiceps nigricollis*
Western grebe	*Aechmophorus occidentalis*
Clark's grebe	*Aechmophorus clarkii*
Pink-footed shearwater	*Ardenna creatopus*
Sooty shearwater	*Ardenna grisea*
Black-vented shearwater	*Puffinus opisthomelas*
Ashy storm-petrel	*Hydrobates homochroa*
California brown pelican	*Pelecanus occidentalis californicus*
Brandt's cormorant[2]	*Phalacrocorax penicillatus*
Double-crested cormorant	*Phalacrocorax auritus*
Pelagic cormorant[2]	*Phalacrocorax pelagicus*
American bittern	*Botaurus lentiginosus*

Table B-5. All species list for Vandenberg SFB.

Common Name	Scientific Name
Least bittern	*Ixobrychus exilis*
Great blue heron[2]	*Ardea herodias*
Great egret	*Ardea alba*
Snowy egret	*Egretta thula*
Cattle egret	*Bubulcus ibis*
Green heron[2]	*Butorides virescens*
Black-crowned night heron	*Nycticorax nycticorax*
White-faced ibis	*Plegadis chihi*
Turkey vulture[2]	*Cathartes aura*
Greater white-fronted goose	*Anser albifrons*
Snow goose	*Anser caerulescens*
Canada goose	*Branta canadensis*
Brant	*Branta bernicla*
Tundra swan	*Cygnus columbianus*
Wood duck	*Aix sponsa*
Gadwall[2]	*Mareca strepera*
American wigeon	*Mareca americana*
Mallard[2]	*Anas platyrhynchos*
Blue-winged teal	*Spatula discors*
Cinnamon teal[2]	*Spatula cyanoptera*
Northern shoveler	*Spatula clypeata*
Northern pintail[2]	*Anas acuta*
Green-winged teal	*Anas crecca*
Canvasback	*Aythya valisineria*
Redhead	*Aythya americana*
Ring-necked duck	*Aythya collaris*
Greater scaup	*Aythya marila*
Lesser scaup	*Aythya affinis*
Surf scoter	*Melanitta perspicillata*
Velvet scoter	*Melanitta fusca*
Common scoter	*Melanitta nigra*
Long-tailed duck	*Clangula hyemalis*
Bufflehead	*Bucephala albeola*
Common goldeneye	*Bucephala clangula*
Common merganser	*Mergus merganser*
Red-breasted merganser	*Mergus serrator*
Ruddy duck[2]	*Oxyura jamaicensis*
Osprey	*Pandion haliaetus*

Table B-5. All species list for Vandenberg SFB.

Common Name	Scientific Name
White-tailed kite[2]	*Elanus leucurus*
Bald eagle	*Haliaeetus leucocephalus*
Northern harrier[2]	*Circus hudsonius*
Sharp-shinned hawk	*Accipiter striatus*
Cooper's hawk[2]	*Accipiter cooperii*
Red-shouldered hawk[2]	*Buteo lineatus*
Red-tailed hawk[2]	*Buteo jamaicensis*
Ferruginous hawk	*Buteo regalis*
Rough-legged hawk	*Buteo lagopus*
Golden eagle	*Aquila chrysaetos*
American kestrel[2]	*Falco sparverius*
Merlin	*Falco columbarius*
American peregrine falcon[2]	*Falco peregrinus anatum*
Prairie falcon	*Falco mexicanus*
California quail[2]	*Callipepla californica*
Virginia rail[2]	*Rallus limicola*
Sora[2]	*Porzana carolina*
Common moorhen	*Gallinula chloropus*
American coot[2]	*Fulica americana*
Black-bellied plover	*Pluvialis squatarola*
Pacific golden-plover	*Pluvialis fulva*
Western snowy plover[2]	*Charadrius alexandrinus nivosus*
Semipalmated plover	*Charadrius semipalmatus*
Killdeer[2]	*Charadrius vociferus*
Mountain plover	*Charadrius montanus*
Black oystercatcher[2]	*Haematopus bachmani*
Black-necked stilt[2]	*Himantopus mexicanus*
American avocet	*Recurvirostra americana*
Greater yellowlegs	*Tringa melanoleuca*
Lesser yellowlegs	*Tringa flavipes*
Spotted sandpiper	*Actitis macularius*
Solitary sandpiper	*Tringa solitaria*
Willet	*Tringa semipalmata*
Wandering tattler	*Tringa incana*
Whimbrel	*Numenius phaeopus*
Long-billed curlew	*Numenius americanus*
Marbled godwit	*Limosa fedoa*
Ruddy turnstone	*Arenaria interpres*

Table B-5. All species list for Vandenberg SFB.

Common Name	Scientific Name
Black turnstone	*Arenaria melanocephala*
Surfbird	*Calidris virgata*
Red knot	*Calidris canutus*
Sanderling	*Calidris alba*
Semipalmated sandpiper	*Calidris pusilla*
Western sandpiper	*Calidris mauri*
Least sandpiper	*Calidris minutilla*
Baird's sandpiper	*Calidris bairdii*
Pectoral sandpiper	*Calidris melanotos*
Dunlin	*Calidris alpina*
Short-billed dowitcher	*Limnodromus griseus*
Long-billed dowitcher	*Limnodromus scolopaceus*
Common snipe	*Gallinago gallinago*
Wilson's phalarope	*Phalaropus tricolor*
Red-necked phalarope	*Phalaropus lobatus*
Red phalarope	*Phalaropus fulicarius*
Pomarine jaeger	*Stercorarius pomarinus*
Parasitic jaeger	*Stercorarius parasiticus*
Bonaparte's gull	*Chroicocephalus philadelphia*
Heermann's gull	*Larus heermanni*
Mew gull	*Larus canus*
Ring-billed gull	*Larus delawarensis*
California gull	*Larus californicus*
Herring gull	*Larus argentatus*
Thayer's gull	*Larus glaucoides thayeri*
Western gull[2]	*Larus occidentalis*
Glaucous-winged gull	*Larus glaucescens*
Glaucous gull	*Larus hyperboreus*
Caspian tern	*Hydroprogne caspia*
Royal tern	*Thalasseus maximus*
Elegant tern	*Thalasseus elegans*
Common tern	*Sterna hirundo*
Forster's tern	*Sterna forsteri*
California least tern[2]	*Sternula antillarum browni*
Common murre	*Uria aalge*
Pigeon guillemot2	*Cepphus columba*
Marbled murrelet	*Brachyramphus marmoratus*
Rhinoceros auklet[2]	*Cerorhinca monocerata*

Table B-5. All species list for Vandenberg SFB.

Common Name	Scientific Name
Rock pigeon[2]	*Columba livia*
Band-tailed pigeon	*Patagioenas fasciata*
Mourning dove[2]	*Zenaida macroura*
Greater roadrunner[2]	*Geococcyx californianus*
Barn-owl[2]	*Tyto alba*
Western screech-owl[2]	*Megascops kennicottii*
Great horned owl[2]	*Bubo virginianus*
Western burrowing owl[2]	*Athene cunicularia hypugaea*
Long-eared owl[2]	*Asio otus*
Short-eared owl	*Asio flammeus*
Northern saw whet owl	*Aegolius acadicus*
Common poorwill[2]	*Phalaenoptilus nuttallii*
Vaux's swift	*Chaetura vauxi*
White-throated swift[2]	*Aeronautes saxatalis*
Black-chinned hummingbird[2]	*Archilochus alexandri*
Anna's hummingbird[2]	*Calypte anna*
Costa's hummingbird[2]	*Calypte costae*
Rufous hummingbird	*Selasphorus rufus*
Allen's hummingbird[2]	*Selasphorus sasin*
Belted kingfisher[2]	*Megaceryle alcyon*
Acorn woodpecker[2]	*Melanerpes formicivorus*
Red-breasted sapsucker	*Sphyrapicus ruber*
Nuttall's woodpecker[2]	*Dryobates nuttallii*
Downy woodpecker[2]	*Dryobates pubescens*
Hairy woodpecker[2]	*Dryobates villosus*
Northern flicker[2]	*Colaptes auratus*
Olive-sided flycatcher[2]	*Contopus cooperi*
Western wood-pewee[2]	*Contopus sordidulus*
Little willow flycatcher	*Empidonax traillii brewsteri*
Southwestern willow flycatcher[2]	*Empidonax traillii extimus*
Pacific-slope flycatcher[2]	*Empidonax difficilis*
Black phoebe[2]	*Sayornis nigricans*
Say's phoebe	*Sayornis saya*
Ash-throated flycatcher[2]	*Myiarchus cinerascens*
Cassin's kingbird[2]	*Tyrannus vociferans*
Western kingbird[2]	*Tyrannus verticalis*
Loggerhead shrike[2]	*Lanius ludovicianus*
Blue-headed vireo	*Vireo solitarius*

Table B-5. All species list for Vandenberg SFB.

Common Name	Scientific Name
Hutton's vireo[2]	*Vireo huttoni*
Warbling vireo[2]	*Vireo gilvus*
California scrub-jay[2]	*Aphelocoma californica*
American crow[2]	*Corvus brachyrhynchos*
California horned lark[2]	*Eremophila alpestris actia*
Tree swallow[2]	*Tachycineta bicolor*
Violet-green swallow[2]	*Tachycineta thalassina*
Northern rough-winged swallow[2]	*Stelgidopteryx serripennis*
Bank swallow	*Riparia riparia*
Purple martin	*Progne subis*
Cliff swallow[2]	*Petrochelidon pyrrhonota*
Barn swallow[2]	*Hirundo rustica*
Chestnut-backed chickadee[2]	*Poecile rufescens*
Oak titmouse[2]	*Baeolophus inornatus*
Bushtit[2]	*Psaltriparus minimus*
Red-breasted nuthatch	*Sitta canadensis*
White-breasted nuthatch	*Sitta carolinensis*
Pygmy nuthatch	*Sitta pygmaea*
Brown creeper	*Certhia americana*
Rock wren[2]	*Salpinctes obsoletus*
Bewick's wren[2]	*Thryomanes bewickii*
House wren[2]	*Troglodytes aedon*
Winter wren	*Troglodytes hiemalis*
Marsh wren[2]	*Cistothorus palustris*
Golden-crowned kinglet	*Regulus satrapa*
Ruby-crowned kinglet	*Regulus calendula*
Blue-grey gnatcatcher[2]	*Polioptila caerulea*
Western bluebird[2]	*Sialia mexicana*
Swainson's thrush[2]	*Catharus ustulatus*
Hermit thrush	*Catharus guttatus*
American robin[2]	*Turdus migratorius*
Varied thrush	*Ixoreus naevius*
Wrentit[2]	*Chamaea fasciata*
Northern mockingbird[2]	*Mimus polyglottos*
California thrasher[2]	*Toxostoma redivivum*
European starling[2]	*Sturnus vulgaris*
American pipit	*Anthus rubescens*
Cedar waxwing	*Bombycilla cedrorum*

Table B-5. All species list for Vandenberg SFB.

Common Name	Scientific Name
Orange-crowned warbler[2]	*Leiothlypis celata*
Nashville warbler	*Leiothlypis ruficapilla*
Yellow warbler[2]	*Dendroica petechia*
Yellow-rumped warbler	*Setophaga coronata*
Black-throated gray warbler	*Setophaga nigrescens*
Townsend's warbler	*Setophaga townsendi*
Hermit warbler	*Setophaga occidentalis*
MacGillivray's warbler	*Geothlypis tolmiei*
Common yellowthroat[2]	*Geothlypis trichas*
Wilson's warbler[2]	*Cardellina pusilla*
Yellow-breasted chat[2]	*Icteria virens*
Western tanager	*Piranga ludoviciana*
Spotted towhee[2]	*Pipilo maculatus*
California towhee[2]	*Melozone crissalis*
Rufous-crowned sparrow[2]	*Aimophila ruficeps*
Black-chinned sparrow[2]	*Spizella atrogularis*
Lark sparrow[2]	*Chondestes grammacus*
Bell's sage sparrow[2]	*Artemisiospiza belli belli*
Belding's savannah sparrow[2]	*Passerculus sandwichensis beldingi*
Grasshopper sparrow[2]	*Ammodrammus savannarum*
Fox sparrow	*Passerella iliaca*
Song sparrow[2]	*Melospiza melodia*
Lincoln's sparrow	*Melospiza lincolnii*
Swamp sparrow	*Melospiza georgiana*
Golden-crowned sparrow	*Zonotrichia atricapilla*
White-crowned sparrow[2]	*Zonotrichia leucophrys*
Dark-eyed junco[2]	*Junco hyemalis*
Black-headed grosbeak[2]	*Pheucticus melanocephalus*
Blue grosbeak[2]	*Passerina caerulea*
Lazuli bunting[2]	*Passerina amoena*
Red-winged blackbird[2]	*Agelaius phoeniceus*
Tricolored blackbird	*Agelaius tricolor*
Western meadowlark[2]	*Sturnella neglecta*
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*
Brewer's blackbird[2]	*Euphagus cyanocephalus*
Brown-headed cowbird[2]	*Molothrus ater*
Hooded oriole[2]	*Icterus cucullatus*
Bullock's oriole[2]	*Icterus bullockii*

Table B-5. All species list for Vandenberg SFB.

Common Name	Scientific Name
Purple finch[2]	*Haemorhous purpureus*
House finch[2]	*Haemorhous mexicanus*
Red crossbill	*Loxia curvirostra*
Pine siskin	*Spinus pinus*
Lesser goldfinch[2]	*Spinus psaltria*
Lawrence's goldfinch[2]	*Spinus lawrencei*
American goldfinch[2]	*Carduelis tristis*
House sparrow[2]	*Passer domesticus*
Important Terrestrial Invertebrates[3]	
Vernal pool fairy shrimp	*Branchinecta lynchi*
Monarch butterfly	*Danaus plexippus*
El Segundo blue butterfly	*Euphilotes battoides allyni*
Plants[4]	
Coastal sand verbena	*Abronia latifolia*
Red sand verbena	*Abronia maritima*
Beach sand verbena	*Abronia umbellata*
Golden Wattle	*Acacia pycnantha*
Box elder	*Acer negundo* var. *californicum*
Chamise	*Adenostoma fasciculatum*
Beach-bur	*Ambrosia chamissonis*
European beachgrass	*Ammophila arenaria*
Aphanisma	*Aphanisma blitoides*
European beachgrass	*Ammophila arenaria*
Manzanita	*Arctostaphylos* sp.
La Purisima manzanita	*Arctostaphylos purissima*
Refugio manzanita	*Arctostaphylos refugioensis*
Sand mesa (shagbark) manzanita	*Arctostaphylos rudis*
Woolly-leafed manzanita	*Arctostaphylos tomentosa*
California sagebrush	*Artemisia californica*
Wild oat	*Avena* sp.
Coyote brush	*Baccharis pilularis*
Mustard	*Brassica* sp.
Brome	*Bromus* sp.
Sea rocket	*Cakile maritima*
Sedge	*Carex* sp.
Schott's sedge	*Carex schottii*
Indian paintbrush	*Castilleja* sp.
California lilac	*Ceanothus* sp.

Table B-5. All species list for Vandenberg SFB.

Common Name	Scientific Name
Buckbrush	*Ceanothus cuneatus* var. *fascicularis*
Santa Barbara ceanothus	*Ceanothus impressus*
Blue blossom	*Ceanothus thyrsiflorus*
Tranquillion Mountain ceanothus	*Cenaothus papillosus* var. *roweanus*
Straight-awned spineflower	*Chorizanthe rectispina*
La Graciosa thistle	*Cirsium scariosum* var. *loncholepis*
Surf thistle	*Cirsium rhothophilum*
Narrow-leaved iceplant	*Conicosia pugioniformis*
Pampas grass	*Cortaderia spp*
Seaside bird's-beak	*Cordylanthus rigidus* ssp. *littoralis*
Giant coreopsis	*Coreopsis gigantea*
Surf thistle	*Crisium rhothophilum*
Monterey cypress	*Cupressus macrocarpa*
Dune larkspur	*Delphinium parryi* ssp. *blochmaniae*
Vandenberg monkeyflower	*Diplacus vandenbergensis*
Beach spectacle-pod	*Dithyrea maritima*
Blochman's dudleya	*Dudleya blochmaniae* ssp. *blochmaniae*
Dudleya	*Dudleya* sp.
Veldt frass	*Ehrharta* spp.
Spikerush	*Eleocharis macrostachya*
Giant rye grass	*Elymus arenarius*
Blue wildrye	*Elymus glaucus* ssp. *glaucus*
Alkali ryegrass	*Elymus triticoides*
Bush sunflower	*Encelia californica*
Coastal goldenbush	*Haplopappus ericoide*
Blochman's leafy dasiy	*Erigeron blochmaniae*
Seaside daisy	*Erigeron glaucus*
Lompoc yerba santa	*Eriodictyon capitatum*
Dune buckwheat	*Eriogonum parvifolium*
Woolly sunflower	*Eriophyllum staechadifolium*
Filarees	*Erodium* sp.
Tasmanian bluegum	*Eucalyptus globulus*
Alkali heath	*Frankenia salina*
California goldenbush	*Ericameria ericoides*
Gaviota tarplant	*Hemizonia increscens* ssp. *villosa*
Low barley	*Hordeum depressum*
Wall barley	*Hordeum murinum* ssp. *leporinum*
Kellogg's horkelia	*Horkelia cuneata* ssp. *sericea*

Table B-5. All species list for Vandenberg SFB.

Common Name	Scientific Name
Coastal goldenbush	*Isocoma menziesii*
Rush	*Juncus* sp.
Sickle-leaved rush	*Juncus falcatus* var. *falcatus*
Brown-headed creeping rush	*Juncus phaeocephalus* var. *phaeocephalus*
Junegrass	*Koeleria macrantha*
Beach layia	*Layia carnosa*
California aster	*Lessingia filaginifolia* var. *filaginifolia*
Tanbark oak	*Notholithocarpus densiflorus*
Deerweed	*Lotus scoparius*
Lupine	*Lupinus* sp.
Chamisso's lupine	*Lupinus chamissonis*
Bush lupine	*Lupinus chamissonis*
Dunedelion	*Malacothrix incana*
California burclover	*Medicago polymorpha*
Small-flowered melic	*Melica imperfecta*
Crystalline iceplant	*Mesembryanthemum crystallinum*
Crisp monardella	*Monardella crispa*
San Luis Obispo monardella	*Monardella frutescens*
Needlegrass	*Nassella* sp.
Lemmon’s canarygrass	*Phalaris lemmonii*
Bishop pine	*Pinus muricata*
Monterey pine	*Pinus radiata*
Annual beard grass	*Polypogon monspeliensis*
Western sword fern	*Polystichum munitum*
Bracken fern	*Pteridium aquilinum* var. *pubescens*
Coast live oak	*Quercus agrifolia* var. *agrifolia*
Santa Cruz Island oak	*Quercus parvula* var. *parvula*
Interior live oak	*Quercus wislizenii* var. *frutescens*
Coffeeberry	*Rhamnus californica*
Gooseberry	*Ribes divaricatum*
Gambel’s water cress	*Rorippa gambellii*
California blackberry	*Rubus ursinus*
Pickleweed	*Salicornia virginica*
Willow	*Salix* sp.
Arroyo willow	*Salix lasiolepis*
Sage	*Salvia* sp.
Black sage	*Salvia mellifera*
Hoffmann’s sanicle	*Sanicula hoffmannii*

Table B-5. All species list for Vandenberg SFB.

Common Name	Scientific Name
American bulrush	*Scirpus americanus*
California bulrush	*Scirpus californicus*
Black-flowered figwort	*Scrophularia atrata*
Blochman's butterweed	*Senecio californicus*
Giant bur-reed	*Spaganium eurycarpum* ssp. *eurycarpum*
Western poison oak	*Toxicodendron diersilobum*
Borad-leaved cattail	*Typha latifolia*
Hoary nettle	*Urtica dioica* ssp. *holosericea*
California huckleberry	*Vaccinium ovatum*
Fescue	*Vulpia* sp.

[1] Identification based on range.

[2] Breeding birds of Vandenberg SFB.

[3] For a complete list of terrestrial arthropods on Vandenberg SFB refer to Pratt 2006.

[4] This is not an all inclusive list of plant species that occur on Vandenberg SFB. Only plant species mentioned in this document are listed in this table.

Table B-6. Regulations, Guidance, and Policies Affecting Natural Resources on Vandenberg SFB.

Regulation Name	Enforcement Agency or Agencies	Action
Clean Water Act of 1977	US Army Corps of Engineers (USACE)	Protects natural resources by requiring permits for discharge and development in waters of the United States.
Endangered Species Act of 1973	US Fish and Wildlife Service (USFWS)	Protects proposed and listed Threatened and Endangered Species.
Federal Coastal Zone Management Act of 1972	National Oceanic and Atmospheric Administration (NOAA)	Protects coastal species by authorizing NOAA to grant funds to states to develop coastal zone management programs to preserve, protect, develop, and restore or enhance coastal resources.
Fish and Wildlife Coordination Act of 1958	USACE in coordination with USFWS and state agencies (California Department of Fish and Game [CDFG] for VSFB)	Protects fish and wildlife species by requiring USACE to consult with USFWS and state agencies on permit applications.
Marine Mammal Protection Act of 1972	NOAA Fisheries and USFWS	Prohibits taking of marine mammals, except for incidental take under certain permitted activities.
Migratory Bird Treaty Act of 1972	Federal Regulation	Protects most species of native birds, their nests, eggs, and young.
National Environmental Policy Act (NEPA) of 1969	US Environmental Protection Agency (US EPA)	Protects natural resources by ensuring assessment of environmental impacts of proposed development.
Public Rangelands Improvement Act of 1978	All federal agencies administering rangelands	Provides direction to inventory, manage, maintain, and improve rangeland conditions according to management objectives and the Federal Land Policy and Management Act of 1976.
Rivers and Harbors Act of 1899	Federal Regulation/USACE	Protects natural resources and habitats by regulating development in or over navigable waters.
Sikes Act and Improvement Amendments of 1997	Department of Defense (DoD), USFWS, CDFG	Requires military departments to coordinate with federal and state natural resources conservation agencies in the preparation and approval of INRMP, and to provide an opportunity for submission of public comments.
Taylor Grazing Act of 1934	All federal agencies administering range lands	Provides standards for grazing on public lands by creating grazing districts and requiring leases.
California Coastal Act of 1976	California Coastal Commission	Protects biological resources in the coastal zone.
California Endangered Species Act of 1970	State Regulation	Provides protection at state level for species designated as rare, threatened, or endangered.
Executive Order (EO) 11990, Protection of Wetlands	All federal agencies responsible for permitting projects in wetlands	Protects fish and wildlife species by requiring agencies to act to minimize destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands.

Table B-6. Regulations, Guidance, and Policies Affecting Natural Resources on Vandenberg SFB.

Regulation Name	Enforcement Agency or Agencies	Action
EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds	USFWS	Protects migratory bird species by requiring federal agencies to develop and implement a Memorandum of Understanding with the USFWS to promote the conservation of migratory bird populations for any action that has or is likely to have measurable negative effects on migratory bird populations.
Space Force Instruction (AFI) 32-7061 Environmental Impact Analysis Process	Space Force/Dependent on NEPA and the President's Council on Environmental Quality Standards and DoD Directive 6050.1	Regulation providing planning considerations for natural resources affected by any federal action
AFI 32-7060 Interagency and Intergovernmental Coordination of Land, Facilities, and Environmental Plans, Programs, and Projects	Space Force/Implements the Intergovernmental Cooperation Act (ICA), NEPA, EO 12372 (as amended by EO 12416), and DoD Directive 4165.61	Protects species on DoD property through coordination and cooperation among federal, state, regional, and local agencies.
AFMAN 32-7003, Environmental Conservation	Space Force (DoD)	Requires each installation to develop an Integrated Natural Resources Management Plan to protect, manage, and conserve natural resources.

Appendix C. Management Goals and Objectives

Appendix D. Public Notification Documentation