APPENDIX A
United States Fish and Wildlife Service Consultations

Biological Assessment for the Phantom Launch Program at Space Launch Complex 5, Vandenberg Space Force Base, California

11 April 2022

Prepared for

Space Launch Delta 30, Installation Management Flight
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ACRONYMS AND ABBREVIATIONS

ac	acre(s)
BA	Biological Assessment
C.F.R.	Code of Federal Regulations
CRLF	California red-legged frog
DAPTF	Declining Amphibian Populations Task Force
dB	decibel(s) unweighted
dBA	A-weighted decibel(s)
E	east
ESA	Endangered Species Act
FR	Federal Register
ft	foot or feet
ft^2	square feet
ft^3	cubic feet
GSE	ground support equipment
ha	hectare(s)
HIF	Horizontal Integration Facility
INRMP	Integrated Natural Resources Management Plan
km	kilometer(s)
km^2	square kilometers
LOX	liquid oxygen
MAMU	marbled murrelet
m	meter(s)
m^2	square meters
mi	mile(s)
mi^2	square miles
MSRS	ManTech SRS Technologies, Inc.
NASA	National Aeronautics and Space Administration
NCI	Northern Channel Islands
Phantom	Phantom Space Corporation
psf	pounds per square foot
RP-1	rocket propellant-1
SEL	sound exposure level
SLC-2	Space Launch Complex Two
SLC-5	Space Launch Complex Five
SLD 30	Space Launch Delta 30
SNPL	western snowy plover
SWFL	southwestern willow flycatcher
TEA-TEB	Triethylaluminum-Triethylborane
TEV	Transporter Erector Vehicle
TWG	tidewater goby
U.S.C.	United States Code
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USSF	United States Space Force
VSFB	Vandenberg Space Force Base
VTF	Vertical Test Facility
W	west

1 Introduction

1.1 Background

The purpose of this Biological Assessment (BA) is to address the effects of the proposed Phantom Space Corporation (Phantom) launch program at Vandenberg Space Force Base (VSFB), California, on federally listed (endangered and threatened) species and their Critical Habitat as required by section 7 of the Endangered Species Act (ESA) of 1973 (16 United States Code [U.S.C.] section 1536). Pursuant to section 7(a)(2) of the ESA of 1973 (16 U.S.C. section 1536), as amended, the United States Space Force (USSF) is required to consult with the United States Fish and Wildlife Service (USFWS) for those actions it has determined may affect ESA-listed species or their Critical Habitat. The USSF is the lead agency for the Phantom launch program for purposes of this BA.

This BA examines the potential effects of the Phantom launch program at VSFB on the tidewater goby (TWG; *Eucyclogobius newberryi*), California red-legged frog (CRLF, *Rana draytonii*), marbled murrelet (MAMU, *Brachyramphus marmoratus*), western snowy plover (SNPL, *Charadrius nivosus*), California condor (*Gymnogyps californianus*), southern sea otter (*Enhydra lutris nereis*), and Critical Habitat for these species, if designated.

1.2 Other Species Considered

Seven additional ESA-listed species were considered during the analysis of this project but dismissed, three are vertebrates. The unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*) was introduced into the Honda Creek, south of Space Launch Complex 5 (SLC-5), in 1984 (ManTech SRS Technologies, Inc. [MSRS] 2009). Surveys conducted by MSRS in 2008 did not detect any fish in the creek (MSRS 2009). Between 2008 and 2022, Honda Creek has gone through multiple cycles of drying and rehydration which would preclude occupancy by and persistence of fish (MSRS 2016). The California least tern (*Sternula antillarum browni*) nests at Purisima Point and adults and fledglings roost and forage at Santa Ynez River lagoon during brief periods of the year. The nesting colony is approximately 9.4 miles (mi) (15.1 kilometers [km]) north of SLC-5. The lagoon is approximately 6.0 mi (9.6 km) north of SLC-5. At these distances, terns would be outside areas where loud noises would occur, potentially experience noise roughly equivalent to or less than a garbage disposal unit at the estuary and or slightly louder than a crashing wave at the nesting colony at Purisima Point. No effect on nesting, foraging, or roosting terns at these distances is expected. Potential habitat for southwestern willow flycatcher (*Empidonax traillii extimus*) exists within riparian corridors on VSFB and adjacent areas. However, there are no records of this species within the areas impacted by loud launch noise and historically occupied breeding habitat along the Santa Ynez River on VSFB has been degraded and is unlikely to support breeding in the future (Seavy et al. 2012). As a result, these species are not carried forward in this BA.

Three additional ESA listed plant species were considered. These were Lompoc yerba santa (*Eriodictyon capitatum*), beach layia (*Layia carnosa*), and Gaviota tarplant (*Deinandra increscens* ssp. *villosa*). There are no historical records of these species within the Proposed Action Area associated with this project and they were not detected during biological surveys of the Proposed

Action Area performed by MSRS botanists in 2021. No physical impacts associated with the proposed action are expected to extend into habitat occupied by federally listed plants, consequently consideration of these species is not carried forward in this BA.

2 Project Description

2.1 Project Location

VSFB occupies approximately 99,100 acres (ac) (400 square kilometers [km^2]) of central Santa Barbara County, California (Figure 2-1). The Santa Ynez River and State Highway 246 divide it into the north Base and south Base. The Proposed Action includes development of a new launch site at SLC-5. SLC-5 is a decommissioned launch site occupying approximately 18 ac (7.3 hectares [ha]) on south Base (Figure 2-2). It was originally used by National Aeronautics and Space Administration (NASA) between 1962 and 1994 to launch Scout space launch vehicles. Upon completion of the Scout program, all facilities at SLC-5 were deactivated and demolished between 2009 and 2012.

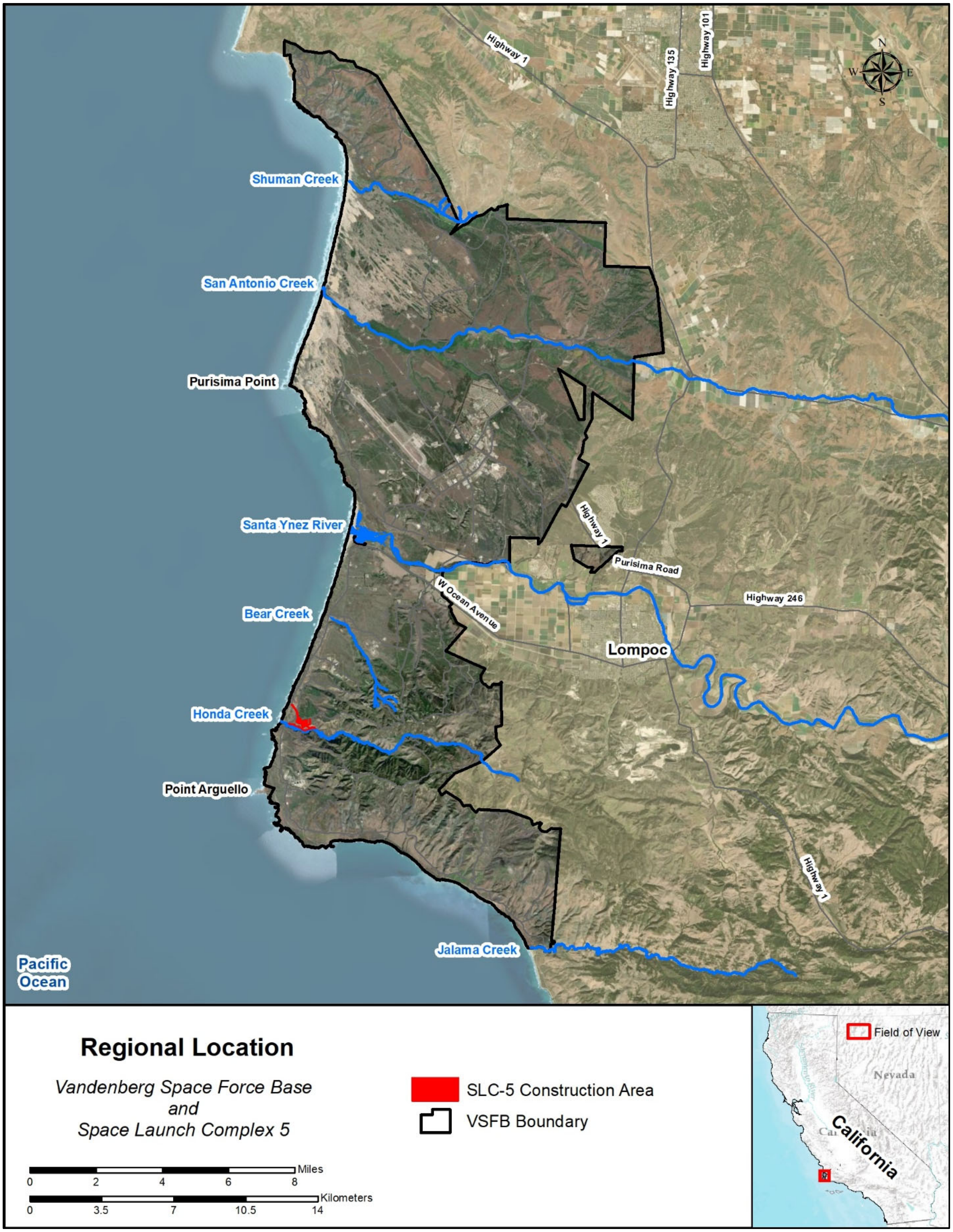

Figure 2-1. Regional location of Proposed Action Area.

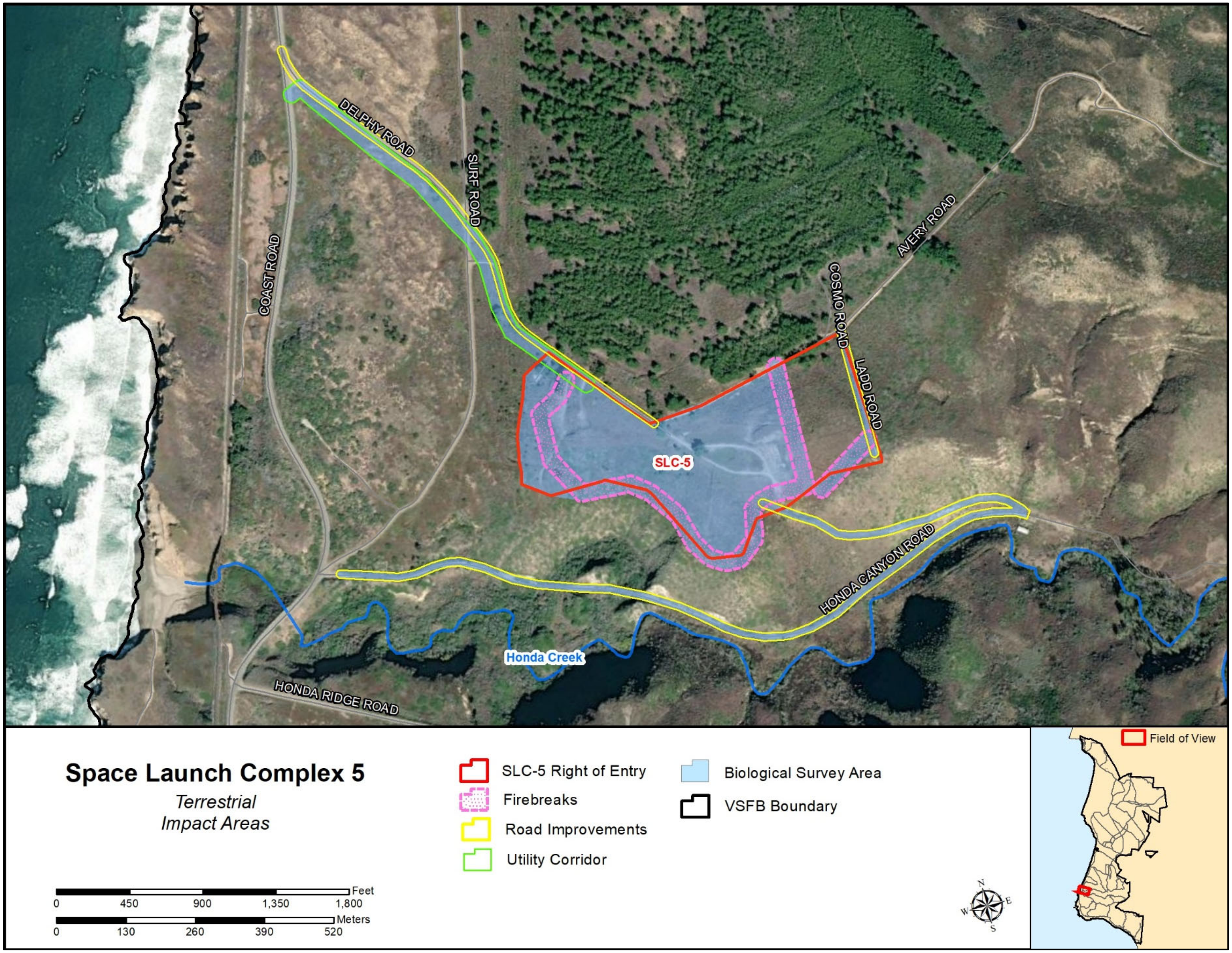

Figure 2-2. Space Launch Complex Five terrestrial impact areas.

2.2 Proposed Action

2.2.1 Launch Operations

Phantom proposes to conduct space launch activities related to the Daytona-E and Laguna-E vehicles at SLC-5 on VSFB in support of commercial and government customers. The Daytona-E is a 54.4-foot (ft) 16.6-meter (m), two-stage, ground-launched vehicle. The Laguna-E is a slightly larger two-stage vehicle, at 78.7 ft (24.0 m). Phantom proposes to conduct a combined total of up to 48 launches and 48 static fire operations at SLC-5 per year.

Phantom would perform primary vehicle and payload assembly offsite at the Phantom Factory in Tucson, Arizona, where first and second stages would be produced on assembly lines before commercial truck transport to VSFB. Final integration would be performed at SLC-5 with marriage of first and second stages and customer payload integration utilizing a Horizontal Integration Facility (HIF; Figure 2-3). The flight-ready vehicle would then be mounted on a Transporter Erector Vehicle (TEV) and transported to one of two launch pads (SLC-5 East [E] and SLC-5 West [W]; Figure 2-3). It would then be erected, and mounted to a launch stool (Figure 2-4). Both Daytona-E and Laguna-E utilize liquid oxygen (LOX) and rocket propellant-1 (RP-1) or Jet-A would be utilized and would be loaded prior to launch. A local operations center would be housed within an existing facility at VSFB to coordinate each launch with an offsite Mission Operations Control center in Tucson, Arizona. Tracking equipment and instrumentation would be located at SLC-5 to support launches.

2.2.2 SLC-5 Construction and Infrastructure Improvements

Launch Pads and Support Facilities

Prior infrastructure supporting the Scout launch program at SLC-5 was demolished and removed; however, some additional demolition may be required if any remaining structures or materials are encountered during construction. The Proposed Action would include the construction of two new concrete launch pads – SLC-5E and SLC-5W (Figure 2-3). Each pad would serve dual use as launch pads and Vertical Test Facilities (VTF) and each would be approximately 1,500 square feet (ft^2) (139 square meters [m^2]) in area. An approximately 12 ft (3.6 m) by 12 ft (3.6 m) launch stool (Figure 2-4) would be installed at each pad, as well as a 12.5-ft flame bucket under the launch stool that curves from vertical to horizontal to handle at least 150,000 pounds-force thrust and ability to contain up to 4,894 gallons of water deluge.

In addition to the pads, Phantom would construct a 7,500-ft^2 (697-m^2) HIF and an instrumentation site (Figure 2-3). During launch operations, mobile fuel trailers would supply LOX/RP-1 or LOX/Jet-A to on-site ground support equipment (GSE). These would be stationed over concrete surfaces approximately 150 ft (46 m) from either launch pad.

Prior to launch an estimated 6,500 to 8,000 gallons of deluge water would be deposited into a flame bucket under the launch stool to reduce vibration. The pads at SLC-5E and SLC-5W would be designed so that there would be no water discharge into surrounding drainages. Any overland flow would be diverted to a retention basin and steam would be ejected away from riparian areas in Honda Canyon. Immediately downstream of the flame deflector outlet, a concrete deluge containment basin would be provided that will collect deluge runoff. The basin would have an outlet structure to allow manual discharge of the basin water through a valved discharge pipe. After each launch, the contents of the basin would be inspected for any contamination. If contamination is encountered, the basin contents would be pumped out and disposed of per relevant state, Federal and local regulations. If the remaining deluge water is clean enough to go to grade, it would be discharged from the retention basin via a spray field or other means to facilitate infiltration. Any stormwater that accumulates within the flame deflector or water deluge catch basin would be tested for any contamination. If contamination is encountered, the contents would be pumped out and disposed of per relevant state, Federal and local regulations. If the water is clean enough to go to grade, it would be discharged from the retention basin to an infiltration area or spray field. If practicable, the water retention basins would be designed to minimize the amount of stormwater that is received into the basin and exclude wildlife from entering.

A security fence and approximately 36 light poles would be installed around the perimeter of SLC-5 for security and support of night operations. The light poles would have a maximum height of 40 ft (12 m) and be placed in holes dug down to approximately 20 ft (6 m) below the surface. The lights would be designed with the minimum lumens needed to meet operational and security requirements and would be shielded to minimize stray light entering Honda Canyon.

Utility Corridor

New electrical power, fiber communication, water, and sewage lines would be extended from existing sources to SLC-5. These utilities would be installed within the footprint of Delphy Road and a 100-ft (30-m) wide utility corridor immediately south of the road (Figure 2-2). Electrical and fiber communication lines would be buried within this utility corridor or the road to establish new service connections at the launch complex.

Roads, Firebreaks, and Vegetation Management

Paved access roads would be installed between the pads and the support facilities. Delphy Road, which connects SLC-5 to Surf Road and Coast Road, is in fair condition, but would require repairs including likely removal of existing pavement and repaving (Figure 2-2). Firebreaks would be established along the western, southern, and eastern perimeter of SLC-5 (Figures 2-2 and 2-3). Avery and Ladd Roads to the north and northeast would serve as firebreaks and fire access roads, but would require repairs to meet fire safety requirements. Clearing of vegetation that has grown over and onto Honda Canyon Road, a decommissioned road south of SLC-5 (Figure 2-2), as well an approximately 1,800-ft (549-m) abandoned former access road connecting Honda Canyon Road to the SLC-5 site, will also be required (Figure 2-2). Vegetation on and along these roads would be cut regularly to enable emergency access for fire equipment. Vegetation would also be managed by routinely mowing within the SLC-5 fence line and surrounding firebreak. During initial site clearing for construction, woody vegetation would be removed using a masticator, chainsaws, or similar equipment.

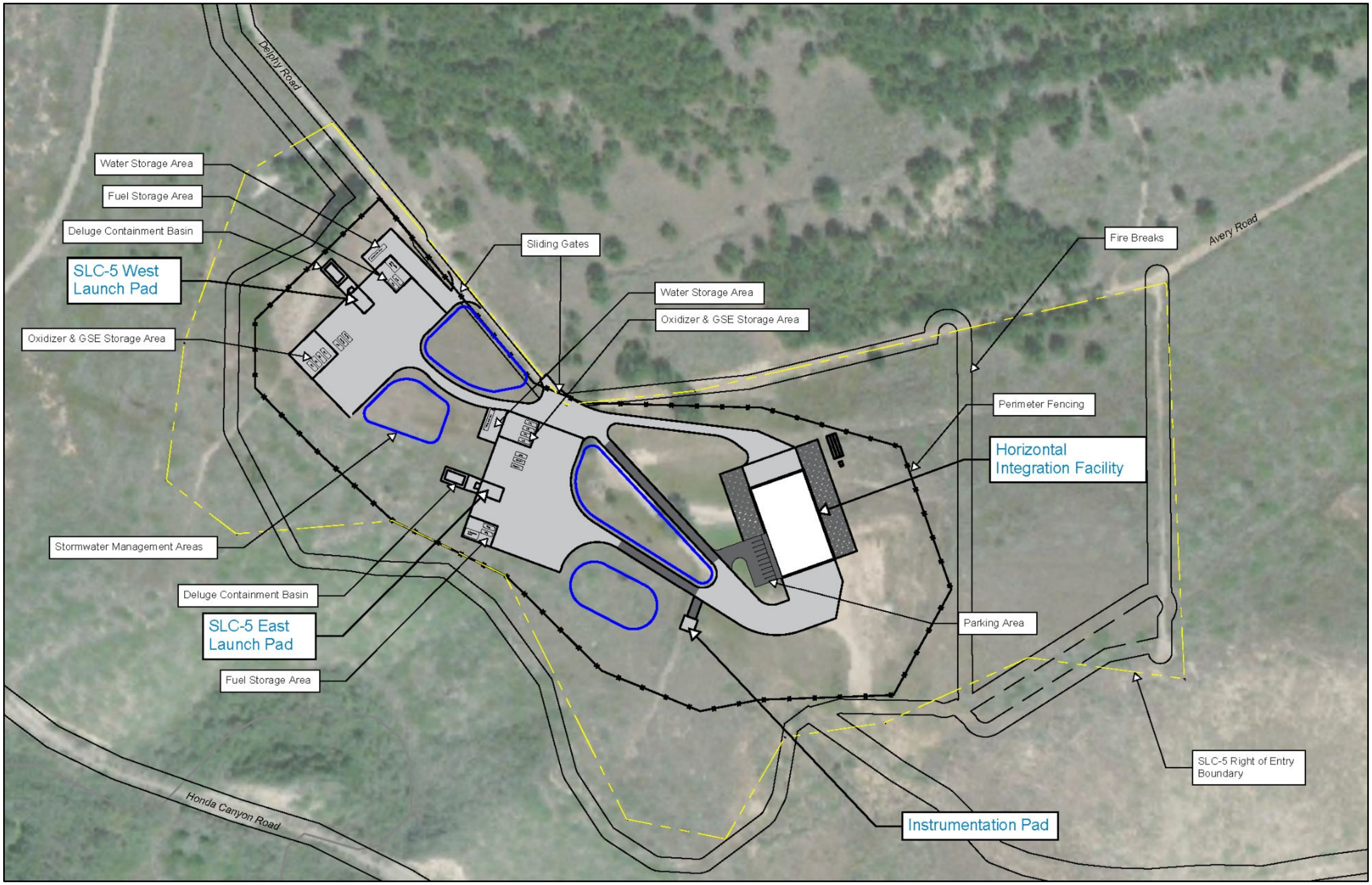

Figure 2-3. Conceptual site plan.

Figure 2-4. Launch stool (conceptual design).

Estimated Area Impacted

The total estimated area impacted is detailed in Table 2-1. The development of SLC-5 includes two launch pads, the HIF, support structures, associated firebreak, and other infrastructure. The area affected by road improvements, utility corridor, and peripheral firebreaks was calculated cumulatively due to overlaps between these features.

Table 2-1. SLC-5 Area Impacted.

Action	Acres	Hectares
Site Development & Vegetation Maintenance	20.4	8.3
Firebreaks	9.3	3.8
Road Improvements (repaving^)	3.9	1.6
Road Improvements (vegetation clearing only)	8.2	3.3
Utility Corridor	6.3	2.5
Total	**48.1***	**19.5***

^ Repaving of existing degraded roads
* Note: total accounts for overlap in some features and is therefore less than combined total of each action's footprint.

2.2.3 Launch Noise

Launch trajectories of vehicles departing from VSFB will be unique to the vehicle configuration, mission, and environmental conditions but within a range of potential launch azimuths from 168° and 220°. For both Daytona-E and Laguna-E vehicles, a sonic boom (overpressure of high energy impulsive sound) up to 2.0 pounds per square foot (psf) would be generated during ascent while the first-stage booster is supersonic (MSRS 2022). The overpressure would be primarily directed at the Pacific Ocean south of Point Conception. Although modeling of the potential sonic booms showed that an impact to the Northern Channel Islands (NCI) would be unlikely, an overpressure of up to 1.5 psf may impact the NCI (Figures 2-5 and 2-6). Given potential variability in actual meteorological conditions during launches, we conservatively assume that sonic boom levels may reach 2.0 psf.

Engine noise produced during launches would primarily impact the area from the Santa Ynez River mouth, south to Sudden Ranch, and east across Tranquillon Ridge (Figures 2-7 and 2-8; MSRS 2022). Static fire engine tests would generate noise over much smaller areas – from Spring Canyon to Cypress Ridge for Daytona-E (Figure 2-9) and from Destroyer Rock to the just north of the Boathouse for Laguna-E (Figure 2-10; MSRS 2020).

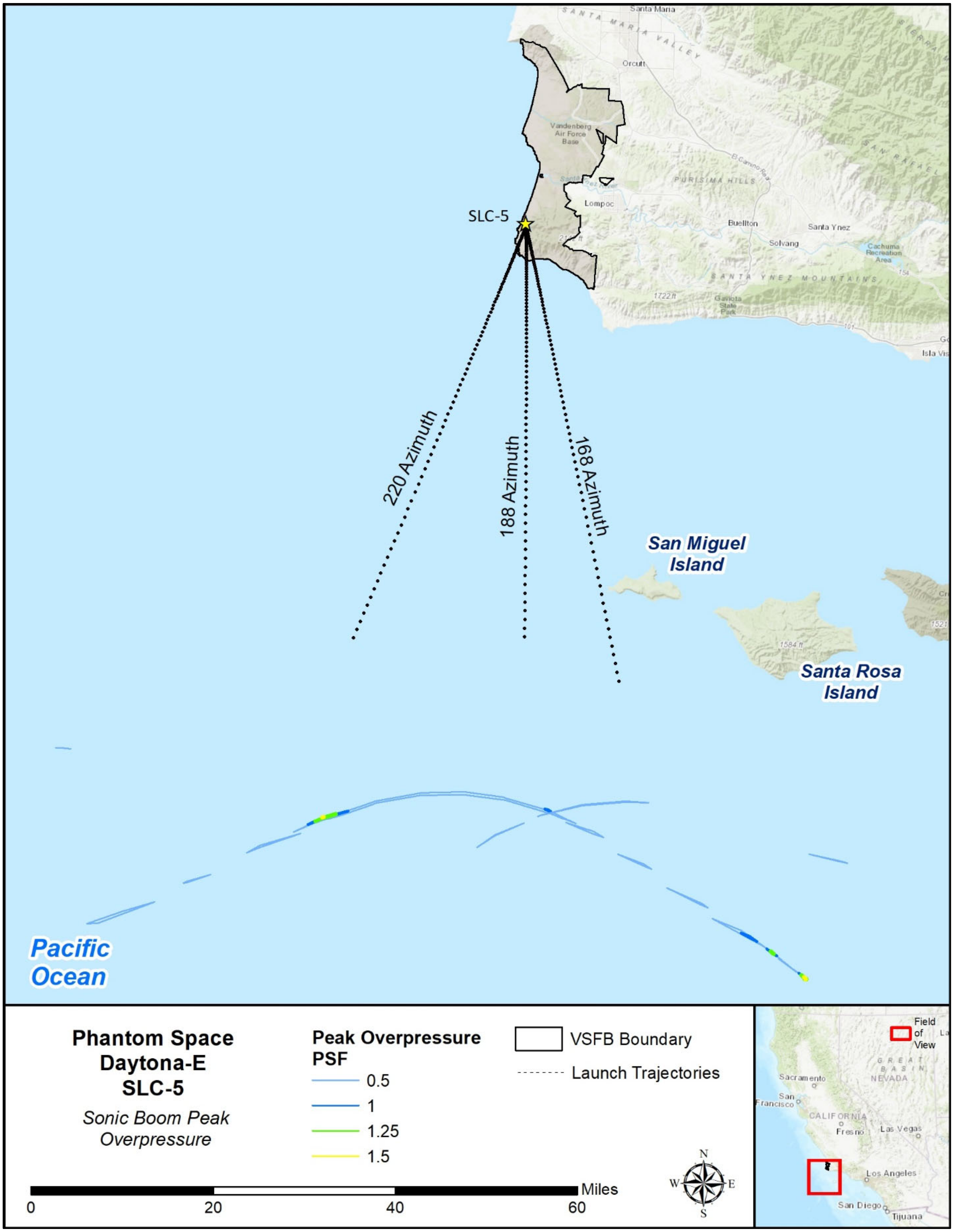

Figure 2-5. Sonic boom modeling results for Daytona-E from SLC-5.

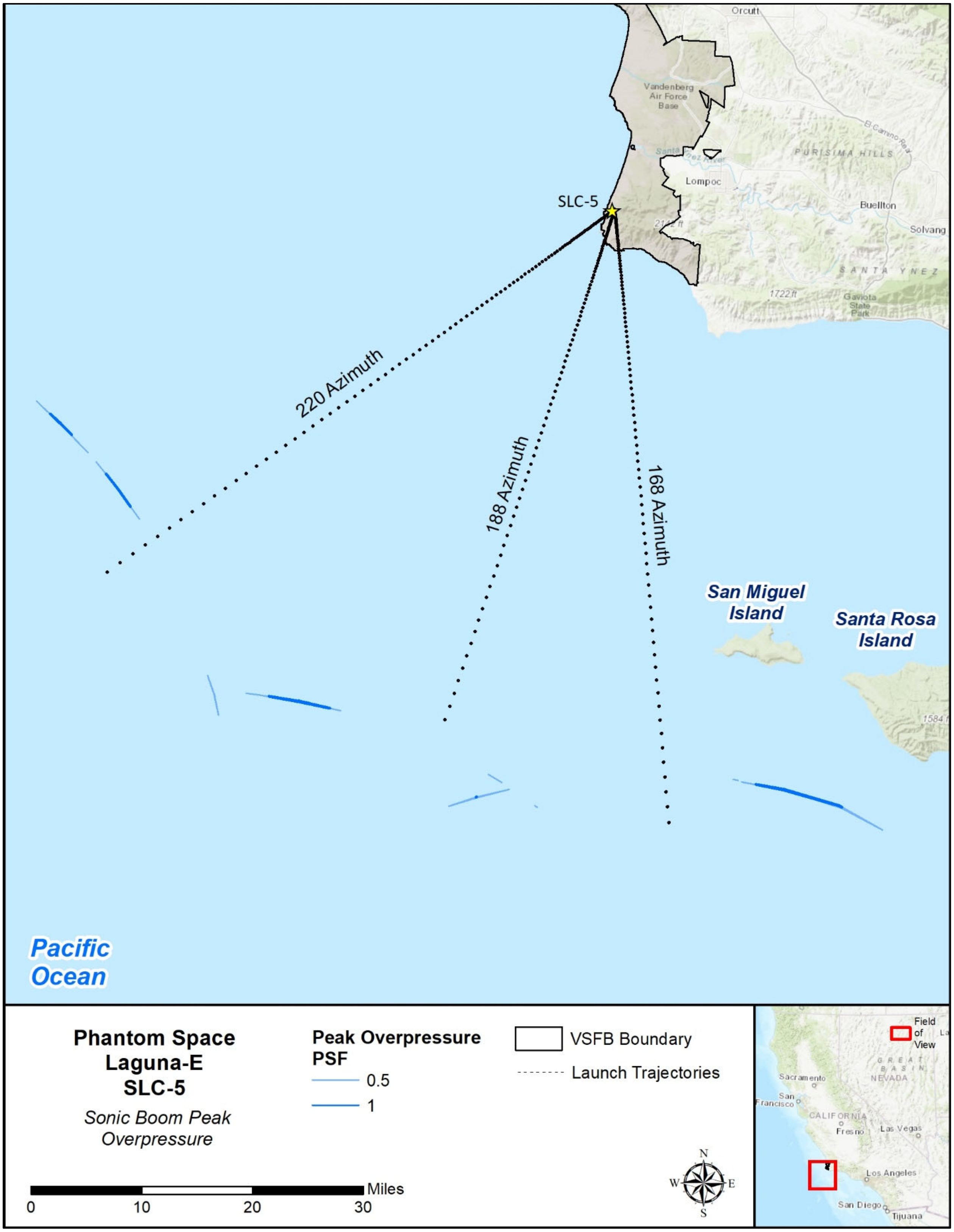

Figure 2-6. Sonic boom modeling results for Laguna-E from SLC-5.

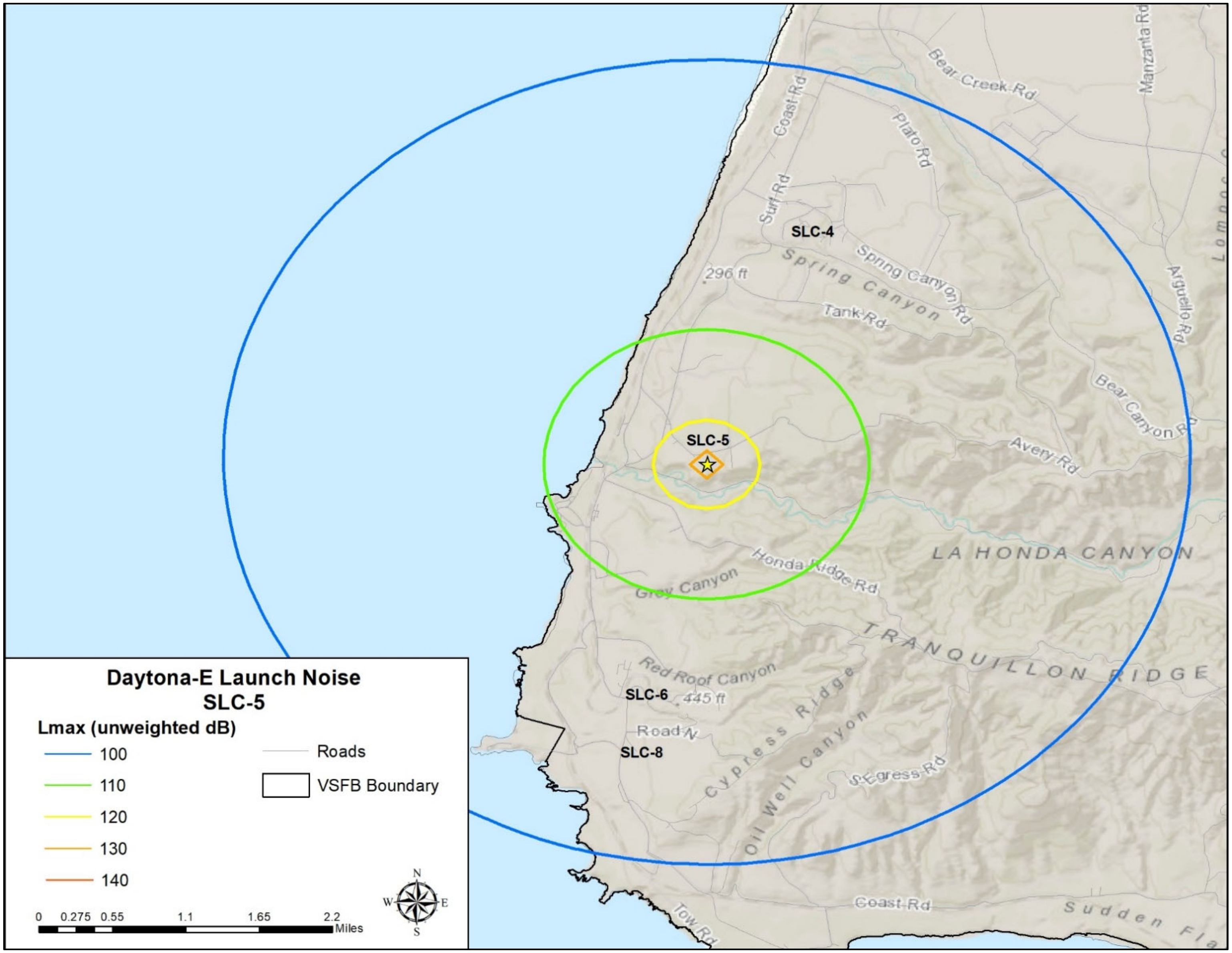

Figure 2-7. Maximum unweighted engine noise during Daytona-E launch from SLC-5.

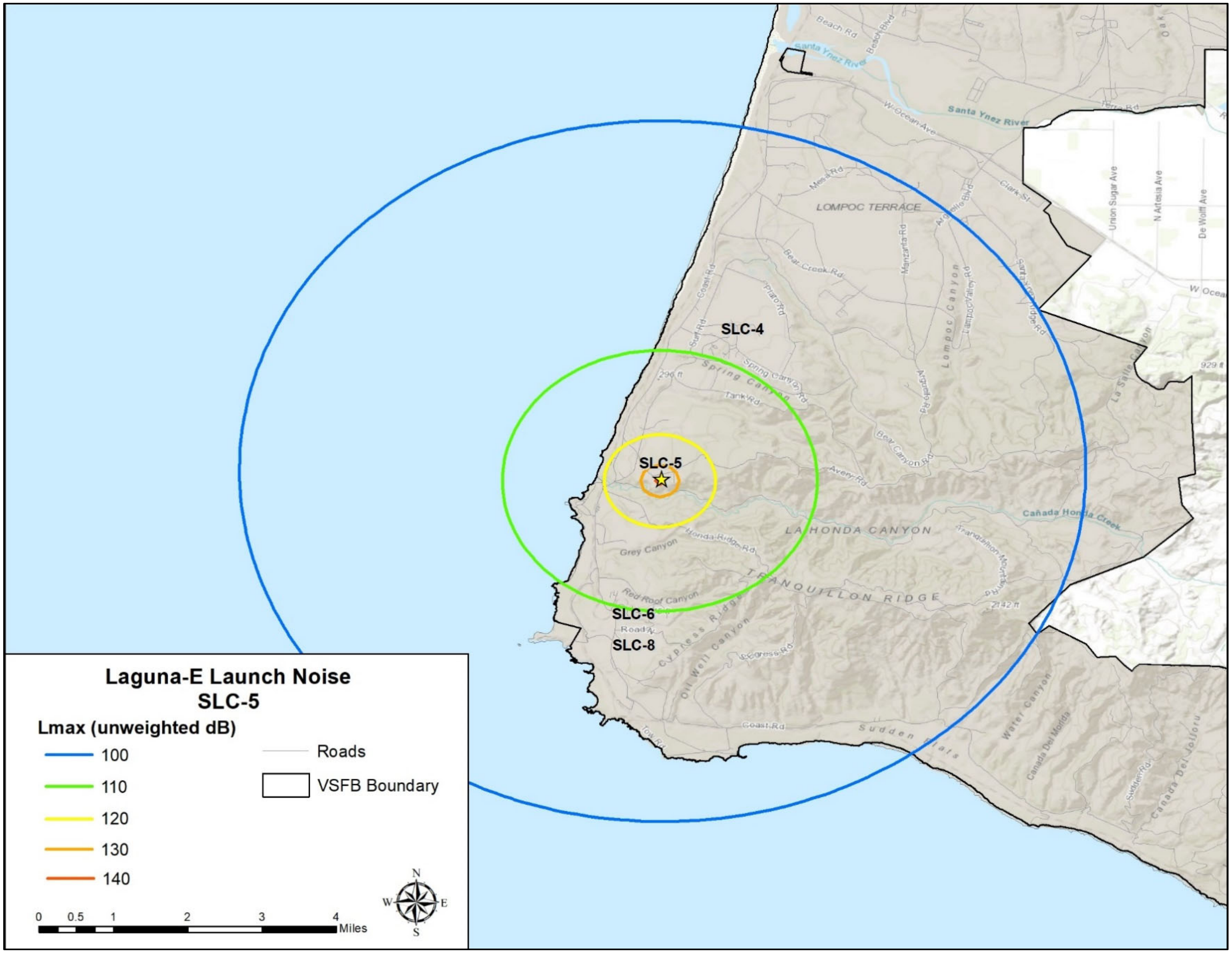

Figure 2-8. Maximum unweighted engine noise during Laguna-E launches from SLC-5.

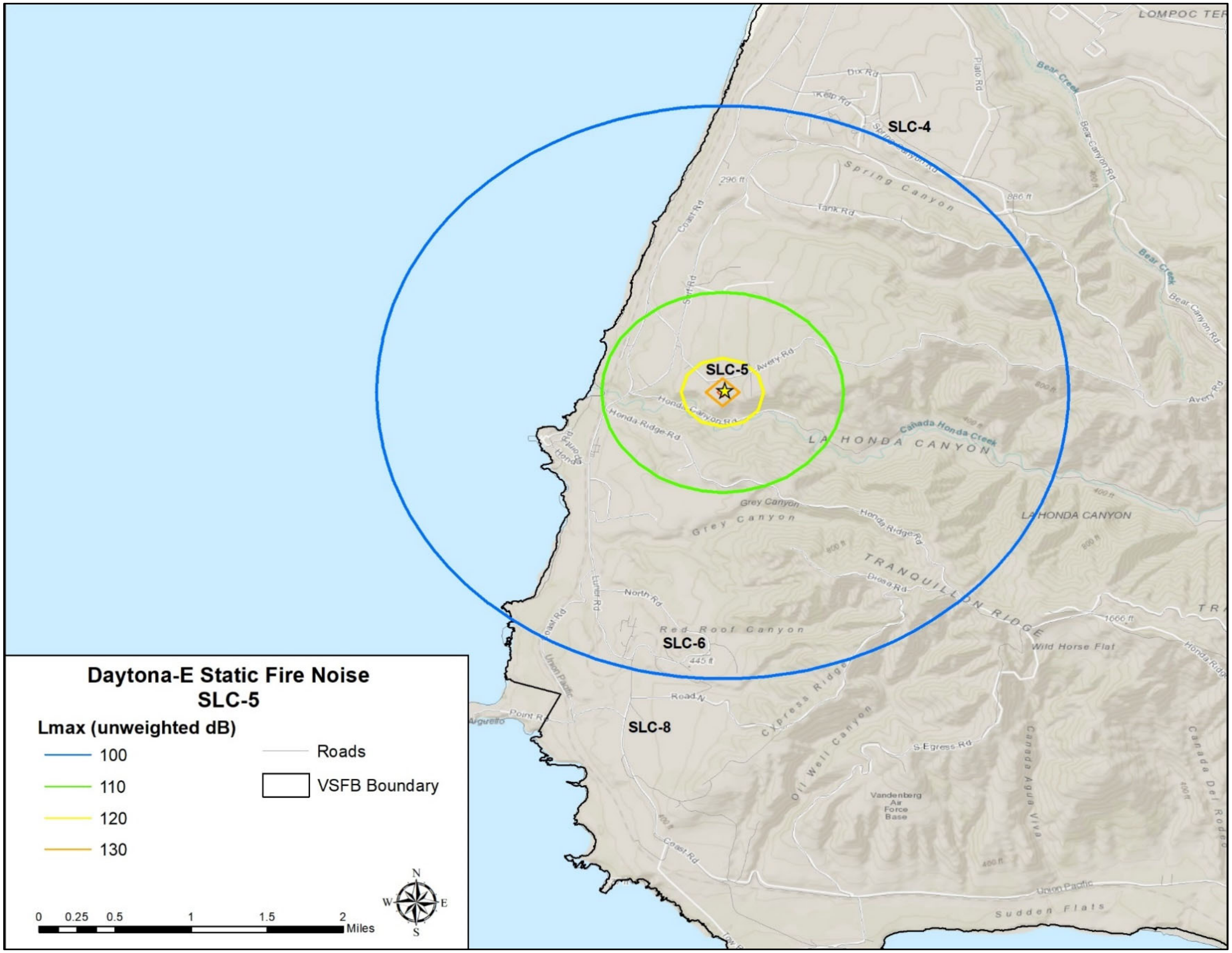

Figure 2-9. Maximum unweighted engine noise during Daytona-E static fire tests from SLC-5.

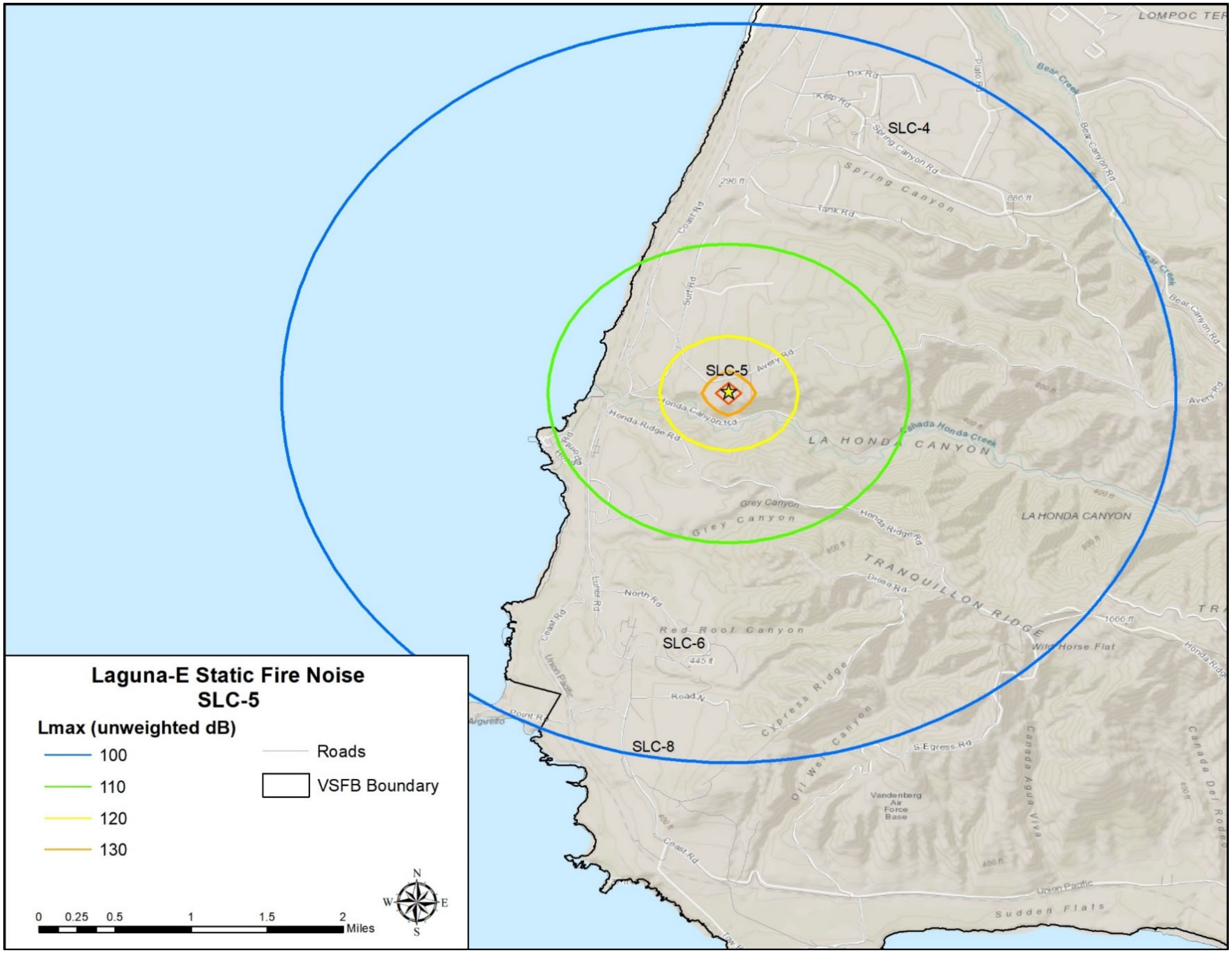

Figure 2-10. Maximum unweighted engine noise during Laguna-E static fire tests from SLC-5.

2.3 Avoidance, Minimization, and Monitoring Measures

The minimization and monitoring measures listed below would be implemented to avoid, minimize, or characterize the effects of the launch vehicles on the CRLF, SNPL, and California condor. There are no minimization or monitoring measures proposed for TWG, MAMU, or southern sea otter. There are no feasible methods to minimize the intensity of the sonic boom or engine noise. Monitoring measures are set forth for listed species likely to be affected by noise.

Avoidance and minimization measures included in this BA require various levels of biological competency from personnel completing specific tasks, as defined below:

- Permitted Biologist: Biologist with a valid and current USFWS section 10(a)(1)(A) Recovery Permit or specifically named as an approved biologist in a project-specific Biological Opinion. The USSF will coordinate with the USFWS prior to assigning permitted biologists to this project.
- USFWS Approved Biologist: Biologist with the expertise to identify listed species and species with similar appearance. The USSF will review and approve the resumes from each individual, and then submit them to the USFWS for review and approval no less than 15 days prior to the start of the Proposed Action. Each resume will list their experience and qualifications to conduct specific actions that could potentially affect listed species and their habitats. A USFWS approved biologist could train other biologists and personnel during surveys and project work; in some cases, a USFWS approved biologist could also provide on-site supervision of other biologists.
- Qualified Biologist: Biologist trained to accurately identify specific federally listed species and their habitats by either a Permitted or USFWS Approved biologist. This person could perform basic project monitoring but would need to have oversight from a permitted or USFWS approved biologist. Oversight will require a permitted or USFWS approved biologist to be available for phone/email consultation during the surveys and to have the ability to visit during monitoring/survey activities if needed.

2.3.1 General Environmental Protection Measures

The following protection and monitoring measures would apply to all aspects of the Proposed Action to protect and minimize effects on biological resources:

- Permitted or USFWS Approved biologists shall be present and monitor activities during construction at appropriate times when CRLF are likely to be encountered and required to be relocated.
- The Permitted or USFWS Approved biologists shall be responsible for delineating areas where special status species are located or concentrated, relocating special status species during construction activities, and inspecting equipment and equipment staging areas for cleanliness and gas and oil leaks.
- A Permitted or USFWS Approved shall brief all project personnel prior to participating in construction activities. At a minimum, the training would include a description of the listed species and sensitive biological resources occurring in the area, the general and specific measures, and restrictions necessary to protect these resources during project

implementation, the provisions of the ESA and the necessity of adhering to the provisions of the ESA, and the penalties associated with violations of the ESA.

- Disturbances shall be kept to the minimum extent necessary to accomplish project objectives.
- All excess materials excavated shall be removed and transported to a designated waste or fill site.
- All erosion control materials used will be from weed-free sources and, if left in place following project completion, constructed from 100 percent biodegradable erosion control materials (e.g., erosion blankets, wattles, etc.).
- All human generated trash at the project site shall be disposed of properly at the end of each workday. Proper waste disposal is deposition of material into a trash receptacle with a lid that will not blow open in the wind. Additionally, trash receptacles are not to be overfilled to the point where the lid does not fit properly. Large dumpsters are appropriate for waste disposal and can be maintained within a staging area for this purpose. All construction debris and trash shall be removed from the work areas upon completion of the project. All waste will be disposed at a designated waste or fill site approved by 30 CES/CEI.
- Equipment vehicles (dozers, mowers, etc.) shall be cleaned of weed seeds prior to use in the project area to prevent the introduction of weeds and be inspected by a qualified biological monitor to verify weed free status prior to use. Prior to site transport, any skid plates shall be removed and cleaned. Equipment should be cleaned of weed seeds daily especially wheels, undercarriages, and bumpers. Prior to leaving the project area, vehicles with caked-on soil or mud shall be cleaned with hand tools such as bristle brushes and brooms at a designated exit area; vehicles may subsequently be washed at an approved wash area. Vehicles with dry dusted soil (not caked-on soil or mud), prior to leaving a site at a designated exit area, shall be thoroughly brushed; vehicles may alternatively be air blasted on site.
- Fueling of equipment will be conducted in a pre-designated location within the staging area and spill containment materials will be placed around the equipment before refueling.
- A qualified biological monitor shall inspect any equipment left overnight prior to the start of work. Equipment would be checked for presence of special status species in the vicinity and for fluid leaks.
- No holes or trenches will be left open overnight. Plywood sheets or steel plates may be used to cover holes or trenches. The biological monitor will inspect these locations before the resumption of work.

2.3.2 California Red-legged Frog

- Worker Education: Before construction activities begin, a qualified biologist will conduct a training session for all construction personnel. At a minimum, the training will include a description of the CRLF and its habitat, the specific CRLF measures implemented for the current project, and project boundaries.

- Pre-Project Surveys: A USFWS approved biologist qualified biologist will conduct pre-project surveys for CRLF. A qualified biologist could complete these surveys on an as needed basis. Biologists will follow these measures:
    - From 15 November to 31 March, a USFWS approved or qualified biologist (as needed) will conduct a pre-construction survey of project areas within suitable aquatic, adjacent upland, or dispersal habitat (690 ft [210 m] from aquatic habitat or other distance as determined by a USFWS approved biologist following adaptive habitat assessment procedures described in the 14 June 2018, reinitiation request letter [Kephart 2018]) immediately before the onset of all work activities.
    - From 1 April to 14 November, a USFWS approved or qualified biologist (as needed) will conduct a pre-project survey of project areas within suitable aquatic or upland habitat (140 ft [43 m] from aquatic habitat or other distance as determined by a USFWS approved biologist following adaptive habitat assessment procedures described in Kephart [2018]) to identify potential artificial water or shelter resources that may contain sheltering CRLF.
    - A USFWS approved or qualified biologist (as needed) will repeat surveys following any precipitation event greater than 0.2 inch (0.5 cm) during a 24-hour period.
    - A USFWS approved or qualified biologist (as needed) will monitor any initial ground disturbance or vegetation removal within suitable aquatic, adjacent upland, or dispersal habitat identified following the adaptive habitat assessment procedures described in Kephart (2018). However, after the initial ground disturbance/vegetation removal is complete, no further monitoring would be required within these bare-dirt areas.
- During construction of the launch site, the following measures will be implemented:
    - The launch construction site will be encircled with minimum 3-ft-high (1-m-high) silt fencing, anchored with metal T-posts, and buried along the bottom edge to inhibit terrestrial wildlife, including CRLF, from entering the site. A qualified biologist will inspect the fence daily and direct maintenance to ensure its efficacy.
    - All work will occur during daylight hours during periods when there is no rainfall.
    - Any open holes or trenches will be covered with plywood or metal sheets if left overnight to minimize the risk of entrapment of CRLF.
    - Precipitation Events: Construction activities will not occur until 24 hours after an actual precipitation event greater than 0.2-inch (0.5-cm) accumulating within a 24-hour period.
    - No overnight staging of equipment or supplies would occur within 0.10 mi (0.16 km) of CRLF aquatic habitat in undeveloped areas, unless a designated staging area is identified, cleared for CRLF by a qualified biologist, and measures are implemented that would preclude CRLF from accessing the supplies or equipment (e.g., drift fence barrier installed).

- A qualified biologist will survey the site, including any open holes or trenches, each day prior to initiation of work.

- CRLF Relocation: A USFWS approved biologist would conduct any CRLF relocation. If CRLF are found within the project area during pre-project surveys, daily monitoring where required, or at any other time, all construction activity within the vicinity of the CRLF occurrence (if any) will cease and the following measures will occur:
  - If the project site is large and if the USFWS approved biologist is satisfied that work in a different area of the project can continue with no threat to CRLF, then that work can continue after workers have received a briefing on the area to avoid.
  - Construction activities within the vicinity of the CRLF occurrence will not begin or resume until a USFWS approved biologist relocates the CRLF or contacts the USFWS for alternate guidance.
  - Using the Declining Amphibians Task Force Fieldwork Code of Practice (DATF 2019), the USFWS approved biologist will relocate all life stages of CRLF the shortest distance possible to a location that is (1) within the same drainage, (2) contains suitable aquatic/upland habitat, and (3) is outside of the project impact area.
- Any water retention basins would be designed to exclude access by CRLF. If such exclusion is not possible, and water is present in retention basin overnight, the basin will be checked daily for CRLF by a qualified biologist prior to pumping. The pump will be screened with 1/8-inch mesh.
- Artificial Lighting:
  - Except when necessary for safety or performance of launch operations, or maintenance, artificial lighting at SLC-5 will be minimized during the hours of darkness.
  - The lighting plan would be designed such that lights are directed away from Honda Canyon and would be shielded to reduce scatter into undeveloped areas. Design details are not currently available, but will be required to minimize illumination of Honda Canyon such that that lighting levels of 1-foot candle would not extend beyond the SLC-5 facility.
- VSFB will continue to conduct baseline studies and population monitoring of CRLF across Base, assess habitat, study the incidence of chytrid fungus, and assess other means of enhancing CRLF habitat across VSFB, per the current VSFB Programmatic Biological Opinion.

2.3.3 Western Snowy Plover

- Between March 1 and September 30, USFWS approved biologists will monitor SNPL to assess potential adverse effects on reproductive success from Daytona-E and Laguna-E launches.

- Monitoring will consist of two pre-launch and two post-launch population surveys in the snowy plover habitat area nearest to the launch location.
  - For daytime launches, if launch safety restrictions allow it and a snowy plover nest is present within the habitat area, the USFWS approved biologist will monitor the nest during the launch to record any abnormal behavior by incubating adults. If safety dictates that a USFWS approved biologist cannot be within a reasonable distance to observe the snowy plover's reaction, if practicable the biologists will use video recording equipment to record the reaction of the snowy plovers.
  - If the biologist documents no adverse effects during the monitoring, the USSF will discontinue monitoring after concurrence from USFWS.
- The USSF and USFWS will coordinate on an adaptive management approach to determine if increased launch frequency demonstrates adverse effects to the snowy plover on VSFB if the USSF conducts more than 12 rocket launches during the breeding season.

2.3.4 California Condor

- Prior to any launch, the USSF will determine if any condors are present by coordinating with Ventana Wildlife Society and USFWS personnel prior to launch. (Note: VSFB computers are unable to review the Service's "Daily Snapshot – California Condor Population" Google Earth imagery). The USSF will contact the USFWS if condors appear to be near or within the area affected by a launch from SLC-5. If nearby, qualified biologists will monitor condor movements in the vicinity of VSFB and analyze data before, during, and after launch events to determine whether there was an effect on condor movement patterns.
- The USSF will coordinate with current USFWS personnel, including Molly Astell, Wildlife Biologist, USFWS California Condor Recovery Program, at molly_astell@fws.gov or (805) 451-0379, Joseph Brandt, Wildlife Biologist, USFWS, at joseph_brandt@fws.gov, 805-677-3324, or 805-644-1766 extension 53324, or Steve Kirkland, California Condor Field Coordinator, USFWS California Condor Recovery Program, at steve_kirkland@fws.gov or 805-644-5185, extension 294. Ventana Wildlife Society contact information: Joe Burnett, joeburnett@ventanaws.org or 831-800-7424.

3 Methods and Action Area

The USFWS's regulations define the "Action Area" as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 Code of Federal Regulations [C.F.R.] section 402.02). Impacts on listed species were considered for all areas potentially impacted by the re-development SLC-5 and associated infrastructure, and the potential disturbances caused during launch, including visual impacts, engine noise, and sonic boom. The Action Areas for each species was determined by considering each species sensitivity to all facets of the Proposed Action, and existing data and studies on effects of noise impacts to species.

The primary stressors inherent in the Proposed Action are physical impacts as a result of vegetation removal and construction activities, loss of habitat, and noise impacts. Noise impacts may induce startle and alert responses in individuals. Responses to noise vary based largely upon individual circumstances and psychological factors unrelated to the intensity of the sound. It is, therefore, difficult to generalize the anticipated behavioral reactions to various noise levels across species. Available studies and data as well as personal observations by qualified biologists in the field were used as the basis for determining what noise levels were likely to produce a significant behavioral response or damage to hearing sensitivity. In most cases, however, no directly applicable studies exist. Therefore, reasonable conclusions were deduced from similar species as proxy to the extent possible and by examining evidence of impacts from other types of noise (e.g., aircraft noise, space vehicle launch noise).

To identify species and habitats likely to be affected by the Proposed Action, MSRS conducted biological surveys which included characterization and mapping of vegetation communities within the portions of the terrestrial Action Area subject to physical impacts. Surveys were conducted within the Biological Survey Area in November 2019, March 2020, and August 2021 (Figure 2-2). Surveys were conducted by walking meandering transects throughout the Biological Survey Area. Prior special status species monitoring data, survey reports, and California Natural Diversity Database records, were also reviewed to assess the potential occurrence, distribution, and habitat use of listed species within the broader Action Area.

During surveys, biologists mapped any special status species detected and special status species habitat, including potential wetlands, wetland vegetation, standing water, or defined channels. Biologists delineated all vegetation communities within the Biological Survey Area using a combination of survey data and aerial photo interpretation (Figure 2-2).

4 Status of the Species

4.1 Tidewater Goby [Federally Listed Endangered Species]

4.1.1 Status

The TWG was listed as endangered on 7 March 1994 (59 Federal Register [FR] 5494). On 24 June 1999, the USFWS proposed to remove the populations occurring north of Orange County, California, from the endangered species list (64 FR 33816). In November 2002, the USFWS withdrew this proposed delisting rule and retained the TWG's listing as endangered throughout its range (67 FR 67803). The USFWS published a Recovery Plan for the TWG in 2005 (USFWS 2005). In January 2014, USFWS proposed to reclassify the TWG from endangered to threatened (79 FR 14340-14362). In addition, the USFWS is considering a proposed taxonomic split between northern and southern populations of this species, with an expectation to delist the northern population (including all individuals at VSFB). A decision on this proposal has not been made.

4.1.2 Life History

The TWG is a small, bottom-dwelling fish found in California's coastal estuaries, wetlands, lagoons, and lower reaches of coastal streams and rivers. It is an annual species, with individuals typically not living for more than a year. TWG population size is heavily influenced by environmental conditions. In years experiencing high rains, when lagoons are breached, TWG numbers fall as fish are washed out to sea. Individuals able to access refugia, such as that provided by vegetation in littoral marshes, are able to survive flood events. These surviving individuals breed after the lagoons close, allowing populations to rebound the following summer (Swift et al. 1989). Breeding may occur year-round (Swenson 1999) with peak spawning activity usually occurring during the spring and a second peak during the late summer (Swift et al. 1989).

The key threat to TWG is the degradation of coastal lagoons as a result of diversion of water (dewatering streams affects marsh habitat extent, and alters temperature and salinity within the marshes), pollution from agricultural and sewage effluents, siltation (often through sediment generated during cattle overgrazing and feral pig activity), and coastal development. In addition, introduced predatory fish (especially centrarchids and channel catfish [*Ictalurus punctatus*], crayfish [*Procambarus clarkii*], and mosquito fish [*Gambusia affinis*]) pose a direct threat to TWG populations through predation of eggs, larvae, and adults.

4.1.3 Occurrence within the Action Area

TWG have been reported in all the major drainages on VSFB, including Shuman Creek, San Antonio Creek, Santa Ynez River, Honda Creek, and Jalama Creek (Swift et al. 1997). TWG typically favor areas within the fresh-saltwater interface with salinities of less than 12 parts per thousand (Swift et al. 1989). However, this species will range into fresh water and has been recorded up to 7.5 mi (12 km) upstream from the ocean in the Santa Ynez River (Swift et al. 1997).

The Action Area for TWG was determined to be the suitable habitat found in Honda Creek. TWG were first found in the Honda estuary lagoon in 1995 (Lafferty et al. 1999). The species was again documented in 2001; however, seine net surveys conducted in Honda Creek in 2008 indicated that TWG were no longer present (MSRS 2009). Seine net surveys were again conducted in Honda Creek in 2015 and 2016 with no TWG present (MSRS 2016, 2018a). Despite being easily detectable in shallow water with a flashlight during night frog surveys, no TWG were observed during night CRLF surveys of the Honda Creek estuary for SpaceX launch monitoring activities in January 2022 (J. LaBonte, pers. obs.).

In 2013, the estuary lagoon dried and stayed dry through 2016 before rehydrating in the winter of 2016-2017 (MSRS 2018a). Since 2017 the lagoon has been subject to drying during late summer months, making more than short-term occupancy by fish dependent on them being able to establish in areas east of Coast Road, but the narrowness and shallowness of the creek in this area makes this unlikely. Occurrence within the Proposed Action Area would be dependent on TWG recolonizing the lagoon if it fills and breaches in response to winter rains.

Unless environmental conditions return to a consistently wetter regime conducive to perennial water in the Honda lagoon, any TWG occupancy is likely to be of short duration.

4.1.4 Critical Habitat

The USFWS issued a final rule for designation of Critical Habitat for the TWG on 6 February 2013 (78 FR 8745-8819). Critical habitat does not include VSFB, since it is owned by the Department of Defense and is exempted under section 4(a)(3) of the ESA. Further, USFWS has adopted VSFB's Integrated Natural Resources Management Plan (INRMP; U.S. Air Force 2021), prepared under section 101 of the Sikes Act (16 U.S.C. 670a).

4.2 California Red-Legged Frog [Federally Listed Threatened Species]

4.2.1 Status

The UFSWS listed the CRLF as threatened on 23 May 1996 (61 FR 25813-25833). In 2002, USFWS issued a Recovery Plan to stabilize and restore CRLF populations (USFWS 2002).

4.2.2 Life History

The CRLF is a member of the family Ranidae and is California's largest native frog. In order to breed, CRLF require water bodies with sufficient hydroperiods and compatible salinity levels to accommodate larval and egg development. Breeding typically takes place from November through April with most egg deposition occurring in March. Eggs require 7 to 28 days, depending on water temperature, to develop into tadpoles (Cook 1997). Tadpoles typically require 11 to 20 weeks to develop into terrestrial frogs (USFWS 2002), although some individuals may overwinter in the tadpole stage (Fellers et al. 2001).

Adult CRLF have been documented traveling distances of over 1.0 mi (1.6 km) during the wet season and spending considerable time in terrestrial riparian vegetation (Tatarian 2008). Christopher (2018) found that 90 percent of the CRLF observations at VSFB within the dry season occurred within 197 ft (60 m) of riparian or other aquatic habitats. It is thought that riparian vegetation provides good foraging habitat, as well as good dispersal corridors, due to canopy cover and presence of adequate moisture (USFWS 2002).

Habitat loss and degradation, combined with over-exploitation and introduction of exotic predators, were important factors in the decline of CRLF in the early to mid-1900s. Continuing threats to CRLF include direct habitat loss due to stream alteration and loss of aquatic habitat and drought, and indirect effects of expanding urbanization, competition, or predation from non-native species including the bullfrog (*Lithobates catesbeianus*), catfish (*Ictalurus* spp.), bass (*Micropterus* spp.), mosquitofish, and crayfish. Chytrid fungus (*Batrachochytrium dendrobatidis*) is a waterborne fungus that can decimate amphibian populations and is considered a threat to CRLF populations.

4.2.3 Occurrence within the Action Area

CRLF have been documented in nearly all permanent streams and ponds on VSFB as well as most seasonally inundated wetland and riparian sites (Figures 4-1 and 4-2; Christopher 2002). CRLF have been consistently documented in Honda Creek, adjacent to SLC-5 (Christopher 2002; MSRS 2009, 2016, 2018a, 2021b) and during SpaceX launch monitoring activities in January 2022 (MSRS in prep.). Honda Creek was therefore determined to be within the Action Area for CRLF.

Suitable upland dispersal habitat exists throughout VSFB between the various riparian zones and ponds on Base, but as noted above, dispersal into these upland habitats is not likely to be as extensive as has been observed in more mesic parts of the range of this species. However, due to the proximity of CRLF aquatic habitat, upland habitat in the Proposed Action Area is likely to support CRLF (Figure 4-2). The SLC-5 site is within 450 ft (137 m) of occupied CRLF habitat within Honda Creek and portions of the Proposed Action Area encompassing Honda Canyon Road are within 50 ft (15 m) of Honda Creek and support areas of dense vegetation that could provide shelter for upland active CRLF, especially during periods of wet weather. Therefore, in addition to Honda Creek, the Action Area for CRLF was determined to include upland areas that would be impacted by construction, utility installation, and road improvements (Figure 4-2).

4.2.4 Critical Habitat

The USFWS issued a final rule revising the CRLF's Critical Habitat on 16 March 2010 (75 FR 12816–12959). The USFWS excluded VSFB from CRLF Critical Habitat designation pursuant to Section 4(b)(2) of the ESA. However, USFWS designated Critical Habitat for the species along the southeastern (Unit STB-4) and northeastern (Unit STB-2) perimeters of VSFB (Figure 4-1).

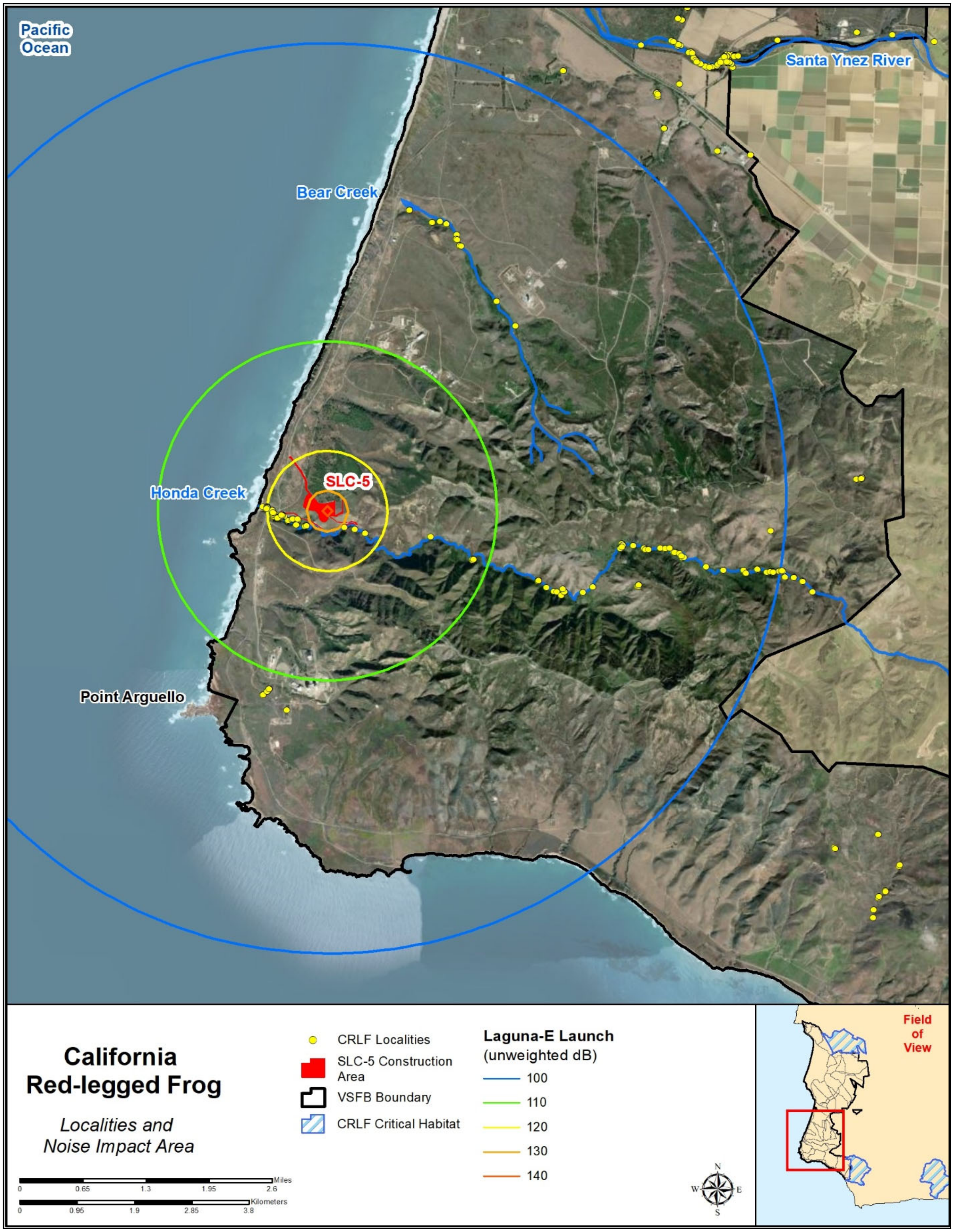

Figure 4-1. California red-legged frog localities, Critical Habitat, and noise impact areas.

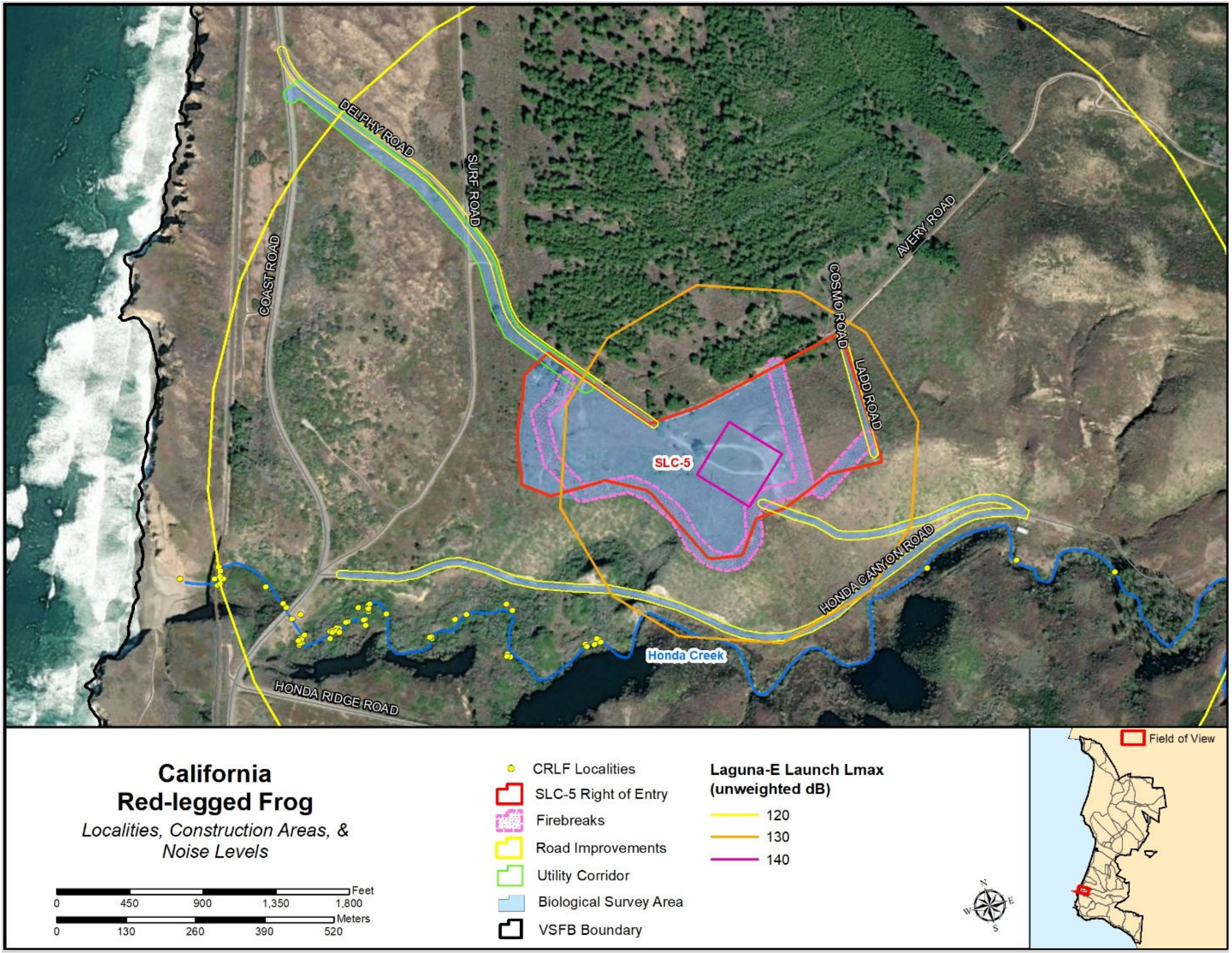

Figure 4-2. California red-legged frog localities and noise levels in the vicinity of SLC-5.

4.3 Marbled Murrelet (Federally Listed Threatened Species)

4.3.1 Status

The USFWS listed the MAMU as threatened on 1 October 1992 (57 FR 45328) and published a Recovery Plan for the species in 1997 (USFWS 1997). The USFWS completed a 5-year review of the species in 2009 (USFWS 2009).

4.3.2 Life History

The MAMU is a small seabird that breeds along the Pacific coast. It forages in nearshore marine waters on small fish and invertebrates, and flies inland to breed. The species requires abundant prey within foraging habitat. Among alcids, the species is unique because it uses old-growth coniferous forests and mature trees for nesting (USFWS 1997). MAMU are wing-pursuit divers. Although little was historically known about the MAMU movement and home range, more information is becoming available. The first MAMU nest was not documented until 1974. Since then, the MAMU's home range has been determined to be 253 square miles (mi^2) (655 km^2) for non-nesters and 93 mi^2 (240 km^2) for nesters within California. In addition, at-sea resting areas have also been observed an average of 3.2 mi (5.1 km) from the mouths of drainages. MAMU spend nighttime hours resting in the ocean in these at-sea resting areas and commute to foraging areas during the day. Nests have been observed from sea level to 5,020 ft (1,530 m) (USFWS 2009).

MAMU range from Alaska to California and may occur as far south as Baja California. The species is considered rare to very rare much of the year in Santa Barbara County. However, the species may be somewhat regular north of VSFB in the late summer and would be considered casual in the spring (Lehman 2020; eBird 2021). There is no known or suitable breeding habitat for MAMU on VSFB. As such, the non-breeding individuals occur within portions of the Proposed Action Area subject to noise impacts (Figure 4-3).

4.3.3 Occurrence Within the Action Area

MAMU have been observed semi-regularly off the coast in nearshore waters between the Santa Maria River and offshore of VSFB from on-land observation sites (Figure 4-3; eBird 2021). Specifically, one individual was observed at an unreported distance offshore from an observation site located approximately 2.0 mi (3.2 km) from SLC-5 in 2011 (Figure 4-3; eBird 2021). Two separate sightings were also documented in 1995 offshore of Purisima Point (Figure 4-3; eBird 2021). As such, the species may occur within offshore portions of the Proposed Action Area subject to noise impacts less than a Maximum Sound Level (L_{max}) of 120 unweighted decibels (dB) (Figure 4-3). MAMU has never been documented breeding on VSFB, nor is any old-growth coniferous forest present on VSFB or in the Proposed Action Area. Therefore, the Action Area for MAMU was determined to be the offshore ocean area encompassed by the 100 dB L_{max} contour (Figure 4-3).

4.3.4 Critical Habitat

The USFWS designated Critical Habitat for the MAMU on 24 May 1996 (61 FR 26257) and revised this designation on 4 August 2016 (81 FR 51348–51370). There is no designated Critical Habitat for this species within or adjacent to the Proposed Action Area. The nearest Critical Habitat is over 160 mi (97 km) to the north near Santa Cruz, California.

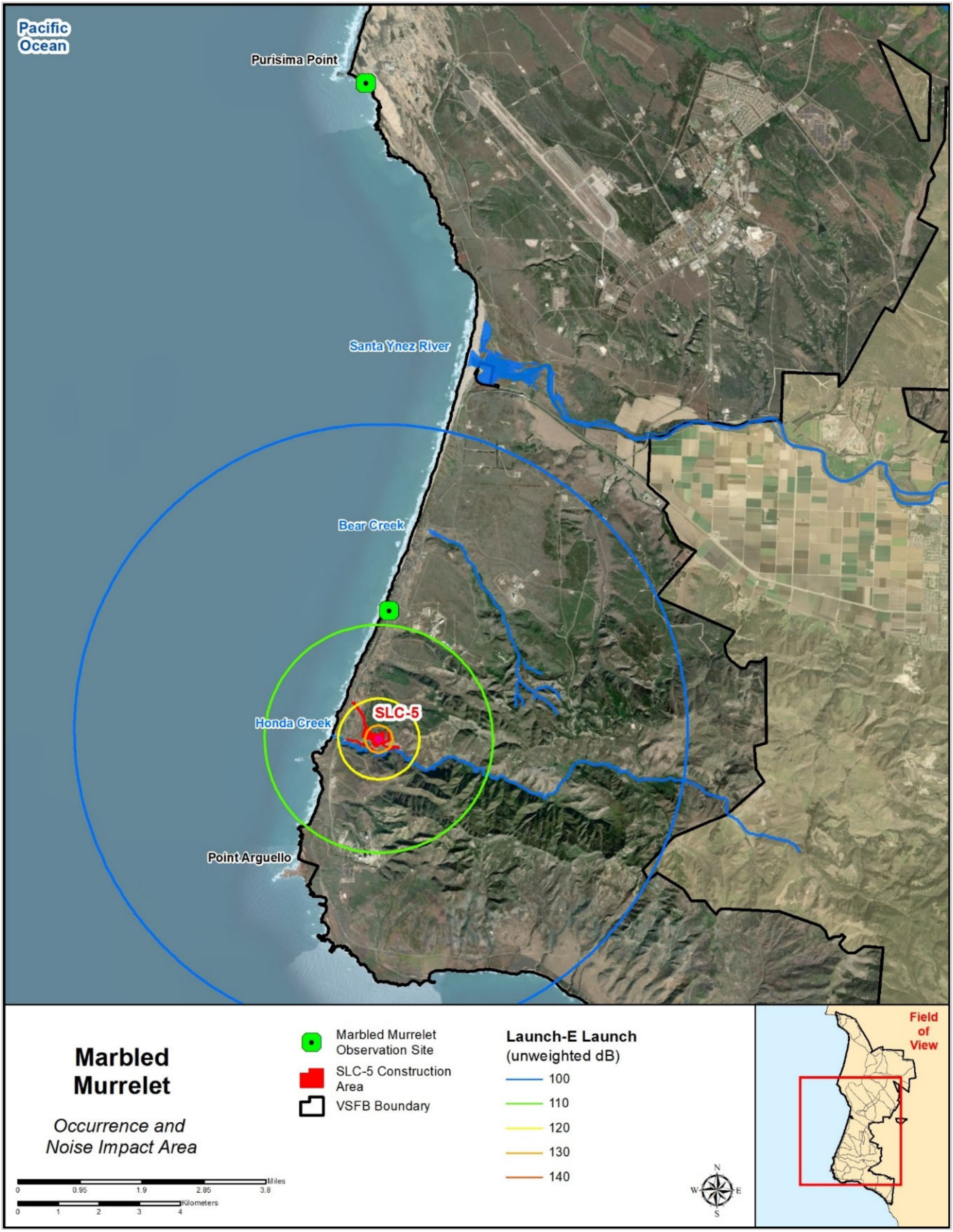

Figure 4-3. Marbled murrelet observation sites and noise impact areas. (Source: eBird 2021; Note: birds were observed at an unrecorded distance offshore of these observation sites).

4.4 Western Snowy Plover [Federally Listed Threatened Species]

4.4.1 Status

The USFWS listed the Pacific coast population of the SNPL as federally threatened in March of 1993 (58 FR 12864–12874) and published a recovery plan for the Pacific coast population in 2007 (USFWS 2007).

4.4.2 Life History

The SNPL is a small shorebird with pale tan back, white underparts, and dark patches on the sides of the neck reaching around to the top of the chest. The Pacific coast population of snowy plovers is limited to individuals that nest adjacent to tidal waters. The population's range extends from Southern Washington to Baja California, Mexico.

4.4.3 Occurrence within the Action Area

VSFB provides important breeding and wintering habitat for SNPL, which includes all sandy beaches and adjacent coastal dunes from the rocky headlands at the north end of Minuteman Beach to the pocket beaches and dune areas adjacent to Purisima Point on north VSFB (approximately 7.7 mi [12.4 km]). Also included are all sandy beaches and adjacent coastal dunes from the rocky headlands at the north end of Wall Beach south to the rock cliffs at the south end of Surf Beach on South VSFB (approximately 4.8 mi [7.7 km]).

VSFB has consistently supported one of the largest populations of breeding SNPL along the west coast of the United States (Robinette et al. 2016). VSFB has performed annual monitoring of SNPL since 1993 (Robinette et al. 2021). In 2014, VSFB supported an estimated 11 percent of California's breeding population (USFWS 2014). The breeding population of SNPL on VSFB has been highly variable but relatively stable since 2007, with 235 adults and 472 nests initiated in 2021 (Robinette et al. 2021). The nearest documented SNPL nest to the SLC-5 was on Surf Beach, approximately 3.5 mi (5.6 km) north of SLC-5 (**Error! Reference source not found.** 4-4).

The SNPL is also considered a permanent resident of Santa Rosa Island. A high count of 61 SNPL was documented during the 2016-2017 winter window survey of San Miguel Island, however, counts at San Miguel Island typically document very few to no individuals (USFWS 2017a). The Action Area for SNPL was determined to be the portion of Surf Beach encompassed by the 100 dB L_{max} contour (Figure 4-4) and Santa Rosa Island (Figure 4-5).

4.4.4 Critical Habitat

The USFWS designated Critical Habitat for the SNPL in 1999 and revised this designation on 29 September 2005 (70 FR 56969–57119) and on 19 June 2012 (77 FR 36727). VSFB was exempted from Critical Habitat designation under section 4(a)(3) of the ESA.

Santa Rosa Island includes Critical Habitat for this species (Figure 4-5). This habitat was occupied at the time of listing and is currently occupied. The unit encompassing SNPL habitat on Santa Rosa Island includes areas of sandy beaches above and below the high tide line with surf-cast wrack that is generally barren but supports small invertebrates. The essential physical and biological features (PBFs) for SNPL include sandy beaches, dune systems immediately inland of an active beach face, salt flats, mud flats, seasonally exposed gravel bars, artificial salt ponds and adjoining levees, and dredge spoil sites, with:

(1) Areas that are below heavily vegetated areas or developed areas and above the daily high tides.

(2) Shoreline habitat areas for feeding, with no or very sparse vegetation, that are between the annual low tide or low water flow and annual high tide or high-water flow, subject to inundation but not constantly under water, that support small invertebrates, such as crabs, worms, flies, beetles, spiders, sand hoppers, clams and ostracods, that are essential food sources.

(3) Surf- or water-deposited organic debris, such as seaweed (including kelp and eelgrass) or driftwood located on open substrates that supports and attracts small invertebrates described in PBF 2 for food, and provides cover or shelter from predators and weather, and assists in avoiding detection (crypsis) for nests, chicks, and incubating adults.

(4) Minimal disturbance from the presence of humans, pets, vehicles, or human-attracted predators, which provide relatively undisturbed areas for individual and population growth and for normal behavior.

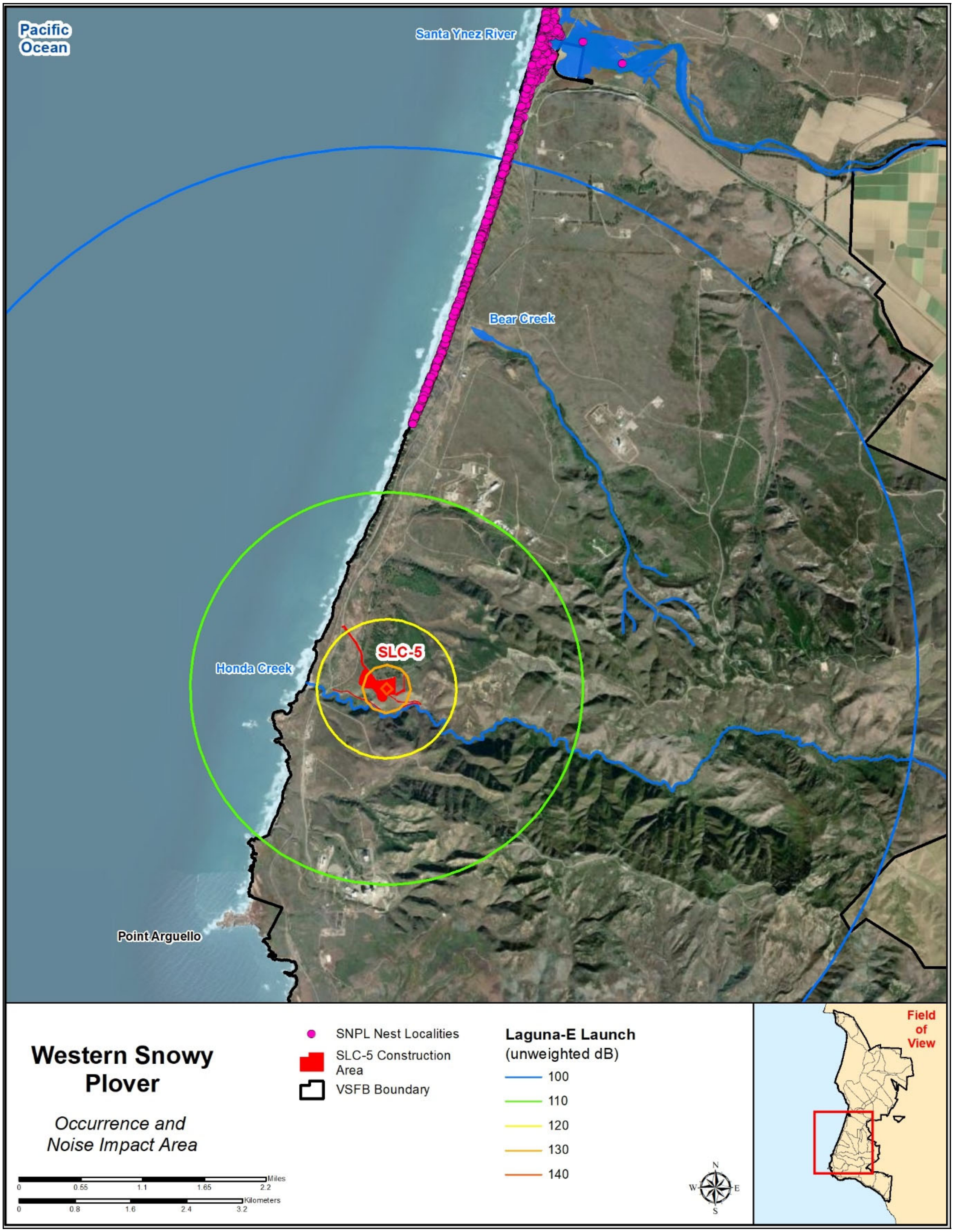

Figure 4-4. Western snowy plover nesting records.

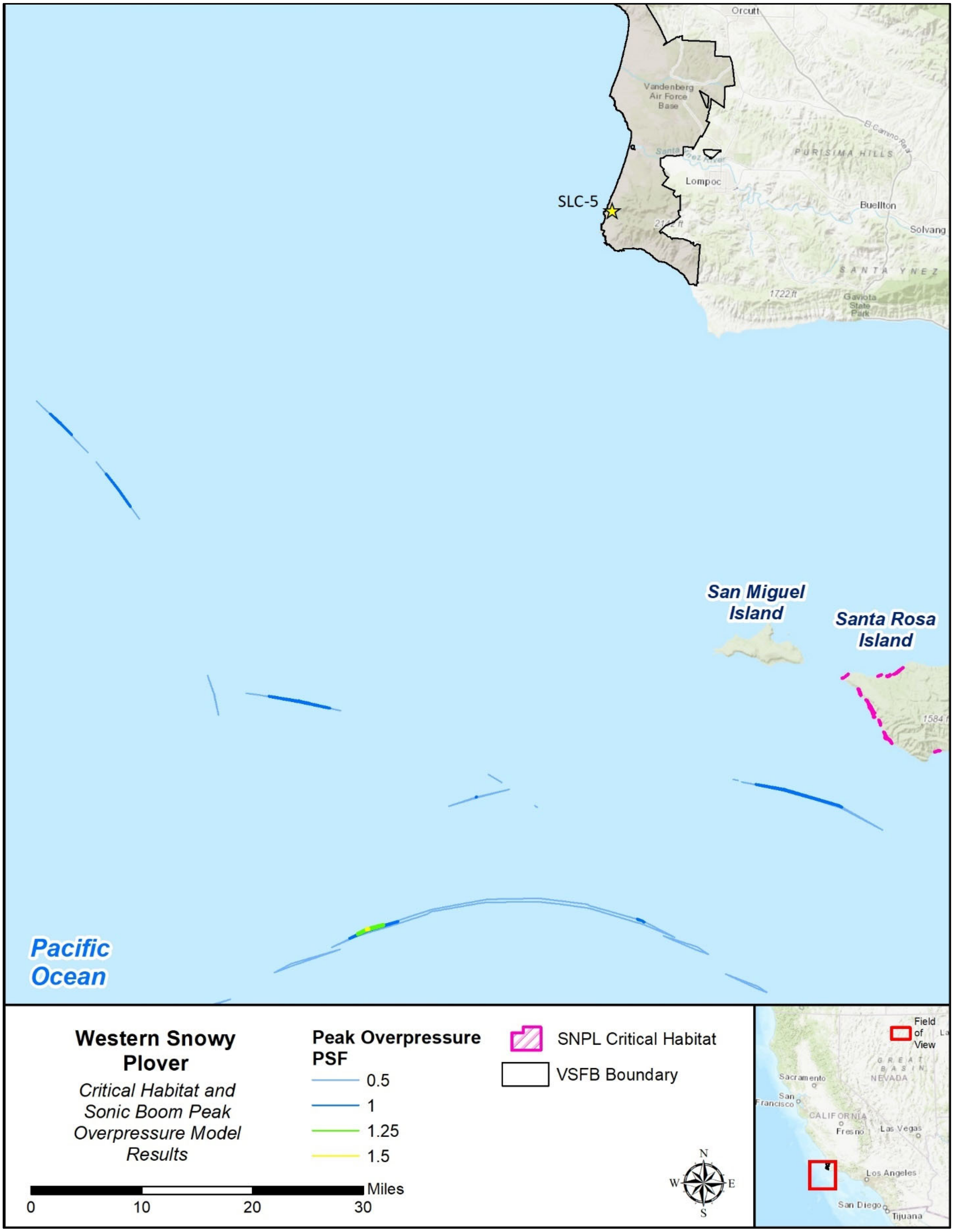

Figure 4-5. Designated Critical Habitat for the western snowy plover and sonic boom model results.

4.5 California Condor [Federally Listed Endangered Species]

4.5.1 Status

The USFWS listed the California condor as endangered on 11 March 1967 (32 FR 4001) and completed a Recovery Plan for the species on 25 April 1996 (USFWS 1996). In 1982, there were only 23 California condors in existence. To prevent the condor from going extinct, all remaining condors were placed into a captive breeding program in 1987. The USFWS and its partners began releasing condors back into the wild in 1992. The nearest release site to the Proposed Action Area is Bitter Creek National Wildlife Refuge (USFWS 2017b). Other release sites include the Ventana Wilderness and Pinnacles National Park. Almost all condors released into Santa Barbara County have either died or were brought back into captivity, with the last nesting attempt occurring in 2001 (Lehman 2020).

4.5.2 Life History

Condors nest in rock formations (e.g., ledges and crevices) and less frequently in giant sequoia trees (*Sequoiadendron giganteum*). They normally lay a single egg between late January and early April. Both parents incubate the egg and share responsibilities for feeding the nestling after hatching. Condors require large remote areas and can range up to 150 mi (241 km) a day in search of food. Chicks usually take their first flight around 6 to 7 months from hatching. The cause of the California condor's decline is inconclusive, but experts believe that lead poisoning and hunting greatly contributed to their decline (USFWS 1996).

4.5.3 Occurrence within the Action Area

The California condor's current range is not within the Proposed Action Area. However, in March 2017, the USSF learned that telemetry data from USFWS showed there was a California condor ranging within VSFB. This condor was SB 760 ("VooDoo"), an immature, non-reproductive female (USFWS, personal communication, 27 March 2017). SB 760 hatched in captivity on 22 May 2014. She was released at the Ventana Wilderness on 9 November 2016 (Ventana Wildlife Society 2017). SB 760 departed the VSFB area on or about 22 April 2017 and several months later, was found deceased, in northern San Luis Obispo County. VSFB natural resource managers maintain routine communications with the USFWS and Ventana Wildlife Society for launch monitoring requirements and condors have not been present since. However, given the wide-ranging nature of this species, individuals may occur on Base in the future. The Action Area for California condor was determined to be the area encompassed by the 100 dB L_{max} contour.

4.5.4 Critical Habitat

The USFWS designated Critical Habitat for the California condor in 1976 and revised it in 1977 (42 FR 47840). The nearest designated Critical Habitat for the California condor is near San Luis Obispo, approximately 28 mi (45 km) from the Proposed Action Area. There is no Critical Habitat within or adjacent to the Proposed Action Area.

4.6 Southern Sea Otter [Federally Listed Threatened Species]

4.6.1 Status

The USFWS listed the southern sea otter as federally threatened on 14 January 1977 (42 FR 2965) and published a Recovery Plan in 2003 (USFWS 2003). The USWFS completed a 5-year review of the species in 2015 (USFWS 2015).

4.6.2 Life History

The southern sea otter is the smallest species of marine mammal in North America. It inhabits the nearshore marine environments of California from San Mateo County to Santa Barbara County with a small geographically isolated population around San Nicolas Island. On occasion, southern sea otters have been observed beyond these limits and have been documented as far south as Baja, Mexico (USFWS 2015).

This species breeds and gives birth year-round and pups are dependent for 120 to 280 days (average 166 days; Riedman & Estes 1990). Sea otters are opportunistic foragers known to eat mostly abalones, sea urchins, crabs, and clams. They play a key ecological role in kelp bed communities by controlling sea urchin grazing.

4.6.3 Occurrence within the Action Area

Southern sea otters occur regularly off the coast of VSFB, with animals typically concentrated in the kelp beds between the Boat House and Jalama Creek on south VSFB (Figure 4-6). Annual surveys performed by United States Geological Survey (USGS) document persistent populations in nearshore waters in this area (USGS Western Ecological Resource Center 2017, 2018, 2020). As many as 55 adult otters have been documented in the Sudden Flats area at one time (SRS Technologies, Inc. 2006a). More recently, a high of 44 adults and 2 pups were observed in November 2020 in the Sudden Flats area during monitoring for a Falcon 9 launch (MSRS 2021c).

Historically, the Purisima Point area also supported a persistent otter population with as many as 18 adult otters documented in the area at one time (SRS Technologies, Inc. 2002). During the last three annual spring census counts that were performed (2017,2018, and 2019), however, there is a running average of only 1 otter within the Purisima Point area (USGS Western Ecological Resource Center 2017, 2018, 2020). Transitory otters also occasionally traverse the coast between Purisima Point and Point Arguello. The Action Area for southern sea otter was determined to be the offshore ocean area encompassed by the 100 dB L_{max} contour (Figure 4-6).

4.6.4 Critical Habitat

The USFWS has not designated Critical Habitat for this species.

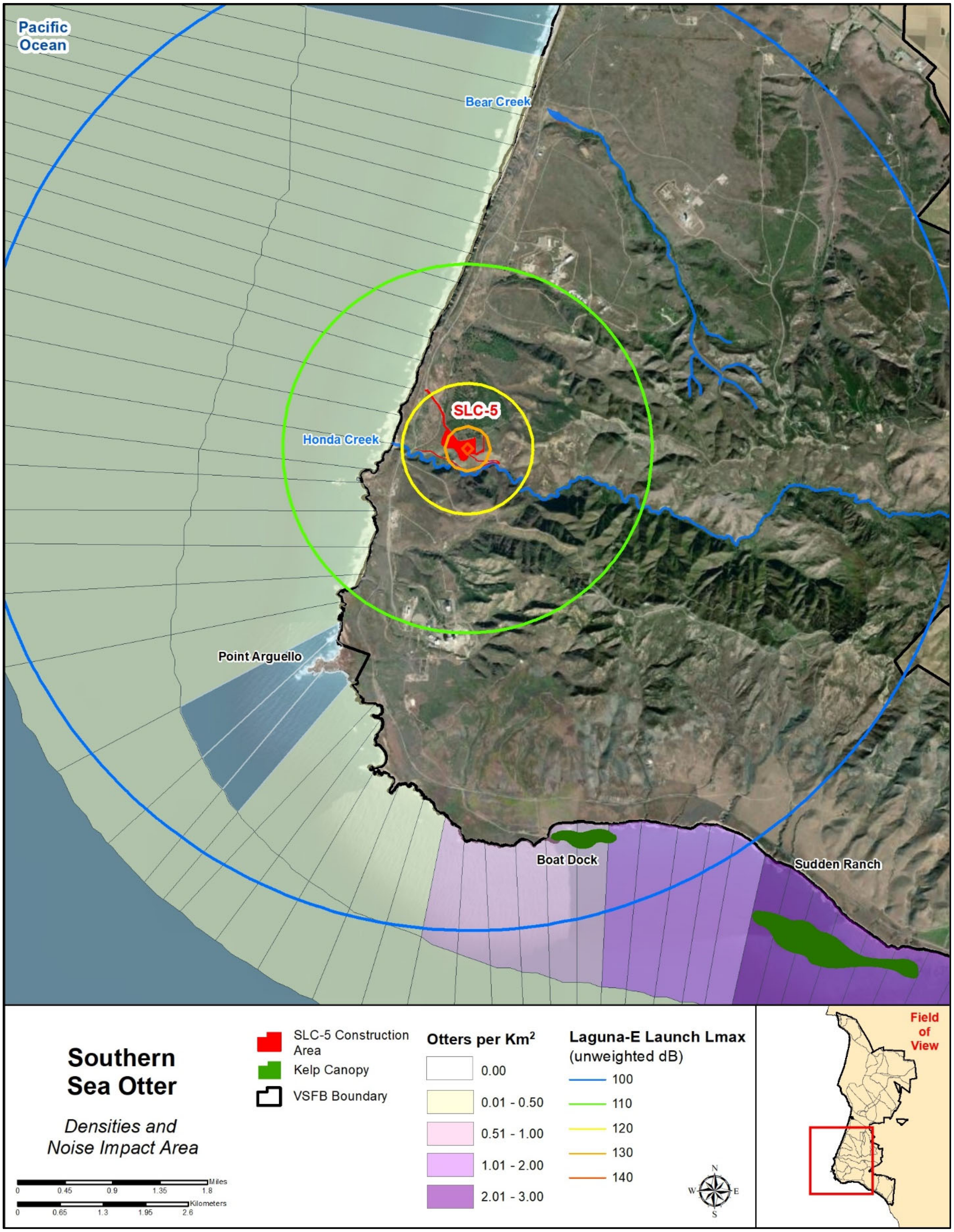

Figure 4-6. 2019 southern sea otter densities and noise impact areas (USGS 2020).

5 Analysis of Effects of the Proposed Action

5.1 Direct and Indirect Effects on Species

Effects of an action include direct and indirect effects. Direct effects are those effects that would be caused by or result from the proposed action and occur contemporaneously with the proposed action (USFWS and National Marine Fisheries Service 1998). USFWS regulations define indirect effects as “those that are caused by the proposed action and are later in time, but still are reasonably certain to occur” (50 C.F.R. section 402.02).

For the impact analyses below, engine noise model results for the Laguna-E were used since this vehicle produces higher intensity noise, represents the worst-case scenario, and therefore, would produce conservative analyses of impacts due to noise caused by the Proposed Action.

5.1.1 Tidewater Goby

Physical Impacts

The SLC-5 launch pads would be designed to direct any ejected steam or water and flame produced during launch away from Honda Canyon, thereby avoiding any potential impacts to Honda Creek, where suitable, but currently unoccupied TWG habitat is located. Therefore, the Proposed Action would not have any direct physical impacts on TWG.

Noise Impacts

During up to 48 launch events per year, engine noise produced by the Laguna-E would reach 130 dB L_{max} at potential TWG habitat in Honda Creek (Figure 4-2). Static fire events would similarly reach up to 130 dB L_{max} at this location.

Exceptionally little sound is transmitted between the air-water interface (Godin 2008). Therefore, in-air sound during launches and static fire events is not expected to cause more than a temporary behavioral disruption to fish, if present, in Honda Creek. Since TWG have not been detected during regular survey efforts dating back to 2008 (MSRS 2009, 2016, 2018a), they are unlikely to be present during the proposed launch and static fire activities; however, TWG could potentially recolonize Honda Creek in the future.

Conclusion

Because of the low likelihood of TWG presence in Honda Creek and the minimal transfer of in-air noise into underwater noise, the anticipated level of disturbance from the Proposed Action would be discountable. Therefore, VSFB has determined that the Proposed Action may affect but is not likely to adversely affect the TWG.

5.1.2 California Red-Legged Frog

Physical Impacts

Direct impacts on post-metamorphic CRLF, including injury and mortality, may inadvertently occur during removal of vegetation, site grading and contouring, construction, firebreak and fire access road establishment, and site maintenance from the operation of heavy equipment, machinery, and vehicles. CRLF that may disperse through the project area could become entrapped in any holes or trenches left open overnight. However, open holes and trenches would be covered overnight and the risk of impacts on CRLF will be reduced because biologists will monitor construction activities and search for animals trapped in open holes and trenches. Any CRLF detected within the construction area would be captured and relocated to nearby suitable habitat. In addition, when any demolition, contouring, or construction is occurring at SLC-5, the active construction areas would be surrounded by exclusion fence (see Section 2.3.2). A USFWS approved biologist would be present to monitor vegetation-clearing activities and move any CRLF encountered to the nearest suitable habitat out of harm's way. Regardless, post-metamorphic frogs may be injured or killed during construction and vegetation clearing activities. The risk of introducing or spreading chytrid fungus would be reduced by requiring implementation of the DAPTF Fieldwork Code of Practice (DAPTF 2019).

During launches, ejected steam, deluge water, and flame may injure or kill CRLF that are in the vicinity of the launch pad or exhaust ducts at time of launch. However, the launch pads would be designed to direct any ejected steam or water and flame away from Honda Canyon, therefore avoiding any potential impacts to Honda Canyon, where frogs would be most likely to occur. Additionally, the exhaust ducts would be maintained free of water between launches and deluge water would only be added for 20-seconds (T-10 seconds to T+10 seconds). Any ejected water would be captured in a retention basin. Retained water would be tested for hydrocarbon contamination in the days following each launch. If the resulting values are compliant with the Vandenberg Hazardous Waste Management Plan (Department of the Air Force 2019), the water will be drained to grade. Otherwise, water will be pumped and properly disposed of as wastewater. Any water retention basins would be designed to exclude access by CRLF. If such exclusion is not possible, and water is present in retention basin overnight, the basin would be checked daily for CRLF prior to pumping. Finally, due to vegetation management around the proposed launch pads, the likelihood of CRLF being present near the pads during launch events would be very low.

Noise Impacts

During up to 48 launch events per year, engine noise from Laguna-E vehicles would reach 130 dB L_{max} in areas known to be occupied by CRLF in Honda Creek. Static fire events would similarly reach up to 130 dB L_{max} in Honda Canyon. Engine noise would reach as high as 144 dB L_{max} in upland CRLF dispersal habitat on SLC-5 during these events. However, vegetation management in the immediate vicinity of launch vehicle launch sites would make CRLF presence above ground in these areas unlikely during typical dry conditions.

All life stages of CRLF can detect noise and vibrations (Lewis & Narins 1985) and are assumed to be able to perceive the engine noise produced by launch vehicles. There are no studies on the effects of noise on CRLF, and few studies on the effects of noise disturbance on anurans in general. Those studies that have been conducted have often focused on the effects of sustained vehicle noise associated with roads near breeding ponds, which have been shown to have negative effects on individual frog's behavior and physiology and may have consequences for populations (see examples in Parris et al. 2009 and Tennessen et al. 2014). However, impacts from engine noise would be of short duration and, therefore are expected to have different effects on frogs than sustained noise.

Engine noise would likely trigger a startle response in CRLF, causing them to flee to water or attempt to hide in place. It is likely that any reaction would be dependent on the sensitivity of the individual, the behavior in which it is engaged when it experiences the noise, and the sound level (e.g., higher stimuli would be more likely to trigger a response). Regardless, the reaction is expected to be the same – the frog's behavior would be disrupted and it may flee to cover in a similar reaction to that of a frog reacting to a predator. As a result, there could be a temporary disruption of CRLF behaviors including foraging, calling, and mating (during the breeding season). However, frogs tend to return to normal behavior quickly after being disturbed. Rodrıguez-Prieto and Fernandez-Juricic (2005) examined the responses in the Iberian frog (*Rana iberica*) to repeated human disturbance and found that the resumption of normal behavior after three repeated human approaches occurred after less than four minutes. Sun and Narins (2005) examined the effects of airplane and motorcycle noise on anuran calling in a mixed-species assemblage, including the sapgreen stream frog (*Rana nigrovittata*). Sun and Narins found that frogs reduced calling rate during the stimulus but the sapgreen stream frog increased calling rate immediately after cessation of the stimuli, likely in response to the subsequent lull in ambient sound levels. Similarly, qualified biologists working on VSFB and elsewhere in CRLF occupied habitat have routinely observed a similar response in this species after disrupting individuals while conducting frog surveys (A. Abela, M. Ball, and J. LaBonte, pers. obs.). CRLF would, therefore, be expected to resume normal activities quickly once the disturbance has ended and any behavioral response would be short term.

Although no studies have been conducted on hearing damage in CRLF, Simmons et al. (2014) found that consistent morphological damage of hair cells in the hearing structures of American bullfrogs (*Lithobates catesbeianus*), which are within the same Family as the CRLF (Ranidae), were observed with exposure to sound levels greater than 150 dB L_{max} SEL. Even after such hearing damage, bullfrogs showed full functional recovery within 3 to 4 days, thus the hearing damage was temporary (Simmons et al. 2014). CRLF in terrestrial environments may be exposed to engine noise levels of 144 dB L_{max} and, therefore, even temporary hearing damage would be unlikely for CRLF that may be present. Additionally, due to vegetation management around the proposed launch vehicle sites, the likelihood of CRLF being present in terrestrial environments exposed to these noise levels would be very low and few individuals would be impacted.

Artificial Lighting Impacts

The effects of artificial lighting on anurans are inconsistent and appear to vary by species and life stage (reviewed in Dutta 2018 and Froglife 2019). Frogs illuminated with acute artificial light originating from flashlights have been shown to reduce calling frequency (Baker & Richardson 2006; Hall 2016). Reduced calling has the potential to negatively impact breeding and, therefore, affect population dynamics (Baker & Richardson 2006).

The reaction to acute artificial light exposure may be different than that to diffused artificial ambient light, such as facility lighting. In studies on wood frogs (*Lithobates sylvaticus*), experimental exposure to artificial light at night was found to make them more vulnerable to other stressors such as parasites and pollution (May et al. 2019). In a study designed to mimic artificial light generated by street and outdoor lighting on common toads (*Bufo bufo*) during their breeding period, the total time spent in activity by male toads decreased by more than half due to decreases in activity during the night period. There were also changes in energy metabolism. Coupled, these changes have the potential to impact reproduction and overall fitness in species exposed to artificial light at night (Touzot et al. 2019).

If facility lighting associated with the Proposed Action results in an increased presence of artificial light in the Honda Creek riparian corridor CRLF are likely to be adversely impacted. However, except when necessary for safety or performance of launch operations, artificial lighting at the SLC-5 facility would be minimized during the hours of darkness. In addition, modeling of the preliminary lighting plan shows that lighting levels of 1-foot candle would not extend beyond the SLC-5 facility (Figure 5-1).

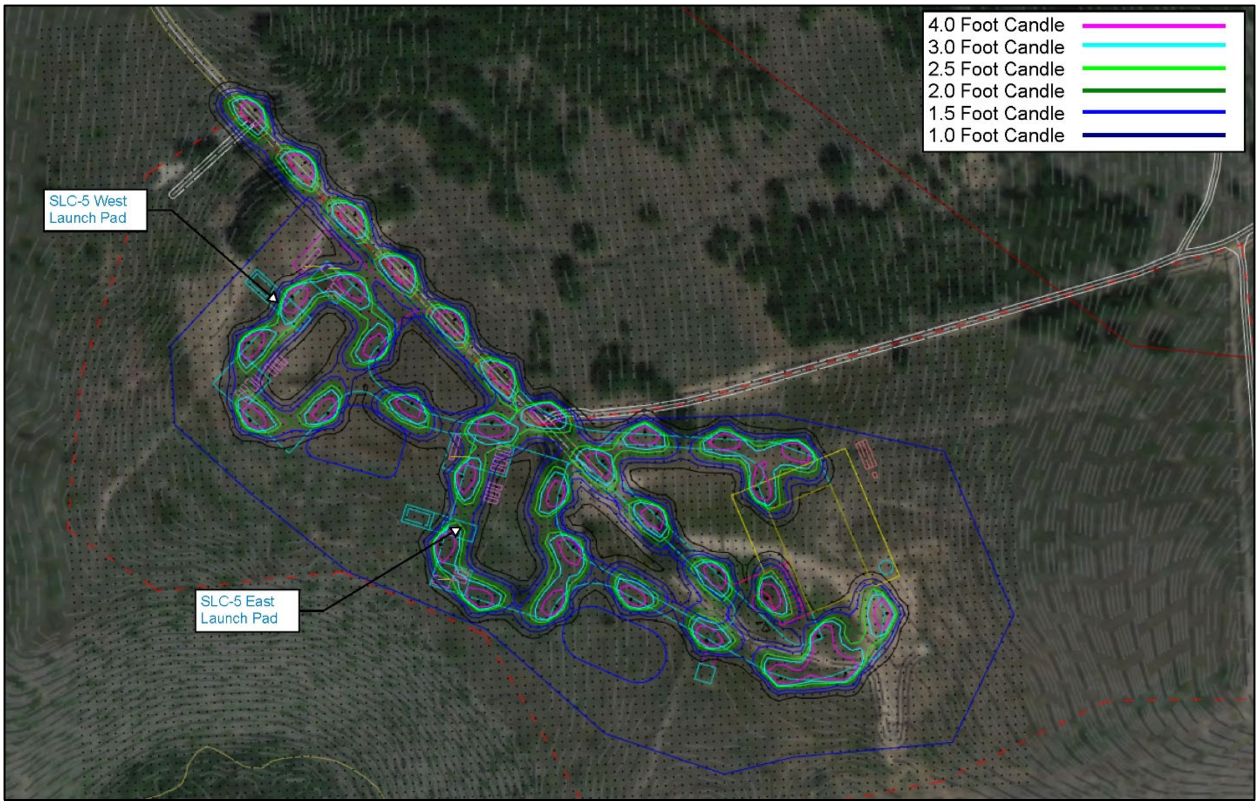

Figure 5-1. Modeling of light intensity at SLC-5 based on the preliminary lighting plan.

Habitat Impacts

The Proposed Action would not have any impacts to CRLF aquatic habitat. The Proposed Action may, however, result in a degradation in the quality of CRLF aquatic habitat in Honda Creek through exposure to artificial light at night. As noted above and in Section 2.4.2, artificial lighting at a project site will be minimized during the hours of darkness, except when necessary for safety or performance of launch operations, and, to the maximum extent practicable, lights would be placed and designed to minimize illumination of Honda Canyon.

Construction of SLC-5 and the associated firebreaks, fire access road maintenance, and utility corridor would result in impacts to approximately 37.8 ac (15.3 ha) of suitable CRLF upland dispersal habitat (Note: total excludes existing paved roads).

Conclusion

VSFB has determined that noise, artificial lighting, and potential physical impacts may affect, and are likely to adversely affect, CRLF, but the effects would be minimized through the implementation of minimization and monitoring measures.

5.1.3 Marbled Murrelet

Physical and Habitat Impacts

No ground disturbing activities or vegetation management activities would occur within or near MAMU habitat; therefore, these actions will have no effect on MAMU. The potential effects of noise are discussed below.

Noise and Visual Disturbance

MAMU have occasionally been observed between the late summer through winter foraging off the coast of south VSFB (eBird 2021). Although unlikely, if MAMU were present immediately off the coast during a Laguna-E launch event, they would experience engine noise of less than 120 dB L_{max} (Figure 4-3). During static fire events, noise directly off the coast of SLC-5 would be less than 115 dB L_{max}. Noise levels during Daytona-E launches and static fire events would be less than those produced by the Laguna-E. Additionally, the majority of MAMU are found in a band about 984 to 6,561 ft (300 to 2,000 m) from shore (Strachan et al. 1995) where noise levels would decrease to as low as 110 dB L_{max}. MAMU do not nest on VSFB so exposure to noise impacts would be limited to foraging adults.

Very little data are available regarding MAMU's response to noise and visual disturbances; however, Bellefleur et al. (2009) examined the response of MAMU to boat traffic. MAMU response was found to depend on the age of the birds, the distance and speed of the boats encountered, and the season. MAMU either showed no reaction, flew, or dove in response. Late in the season (July through August), some MAMU were found to fly completely out of feeding areas when approached by boats traveling in excess of 17.9 mi per hour (28.8 km per hour). The dominant response of MAMU to approach by boats was, however, for birds to dive and resurface a short distance away. MAMU are, therefore, expected to exhibit a startle response that will cause birds to dive and resurface, but they are expected to return to normal behavior soon after each launch or static fire event has been completed.

Conclusion

Because MAMU would be unlikely to be present during a launch or static fire event, and the expected impact would be a temporary behavioral reaction in response to noise, the Proposed Action would have a discountable effect on MAMU. Therefore, VSFB has determined that the Proposed Action may affect, but is not likely to adversely affect, the MAMU.

5.1.4 Western Snowy Plover

Physical and Habitat Impacts

No ground disturbing activities or vegetation management activities would occur within or near SNPL habitat; therefore, these actions would have no effect on SNPL. The potential effects of noise are discussed below.

Noise and Visual Disturbance

SNPL would be exposed to levels between 100 and 110 dB L_{max} during Laguna-E launches (Figure 4-4) and less than 100 dB L_{max} during static fire events. SNPL monitoring for impacts from launch-related engine noise and visual disturbance has been conducted during numerous launches on VSFB. Direct observations of wintering birds were made during a Titan IV and Falcon 9 launch from SLC-4E (SRS Technologies, Inc. 2006b; Robinette and Ball 2013). The Titan IV launches resulted in sound levels of 130 dBA L_{max}. SNPL did not exhibit any adverse reactions to these launches (SRS Technologies, Inc. 2006b; Robinette and Ball 2013) with the exception of one observation. During the launch of a Titan II from SLC-4W in 1998, monitoring of SNPL found the nest located closest to the launch facility had one of three eggs broken after the launch (Applegate and Schultz 1998). The cause of the damaged egg was not determined.

More recently on 12 June 2019, SNPL response was documented during a SpaceX Falcon 9 launch and first stage recovery at SLC-4. The return flight of the first stage to VSFB produced a 3.36 psf sonic boom and landing engine noise of 138 dB L_{max} and 130 dB SEL, as measured on South Surf Beach. SNPL response to the noise impacts was documented via pre- and post-launch monitoring and video recording during the launch event. Incubating SNPL captured on video were observed to startle and either jump or hunker down in response to the sonic boom. One SNPL egg showed signs of potential damage. This egg was part of a three-egg clutch in which the other two eggs successfully hatched. It is not uncommon for one or more eggs from a successful nest to not hatch. Failure of the egg to hatch could not be conclusively tied to the launch event (Robinette and Rice 2019).

On Santa Rosa Island, impacts on SNPL related to the Proposed Action would be substantially less. There would not be any exposure to launch engine noise or associated visual stimuli, and the sonic booms produced during launches are not expected to impact the island based on the trajectories analyzed (Figure 4-5). If a change in trajectory were to occur such that SNPL breeding habitat on Santa Rosa Island was impacted by a sonic boom, is not likely exceed 1.5 psf, although a sonic boom as high as 2.0 psf is possible. Such a sonic boom would have a short term, transitory impact and would affect relatively few individuals. Given the low chance of sonic boom impacts and the small magnitude of expected sonic booms, the impacts on SNPL on Santa Rosa Island would be insignificant.

Conclusion

VSFB has determined that the Proposed Action may affect, and is likely to adversely affect, the SNPL on VSFB. Further, VSFB has determined that the Proposed Action may affect, but is not likely to adversely affect, the SNPL on Santa Rosa Island. USFWS approved biologist would monitor SNPL to assess any potential adverse impacts on the species at VSFB, during the first launches of the Daytona-E and Laguna-E. If no adverse effects are found, the USSF would discontinue monitoring with USFWS concurrence.

5.1.5 California Condor

Physical and Habitat Impacts

The Proposed Action Area is outside the normal range of the species and the species is not known to breed within the Proposed Action Area; therefore, physical impacts to habitat associated with the Proposed Action would have no effect on California condor. The potential effects of noise are discussed below.

Noise and Visual Disturbance

It has been difficult to analyze the effect human disturbance could have on California condors. Generally, California condors are less tolerant of human disturbances near nesting sites than at roosting sites. The species is described as being "keenly aware of intruders" and may be alarmed by loud noises from distances greater than 1.6 mi. (2.6 km). In addition, the greater the disturbance in either noise level or frequency, the less likely the condor would be to nest nearby. As such, USFWS typically requires isolating roosting and nesting sites from human intrusion (USFWS 1996). Noise from a launch coupled with visual disturbance could cause a startle response and disrupt behavior if a condor is within the Proposed Action Area.

Although launch noise and visual disturbance may cause a startle response and disrupt behavior, the likelihood of a condor being present during these activities is extremely low and, therefore, the effect of the Proposed Action would be discountable.

Conclusion

The overall likelihood of a California condor occurring within the Proposed Action Area during a launch or static fire event is extremely unlikely, hence, discountable. Therefore, VSFB has determined that Proposed Action may affect, but is not likely to adversely affect, the California condor. The USSF will coordinate with the USFWS and Ventana Wildlife Society to monitor for condor presence prior to launches.

5.1.6 Southern Sea Otter

Physical and Habitat Impacts

No ground disturbing activities or vegetation management activities would occur within southern sea otter habitat; therefore, these actions will have no effect on the southern sea otter. The potential effects of noise and visual disturbance are discussed below.

Noise and Visual Disturbance

Otters present directly offshore of SLC-5 during a Laguna-E launch would experience noise levels of less than 120 dB L_{max} (Figure 4-6). During static fire noise directly off the coast of SLC-5 would be less than 115 dB L_{max}. However, otters are only occasionally observed along the coast between Purisima Point and Point Arguello, likely transiting through the area. Beginning at the Boat Dock and continuing to the south along Sudden Flats, the inshore habitat supports expansive kelp beds and a relatively high density of otters (Figure 4-6). Noise levels during a Laguna-E launch would reach between 100 and 110 dB L_{max} in these areas (Figure 4-6).

Exceptionally little sound is transmitted between the air-water interface; thus, in-air sound would not have a significant effect on submerged animals (Godin 2008). In addition, according to Ghoul & Reichmuth (2014), "Under water, hearing sensitivity [of sea otters] was significantly reduced when compared to sea lions and other pinniped species, demonstrating that sea otter hearing is primarily adapted to receive airborne sounds." This study suggested that sea otters are less efficient than other marine carnivores at extracting noise from ambient noise (Ghoul & Reichmuth 2014). Therefore, the potential impact of underwater noise caused by in-air sound would be insignificant and discountable.

Extensive launch monitoring has been conducted for sea otters on both north and south VSFB, with pre- and post-launch counts and observations conducted at rafting sites immediately south of Purisima Point for numerous Delta II launches from SLC-2 and one Taurus launch from Launch Facility-576E and at the rafting sites off of Sudden Flats for two Delta IV launches from SLC-6. No abnormal behavior, mortality, or injury of effects on the population has ever been documented for sea otter as a result of launch-related disturbance (SRS Technologies, Inc. 2006a, 2006b, 2006c, 2006d, 2006e, 2006f, 2006g; MSRS 2007a, 2007b, 2007c, 2008a, 2008b). More recently, for the SpaceX Falcon 9 SAOCOM launch and landing on 7 October 2018, sea otters were monitored during pre- and post-launch surveys on south VSFB (MSRS 2018b). The sonic boom received at the otter monitoring location was estimated at 0.71 psf and the maximum landing engine noise at this location was estimated at 99.5 dB L_{max}. Count totals of both pups and adults were similar before and after the launch and there was no discernable impact on otters on south VSFB.

A prior study suggests that sea otters may be able to acclimate to sound exposures in excess of those anticipated due to the Proposed Action. Davis et al. (1988) conducted a study of northern sea otter's (*Enhydra lutris kenyoni*) reactions to various underwater and in-air acoustic stimuli. The purpose of the study was to identify a means to move sea otters away from a location in the event of an oil spill. Anthropogenic sound sources used in this behavioral response study included truck air horns and an acoustic harassment device (10 to 20 kHz at 190 dB) designed to keep dolphins and pinnipeds from being caught in fishing nets. The authors found that the sea otters often remained undisturbed and quickly became tolerant of the various sounds. When a fleeing response occurred as a result of the harassing sound, sea otters generally moved only a short distance (328 to 656 ft [100 to 200 m]) before resuming normal activity (Davis et al. 1988).

Curland (1997), studying the southern sea otter, also found that they may acclimate to disturbance. The author compared otter behavior in areas with and without human-related disturbance (e.g., kayaks, boats, divers, planes, sonic booms, and military testing at Fort Ord) near Monterey, California. Otters spent more time traveling in areas with disturbance compared to those without disturbance; however, there was no significant differences in the amount of time spent resting, foraging, grooming, and interacting, suggesting that the otters were becoming acclimated to regular disturbances from a variety of sources (Curland 1997). Extensive launch monitoring of sea otters on VSFB has shown that launch noise is not a primary driver of sea otter behavior or use of the habitat along Sudden Flats and has not had any apparent long-term consequences for populations, potentially indicating that this population has acclimated to launch activities. Therefore, any impacts as a result of noise or visual disturbance are expected to be limited to minor behavioral disruption and, therefore, insignificant.

Conclusion

VSFB has determined that the Proposed Action would have an insignificant impact on otters and therefore, may affect, but is not likely to adversely affect, the southern sea otter off the coast of VSFB.

5.2 Direct and Indirect Effects on Critical Habitat

5.2.1 Tidewater Goby

The Proposed Action Area does not overlap TWG Critical Habitat. Therefore, the Proposed Action would have no effect on Critical Habitat for this species.

5.2.2 California Red-Legged Frog

The Proposed Action Area does not overlap CRLF Critical Habitat. Therefore, the Proposed Action would have no effect on Critical Habitat for this species.

5.2.3 Marbled Murrelet

The Proposed Action Area does not overlap MAMU Critical Habitat. Therefore, the Proposed Action would have no effect on Critical Habitat for this species.

5.2.4 Western Snowy Plover

The Proposed Action Area includes portions of Santa Rosa Island which are designated Critical Habitat for the SNPL. These areas would potentially receive sonic booms of up to 2 psf during launch events (Figure 4-5). The Proposed Action does not include any ground disturbance within Critical Habitat nor would it appreciably diminish the species' prey base or any other physical features of habitat. Therefore, the Proposed Action would have no effect on Critical Habitat for this species.

5.2.5 California Condor

The Proposed Action Area does not overlap California Condor Critical Habitat. Therefore, the Proposed Action would have no effect on Critical Habitat for this species.

5.2.6 Southern Sea Otter

The USFWS has not designated Critical Habitat for the southern sea otter. Therefore, the Proposed Action would have no effect on Critical Habitat for this species.

5.3 Cumulative Effects

Cumulative effects are defined in 50 C.F.R. § 402.02 as “those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the Action Area of the Federal action subject to consultation.” Reasonable, foreseeable, future federal actions, and potential future federal actions, that are unrelated to the Proposed Action, are not considered in the analysis of cumulative effects because they would require separate consultation pursuant to Section 7 of the ESA. There are no known cumulative effects related to the Proposed Action.

5.4 Interrelated and Interdependent Effects

Under USFWS's regulations, interrelated actions are "those that are part of a larger action and depend on the larger action for their justification." Interdependent actions are "those that have no independent utility apart from the action under consideration" (50 C.F.R. § 402.02). There are no interrelated or interdependent actions related to the Proposed Action.

6 Conclusion

Phantom proposes to conduct space launch activities of the Daytona-E and Laguna-E vehicles at SLC-5 on VSFB. This Proposed Action would result in ground disturbance during construction and increases in airborne noise and visual disturbance during launches and static fire events within the Proposed Action Area.

After reviewing the Proposed Action, including the proposed avoidance, minimization, and monitoring measures (Section 2.4), the USSF has come to the conclusions which are summarized in Table 6-1.

Table 6-1. Federally listed species with potential to occur in Santa Barbara County and summary of effects determinations.

Common Name	Scientific Name	Federal Listing	Critical Habitat	General Habitat	Effects Determinations
Tidewater Goby	*Eucyclogobius newberryi*	Endangered	Designated, no overlap with Action Area	Estuaries and lagoons typically in areas of fresh-saltwater interface	May affect, but is not likely to adversely affect.
California Red-legged Frog	*Rana draytonii*	Threatened	Designated, no overlap with Action Area	Coastal drainages of central California with aquatic breeding areas (ponds, creeks, marshes, springs, etc.) and upland habitat	May affect, and is likely to adversely affect.
Marbled Murrelet	*Brachyramphus marmoratus*	Threatened	Designated, no overlap with Action Area	Coastal species, nests in high trees within coastal forests	May affect, but is not likely to adversely affect.
Western Snowy Plover on VSFB	*Charadrius nivosus*	Threatened	Designated, no effect on Critical Habitat on Santa Rosa Island	Coastal beaches, breeds above the high tide but may also breed in salt ponds and dredged material sites	May affect, and is likely to adversely affect.
Western Snowy Plover on Santa Rosa Island					May affect, but is not likely to adversely affect.
California Condor	*Gymnogyps californianus*	Endangered	Designated, no overlap with Action Area	Large remote areas; nests in rock formations and trees	May affect, but is not likely to adversely affect.
Southern Sea Otter	*Enhydra lutris nereis*	Threatened	Not Designated	Shallow coastal waters with kelp beds	May affect, but is not likely to adversely affect.

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April 24, 2023

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Subject: Biological Opinion on the Construction and Operation of the Phantom Launch Program at Space Launch Complex 5, Vandenberg Space Force Base, Santa Barbara County, California (2022-0045260-S7).

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion based on our review of the U.S. Space Force's (Space Force) proposed authorization of the Phantom Space Corporation (Project Proponent) to construct and operate the Phantom Launch Program at Space Launch Complex (SLC)-5, Vandenberg Space Force Base (VSFB), Santa Barbara County, California and its effects on the federally threatened California red-legged frog (*Rana draytonii*) and western snowy plover (*Charadrius nivosus*), in accordance with section 7 of the Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 et seq.). We received your August 1, 2022, request for consultation on August 2, 2022.

We have based this biological opinion on information that followed your original May 18, 2022 request for consultation (Kaisersatt, S., pers. comm., 2022a), including the biological assessment (MSRS 2022a), and further coordination between Space Force and Service staff. These documents, and others relating to the consultation, are located at the Ventura Fish and Wildlife Office.

Definitions Related to Launch Noise Disturbance

The following abbreviations and terms related to launch noise disturbance occur frequently throughout this document. We define them briefly here for clarification and discuss them in more detail below under *Description of the Proposed Action*.

<u>Launch and Static Test Fire Noise</u>

The proposed project would generate engine noise disturbance with the highest sound pressure level (SPL) modeled to be 144 unweighted decibels (dB). The highest sound level measure during a single event is called the L_{max} (MSRS 2022a, p. 44).

Launch Sonic Boom

Each proposed launch would generate a separate sonic boom disturbance event that will not impact terrestrial areas (York, D., in litt., 2022, p. 6). Each sonic boom would produce disturbance in the form of overpressure which is high energy impulsive sound that would last for a fraction of a second. The maximum applicable overpressure produced for the purposes of this analysis would be up to 1.5 pounds per square foot (psf; MSRS 2022a, p. 11).

Not Likely to Adversely Affect Determination

The Space Force's request for consultation also included the determination that the proposed action may affect but is not likely to adversely affect the federally threatened marbled murrelet (*Brachyramphus marmoratus*) and southern sea otter (*Enhydra lutris nereis*), and the federally endangered California condor (*Gymnogyps californianus*), unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*), and tidewater goby (*Eucyclogobius newberryi*).

Marbled Murrelet

There were 23 total observations of marbled murrelets offshore from VSFB between 1995 and 2020 (MSRS 2022a, pp. 40-41; eBird 2022). In 2011, one observation from approximately 2 miles north of SLC-5 indicated presence of a marbled murrelet at an unreported distance offshore. Two additional observations from 1995 each indicated an individual present offshore from Purisima Point. The remaining observations occurred north of Minuteman Beach. Marbled murrelets do not breed on VSFB due to lack of breeding habitat, limiting the impacts of project activities to foraging adults. Marbled murrelet observations in this area have occurred as close as 984 to 6,561 feet from the shore (Strachan et al. 1995, p. 247).

Sound pressure and overpressure levels produced from the project's proposed operations have the potential to affect marbled murrelets in the vicinity of SLC-5. The Launch Noise Effect Area encompasses the Construction Effect Area and extends over the Pacific Ocean (Appendix A, Figures 2a and 2b), and the project area affecting marbled murrelets is a portion of offshore ocean encompassed by a 100 dB L_{max} contour (MSRS 2022a, p. 40). If marbled murrelets were to be present immediately off the coast during the proposed activities, they would be subjected to launch noise levels up to 120 dB L_{max} for launches or 115 dB L_{max} for static fire events (MSRS 2022a, p. 40). However, the further out areas typically inhabited by marbled murrelets would experience much lower noise levels. It is unknown how various noise and overpressure levels can affect marbled murrelet hearing capabilities, but we expect any nearby individuals to exhibit a startle response (i.e., dive and resurface) during launch or static fire events and return to normal behavior post-event (Bellefleur et al. 2009, p. 535).

The Space Force did not produce a strike probability analysis for the proposed action, but the Service assumes there is an extremely low probability of a strike potential due to the scarcity and transitory nature of marbled murrelets occurring in the project vicinity. It is unlikely for marbled murrelets to be present at the exact moment of each launch or static fire event. If a projectile or a component of launches struck a marbled murrelet on the water surface, it could result in injury or death to the individual, but the probability of a direct strike would be extremely low.

After reviewing the information provided, we concur with your determination that the proposed project may affect but is not likely to adversely affect the marbled murrelet on the basis of discountable effects. Our concurrence is based on the following:

1. Marbled murrelets occur irregularly and only as adults foraging offshore. They do not breed within the project area.
2. Monitoring data indicate maximum noise levels produced from launch operations are unlikely to have a significant effect on marbled murrelets. Effects would likely include only temporary behavioral reactions to noise disturbance.
3. The probability of launch debris striking a marbled murrelet individual is extremely low.

Southern Sea Otter

Southern sea otters are irregularly present in transit or foraging off the coast to the west and south of SLC-5. A small breeding colony of southern sea otter is located approximately 4 miles south of SLC-5 at the boat harbor, near Sudden Flats, and is located within the Launch Noise Effect Area (Appendix A, Figures 2a and 2b). Consequently, noise produced from the proposed project's launch operations has the potential to affect southern sea otters in the vicinity of SLC-5. No southern sea otter habitat is available within the launch pad Construction Effect Area (Appendix A, Figure 1). No southern sea otters are known to occur in the Overpressure Effect Area or Vehicle Splashdown Effect Area (Appendix A, Figure 3).

Southern sea otters located offshore at the time of a launch within the vicinity of SLC-5, including the breeding colony at the boat harbor, may be impacted by routine noise levels of less than 120 dB L_{max} and associated visual disturbance during individual launches (MSRS 2022a, p. 15). Monitoring data during space launch activities since 1998 indicate that launch noise and visual disturbances do not substantially affect the number or activities of southern sea otter in the nearshore marine environments of VSFB (Service 2015a, p. 4; MSRS 2022a, p. 69). Southern sea otters adjacent to LF-05 on north base have historically experienced launch noise of 136.6 dB SPL associated with Peacekeeper launches and continue to experience 127.8 dB SPL associated with Minuteman III launches with no observed effects (SRS 1999a as cited in MSRS 2021, p. 55). Consequently, the Service assumes that noise levels and visual disturbance resulting from individual launches associated with the proposed project's launch program would be similar to those already experienced on base and unlikely to result in observable effects to southern sea otter.

The proposed project would introduce novel launch noise disturbance frequency with launch related disturbance event every 2 days. Previous research indicates that sea otters may be capable of some level of acclimatization to noise. Davis, Williams, and Awbrey (1988) conducted a study of northern sea otter's (*Enhydra lutris kenyoni*) response to underwater and in-air noise stimuli utilizing a variety of sounds including air horns and an underwater acoustic harassment device capable of producing 190 dB SPL, for longer period playbacks (sound pulses every 15 seconds over a maximum of 3 hours (Davis et al. 1988, pp. 7 and 14). When exposed to the louder underwater acoustic harassment device, they remained undisturbed (Davis et al. 1988, p. 22). Following noise exposure to the air horn, the northern sea otter exhibited a startle, fleeing response. However, when a specific noise triggered a startle response, individuals only moved between 300 to 600 feet before resuming normal activity and exhibited habituation to the variety of noise stimuli over a short amount of time (Davis et al. 1988, pp. 31 and 35). Consequently, the Service anticipates any southern sea otters within the project area may exhibit a startle response to initial launch noise disturbance which may cause them to move a short distance but that they will likely resume normal behavior soon after. We also anticipate that southern sea otters located off the coast of VSFB may already exhibit a degree of habituation due to the existing launch environment and we do not currently expect the proposed project to result in novel effects.

Permanent and temporary threshold shifts in hearing sensitivity have yet to be determined for the southern sea otter. Based on biological similarities to southern sea otter, the Service has reviewed thresholds developed by U.S. Navy and the National Marine Fisheries Service for otariid pinnipeds as a surrogate (Finneran and Jenkins 2012, p. 5, 19-21; Navy 2017, p. 164). The lower limit for temporary threshold in-air shifts for otariids is 170 dB SPL and the lower limit permanent threshold in-air shift is 176 dB SPL (Navy 2017, p. 164). Being that the Service anticipates these levels would be above the predicted exposure level of 110 dB L_{max} for southern sea otters due to the proposed action and that individual noise occurrences will be of short duration (less than one minute), the Service does not anticipate associated temporary or permanent hearing loss.

If a launch component or associated debris struck a southern sea otter on the water surface, it could result in injury or death to the individual. The Space Force did not produce a projectile strike probability analysis for the proposed action. Without this information, the Service assumes there is an extremely low probability of a strike potential being that sea otters are not known to occur in the Vehicle Splashdown Effect Area which is located a significant distance offshore within the Pacific Ocean to the south of VSFB (Appendix A, Figure 3; Evans, R., Space Force, pers. comm., 2022a). If any debris from launch components fell near shore within the ocean water, it may disturb or injure southern sea otters resting on the water surface being that they occur in small numbers off the coast of VSFB. However, we anticipate that the probability for strike potential would still be unlikely given the extent of the coastline and the presumed small number of generated debris that could fall outside of the Vehicle Splashdown Effect Area.

After reviewing the information provided, we concur with your determination that the proposed action may affect, but is not likely to adversely affect, the southern sea otter on the basis of discountable effects. Our concurrence is based on the following:

1. Monitoring data indicate maximum noise levels produced from launch operations are unlikely to have a significant effect on southern sea otters. Effects would likely be temporary behavioral reactions being that southern sea otters have demonstrated acclimatization to routine noise disturbance.
2. The probability of launch debris striking a southern sea otter individual is extremely low.

California Condor

California condors do not range over VSFB except for one known instance in March 2017, when telemetry data indicated a California condor was within VSFB. This California condor (studbook number 760) was an immature, non-reproductive female hatched in captivity on May 22, 2014, and released in the Ventana Wilderness on November 9, 2016. The individual departed the VSFB area on April 12, 2017, and later died on approximately July 19, 2017, in northern San Luis Obispo County. Under launch monitoring requirements, the Space Force has maintained routine communication with the Service and the Ventana Wildlife Society to monitor California condor locations during launches. California condors have not been present since 2017. However, given the wide-ranging nature of this species, other California condors may occur on VSFB in the future if this species expands into their historical range.

Sound pressure levels produced from the proposed project's test firings and launches have a low potential to affect California condors in the vicinity of SLC-5. As described in the recovery plan for California condors, this species appears less tolerant of human disturbances near nesting sites than at roosting sites, and loud noises may alarm them from distances greater than 1.6 miles (Service 1996, p. 5). In addition, the greater the disturbance in either noise level or frequency, the less likely the California condor would be to nest nearby (Service 1996, p. 5). As such, the Service typically recommends isolating roosting and nesting sites from human intrusion when feasible (Service 1996, p. 27). If California condors are present in the project area during the proposed action, they would likely be foraging or roosting, and the noise from a launch or static fire event coupled with visual disturbance could cause a temporary startle response or other minor and temporary behavioral shifts. However, it is unlikely that California condors would be present during these activities or that they would establish nesting on VSFB in the near future.

Avoidance and Minimization Measures

- Prior to any launch, the Space Force will determine if any California condors are present by coordinating with Service and Ventana Wildlife Society personnel (Note: VSFB computers are unable to review the Service's 'Daily Snapshot – California Condor Population' Google Earth imagery). The Space Force will contact the Service if California condors appear to be near or within the area affected by a launch from SLC-5. In the unlikely event that a California condor is nearby, Qualified Biologists will monitor California condor movements in the vicinity of VSFB and coordinate with the Service to analyze data before, during, and after launch events to determine whether any changes in movement occur.

- The Space Force will coordinate with current Service personnel, including Arianna Punzalan, Supervisory Wildlife Biologist, USFWS California Condor Recovery Program, at arianna_punzalan@fws.gov or (805) 377-5471; Joseph Brandt, Senior Biologist, USFWS, at joseph_brandt@fws.gov, 805-677-3324, or 805-644-1766 extension 53324; or Steve Kirkland, California Condor Field Coordinator, USFWS California Condor Recovery Program, at steve_kirkland@fws.gov or 805-766-4630. The Space Force will also coordinate with current Ventana Wildlife Society personnel, including Joe Burnett, Senior Wildlife Biologist, at joeburnett@ventanaws.org or 831-800-7424.

After reviewing the information provided, we concur with your determination that the proposed action may affect, but is not likely to adversely affect, the California condor on the basis of discountable effects. Our concurrence is based on the following:

1. The proposed project is in an area outside the normal range of California condors and the species is not known to breed or roost within the project area.
2. The probability of a California condor being present during project activities is extremely low.

<u>Unarmored Threespine Stickleback and Tidewater Goby</u>

Unarmored threespine stickleback occupy San Antonio Creek from Barka Slough to the lagoon (Swift 1999, p. 17). Tidewater gobies occur in all major drainages of VSFB up to 7.5 miles upstream from the Pacific Ocean (Swift et al. 1997, p. 34). The project area consists of suitable habitat for tidewater goby within Honda Creek and for both species within San Antonio Creek. Neither species has occurred in Honda Creek since 2008 as the creek is becoming shallower and narrower due to drought, making the potential for presence of either species unlikely. In San Antonio Creek, unarmored threespine stickleback occur mostly in the creek channel and tidewater gobies primarily inhabit the lagoon.

The proposed project would not physically impact unarmored threespine stickleback or tidewater goby because SLC-5 launch pads would direct steam, water, and flame away from Honda Canyon where suitable but unoccupied tidewater goby habitat exists. Potential sedimentation during the construction of SLC-5 could result in negative impacts, including injury, death, reduced breeding success, impaired efficiency of gill filaments, and exposure to higher salinities and/or predation as they flee downstream. Additionally, if unarmored threespine sticklebacks or tidewater gobies were present in Honda Creek, launch noise, which could reach up to 130 dB L_{max} at Honda Creek, and vibrations could cause a temporary disruption to individuals. However, using the best available information, the Service anticipates that any perceived disturbance would be temporary and overall unlikely given that neither species occupies Honda Creek, they are unlikely to recolonize in the future, and individuals within San Antonio Creek would be located outside of the Launch Noise Effect Area (Appendix A, Figure 2).

Extending the VSFB water supply line from the source at the San Antonio Creek basin and increasing water usage due to project activities could reduce flow rates, hydration periods, or water levels in San Antonio Creek resulting in negative impacts to unarmored threespine sticklebacks and tidewater gobies. However, the Service reviewed past hydrological assessments (USGS 2019; AECOM 2019) and determined that the estimated 1.69 acre-feet per year (0.06 percent of total annual VSFB water usage) increase in water extraction from the project alone is not anticipated to produce observable effects to these two species.

Avoidance and Minimization Measures

- The Space Force will implement erosion control measures wherever the potential for project-related sedimentation into Honda Creek exists, as described below under section *Avoidance and Minimization Measures* (AM-5).

After reviewing the information provided, we concur with your determination that the proposed action may affect but is not likely to adversely affect the unarmored threespine stickleback or tidewater goby. Our concurrence is based on the following:

1. Unarmored threespine sticklebacks and tidewater gobies do not currently occur in Honda Creek, and there is low likelihood for tidewater goby recolonization.
2. Project-related noise, vibration, and sedimentation are unlikely to impact occupied unarmored threespine stickleback and tidewater goby habitat. The implementation of avoidance and minimization measures will further reduce the potential for effects.
3. Increased water extraction from the San Antonio Creek basin due to proposed project activities in combination with future water use would be negligible.

Our concurrence with the determinations that the proposed action is not likely to adversely affect marbled murrelet, southern sea otter, California condor, unarmored threespine stickleback, and tidewater goby is contingent on the project activities as outlined above being implemented by the Space Force. If the Space Force fails to implement the project as proposed, we will consider our concurrence invalid. If the proposed action changes in any manner, if novel effects associated with the proposed project not previously considered within this concurrence are observed over time, or if new information reveals the presence of listed species in the project area, you must contact our office immediately to determine whether additional consultation is required.

Consultation History

We received your initial May 18, 2022, request for formal consultation in our office on May 18, 2022 (Kaisersatt, pers. comm., 2022a). The Service responded with a request for additional information to clarify the project description and provide effects analyses in relation to the proposed launch frequency and water extraction. The Space Force clarified their original request's effects determination and provided a revised project description and analysis to the Service on August 1, 2022 (Kaisersatt, pers. comm., 2022b). The Service provided a response letter with initial clarifying questions and recommendations on the Space Force's proposed monitoring plan on Sept 26, 2022 (Termondt, S., pers. comm., 2022a). The Space Force responded to comments on November 1, 2022 (Kephart, in. litt., 2022). Both agencies mutually agreed the draft due date of the biological opinion would be on or before January 13, 2023 (Termondt, pers. comm., 2022b). The Space Force provided comments on the draft biological opinion on February 16, 2023 (Kaisersatt, pers. comm., 2023a). Additional minor changes and clarifications to the project description through subsequent phone calls and electronic mails occurred in March 2023 which the Service worked to incorporate into this final biological opinion (Kaisersatt, pers. comm., 2023b).

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

Project Overview

The Space Force proposes to authorize the Project Proponent to construct and operate the Daytona-E and Laguna-E space launch program at VSFB. The purpose of the proposed project is to provide Daytona-E and Laguna-E space launch program service from VSFB to support commercial and government customers. The proposed project would include launch pad construction, auxiliary support facilities, and rocket launch operations.

Space Launch Complex-5 Location

The Space Force would authorize the construction of two new concrete launch pads (SLC-5E and SLC-5W, herein referred to collectively as SLC-5). Launch pad construction would occur in the south base of VSFB, 0.1 mile north of Honda Creek, and sited in between existing SLC-6 and SLC-4 facilities, approximately 2 miles from each. The newly proposed SLC-5 would be located on a previously disturbed site that had supported the former Scout Launch Program which is now inactive. The Space Force had removed the vast majority of the Scout Launch Program's associated infrastructure prior to this proposed project.

Construction

Site Construction

The Space Force would authorize the development of SLC-5 (Appendix A, Figure 1). Each pad would be approximately 1,500 square feet in area. Each pad would contain infrastructure including a launch stool (structure that supports the launch vehicle), flame bucket, deluge water containment system and associated basins, and fuel storage areas.

In addition to the pads, the Space Force would authorize the construction of a 7,500-square-foot horizontal integration facility and an instrumentation site. The Project Proponent would also construct multiple above ground water storage tank systems, holding approximately 21,000 gallons, for the purpose of supplying water to the deluge and fire suppression system on site.

Utilities

The Project Proponent would extend new electrical power, fiber communication, water, and sewage lines from existing sources to SLC-5. The Project Proponent would install these utilities within the footprint of Delphy Road and a 100-foot-wide utility corridor immediately south of the road (Appendix A, Figure 1). They would bury electrical and fiber communication lines within this utility corridor or the road to establish new service connections at SLC-5.

The Space Force removed Scout Launch Program infrastructure materials from SLC-5 prior to this proposed project. In the unlikely event that any remnant Scout Launch Program structures or materials are encountered, they would be located entirely within the SLC-5 Right of Entry and the Space Force would authorize their removal if they interfered with the proposed construction footprint (Kaisersatt, pers. comm., 2022c).

Fencing

During construction, the Space Force would implement and maintain a 3-foot-high low porosity (silt) construction barrier fence. The Space Force would also encompass the work site with a permanent security fence (6 to 8 feet high with standard 2-inch spaced chain link with three stands of barbed wire on the top).

Roads, Firebreaks, and Vegetation Management

The Space Force would authorize the installation of paved access roads between the pads and the support facilities. Delphy Road, an existing roadway that connects SLC-5 to Surf Road and Coast Road, would require significant repair including removal of existing pavement and repaving. Avery and Ladd Roads to the north and northeast of SLC-5 would serve as firebreaks and fire access roads and would also require repairs to meet fire safety requirements. The Space Force would authorize the establishment of firebreaks along the western, southern, and eastern perimeters of SLC-5. During initial site clearing for construction, the Project Proponent would remove woody vegetation using a masticator, chainsaws, or similar equipment.

Staging Areas

The Space Force was unable to provide the exact locations of staging areas. However, the Space Force would require that staging areas would be located within the SLC-5 Right of Entry and/or a designated utility corridor (Appendix A, Figure 1).

Construction Schedule

Work would occur during daylight hours at any time of the year and in three phases. Phase I-A would include construction of SLC-5W, site security, roadways, and primary site utility connections and would occur in 2023. Phase I-B would include construction of the horizontal integration facility and instrumentation pad and would occur in 2024. Phase II would incorporate the construction of SLC-5E, supporting roadways, and utility connections and would occur in 2025. Installation of electrical utilities connecting SLC-5 to existing VSFB may be shifted from Phase I-A to Phase I-B or Phase II (Evans, pers. comm, 2022a).

Operations

Launches

Launch Vehicles

The Space Force would authorize launch operations of two vehicles, Daytona-E and Laguna-E vehicles, at SLC-5. Both the Daytona-E and Laguna-E are small launch vehicles. The Daytona-E is a 54.4-foot, two-stage, ground-launched vehicle. The Laguna-E is a slightly larger two-stage vehicle, at 78.7 feet. Both vehicles would achieve altitude within 1 minute.

Launch Schedule

For the purposes of this analysis, the Space Force includes that at full launch tempo the proposed project would conduct launches weekly being separated by at least four days (York, in litt., 2022, p. 3). Launch operations may occur at any time of day with most launches occurring during the daytime between 0700 to 1900 hours.

The Space Force would also authorize a separate associated static fire test for each launch to provide a thorough test of all systems. Static fire test events would occur within 2 days of each individual launch (York, in litt., 2022, p. 3). Individual launch disturbance would last less than 1 minute and static fire launch would last less than 30 seconds.

Following SLC-5 construction, the Space Force proposes the following staggered launch operation schedule until 2028 when the proposed project would attain full launch tempo with 48 launches and 48 static test fires (Table 1). A launch related disturbance event could occur once every two days consecutively across 192 days annually at full launch tempo in 2028 (Evans, pers. comm., 2022a).

Table 1. The proposed launch schedule from 2023 to 2028 when the launch program will attain full launch tempo.

Calendar Year	Number of Launches	Number of Static Fire Tests
2023	1	1
2024	2	2
2025	5	5
2026	12	12
2027	24	24
2028	48	48

Launch Fueling and Combustion

During launch operations, mobile fuel trailers would supply fuel (liquid oxygen (LOX) rocket propellant or Jet-A) to on-site ground support equipment. The Project Proponent would station these over concrete surfaces approximately 150 feet from either launch pad.

Black carbon (soot) can be a biproduct of rocket launches and is largely a factor of running a fuel-rich mixture, such as a fuel-rich gas generator rocket engine. The Space Force has included that the proposed project uses oxidizer-rich staged combustion engines from Ursa Major Technologies that produce a diminutive amount of soot. Assuming the full cadence of 48 launches per year with a 2-minute first stage flight to space, a total of 1.62 pounds per second of soot would be produced which is estimated to be 195 pounds per year (Kaisersatt, pers. comm., 2022d). Referencing previously produced environmental assessments for other launch operations, the Space Force further specifies that the proposed project's exhaust process results in the complete conversion of produced carbon monoxide into carbon dioxide as well as the oxidation of soot from the gas generation exhaust. The Space Force consequently expects that the produced soot would subsequently burn up in the exhaust plume (Kaisersatt, pers. comm., 2022d). The biological assessment did not include any additional discussion of launch combustion biproducts for the purposes of this analysis.

The Space Force would authorize the installation of a 12.5-foot flame bucket under an approximately 12-square-foot launch stool at each pad. The flame bucket is meant to receive and channel combustion (hot exhaust gases) from a rocket during lift-off. The Project Proponent would connect the flame bucket to a concrete catchment with an underground tank that contains up to 10,000 gallons of water deluge. The *Deluge Water System and Water Usage* section discusses this in more detail below.

Launch Noise

The Space Force provided modeling of individual launches and associated static test fire events for the purposes of this analysis using the L_{max} noise metric. L_{max} is the highest sound level measure during a single launch event. Although it provides some measure of the event, L_{max} does not fully describe the noise disturbance because it does not account for the duration of the sound. Sound exposure level (SEL) considers the length of time a noise occurs and provides a measure of the net impact of the entire acoustic event. In previous analyses, the Service has considered the SEL metric; however, for the purposes of this analysis, the biological assessment did not include SEL information and consequently the Service will use the L_{max} metric.

Variability in noise level between the two vehicle types is approximately 5 dB SPL. The biological assessment did not specify vehicle type use in the proposed schedule and consequently the Service will use the larger Laguna-E vehicle to provide a conservative analysis. The Space Force includes that engine noise would reach as high as 144 dB L_{max} on SLC-5 during launch events with noise level attenuating outward. Noise produced by launch operations to terrestrial areas would last approximately one minute during launches and approximately 30 seconds during static fire events.

Appendix A, Figures 2a and 2b depict the Launch Noise Effect Area, which is the modeled L_{max} footprint of the proposed project generated by noise modeling software (RUMBLE 4.1, Rocket Propulsion Noise and Emissions Simulation, developed by Blue Ridge Research and Consulting). Noise modeling conducted for the proposed project did not consider topography and how topographical features may attenuate or enhance actual noise levels. The modeling does account for the attenuation of sound by the ground surface when estimating the received noise. The model assumes a 5-foot receiver height and a variable ground impedance to account for grass (soft) or water (hard) ground surfaces.

Launch Sonic Boom (*Overpressure*) *and Vehicle Splashdown*

Each proposed launch would generate a sonic boom resulting in overpressures of high energy impulsive sound. Sonic booms are low frequency, impulsive noise events with durations lasting a fraction of a second (BRRC 2020, p. 32). The maximum applicable overpressure produced for the purposes of this analysis would be up to 1.5 psf, occurring entirely within the Pacific Ocean for each vehicle type, typically to the south and west of San Miguel Island. The Space Force has clarified that overpressure would not impact any terrestrial areas, including the Northern Channel Islands (York, in. litt., 2022, p. 4). Appendix A, Figure 3 depicts the modeled sonic boom footprint, or Overpressure Effect Area, provided in the biological assessment. The Space Force utilized PCBoom 6.7b software to calculate the magnitude, waveform, and location of sonic boom overpressures on the ground from supersonic flight operations. Overpressure modeling conducted for the project did not consider topography and how topographical features may attenuate or enhance actual overpressure levels.

Both Laguna-E and Daytona-E launch vehicles would be expendable rockets with equipment that drops into the Pacific Ocean following delivery of payloads into orbit. The biological assessment includes a depiction of various azimuths associated with both vehicle types. The Vehicle Splashdown Effect Area is located entirely within the Pacific Ocean, to the south and west of San Miguel Island (Appendix A, Figure 3). The Space Force does not expect any land mass or shoreline to be present in the Vehicle Splashdown Effect Area.

Deluge Water System and Water Usage

The proposed project would include the development of a deluge water system. The intention of the deluge water system involves spraying water in large volumes to reduce vibration, heat, and energy produced during launch and static test fire operations. The Project Proponent would add deluge water for approximately 10 seconds before and 10 seconds after each launch and static test fire event for a total of 20 seconds.

The Space Force would also authorize the associated construction of multiple water features to support the deluge water system. Features would include two deluge containment basins meant to collect deluge water runoff and four infiltration areas referred to as Storm Water Management areas. The deluge containment basins would have an outlet structure to allow manual discharge of the basin water through a valved discharge pipe. The Project Proponent would screen the outlet pipe with 1/8-inch mesh. After each launch, the Project Proponent would inspect stored water within the basin for any contamination. The Space Force anticipates this inspection process would take up to 3 days in total. If the Project Proponent encounters contamination, they would pump out and dispose of the basin contents per relevant state, Federal, and local regulations. If there is no contamination and it meets relevant state, Federal, and local regulations, the Project Proponent would discharge it from the retention basin to the Stormwater Management Areas for infiltration into the ground. Similarly, the Project Proponent would test any stormwater that accumulates within the flame deflector or water deluge catchment system for any contamination prior to potential release into the Stormwater Management Areas.

The proposed project would use a combined total of 2,100 to 10,000 gallons (0.006 to 0.03 acre-feet) of potable water in the proposed deluge water system during each launch and associated static test fire. At full launch tempo of 48 launch events and 48 static test fire events per year, the Space Force would authorize a maximum of 480,000 gallons (1.47 acre-feet) annually of water usage for the deluge water system. The proposed project would require an additional 72,000 gallons (0.22 acre-feet) annually to support personnel and operational activities at SLC-5 (Kaisersatt, pers. comm., 2022c). Consequently, the Space Force would authorize a maximum of 552,000 gallons (1.69 acre-feet) of water per year to support the project. The current water source for VSFB consists of four water wells located within the San Antonio Creek Basin.

SLC-5 Facility Lighting

The Space Force would authorize the installation of 36 light poles around the perimeter of SLC-5 for security and support of night operations. The light poles would have a maximum height of 40 feet which the Project Proponent would place in holes dug down to approximately 20 feet below the surface. The Space Force provided a preliminary lighting plan within the biological assessment (MSRS 2022a, p. 21). The proposed project would include lighting levels between 1- to 4-foot candle within the SLC-5 facility (MSRS 2022a, p. 59, Figure 5.1–4).

Road maintenance and Associated Vegetation Management

The Space Force would authorize annual routine vegetation clearance on Honda Canyon Road as well as a connected former access road to enable emergency access for fire equipment. Vegetation maintenance would occur within 15 feet of either side of these roadways. Honda Canyon Road is currently paved and the former access road that serves as the connection to SLC-5 consists of gravel. There would be no improvements or repairs to Honda Canyon Road (Kaisersatt, pers. comm., 2023). The improvements to the abandoned access road would involve similar vegetation maintenance and light grading (Kaisersatt, pers. comm., 2022c, p. 4)

Additional vegetation management at SLC-5 would involve routinely mowing the SLC-5 fence line and surrounding firebreaks.

AVOIDANCE AND MINIMIZATION MEASURES

Biologist Definitions

Avoidance and minimization measures included in this biological opinion require various levels of biological competency from personnel completing specific tasks, as defined below:

- Permitted Biologist: Biologist with a valid and current Section 10(a)(1)(A) Recovery Permit issued by the Service or specifically named as a Service Approved Biologist in a project-specific biological opinion. The Space Force will coordinate with the Service prior to assigning Permitted Biologists to a specific project.
- Service Approved Biologist: Biologist with the expertise to identify listed species and species with similar appearance. The Space Force will review and approve the resumes for each individual, and then submit them to the Service for review and approval no less than 15 days prior to the start of the project. A Service Approved Biologist could train other biologists and personnel during surveys and project work; in some cases, a Service Approved Biologist could also provide on-site supervision of other biologists.
- Qualified Biologist: Biologist trained to accurately identify specific federally listed species and their habitats by either a Permitted or Service Approved Biologist. This person could perform basic project monitoring but would need to have oversight from a

Permitted or Service Approved Biologist. Oversight will require a Permitted or Service Approved Biologist to be available for phone/electronic mail consultation during the surveys and to have the ability to visit during monitoring/survey activities if needed.

General Project Avoidance and Minimization Measures

The following protection and monitoring measures would apply to all aspects of the proposed action to protect and minimize effects on biological resources. The Space Force will ensure the Project Proponent takes all identified applicable actions as listed below.

AM-1. The Space Force will require the Permitted or Service Approved Biologists to be responsible for delineating areas where special status species are located or concentrated, relocating special status species during construction activities, and inspecting equipment and equipment staging areas for cleanliness and gas and oil leaks daily. The Space Force will require that contractors immediately address any unanticipated leaks or spills.

AM-2. The Space Force will require a Permitted or Service Approved Biologist to brief all project personnel prior to participating in construction activities. At a minimum, the training will include a description of the listed species and sensitive biological resources occurring in the project area, the general and specific measures, restrictions necessary to protect these resources during project implementation, the provisions of the Act, the necessity of adhering to the provisions of the Act, and the penalties associated with violations of the Act.

AM-3. The Project Proponent will keep disturbances to the minimum extent necessary to accomplish project objectives.

AM-4. The Project Proponent will remove and transport all excess excavated materials to a designated waste or fill site.

AM-5. The Project Proponent will implement erosion control measures wherever potential for project-related sedimentation into Honda Creek exists. The Project Proponent will use all erosion control materials from weed-free sources and, if left in place following project completion, constructed from 100 percent biodegradable erosion control materials (e.g., erosion blankets, wattles, etc.).

AM-6. The Project Proponent will dispose of all human generated trash at the project site properly at the end of each workday with specific attention concerning food waste. Proper waste disposal is deposition of material into a trash receptacle with a lid that will not blow open in the wind. The Project Proponent will not overfill trash receptacles to the point that the lid does not fit properly. Large dumpsters are appropriate for waste disposal which the Project Proponent can maintain within a staging area for this purpose. The Project Proponent will remove all construction debris and trash from the work areas upon completion of the project and will dispose of all waste at a designated waste or fill site approved by 30 CES.

AM-7. The Project Proponent will clean equipment vehicles (dozers, mowers, etc.) of weed seeds prior to use in the project area to prevent the introduction of weeds. A Qualified Biologist will inspect equipment vehicles to verify weed free status prior to use. Prior to site transport, the Project Proponent will remove and clean any skid plates and will clean equipment vehicles of weed seeds daily especially wheels, undercarriages, and bumpers. Prior to leaving the project area, the Project Proponent will clean equipment vehicles with caked-on soil or mud with hand tools such as bristle brushes and brooms at a designated exit area and may subsequently wash vehicles at an approved wash area. The Project Proponent will thoroughly brush equipment vehicles with dry dusted soil (not caked-on soil or mud) prior to leaving a site at a designated exit area; vehicles may alternatively be air blasted on site.

AM-8. The Project Proponent will conduct fueling of equipment in a pre-designated location within the staging area and will place spill containment materials around the equipment before refueling.

AM-9. The Space Force will require a Qualified Biologist to inspect any equipment left overnight prior to the start of work and to check equipment for the presence of special status species in the vicinity and for fluid leaks.

AM-10. The Project Proponent will not leave holes or trenches open overnight and may use plywood sheets or steel plates to cover holes or trenches. A Qualified Biologist will inspect these locations before the resumption of work.

Species-specific Avoidance and Minimization Measures

<u>California Red-legged Frog</u>

AM-11. The Space Force will require Permitted or Service Approved Biologists to be present and monitor activities during construction when project activities are likely to encounter California red-legged frogs that require relocation.

AM-12. Prior to construction activities, the Space Force will require a Qualified Biologist to conduct a training session for all construction personnel. At a minimum, the training will include a description of the California red-legged frog and its habitat, the specific California red-legged frog measures implemented for the current project, and project boundaries.

AM-13. The Space Force will require that a Service Approved Biologist conducts pre-project surveys for California red-legged frog. If no Service Approved Biologist is determined to be available, the Space Force will require a Qualified Biologist to complete these surveys on an as needed basis. Biologists may also conduct additional surveys as needed at their discretion. The Space Force will require that all biologists adhere to the following measures:

a. From November 15 to March 31, the Space Force will require a Service Approved Biologist (or Qualified Biologist, as needed) to conduct a pre-construction survey of project areas within suitable aquatic, adjacent upland, or dispersal habitat (690 feet from aquatic habitat or other distance as determined by a Service Approved Biologist) immediately before the onset of all work activities.

b. From April 1 to November 14, the Space Force will require that a Service Approved Biologist (or Qualified Biologist, as needed) conduct a pre-construction survey of project areas within suitable aquatic or upland habitat (140 feet from aquatic habitat or other distance as determined by a Service Approved Biologist) to identify potential artificial water or shelter resources that may contain California red-legged frogs.

c. A Service Approved Biologist (or Qualified Biologist, as needed) will repeat surveys following any precipitation event greater than 0.2 inch during a 24-hour period.

d. A Service Approved Biologist (or Qualified Biologist, as needed) will monitor any initial ground disturbance or vegetation removal within suitable aquatic, adjacent upland, or dispersal habitat as determined above. After the initial ground disturbance/vegetation removal is complete, the Space Force would not require further monitoring within bare-dirt areas.

AM-14. During construction of the launch site, the Space Force and the Project Proponent will implement the following measures:

a. The Project Proponent will encircle the launch construction site with a minimum of 3-foot-tall silt fencing, anchored with metal T-posts, and buried along the bottom edge to inhibit terrestrial wildlife, including California red-legged frogs, from entering the site. The Space Force will require a Qualified Biologist to inspect the fence daily and direct maintenance to ensure its efficacy.

b. The Project Proponent will conduct all work during daylight hours during periods when there is no rainfall.

c. The Project Proponent will cover any open holes or trenches with plywood or metal sheets if left overnight to minimize the risk of entrapment of California red-legged frogs.

d. The Project Proponent will not conduct construction activities until 24 hours after an actual precipitation event greater than 0.2-inch accumulating within a 24-hour period.

e. The Project Proponent will not stage equipment or supplies overnight within 0.10 mile of California red-legged frog aquatic habitat (see Appendix A, Figure 1). The Project Proponent will implement measures that preclude California red-legged frog from accessing the staging area (e.g., install drift fence barrier).

f. The Space Force will require that a Qualified Biologist surveys the site, including any open holes or trenches, each day prior to initiation of work.

AM-15. The Space Force will require that a Service Approved Biologist conduct any necessary California red-legged frog relocation. If biologists find California red-legged frogs of any life stage within the project area during pre-project surveys, daily monitoring where required, or at any other time, the Space Force will require that all construction activity within the vicinity of the California red-legged frog occurrence cease and will adhere to the following measures:

a. If the Service Approved Biologist is satisfied that work in a different area of the project can continue with no threat to California red-legged frogs, the Space Force may permit work to continue after workers have received a briefing on the area to avoid.

b. The Space Force will require that construction activities within the vicinity of the California red-legged frog occurrence not begin or resume until a Service Approved Biologist relocates the individual(s) or contacts the Service for alternate guidance.

c. Using the Declining Amphibians Task Force Fieldwork Code of Practice (DAPTF 2019), the Space Force will require that the Service Approved Biologist relocate all life stages of California red-legged frog the shortest distance possible to a location that is (1) within the same drainage, (2) contains suitable aquatic/upland habitat, and (3) is outside of the project impact area.

AM-16. The Project Proponent will design retention basins and water storage features to prevent access by California red-legged frogs (York, in. litt., 2022, p. 4) . If total exclusion is not possible, and water is present in retention basins overnight, the Space Force will require that a Qualified Biologist check daily for California red-legged frogs prior to pumping. The Project Proponent will screen the pump with 1/8-inch mesh.

AM-17. The Project Proponent will design deluge containment basins to minimize the amount of stormwater received into the basin (MSRS 2022a, p. 5).

AM-18. The Project Proponent will design Stormwater Management Areas to prevent the presence of standing water, other than immediately after a rainstorm, by using design features similar to a French drain.

AM-19. The Project Proponent will design pads at SLC-5 to prevent discharge of deluge water into surrounding drainages and will divert any overland flow to the deluge containment basins.

AM-20. The Project Proponent will design the position of the flame buckets and deluge system to direct flames and associated steam to the north of SLC-5, away from Honda Canyon, to minimize potential impacts to California red-legged frog.

AM-21. Except when necessary for the performance and safety of launch operations or maintenance, the Project Proponent will minimize artificial lighting at SLC-5 to provide site security during the hours of darkness. For the purposes of this analysis, the Service understands this will include no lighting during construction operations being that the Project Proponent will conduct all work during daylight hours (AM-14).

AM-22. The Space Force will require the development of a lighting plan for the proposed project. The Space Force will design this plan such that the Project Proponent will direct all light away from Honda Canyon and shield it to reduce scatter into natural, undeveloped areas to the maximum extent possible. The Space Force will require that the Project Proponent shield any installed lighting ensuring that illumination lighting levels of 1-foot candle would not extend beyond the SLC-5 facility into natural habitats (MSRS 2022a, p. 59). The Space Force will require that the lighting design includes use of the minimum number of lumens necessary to accomplish lighting requirements. This requirement will be accomplished through strategic placement of lights, and the use of shields, timers, and motion sensors wherever possible to minimize potential effects associated with novel persistent artificial light at night (York, in litt., 2022, p. 6).

AM-23. The Space Force will conduct quarterly night surveys and spring tadpole surveys for California red-legged frog in lower Honda Creek within the 120 dB L_{max} Laguna-E noise contour (Figure 2a). The Space Force will use existing California red-legged frog protocol level survey data collected at lower Honda Creek between 2013 through 2023 prior to construction and launch operations to serve as an existing baseline in coordination with the Service. Comparison of post-launch operation data with the established baseline will allow the Space Force to assess if there are any changes in California red-legged frog habitat occupancy, breeding behavior (calling), and breeding success (egg mass and tadpole densities) in lower Honda Creek as Phantom's launch and static fire tempo gradually increases over six years to reach full cadence (Table 1). The Space Force will record and measure the following during the surveys:

a. California red-legged frog detection density (number of frogs per survey hour) following the same survey methods conducted previously at these sites and throughout VSFB;

b. California red-legged frog locations and breeding evidence (e.g., calling, egg masses);

c. environmental data during surveys (temperature, wind speed, humidity, and dewpoint) to determine if environmental factors are affecting California red-legged frog detection or calling rates;

d. annual habitat assessments to measure flow rates, stream morphology, depths, and sediment to determine if any changes in California red-legged frog metrics are associated with other environmental factors, such as drought;

e. and locations and densities of co-occurring anurans including bullfrogs (*Lithobates catesbeianus*) and Baja California tree frogs (*Pseudacris hypochondriaca*).

AM-24. The Space Force will conduct passive bioacoustic monitoring annually during California red-legged frog breeding season (typically November through April) to characterize the baseline noise environment and determine if there are changes in calling behaviors as launch and static fire tempo gradually increase over six years. Passive bioacoustic recording would occur throughout the entirety of the breeding season using the Wildlife Acoustics Song-Meter 4 (or similar technology) with software that enables autodetection of California red-legged frog calling (Kephart 2022, p. 2). The Space Force will place these passive noise recorders and environmental data loggers (temperature, relative humidity, dew point) at two suitable breeding locations in lower Honda Creek within the 120 dB L_{max} Laguna-E noise contour (Appendix A, Figure 2a) as well as at two suitable breeding locations in San Antonio Creek to serve as a control site. The Space Force will use bioacoustic monitoring to characterize and analyze any impacts of launch and static fire events during the breeding season on calling behavior to assess whether Phantom's gradual increase in launch and static fire tempo affects California red-legged frog calling frequency. The Space Force will report on monitoring results within an annual report.

AM-25. The Space Force will conduct monitoring to detect changes in calling frequency and declines in the abundance, distribution, or tadpole densities of California red-legged frog. The Space Force will utilize existing survey data for Honda Creek to establish the California red-legged frog baseline (Kephart 2022, p. 1). To address potential declining trends that may be a result of the proposed project, the specified threshold criteria is described below.

a. Annual protocol survey efforts conducted in the same area of Honda Creek document fewer adult frog detections than baseline average two years consecutively;

b. egg mass or tadpole densities decrease by 15 percent from baseline average;

c. and/or surveys document average call-rate changes (decrease) with increasing disturbance level.

If any of these threshold criteria are met and cannot confidently be attributed to other natural- or human-caused catastrophic factors, not related to the proposed action, that may eliminate or significantly degrade suitable habitat (see potential scenarios described below), the Space Force will mitigate for these impacts (Kephart 2022, p. 3) as discussed under the *Habitat Mitigation and Monitoring Plan* section. Examples of potential catastrophic scenarios include the following:

a. Fire, unrelated to project activities or launch operations, that directly impacts Honda Canyon and is demonstrated to degrade or eliminate breeding habitat.

b. Landslides or significant erosion events in Honda Canyon, unrelated to project activities or launch operations, that result in the elimination or degradation of California red-legged frog breeding habitat.

c. Drought or climate impacts that quantifiably reduces available aquatic habitat further than what was available during existing baseline.

d. Flash flood events during the breeding season that are more significant than what was experienced during the existing baseline.

The Space Force will review the supported cause of decline with the Service and reach agreement. If cause of declines is determined to be inconclusive, the Project Proponent will implement proposed mitigation.

AM-26. The Space Force will discontinue monitoring after concurrence from the Service if California red-legged frog occupancy, calling frequency, or tadpole densities do not demonstrate adverse effects after three years of monitoring once Phantom has achieved full or near full tempo.

Western Snowy Plover

AM-27. The Space Force will augment the current western snowy plover monitoring program on VSFB by performing acoustic monitoring and geospatial analysis of nesting activity on South Surf Beach to assess potential adverse effects from Daytona-E and Laguna-E launch and static fire activities (Kephart 2022, p. 2).

a. The current basewide western snowy plover monitoring program estimates breeding effort, nest fates, and fledging success while recording patterns of habitat use throughout the season. The Space Force will augment this program for the proposed project by placing sound level meters (SLMs) immediately inland of South Surf Beach within the Daytona-E and Laguna-E noise footprint to characterize the noise environment (Appendix A, Figure 2b).

b. Acoustic monitoring will begin during the first calendar year of launch operations and continue annually during the breeding season as Phantom's program gradually increases over six years to full cadence (Table 1).

AM-28. The Space Force will conduct monitoring to detect declines in the abundance, distribution, and nest success of western snowy plover. To address potential declining trends that may be a result of the proposed project, the specified threshold criteria is described below.

a. The Space Force will require geospatial analysis to show the decline is a statistically significant reduction in breeding effort or nest success that continues over two consecutive years within the areas impacted by noise from the Daytona-E and Laguna-E launch vehicles.

b. The Space Force defines a statistically significant reduction as a decline greater than the baseline annual variation in these variables over the past 10 years at South Surf Beach. The Space Force may calculate baseline annual variation in a variety of ways but likely will use 95 percent confidence intervals (Kephart 2022, p. 2).

c. The Space Force will perform geospatial analysis annually to assess whether noise from the proposed project negatively impacts patterns of nesting activity, nest fates, or fledgling success as Phantom's launch and static fire tempo increases to full cadence. The Space Force will report on monitoring results within an annual report.

If any of these threshold criteria are met and cannot confidently be attributed to other natural- or human-caused catastrophic factors, not related to the proposed action, that may eliminate or significantly degrade suitable habitat (see potential scenarios described below), the Space Force will mitigate for these impacts (Kephart 2022, p. 3) as discussed under the *Habitat Mitigation and Monitoring Plan* section below. Examples of potential catastrophic scenarios include the following:

a. Significantly higher levels of tidal activity, predation, etc. as compared with the existing baseline and demonstrable across remainder of base population.

b. Significant avian disease demonstrable across the recovery unit.

c. Separate work activities (i.e., restoration efforts) not related to project.

The Space Force will review the supported cause of decline with the Service and reach agreement. If cause of declines is determined to be inconclusive, the Project Proponent will implement proposed mitigation.

AM-29. The Space Force will discontinue monitoring after concurrence from the Service if they do not document adverse effects attributable to the proposed project after three years of monitoring once Phantom has reach full or near full tempo.

Habitat Mitigation and Monitoring Plan

The Space Force proposes a mitigation and monitoring plan in the event the proposed project's monitoring detects a change in the baseline of species populations (AM-23, 28). In the event the Space Force detects declines and declines meet threshold trigger criteria, the Space Force will implement mitigation activities as detailed below.

The potential mitigation actions for California red-legged frog include the creation of new breeding habitat at a 2:1 ratio (habitat enhanced: habitat affected) within the San Antonio Creek Oxbow Restoration "expansion area" (Appendix A, Figure 4a). The Oxbow Restoration site is an abandoned tract of agricultural land that riparian vegetation historically occupied. The Space Force initiated compensatory mitigation restoration work at this site associated with a separate previous project (San Antonio West Bridge; 2016-F-0103; Service 2018) in the fall of 2019 to improve California red-legged frog habitat within San Antonio Creek (MSRS 2020, p. 2). Specifically, potential mitigation actions associated with the proposed project within the Oxbow Restoration include site preparation via herbicide application, plowing, container plant installation, seeding, willow pole planting, and watering via water truck. The existing biological opinion (2016-F-0103; Service 2018) includes potential mitigation actions for California red-legged frog and the Space Force will implement all required avoidance, minimization, and monitoring measures. The Space Force will track and report on restoration efforts and success within an annual report.

The potential mitigation actions for western snowy plover consist of increasing predator control to include the non-breeding season, which includes trapping, shooting, and tracking known western snowy plover predators with particular focus on raven removal at and adjacent to VSFB beaches (Appendix A, Figure 4b). Predator control efforts are intended to increase wintering adult snowy plover survival and control predators prior to the breeding season. An existing biological opinion (8-8-12-F-11R; Service 2015b) permits these actions, and the Space Force will implement all required avoidance, minimization, and monitoring measures. The Space Force also maintains a depredation permit issued by the Service. The Space Force will report on predator removal efforts and success within an annual report. Additionally, the Space Force will continue pursuing other beneficial actions including recovery opportunities outlined in the western snowy plover recovery plan (Service 2007) and 5-year review (Service 2019) following mutual agreement by the Service and the Space Force annually, supporting the Space Force's goals to ensure no net loss (Kephart 2022, p. 3).

ANALYTICAL FRAMEWORK FOR THE JEOPARDY DETERMINATIONS

Jeopardy Determination

Section 7(a)(2) of the Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species. "Jeopardize the continued existence of" means "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02).

The jeopardy analysis in this biological opinion relies on four components: (1) the Status of the Species, which describes the current rangewide condition of the California red-legged frog and western snowy plover, the factors responsible for that condition, and its survival and recovery needs; (2) the Environmental Baseline, which analyzes the condition of the California red-legged frog and western snowy plover in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the California red-legged frog and western snowy plover; (3) the Effects of the Action, which determines all consequences to the California red-legged frog and western snowy plover caused by the proposed action that are reasonably certain to occur in the action area; and (4) the Cumulative Effects, which evaluates the effects of future, non-Federal activities, that are reasonably certain to occur in the action area, on the California red-legged frog and western snowy plover.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the current status of the California red-legged frog and western snowy plover, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to reduce appreciably the likelihood of both the survival and recovery of the California red-legged frog and western snowy plover in the wild by reducing the reproduction, numbers, and distribution of that species.

STATUS OF THE SPECIES AND ITS CRITICAL HABITAT

California Red-legged Frog

Legal Status

The California red-legged frog was federally listed as threatened on May 23, 1996 (61 Federal Register (FR) 25813). Revised critical habitat for the California red-legged frog was designated on March 17, 2010 (75 FR 12816, Service 2010). The Service issued a recovery plan for the species on May 28, 2002 (Service 2002, entire).

Natural History

The California red-legged frog uses a variety of habitat types, including various aquatic systems, riparian, and upland habitats. They have been found at elevations ranging from sea level to approximately 5,000 feet. California red-legged frogs use the environment in a variety of ways, and in many cases, they may complete their entire life cycle in a particular area without using other components (i.e., a pond is suitable for each life stage and use of upland habitat or a riparian corridor is not necessary). Populations appear to persist where a mosaic of habitat elements exists, embedded within a matrix of dispersal habitat. Adults are often associated with dense, shrubby riparian or emergent vegetation and areas with deep (greater than 1.6 feet) still or slow-moving water; the largest summer densities of California red-legged frogs are associated with deep-water pools with dense stands of overhanging willows (*Salix* spp.) and an intermixed fringe of cattails (*Typha latifolia*) (Hayes and Jennings 1988, p. 147). Hayes and Tennant found juveniles to seek prey diurnally and nocturnally, whereas adults were largely nocturnal (Hayes and Tennant 1985, p. 604).

California red-legged frogs breed in aquatic habitats; larvae, juveniles, and adult frogs have been collected from streams, creeks, ponds, marshes, deep pools and backwaters within streams and creeks, dune ponds, lagoons, and estuaries, and frequently breed in artificial impoundments such as stock ponds, given the proper management of hydroperiod, pond structure, and control of exotic predators, and can proliferate in a wide range of edge and emergent cover amounts, including ponds devoid of emergent vegetation (Service 2002, p. 12). While frogs successfully breed in streams and riparian systems, high spring flows and cold temperatures in streams often make these sites risky egg and tadpole environments. An important factor influencing the suitability of aquatic breeding sites is the general lack of introduced aquatic predators. Accessibility to sheltering habitat is essential for the survival of California red-legged frogs within a watershed and can be a factor limiting population numbers and distribution.

California red-legged frogs are “irruptive” breeders where their breeding capacity is highly dependent on local environmental conditions, specifically the availability of cool water for egg deposition and larval maturation (Jennings and Hayes 1994, p. 62). California red-legged frogs breed from November to May and breeding activity typically begins earlier at southern coastal than northern coastal localities (Storer 1925, p. 2; Alvarez et al. 2013, pp. 547-548). Breeding may start as late as March or April in Sierra Nevada localities, due to low temperatures at these sites in January and February (Tatarian 2008, p. 16). Breeding in southern California localities may start as late as April, as exemplified in Matilija Canyon following the 2017 Thomas Fire (P. Lieske, pers. comm., 2021). High water flows in the winter and spring also can delay breeding in streams and rivers (Fellers et al. 2001, p. 157). Adult males call at night in the air and underwater. Calls can be easily missed because of their low volume and calling lasts only one to two weeks at a location (Nafis 2020). Eggs will hatch after approximately 4 weeks and tadpoles will typically metamorphose between 4-7 months, although they have been reported to overwinter at some sites (Nafis 2020). Female California red-legged frogs lay only one egg mass in a breeding year and each egg mass contains between 300 to 4,000 eggs (Storer 1925, p. 240). Egg masses typically hatch after approximately 4 weeks (Nafis 2020). Frogs typically deposit egg masses in relatively shallow water (approximately 1.6 to 2 feet deep) on emergent vegetation within 4 feet of shore (Storer 1925, p. 239; Jennings and Hayes 1994, p. 64). However, the species can deposit eggs on a wide variety of substrates including boulders and cobbled substrate and submerged tips of overhanging branches, and egg masses have been documented 39 feet from shore and in water up to 10.5 feet deep (Alvarez et al. 2013, pp. 544-545; Wilcox et al. 2017, p. 68).

California red-legged frog tadpoles hatch from egg masses after 6 to14 (Storer 1925, p. 241). Tadpole development and growth rates are variable and likely temperature dependent (Fellers 2005, pp. 552-554). Occasionally, tadpoles may overwinter and then metamorphose the following spring, a phenomenon so far observed in Santa Clara, Marin, Contra Costa, and San Luis Obispo Counties (Fellers et al. 2001, entire). The juvenile California red-legged frog life stage is defined as the time after an individual undergoes metamorphosis (when they lose their tails and become small froglets) which typically occurs four to five months after hatching and it spans to when an individual is able to breed (Storer 1925, p. 241; Wright and Wright 1949, p. 422). On average, the juvenile life stage is from about five months of age to three years in California red-legged frogs. Immediately after metamorphosis, juveniles shelter near their natal pond. However, some juveniles may disperse in the fall to nearby moist uplands or different aquatic habitat to avoid predation by larger, older frogs. Hayes and Tennant (1985, p. 604) found juveniles to seek prey diurnally and nocturnally, whereas adults were largely nocturnal.

During periods of wet weather, starting with the first rains of fall, some individual California red-legged frogs may make long-distance overland excursions through upland habitats to reach breeding sites. In Santa Cruz County, Bulger et al. (2003, p. 90) found marked California red-legged frogs moving up to 1.74 miles through upland habitats, via point-to-point, straight-line migrations without regard to topography, rather than following riparian corridors. Most of these overland movements occurred at night and took up to 2 months. Similarly, in San Luis Obispo County, Rathbun and Schneider (2001, p. 1302) documented the movement of a male California red-legged frog between two ponds that were 1.78 miles apart in less than 32 days; however, most California red-legged frogs in the Bulger et al. (2003, p. 93) study were non-migrating frogs and always remained within 426 feet of their aquatic site of residence (half of the frogs always stayed within 82 feet of water). Rathbun et al. (1993, p. 15) radio-tracked three California red-legged frogs near the coast in San Luis Obispo County at various times between July and January; these frogs also stayed close to water and never strayed more than 85 feet into upland vegetation. Scott (2002, p. 2) radio-tracked nine California red-legged frogs in East Las Virgenes Creek in Ventura County from January to June 2001, which remained relatively sedentary as well; the longest within-channel movement was 280 feet and the farthest movement away from the stream was 30 feet.

After breeding, California red-legged frogs often disperse from their breeding habitat to forage and seek suitable dry-season habitat. Cover within dry-season aquatic habitat could include boulders, downed trees, and logs; agricultural features such as drains, watering troughs, spring boxes, abandoned sheds, or hayricks, and industrial debris. California red-legged frogs use small mammal burrows and moist leaf litter (Jennings and Hayes 1994, p. 64; Rathbun and Schneider 2001, p. 15); incised stream channels with portions narrower and deeper than 18 inches may also provide habitat (Service 2002, p. 14). This type of dispersal and habitat use, however, is not observed in all California red-legged frogs and is most likely dependent on the year-to-year variations in climate and habitat suitability and varying requisites per life stage.

Although the presence of California red-legged frogs is correlated with still water deeper than approximately 1.6 feet, riparian shrubbery, and emergent vegetation (Jennings and Hayes 1994, p. 64), California red-legged frogs appear to be absent from numerous locations in its historical range where these elements are well represented. The cause of local extirpations does not appear to be restricted solely to loss of aquatic habitat. The most likely causes of local extirpation are thought to be changes in faunal composition of aquatic ecosystems (i.e., the introduction of invasive predators and competitors) and landscape-scale disturbances that disrupt California red-legged frog population processes, such as dispersal and colonization. The introduction of contaminants or changes in water temperature may also play a role in local extirpations. These changes may also promote the spread of predators, competitors, invasive plants, parasites, and diseases.

Rangewide Status

The historical range of the California red-legged frog extended coastally from southern Mendocino County and inland from the vicinity of Redding, California, southward to northwestern Baja California, Mexico (Storer 1925, p. 235; Jennings and Hayes 1985, p. 95; Shaffer et al. 2004, p. 2673). The California red-legged frog has sustained a 70 percent reduction in its geographic range because of several factors acting singly or in combination (Davidson et al. 2001, p. 465).

Over-harvesting, habitat loss, non-native species introduction, and urban encroachment are the primary factors that have negatively affected the California red-legged frog throughout its range (Jennings and Hayes 1985, pp. 99-100; Hayes and Jennings 1988, p. 152). Habitat loss and degradation, combined with over-exploitation and introduction of exotic predators, were important factors in the decline of the California red-legged frog in the early to mid-1900s. Continuing threats to the California red-legged frog include direct habitat loss due to stream alteration and loss of aquatic habitat, indirect effects of expanding urbanization, competition or predation from non-native species including the bullfrog, catfish (*Ictalurus* spp.), bass (*Micropterus* spp.), mosquito fish (*Gambusia affinis*), red swamp crayfish (*Procambarus clarkii*), and signal crayfish (*Pacifastacus leniusculus*). Chytrid fungus (*Batrachochytrium dendrobatidis*) is a waterborne fungus that can decimate amphibian populations and is considered a threat to California red-legged frog populations.

A 5-year review of the status of the California red-legged frog was initiated in May 2011 but has not yet been completed.

Recovery

The 2002 final recovery plan for the California red-legged frog (Service 2002, entire) states that the goal of recovery efforts is to reduce threats and improve the population status of the California red-legged frog sufficiently to warrant delisting. The recovery plan describes a strategy for delisting, which includes: (1) protecting known populations and reestablishing historical populations; (2) protecting suitable habitat, corridors, and core areas; (3) developing and implementing management plans for preserved habitat, occupied watersheds, and core areas; (4) developing land use guidelines; (5) gathering biological and ecological data necessary for conservation of the species; (6) monitoring existing populations and conducting surveys for new populations; and (7) establishing an outreach program. The California red-legged frog will be considered for delisting when:

1. Suitable habitats within all core areas are protected and/or managed for California red-legged frogs in perpetuity, and the ecological integrity of these areas is not threatened by adverse anthropogenic habitat modification (including indirect effects of upstream/downstream land uses).
2. Existing populations throughout the range are stable (i.e., reproductive rates allow for long-term viability without human intervention). Population status will be documented through establishment and implementation of a scientifically acceptable population monitoring program for at least a 15-year period, which is approximately 4 to 5 generations of the California red-legged frog. This 15-year period should coincide with an average precipitation cycle.
3. Populations are geographically distributed in a manner that allows for the continued existence of viable metapopulations despite fluctuations in the status of individual populations (i.e., when populations are stable or increasing at each core area).
4. The species is successfully reestablished in portions of its historical range such that at least one reestablished population is stable/increasing at each core area where California red-legged frog are currently absent.
5. The amount of additional habitat needed for population connectivity, recolonization, and dispersal has been determined, protected, and managed for California red-legged frogs.

The recovery plan identifies eight recovery units based on the assumption that various regional areas of the species' range are essential to its survival and recovery. The recovery status of the California red-legged frog is considered within the smaller scale of recovery units as opposed to the overall range. These recovery units correspond to major watershed boundaries as defined by U.S. Geological Survey hydrologic units and the limits of the range of the California red-legged frog. The goal of the recovery plan is to protect the long-term viability of all extant populations within each recovery unit.

Within each recovery unit, core areas have been delineated and represent contiguous areas of moderate to high California red-legged frog densities that are relatively free of exotic species such as bullfrogs. The goal of designating core areas is to protect metapopulations that combined with suitable dispersal habitat, will support long-term viability within existing populations. This management strategy allows for the recolonization of habitat within and adjacent to core areas that are naturally subjected to periodic localized extinctions, thus assuring the long-term survival and recovery of the California red-legged frog.

<u>Western Snowy Plover</u>

Legal Status

The Service listed the Pacific Coast population of the western snowy plover as threatened on March 5, 1993 (Service 1993). We designated critical habitat in 1999 (Service 1999) and redesignated it in 2005 (Service 2005). In 2012, we issued a revised critical habitat designation which included a change in taxonomic nomenclature (Service 2012). We issued a recovery plan in August 2007 (Service 2007) and completed 5-year status reviews in 2006 and 2019 (Service 2006, 2019).

Natural History

The western snowy plover is a small shorebird in the family Charadriidae, a subspecies of the snowy plover (*Charadrius nivosus*). It is pale gray/brown above and white below, with a white collar on the hind neck and dark patches on the lateral breast, forehead, and behind the eyes. The bill and legs are black.

<u>Foraging Behavior</u>

Western snowy plovers are primarily visual foragers, using the run-stop-peck method of feeding typical of most plover species. They forage on invertebrates in the wet sand and amongst surf-cast kelp within the intertidal zone, in dry sand areas above the high tide, on saltpans, on spoil sites, and along the edges of salt marshes, salt ponds, and lagoons. They sometimes probe for prey in the sand and pick insects from low-growing plants (Service 2007, pp. 17–18).

<u>Breeding</u>

The Pacific Coast population of the western snowy plover breeds primarily on coastal beaches from southern Washington to southern Baja California, Mexico. The main coastal habitats for nesting include sand spits, dune-backed beaches, beaches at creek and river mouths, and saltpans at lagoons and estuaries (Wilson 1980, p. 23; Page and Stenzel 1981, p. 12). Western snowy plovers nest less commonly on bluff-backed beaches, dredged material disposal sites, salt pond levees, dry salt ponds, and gravel river bars (Wilson 1980, p. 9; Page and Stenzel 1981, pp. 12, 26; Tuttle et al. 1997, pp. 1–3; Powell et al. 2002, pp. 156, 158, 164).

Their nests consist of a shallow scrape or depression, sometimes lined with beach debris (e.g., small pebbles, shell fragments, plant debris, and mud chips). As incubation progresses, western snowy plovers may add to and increase the nest lining. Driftwood, kelp, and dune plants provide cover for chicks that crouch near objects to hide from predators. Because invertebrates often occur near debris, driftwood and kelp are also important for harboring western snowy plover food sources (REPEATPage et al. 2009, Breeding).

Along the west coast of the United States, the nesting season of the western snowy plover extends from early March through late September. Generally, the breeding season may be 2 to 4 weeks earlier in southern California than in Oregon and Washington. Fledging (reaching flying age) of late-season broods may extend into the third week of September throughout the breeding range (Service 2007, p. 11).

The approximate periods required for western snowy plover nesting events are: 3 days to more than a month for scrape construction (in conjunction with courtship and mating), usually 4 to 5 days for egg laying, and incubation averaging 28.4 days in the early season (before May 8) to 26.9 days in the late season (Warriner et al. 1986, pp. 23–24). The usual clutch size is three eggs with a range from two to six (REPEATPage et al. 2009, Breeding). Both sexes incubate the eggs with the female tending to incubate during the day and the male at night (Warriner et al. 1986, pp. 24–25). Adult western snowy plovers frequently will attempt to lure people and predators from hatching eggs and chicks with alarm calls and distraction displays.

Western snowy plover chicks are precocial, leaving the nest with their parents within hours after hatching (Service 2007, p. 14). They are not able to fly for approximately 1 month after hatching; fledging requires 29 to 33 days (Warriner et al. 1986, p. 26). Broods rarely remain in the nesting area until fledging (Warriner et al. 1986, p. 28; Lauten et al. 2010, p. 10). Casler et al. (1993, pp. 6, 11–12) reported broods would generally remain within a 1-mile radius of their nesting area; however, in some cases would travel as far as 4 miles.

Wintering

In winter, western snowy plovers use many of the beaches used for nesting, as well as beaches where they do not nest. They also occur in man-made salt ponds and on estuarine sand and mud flats. In California, most wintering western snowy plovers concentrate on sand spits and dune-backed beaches. Some also occur on urban and bluff-backed beaches, which they rarely use for nesting (Page and Stenzel 1981, p. 12; Page et al. 1986, p. 148). South of San Mateo County, California, wintering western snowy plovers also use pocket beaches at the mouths of creeks and rivers on otherwise rocky points (Page et al. 1986, p. 148). Western snowy plovers forage in loose flocks. Roosting western snowy plovers will sit in depressions in the sand made by footprints and vehicle tracks, or in the lee of kelp, driftwood, or low dunes in wide areas of beaches (REPEATPage et al. 2009, Behavior). Sitting behind debris or in depressions provides some shelter from the wind and may reduce their detectability by predators.

Rangewide Status

Historical records indicate that nesting western snowy plovers were once more widely distributed and abundant in coastal Washington, Oregon, and California (Service 2007, p. 21). In Washington, western snowy plovers formerly nested at five coastal locations (WDFW 1995, p. 14) and at over 20 sites on the coast of Oregon (Service 2007, p. 24). In California, by the late

1970s, nesting western snowy plovers were absent from 33 of 53 locations with breeding records prior to 1970 (Page and Stenzel 1981, p. 27).

The first quantitative data on the abundance of western snowy plovers along the California coast came from window surveys conducted during the 1977 to 1980 breeding seasons by Point Reyes Bird Observatory (Page and Stenzel 1981, p. 1). Observers recorded an estimated 1,593 adult western snowy plovers during these pioneering surveys. The results of the surveys suggested that the western snowy plover had disappeared from significant parts of its coastal California breeding range by 1980 (Service 2007, p. 27).
Breeding and winter window survey data from 2005 to 2022 includes approximately 250 sites in Washington, Oregon, and California, with most sites located in California (Table 2). In California, biological monitors counted 1,830 western snowy plovers during the 2022 breeding window survey, and 4,196[1] western snowy plovers during the 2021 to 2022 winter window survey (Service 2022a, entire). Across the Pacific Coast range, the 2022 breeding window survey estimated 2,371 western snowy plovers, and the 2021 to 2022 winter window survey estimated 4,803 western snowy plovers in Washington, Oregon, and California (Service 2022a, entire). These numbers demonstrate that monitors counted a large percentage of all western snowy plovers in the Pacific Coast range in California during both winter and breeding window surveys.

Table 2. Pacific Coast western snowy plover breeding window survey results, in descending order from 2022 to 2005, for each recovery unit (RU1 through RU6) and the U.S. Pacific Coast (excludes the Baja California peninsula). All counts are breeding age adults and are uncorrected (raw). Recovery Units are RU1: Washington and Oregon; RU2: Northern California (Del Norte to Mendocino Counties); RU3: San Francisco Bay; RU4: Monterey Bay area (Sonoma to Monterey Counties); RU5: San Luis Obispo area (San Luis Obispo to Ventura Counties); RU6: San Diego area (Los Angeles to San Diego Counties) (Service 2019, p. 3).

Year	***RU1***	***RU2***	***RU3***	***RU4***	***RU5***	***RU6***	***TOTAL (U.S. Pacific Coast)***
2022	541	71	281	281	804	393	2,371
2021	624	84	263	292	737	358	2,358
2020	469	46	147	308	855	484	2,309
2019	479	41	190	303	807	397	2,217
2018	402	52	235	361	874	451	2,375
2017	342	56	246	369	856	464	2,333
2016	477	46	202	366	820	373	2,284
2015	340	38	195	348	963	376	2,260

1 This number likely includes wintering inland birds that are not part of the listed Pacific Coast population.

2014	269	27	178	374	822	346	2,016
2013	260	23	202	261	754	326	1,826
2012	234	21	147	324	771	358	1,855
2011	202	28	249	311	796	331	1,917
2010	196	19	275	298	686	311	1,785
2009	182	15	147	279	707	257	1,587
2008	147	18	133	257	717	269	1,541
2007	175	26	207	270	676	183	1,537
2006	158	45	102	357	917	298	1,877
2005	137	41	124	337	969	209	1,817

Recovery and Threats

The primary objective of the recovery plan (Service 2007, p. vi) is to remove the Pacific Coast population of the western snowy plover from the list of endangered and threatened wildlife and plants by:

1. Increasing population numbers distributed across the range of the Pacific Coast population of the western snowy plover;
2. Conducting intensive ongoing management for the species and its habitat and developing mechanisms to ensure management in perpetuity; and
3. Monitoring western snowy plover populations and threats to determine success of recovery actions and refine management actions.

Outlined below are the delisting criteria for the Pacific Coast population of the western snowy plover (Service 2007, p. vii):

1. An average of 3,000 breeding adults has been maintained for 10 years, distributed among 6 recovery units as follows: Washington and Oregon, 250 breeding adults; Del Norte to Mendocino Counties, California, 150 breeding adults; San Francisco Bay, California, 500 breeding adults; Sonoma to Monterey Counties, California, 400 breeding adults; San Luis Obispo to Ventura Counties, California, 1,200 breeding adults; and Los Angeles to San Diego Counties, California, 500 breeding adults. This criterion also includes implementing monitoring of site-specific threats, incorporation of management activities into management plans to ameliorate or eliminate those threats, completion of research

necessary to modify management and monitoring actions, and development of a post-delisting monitoring plan.

2. A yearly average productivity of at least one (1.0) fledged chick per male has been maintained in each recovery unit in the last 5 years prior to delisting.
3. Mechanisms have been developed and implemented to assure long-term protection and management of breeding, wintering, and migration areas to maintain the subpopulation sizes and average productivity specified in Criteria 1 and 2. These mechanisms include establishment of recovery unit working groups, development and implementation of participation plans, development and implementation of management plans for Federal and State lands, protection and management of private lands, and public outreach and education.

Our current estimate (2,371 breeding adults) remains below the population size of 3,000 birds listed as a recovery objective in the recovery plan (Service 2007), although some local population sizes have surpassed recovery objectives for some areas (e.g., Monterey Bay, Oregon, Washington). Yearly average productivity (Criterion 2; number of fledglings per male) are not compiled annually for the entire U.S. Pacific Coast; however, the best available information indicates that the yearly average productivity has not been met (Service 2019, p. 6).

Threats have not changed significantly since the 2006 5-year review. Evidence of habitat loss and degradation remains widespread; while the degree of this threat varies by geographic location, habitat loss and degradation attributed to human disturbance, urban development, introduced beachgrass, and expanding predator populations remain the management focus in all six recovery units. Efforts to improve habitat at current and historic breeding beaches, and efforts to reduce the impacts of human recreation and predation on nesting plovers, have improved western snowy plover numbers. Active vegetation and predator management and habitat restoration should be continued. Because of active management efforts, including increased monitoring, use of predator exclosures at some sites, predator management, and expanded beach closures, western snowy plover population numbers have increased at some locations. However, despite active vegetation and predator management, we expect ongoing and projected changes in sea level and climate to affect coastal habitat suitability, nest survival, overwinter survivorship, and quality of nesting and roosting habitats (Service 2019, p. 7).

ENVIRONMENTAL BASELINE

The implementing regulations for section 7(a)(2) (50 CFR 402.02) define the environmental baseline as "the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline."

Action Area

The implementing regulations for section 7(a)(2) of the Act (50 CFR 402.02) define the "action area" as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. The action area for this biological opinion includes all areas subject to temporary and permanent ground-disturbing activities required to prepare the SLC-5 site; areas subject to noise generated from individual launches; areas subject to overpressure as a result of sonic booms generated from launches breaking the sound barrier; areas subject to launch vehicle disposal; four water extraction wells located within the San Antonio Creek Basin and the 9.5 miles of San Antonio Creek downstream habitat; and areas subject to potential mitigation/restoration efforts that may occur as a result of the proposed project.

Appendix A, Figure 1 depicts the Construction Effect Area, Figure 2 (a, b) depicts the Launch Noise Effect Area of potential disturbance, Figure 3 depicts the Sonic Boom Overpressure Effect Area and Vehicle Splashdown Effect Area of potential disturbance, and Figure 4 (a, b) depicts potential mitigation areas associated with the proposed project. The Service considers all areas within the construction, noise, overpressure, vehicle splashdown, water extraction within the San Antonio Creek Basin, as well as potential mitigation/restoration areas to encompass the entirety of the action area.

Habitat Characteristics of the Action Area

The proposed action includes development of a new launch site at SLC-5, located in south VSFB, immediately north (450 feet) of Honda Creek. The area incorporates previously developed areas (5.68 acres) and includes a large portion of native habitat types (27.37 acres) with some non-native habitat (11.08 acres) present (Kaisersatt, pers. comm., 2022e). ManTech SRS Technologies (MSRS) conducted biological surveys in November 2019, March 2020, and August 2021 to characterize and map vegetation communities within the portions of the terrestrial action area subject to physical impacts (MSRS 2022a, p. 30). During surveys, biologists mapped any special status species and their habitat detected, including potential wetlands, wetland vegetation, standing water, or defined channels. Biologists delineated all vegetation communities within the survey area using a combination of survey data and aerial photo interpretation (MSRS 2022a, p. 30).

The majority of the Construction Effect Area is comprised of central coastal scrub/iceplant (9.5 acres) and Venturan coastal sage scrub/herb (10.54 acres) with portions of ruderal vegetation (Kaisersatt 2022e). Within the Construction Effect Area, Honda Canyon Road is located within Honda Canyon and the riparian canopy-associated floodplain of Honda Creek running parallel to the ordinary high-water mark of Honda Creek (between 50 to 550 feet) for approximately 1 mile (Google Earth Pro, 2022; Kaisersatt, pers. comm., 2023). Honda Creek contains aquatic habitat with deep ponded features as well as Central Coast Arroyo Willow Riparian Forest and Scrub (30 CES 2021, Appendix A, Figure 2). Immediately to the north of SLC-5 is a mix of Monterey cypress (*Hesperocyparis macrocarpa*) and coastal scrub (Kaisersatt 2022e). The Launch Noise Effect Area also includes portions of central dune scrub, maritime chapparal, live oak woodland, and pine forest (30 CES 2021, Appendix A, Figure 2).

Existing Conditions in the Action Area

SLC-5 is a decommissioned launch site occupying approximately 18 acres in the south base of VSFB (Appendix A, Figure 1). The National Aeronautics and Space Administration (NASA) originally used this site between 1962 and 1994 to launch Scout space vehicles. Upon completion of the Scout Launch Program, the Space Force deactivated and demolished all facilities at SLC-5 between 2009 and 2012.

Previous Consultations in the Action Area

On May 14, 2021, Vandenberg Air Force Base (VAFB) changed its name to Vandenberg Space Force Base. Consultations prior to this date refer to the U.S. Air Force (Air Force).

1. August 23, 2022: The Service issued a draft biological opinion to the Space Force for the Terran 1 Launch Program (Relativity Space, Inc.) at SLC-11 project. We determined that the proposed action was not likely to jeopardize the continued existence of the western snowy plover and the California red-legged frog. This action has not yet occurred to date.

2. November 18, 2020: The Service issued a biological opinion to the Air Force for the Blue Origin Orbital Launch Site at SLC-9 project. We determined that the proposed action was not likely to jeopardize the continued existence of the California least tern (*Sterna antillarum browni*), beach layia (*Layia carnosa*), western snowy plover, and California red-legged frog. This action has not yet occurred to date.

3. November 21, 2018: The Service issued a reinitiation of a biological opinion to the Air Force on routine mission operations and maintenance activities at VAFB for changes to California red-legged frog-specific avoidance and minimization measures. We concluded the proposed action was not likely to jeopardize the continued existence of the California red-legged frog or alter effects of the proposed activities on the beach layia, Gaviota tarplant (*Deinandra increscens* ssp. *villosa*), Lompoc yerba santa (*Eriodictyon capitatum*), Vandenberg monkeyflower (*Diplacus vandenbergensis*), vernal pool fairy shrimp (*Branchinecta lynchi*), El Segundo blue butterfly (*Euphilotes battoides allyni*), tidewater goby, unarmored threespine stickleback, California least tern, and western snowy plover.

4. December 12, 2017: The Service issued a biological opinion to the Air Force for the proposed launch, boost-back, and landing of the Falcon 9 first stage at Space Launch Complex 4 (SLC-4). We concluded that the proposed action was not likely to jeopardize the continued existence of the El Segundo blue butterfly, California red-legged frog, California least tern, and western snowy plover. This project began in spring of 2018 and is currently ongoing. This consultation was reinitiated due to an increase in launch cadence with the associated final biological opinion issued on March 22, 2023.

5. February 4, 2015: The Service issued a biological opinion to the Air Force for the proposed beach management plan for VAFB. We concluded that the proposed action was not likely to jeopardize the continued existence of the El Segundo blue butterfly, California red-legged frog, California least tern, and western snowy plover.

6. December 3, 2015: The Service issued a programmatic biological opinion to the Air Force for routine mission operations and maintenance activities at VAFB. We concluded that the proposed action was not likely to jeopardize the continued existence of the Vandenberg monkeyflower, beach layia, Gaviota tarplant, Lompoc yerba santa, vernal pool fairy shrimp, El Segundo blue butterfly, California red-legged frog, tidewater goby, unarmored threespine stickleback, California least tern, and western snowy plover.

Condition (Status) of the Species in the Action Area

California Red-legged Frog

California red-legged frogs have been documented in nearly all permanent streams and ponds on VSFB as well as most seasonally inundated wetland and riparian sites (MSRS 2022a, p. 33). Biologists have consistently documented a moderately sized population of California red-legged frogs over the last 10 years across variable survey efforts within Honda Creek adjacent to SLC-5. Using protocol night California red-legged frog survey information between 2013 and 2022, adult frogs encountered ranged between 1 to 12 adult individuals, with the current average annual high number being 7.2 within the anticipated 120 dB contour of the Launch Noise Effect Area. Honda Creek includes multiple deep pond features that biologists have documented regularly support breeding. In 2017, biologists observed 68 juvenile California red-legged frogs within the Honda Pond area. In 2022, 50 California red-legged frog tadpoles and 13 egg masses were observed in a single day in the westernmost portion of Honda Creek (USSF, unpublished data, 2022a).

Suitable upland dispersal habitat exists throughout VSFB between the various riparian zones and ponds, but dispersal into these upland habitats is not likely to be as common as biologists have observed in more mesic parts of the range of this species. However, due to the proximity to aquatic habitat within Honda Creek, upland habitat within the proposed project's Construction Effect Area is likely to support dispersing California red-legged frog individuals. The proposed SLC-5 site is within 450 feet of occupied California red-legged frog breeding habitat within

Honda Creek (CNDDB 2022, Occurrence #1442). Honda Canyon Road runs parallel to Honda Creek for approximately 1 mile, at points is located approximately 50 feet from occupied breeding habitat in Honda Creek (CNDDB 2022, Occurrence #1442), and supports areas of dense riparian vegetation that likely provides shelter for California red-legged frog.

The Launch Noise Effect Area extends approximately 5 miles from SLC-5 in all directions. This includes approximately 6.5 miles of occupied California red-legged frog habitat within Honda Creek with modeled noise levels between 100 to 120 dB as well as the entirety of Bear Creek with modeled noise levels of 100 dB.

The Space Force provided approximate estimates of the number of California red-legged frog life stages present within each noise level contour of the Launch Noise Effect Area (Table 3; Appendix A, Figure 2a).

Table 3. California red-legged frog life stage estimates within each noise level contour of the Launch Noise Effect Area.

Unweighted dB L_{max}	Adult	Metamorph	Larvae	Egg Mass
100	19	2	90	13
110	12	1	50	13
120	2	0	0	3
130	0	0	0	0

The Space Force includes that these numbers are likely conservative when estimating adults as these are the largest number of individuals observed during surveys. Conversely, the estimated number of metamorphs, larvae, and eggs masses should be considered a less accurate approximation as not all locations have received equal survey effort for these life stages within each noise contour; stochastic events (flash storms) may have resulted in detection difficulty due to survey timing and drought has likely resulted in the failure of many cohorts over the past ten years (USSF, unpublished data, 2022a; Kaisersatt, pers. comm., 2022c). Similarly, an above average level of rainfall has occurred throughout the winter of 2023 and will likely have rehydrated aquatic habitat previously impacted by drought. This may increase population numbers and impact the establishment of the associated California red-legged frog population baseline (AM-25) in these areas in the immediate future.

No California red-legged frogs are known or expected to occur within the Overpressure Effect Area which is located entirely in the Pacific Ocean.

California red-legged frogs are well documented within the portions of the action area that include San Antonio Creek (MSRS 2022a, p. 34). This includes the potential Oxbow mitigation area and 9.5 miles downstream of the well water extraction in Barka Slough to the estuary.

Annual VSFB water use between 2019 and 2021 has averaged 2,794 acre-feet (MSRS 2022a, p. 51). However, the Space Force is planning to expand additional launch programs that will contribute to this average water extraction in the future years. Consequently, the Service considers the current average water use in addition to what has been permitted to constitute the existing water extraction baseline.

Western Snowy Plover

VSFB provides important nesting and wintering habitat for western snowy plovers, which includes all sandy beaches and adjacent coastal dunes from the rocky headlands at the north end of Wall Beach on north VSFB to the rock cliffs at the south end of Surf Beach on south VSFB (approximately 12.5 miles). VSFB has consistently supported one of the largest populations of breeding western snowy plovers along the west coast of the United States.

The nearest observation of western snowy plover nesting to the action area (Launch Noise Effect Area) is on the southern end of Surf Beach, approximately 3.5 miles north of SLC-5 (Appendix A, Figure 2b). Numerous known western snowy plover nesting areas are located across Surf Beach, the majority of which are located within the anticipated Launch Noise Effect Area (Appendix A, Figure 2b). Between 2012 to 2021, a total of 1,083 known western snowy plover nests fell within the Launch Noise Effect Area with an average of 108.3 nests per year (Table 4; USSF 2021, 2022b).

Table 4. Number of known western snowy plover nests per year from 2012 to 2021 within the Launch Noise Effect Area.

Year	Nest Count
2021	102
2020	111
2019	103
2018	138
2017	129
2016	91
2015	117
2014	120
2013	80
2012	92

Recovery

California Red-legged Frog

In the recovery plan for California red-legged frog, the Service revised recovery units and identified core areas that are watersheds, or portions thereof, that biologists determined essential to the recovery of the California red-legged frog. VSFB is located within the Northern Transverse Ranges and Tehachapi Mountains Recovery Unit and Core Area 24, Santa Maria River-Santa Ynez River. This core area is important because it is currently occupied, contains a source population, and provides connectivity between source populations (Service 2002, pp. 6, 146).

In this recovery unit, biologists consider the lower drainage basin of San Antonio Creek, the adjacent San Antonio Terrace, and San Antonio Lagoon to be among the most productive areas for California red-legged frogs in Santa Barbara County (Christopher 1996, as cited in Service 2002, p. 10). Most of this area occurs on VSFB.

Recovery task 1.24 identifies that the conservation needs in Core Area 24 are (1) to protect existing populations; (2) reduce contamination of habitat (e.g., clean contaminated ponds on VSFB); (3) control non-native predators; (4) implement management guidelines for recreation; (5) cease stocking dune ponds with non-native, warm water fish; (6) manage flows to decrease impacts of water diversions; (7) implement guidelines for channel maintenance activities; and (8) preserve buffers from agriculture (e.g., in lower reaches of Santa Ynez River and San Antonio Creek) (Service 2002, p. 75).

<u>Western Snowy Plover</u>

In the recovery plan for western snowy plover, the Service designated six recovery units across the range. VSFB is located within Recovery Unit (RU) 5, which includes San Luis Obispo, Santa Barbara, and Ventura Counties. RU5 supports the greatest number of western snowy plovers in the range (approximately half of the U.S. population) and has the greatest amount of available suitable habitat (Service 2007, p. 142).

The population trajectory of RU5 since 2007 is stable, positive, and has had minimal annual fluctuation (Service 2019, p. 5). The population has not attained or exceeded the recovery target in any survey year. Annual monitoring reports from several of the larger sites, including VSFB, report fecundity results that exceed the recovery criterion in most years (Service 2019, p. 5).

In 2022, VSFB comprised approximately 26 percent of breeding adults in RU5, 12 percent of California's breeding population, and 10 percent of breeding adults rangewide (Service 2022b, entire). Table 5 outlines average numbers of breeding adults counted during breeding window surveys from 2014 to 2022. Percentages illustrate the numbers of breeding western snowy plovers at VSFB relative to numbers rangewide, across California, and within RU5.

Table 5. 2014–2022 breeding adult averages from uncorrected (raw) breeding window survey numbers for the Pacific Coast range of western snowy plover, California, RU5, and VSFB with relative percentages (Service 2022b).

Area Surveyed	2014–2022 Averages	Percent of Range	Percent of CA	Percent of RU5
Rangewide	2,283	100	-	-
California Only	1,843	81	100	-
RU5	857	38	47	100
VSFB	226	10	12	26

EFFECTS OF THE ACTION

The implementing regulations for section 7(a)(2) define effects of the action as "all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action" (50 CFR 402.02).

In conducting this analysis, we have considered factors such as previous consultations, 5-year reviews, published scientific studies and literature, and the professional expertise of Service personnel and other academic researchers with aspects directly related to the sensitive species involved in determining whether effects are reasonably certain to occur. We have also determined that certain consequences are not caused by the proposed action, such as the increase or spread of disease, poaching, or collecting, because they are so remote in time, or geographically remote, or separated by a lengthy causal chain, so as to make those consequence not reasonably certain to occur.

Effects of the Proposed Action on the California Red-legged Frog

Construction

The Service assumes that project construction would take place at any point of the year. Due to the proposed project's close adjacency to Honda Creek, SLC-5 site construction, ground disturbance, and vegetation removal activities may result in the injury or mortality of California red-legged frogs due to entrapment, trampling, or crushing by work equipment, materials, and vehicles, at any point of the year. Injury or mortality levels would likely be higher when California red-legged frogs are expected to be moving across the landscape during the wet season (between November 15 and March 31). The Space Force will minimize these effects by conducting work activities during daylight hours and in dry conditions (AM-14). The Space Force will install exclusion fencing to help inhibit terrestrial wildlife, including California red-legged frogs, from entering work areas (AM-14). A Qualified Biologist will survey the site and associated fencing during any activity that has the potential to impact California red-legged frog to minimize associated effects to this species (AM-14). The Qualified Biologist will relocate any California red-legged frogs encountered during work activities that are in harm's way to the nearest suitable habitat (AM-15). Work activities may create open holes or trenches that could entrap California red-legged frogs if left open overnight and lead to subsequent work-related injury or mortality. The Space Force will minimize the potential for effects by securely covering any open holes or trenches with plywood or metal sheets if left overnight, as well as having a Qualified Biologist search any open holes and trenches the following morning for entrapped animals (AM-10).

The proposed project's construction may produce temporary and persistent elevated noise levels during the construction of SLC-5 features. The Space Force did not produce a specific construction noise analysis for the project. We assume that construction noise levels may disturb California red-legged frogs and has the potential to alter California red-legged frog behavior and induce physiological effects. California red-legged frogs are known to occur within 0.1 mile of the proposed SLC-5 Construction Effect Area. Using guidance provided by the Federal Transit Administration (FTA), the Service assumes the proposed project's construction would result in intermittent noise produced by pile driving equipment of 101 dB and persistent noise with average levels of 85 dB (at 50 feet from the source) across an 8-hour period (FTA 2006, p. 12-6, 12-8). We assume noise levels would attenuate to some degree from the construction source at SLC-5 within Honda Canyon. We have no specific data on the response of California red-legged frogs to varying levels or duration of construction noise exposure and consequently use research conducted on related anurans as a surrogate. Traffic noise playback experiments using noise levels between 75 to 87 dB have demonstrated physiological responses including increased level of stress hormone in *Hyla* and *Lithobates* (Tennessen et al. 2014; Troïanowski et al. 2017). Prolonged elevated stress hormone concentrations can have deleterious effects on survival and subsequent reproduction (reviewed in Tennessen et al. 2014). Cases of anuran spatial displacement in response to traffic noise playback experiments have been documented (Caorsi et al. 2017, pp. 9, 14) with different movement effects depending on land cover type (Nakano et al. 2018, entire). Exposure to persistent traffic noise, averaging 70 dBA (A-weighted decibels), significantly reduced the amount of food consumed by Cuban treefrog (*Osteopilus septentrionalis*) tadpoles and also increased the activity level of both Southern toad (*Anaxyrus terrestris*) and Cuban treefrog tadpoles (Castaneda et al. 2020, p. 249). It is possible that increased tadpole activity in response to noise may increase their risk to predation as previous work has shown (Lawler 1989 as cited in Castaneda et al. 2020, p. 251). Adult and sub-adult California red-legged frogs may face increased risk of predation if they move away from noisy construction areas with increased activity potentially making them more noticeable to predators. During the breeding season most adult male anurans, including California red-legged frog, rely on auditory specific advertisement calls which can be critical to female choice of a mate. Consequently, associated effects of construction noise may also include auditory cue masking and loss of signal content. The Space Force will minimize potential noise related impacts on California red-legged frogs by limiting work activities associated with the proposed new facility construction to occur outside of peak vocalization periods during daylight hours and dry weather (AM-14).

The Service also assumes that construction activity has the potential to create associated ground vibration within Honda Creek due to the near adjacency of SLC-5. We cannot anticipate the level or duration of substrate vibration that the proposed project may produce at this time but assume conservatively that low levels of vibration may occur routinely for extended periods of the day during the construction of SLC-5. The Service assumes that potential construction related vibration may be of low frequency which attenuates less readily than high frequency (Norton et al. 2011, p. 658). We have no specific data on the response of California red-legged frogs to varying levels or duration of exposure to construction vibration. We consequently use available research on the effects of vibration on related anurans as a surrogate. In a laboratory study, researchers investigated the effects of low frequency vibrations on early embryonic development of African clawed frog (*Xenopus laevis*). The study demonstrated that vibrating embryos in petri dishes overnight during the embryo development process at 3 low frequency levels (7, 15, and 100 hertz) induced significant levels of physiological effects (heterotaxia, defined by the abnormal position of the heart, gall bladder, and/or gut loop), with some treatments inducing neural tube defects as well as bent tail morphology (Vandenberg et al. 2012, pp. 3-5). Other research has demonstrated negative effects of anthropogenic vibration on anuran communication. Researchers carried out field based vibratory playbacks during 13 days from sunset until dawn when male common midwife toads (*Alytes obstetricans*) were calling. During vibratory playback stimuli, call-rate of the common midwife toad significantly decreased with a smaller number of toads ceasing calling activity completely or abandoning their calling sites (Caorsi et al. 2019, p. 2). Being that construction on SLC-5 would occur within 0.1 mile of California red-legged frog breeding habitat, these findings suggest that if routine construction related vibration occurs during the breeding season, routine exposure to low frequency vibration may adversely affect California red-legged frogs and has the potential to negatively impact breeding success during construction. However, the Space Force did not perform vibration modeling for the purposes of this assessment. The Service cannot anticipate the specific levels or duration of any construction vibration that the project may cause and consequently is unable to predict the magnitude of potential effects. Although more information is needed, the Service conservatively assumes that the project may generate routine construction vibration levels that could result in adverse effects to adjacent California red-legged frog breeding habitat which may include tadpole developmental effects, adult communication, and overall breeding success. Until more information is available, and the effects of the project activity are studied, we are unable to anticipate the specific response at this time.

In the event that construction related vibration causes small scale erosion into Honda Creek, the quality of California red-legged frog breeding habitat may degrade if sedimentation of the creek occurs. The Space Force will conduct annual habitat assessments to measure stream characteristics, including sediment level, to monitor that no unanticipated changes to sedimentation are occurring as a result of the proposed project (AM-23). The Project Proponent will implement erosion control measures wherever potential for project related sedimentation into Honda Creek exists using weed-free biodegradable materials (AM-5). Implementation of erosion control materials has the potential to injure individual California red-legged frogs or disturb their habitat. However, the Service expects these effects to be temporary and minimized by the presence of a Qualified Biologist that will attempt to capture and relocate any California red-legged frogs encountered within the project area (AM-1, 14, 15).

Capture and relocation of California red-legged frogs could result in injury or death as a result of improper handling, containment, transport, or release into unsuitable habitat. Although we do not have an estimated survivorship for translocated California red-legged frogs, intraspecific competition, lack of familiarity with the location of potential breeding, feeding, and sheltering habitats, and increased risk of predation reduces survivorship of translocated wildlife in general. The Space Force will minimize effects by using Qualified Biologists as proposed, limiting the duration of handling, requiring proper transport of individuals, and identifying suitable relocation sites (AM-1, 15). The Service expects the relocation of individuals from work areas to greatly reduce the overall level of injury and mortality, if any, which would otherwise occur. The Space Force will also reduce any associated risk of spreading chytrid fungus during capture and relocation activities by requiring the implementation of DAPTF (AM-15).

Accidental spills of hazardous materials, careless fueling or oiling of vehicles and equipment, and associated runoff could impact California red-legged frogs if materials enter adjacent aquatic habitat. Vehicle and worker movement within staging areas may also injure or crush any California red-legged frogs that enter these areas. The Space Force includes that although the exact locations of laydown and staging areas are unknown at this time, they will limit potential locations to within the SLC-5 Right of Entry or designated utility corridors. Additionally, the Space Force will require that these areas and individual equipment or supplies staged overnight will be located at least 0.1 mile away from California red-legged frog aquatic habitat (AM-14). The Space Force will also ensure that the Project Proponent implements measures to deter California red-legged frogs from accessing designated staging areas (e.g., drift fence barriers). The Space Force will require that the Project Proponent conducts any fueling of equipment in a pre-designated location within the staging areas as well as place spill containment materials around equipment before refueling (AM-8). The Space Force will ensure that Permitted or Service Approved Biologists inspect equipment and staging areas for cleanliness and gas and oil leaks on a daily basis and require that contractors immediately address any unanticipated leaks or spills (AM-1).

During construction, open standing water may be present within excavation areas of SLC-5 infrastructure features (e.g., detention basins, other open site features) for an unknown period of time. Consequently, the Service must assume that features within the proposed construction area have the potential to serve as ephemeral breeding habitat, particularly for California red-legged frogs that may be competing for resources within adjacent habitat in Honda Creek. If filled with storm or construction-related water, these features may attract California red-legged frogs for breeding. Work activities and any associated water drainage during construction activities have the potential to result in the injury or death of any present California red-legged frogs or their egg masses through crushing or desiccation. During construction the Space Force will decrease risks by ensuring the Project Proponent covers all holes or trenches and places wildlife exclusionary fencing around the project area (AM-10). The Space Force will require that a Qualified Biologist survey the site, including any open holes or trenches, each day prior to initiation of work (AM-14) and attempt to capture and relocate any California red-legged frogs encountered within the project area (AM-1, 15).

Operations

The Space Force would authorize routine operational vegetation clearance on Honda Canyon Road as well as an abandoned former access road. Operational vegetation management would also involve routinely mowing the SLC-5 fence line and surrounding firebreak. The Space Force did not provide a project end date and consequently the Service assumes these activities would occur into perpetuity. Due to the proposed project's close adjacency to Honda Creek, routine vegetation management activities may result in the injury or mortality of California red-legged frogs due to entrapment, trampling, or crushing by work equipment, materials, and vehicles, at any point of the year. Injury or mortality levels would likely be higher if the Space Force conducts activities when California red-legged frogs are expected to be moving across the landscape during the wet season (between November 15 and March 31). The Space Force will minimize effects by conducting work activities during daylight hours and in dry conditions (AM-14). The Space Force will continue to require that a Qualified Biologist survey the vegetation maintenance work areas to minimize associated effects to California red-legged frogs (AM-14). The Qualified Biologist will relocate any California red-legged frogs encountered during work activities out of harm's way to the nearest suitable habitat (AM-15). Operational capture and relocation effects would be similar to those described above under Construction.

The Space Force would authorize a maximum of 552,000 gallons (1.69 acre-feet) of water per year to support the project. The current water source for VSFB consists of four water wells located within the San Antonio Creek Basin. Water withdrawal from the San Antonio Creek wells has the potential to reduce streamflow and water levels within San Antonio Creek. This could adversely affect all life stages of California red-legged frog downstream of Barka Slough by reducing associated wetland and riparian habitats supported by the existing groundwater level and extent of inundated area. Annual VSFB water use between 2019 through 2021 has averaged 2,794 acre-feet (MSRS 2022a, p. 51). Utilizing available data for purposes of comparison, a previous analysis for a separate project involving groundwater extraction within the Barka Slough estimated that a 5.1 percent decrease in average annual base flow (up to 0.07 cubic feet per second) in near normal precipitation years could occur within the associated downstream creek channel as a result of pumping a maximum of 921 acre-feet (USGS 2019, p. 5). When using this provided ratio for reference, the Service assumes that pumping 1.47 acre-feet annually would likely result in less than an approximate 0.01 percent decrease in average annual base flow with a correspondingly low level of associated aquatic habitat within the creek channel. Discussion with hydrologists involved with the previously generated hydrological modeling indicate that a 1.47 acre-feet extraction amount is not anticipated to result in measurable decline of streamflow or aquatic habitat considering current water usage at this point in time (C. Faunt and G. Cromwell, USGS, pers. comm. 2021). The Service considers the extraction level of 1.47 acre-feet to be insignificant at this time based on the information provided. Factors including future surrounding water usage (e.g., collective existing and future launch program water needs, surrounding agriculture, etc.) as well as increased variability of annual precipitation due to climate change, including shorter wet seasons and longer dry periods, may influence true effects (Myers et al. 2017, p. 15, 59). An additional hydrological model incorporating various precipitation scenarios predicts that an extraction amount of 921 acre-feet would decrease inundated area between 0.14 and 10.14 percent (AECOM 2019, p. 6). Similarly, given that the maximum annual extraction amount of 1.69 acre-feet is less than 1 percent of the 921 acre-feet used for the supplemental model analysis, it is not reasonably foreseeable that it would result in a discernable reduction of inundated area. Although potential impacts to associated riparian terrestrial habitat were not initially characterized, based on the best available information (USGS 2019; AECOM 2019), the Service does not anticipate measurable decline in the quality or overall extent of these associated habitats as a result of the proposed quantity of 1.69 acre-feet to be extracted annually at this time referencing available information. However, the Service understands that there has been a level of habitat change within Barka Slough driven by increasing groundwater withdrawals from the San Antonio Creek groundwater basin for agriculture on and off VSFB. Since the 1980s, withdrawals have exceeded the recharge rate for the basin (Public Works 2020 as referenced in MSRS 2022b, p. 5). Since the 1950's, ground water levels have dropped between 10 to over 30 meters (USGS 2019 as referenced in MSRS 2022b, p. 5). The Service also understands that there are additional launch programs currently permitted but not yet operational that represent the true existing water extraction baseline. However, the Space Force did not provide the total permitted extraction amounts. Without this information, the Service is unable to make clear quantifiable reference for how the proposed project would contribute to the existing baseline of water extraction. Consequently, additional monitoring and analysis would be necessary to confirm preliminary assumptions and understand the impacts of the proposed project's extraction levels in the event ground water overdraft continues to occur over time.

The proposed project would include the development of a deluge water system. The Space Force has not provided specific design plans for features involved within this system. The Service anticipates water would be present within the retention basin up to three days during the described inspection process to test deluge water quality following static fire and launch events. The Service also assumes rainstorm events could also fill these features with stormwater held for a short period until actively drained. Being that the Project Proponent would remove wildlife exclusionary fencing (AM-10) following construction, there is the potential that California red-legged frogs may enter basins more easily. California red-legged frogs frequently breed in artificial impoundments and consequently the Service must assume that the proposed deluge water retention basin features, when filled, may serve as ephemeral breeding habitat for California red-legged frogs. Deluge water drainage from basins has the potential to result in the injury or death of any individuals or present egg masses through desiccation. The Space Force would transport tested deluge water that does not meet permit water criteria to an offsite facility.

This action may injure any life stages of California red-legged frog present within basins if not relocated prior to water transport. The Project Proponent will design retention basins and water storage features to prevent access by California red-legged frogs. However, the Space Force indicates that if total exclusion is determined impossible, the Space Force will require that the Project Proponent screen all pumps with a 1/8-inch mesh and that a Qualified Biologist check daily for California red-legged frogs prior to pumping (AM-16). To minimize impacts associated with stormwater, the Project Proponent will design deluge containment basins to minimize the amount of stormwater they receive (AM-17). The Project Proponent will also design stormwater management areas to prevent the presence of standing water (other than immediately after a rainstorm) by using design features similar to a French drain. Consequently, the Service assumes stormwater would not fill retention features to an adequate depth or hydroperiod to support the potential for breeding. Based on the implemented avoidance and minimization measures, the Service assumes that all SLC-5 water features will passively drain in less than 24 hours following a storm event and not serve as an attractive nuisance.

The Space Force indicates they would test stored deluge water for chemicals to see if it meets permit water quality criteria before releasing water into the deluge water infiltration pond. The Service does not know what chemicals or elements the Space Force would be testing for that may contaminate deluge water temporarily stored in the basin. Amphibians, including California red-legged frogs, have highly permeable skin and are thought to be particularly susceptible to poor water quality or waterborne pollutants (Jung 1996, p. i; Llewelyn et al. 2019, p. 1). Consequently, the Service must assume that this deluge water has the potential to injure or kill any California red-legged frogs that contact it. The Service also assumes that the deluge water retention features may require maintenance including sediment and associated vegetation removal. Basin maintenance activities could result in the injury or death of adult California red-legged frogs if present. To minimize effects, the Project Proponent will design retention basins and water storage features to prevent access by California red-legged frogs. However, if total exclusion is determined not to be possible, the Space Force will require that a Qualified Biologist check daily for California red-legged frogs prior to pumping (AM-16).

Similarly, the Space Force anticipates the proposed project's launches will produce soot biproduct that also has the potential to impact California red-legged frogs. Conservatively, assuming the full cadence of 48 launches per year, a total of 1.62 pounds per second of soot would be produced, which is estimated to be 195 pounds in total per year (Kaisersatt, pers. comm., 2022d). In the event enough soot or other similar launch related biproducts contact dispersing California red-legged frogs or enter Honda Creek and other adjacent occupied waterbodies, the Service must assume it has the potential to injure or kill California red-legged frogs. However, the Space Force references a comparable launch assessment (FAA 2020, entire) and expects that the actual amount of soot produced would be diminutive being that it would subsequently burn up in the exhaust plume (Kaisersatt, pers. comm., 2022d). Consequently, the Service assumes that the proposed project's launch biproducts are not likely to impact dispersing California red-legged frog or their aquatic habitats.

The project's associated flame bucket and deluge system may produce temporary high intensity flame and steam that could result in the injury or mortality of any California red-legged frogs within the project area during launch or test fire events. To minimize potential impacts to California red-legged frogs, the Project Proponent will design the position of the flame buckets and deluge system to direct flame and associated steam to the north of SLC-5, away from Honda Canyon, to minimize potential impacts to California red-legged frog (AM-20). The Space Force will also maintain exhaust ducts to be free of water between launches to help minimize the potential to attract California red-legged frogs to the immediate area.

The Service also assumes that launch and static test fire events have the potential to create associated ground vibration within Honda Creek due to the near adjacency of SLC-5. We cannot anticipate the level of substrate vibration that the proposed project may produce at this time but assume conservatively that low levels of vibration may occur routinely for a short period (up to 1 minute every 2 days) during the operation of SLC-5. The Service assumes that potential construction related vibration may be of low frequency which attenuates less readily than high frequency (Norton et al. 2011, p. 658). We have no specific data on the response of California red-legged frogs to varying levels or duration of exposure to launch operation vibration. Although it is likely that vibration level and duration would differ, we anticipate effects of potential launch vibration could be similar to those previously described for construction-related vibration. The Service considers that although the project has the potential to result in effects from launch related vibration to California red-legged frog's tadpole development, communication, and breeding success, until the novel effects of this project activity are studied, we are unable to anticipate the specific response at this time.

The proposed project's launch operations will produce noise levels that may adversely affect California red-legged frogs. There are no studies on the effects of noise on California red-legged frogs, but available literature on the effects of noise disturbance on anurans in general has grown in recent years (Zaffaroni-Caorsi et al. 2022, entire). A previous study reviewed the effects of noise exposure on American bullfrogs (*Lithobates* (*Rana*) *catesbeianus*), which are closely related to California red-legged frogs. Although no specific acoustic thresholds were determined during the study, American bullfrogs were exposed to sound levels greater than 150 dB SPL for 20 to 24 hours straight, which produced observable damage to their inner ears (Simmons et al. 2014a, p. 1629). American bullfrogs' inner ears showed physical signs of recovery nine days after noise exposure (Simmons et al. 2014b). A moderately large population of breeding California red-legged frogs are known to occur approximately 0.1 mile south of proposed SLC-5 within Honda Creek. Any California red-legged frogs present in upland habitat near SLC-5 may experience modeled noise levels of 144 dB L_{max}. California red-legged frogs distributed throughout the western most approximate 6.5 miles of Honda Creek will experience routine (up to 1 minute every 2 days) noise levels between 100 to 130 dB as a result of the proposed project. The entirety of Bear Creek which also supports a moderate population of breeding California red-legged frog is also within the noise action area and would routinely experience modeled noise levels of 100 dB. Although the proposed project's maximum noise levels are only slightly lower than those documented to produce observable damage to American bullfrog ears, the duration of the noise events would be much shorter than the exposure duration used in this study. However, the specific acoustic thresholds of California red-legged frog are unknown. In the event that the proposed project's noise levels did result in hearing damage to California red-legged frogs, it may temporarily deafen them. The Service assumes the California red-legged frog inner ear recovery period may be similar to the 9-day recovery period exhibited by American bullfrogs. In the event the proposed project's noise levels physically damage California red-legged frog's inner ears and given that project's noise events may occur every 2 days, this may lead to routine deafening. Routine deafening of a substantial portion of the Honda Creek breeding population may alter California red-legged frog's ability to effectively communicate across the breeding season when frogs are calling with the potential to result in overall lower likelihood of reproductive success. California red-legged frogs that exhibit hearing loss may have a decreased ability to detect danger which increases their risk of predation.

However, without refined specific acoustic threshold information, the Service is unable to determine if the proposed project will result in routine deafening of the California red-legged frog population. The Service considers that although specific acoustic thresholds are not available, the American bullfrog surrogate study used higher noise levels (greater than 150 dB) with significantly longer exposure duration (20 to 24 hours). The same study reported that shorter duration (4 hours) of levels below 150 dB did not produce observable morphological damage (Simmons et al. 2014b). Further, noise modeling for the proposed action did not account for topography, and it is likely that surrounding topographic features may serve to attenuate noise levels produced from the proposed project (Bermingham 2013, pp. 19–21). The incised topography associated with Honda Canyon may influence the received noise levels produced by the proposed action within Honda Creek. This may result in lower levels within the action area than was predicted within noise modeling (MSRS 2021, p. 51). Consequently, although the acoustic thresholds for California red-legged frog are unknown, the Service does not anticipate physiological effects to California red-legged frog's inner ears at this time due to the short duration and lower noise levels of the project's anticipated noise disturbance events. Observed call-rate changes could be correlated with hearing loss as frogs may logically call more often if they are unable to perceive responses. The Service has reviewed previous short-term California red-legged frog call-rate monitoring conducted following a single launch event (MSRS 2023, pp 12, 15-16). Short term monitoring documented a significant increase in call-rate following previous Falcon-9 launch activities in December 2022 (MSRS 2023, pp 12, 15-16) . However, data was collected over an insufficient time period (6 days) to be able to analyze results in a meaningful manner. The Service has determined that significantly more data is necessary to begin to understand potential effects. To address the need for better information, the Space Force will implement annual long-term, passive bioacoustics monitoring during the California red-legged frog breeding season to characterize the baseline noise environment and determine if there are unanticipated changes to calling behaviors that may indicate inner ear damage (AM-23).

In addition to call-rate, introduction of novel noise disturbance may result in changes to other signal characteristics including amplitude, frequency, duration, and complexity. Changes (increases or decreases) to an individual's signal characteristics may represent energetic and vocal performance trade-offs. Receiver interpretation of altered signals may influence assessment of signaler quality. This may have implications on the long-term fitness of anuran populations which rely heavily on acoustic signals to attract females and to defend resources against rivals. Previous research looking at traffic noise has demonstrated a trade-off between call-rate and call duration in *Hyla versicolor* (Schwartz et al. 2002). Females were found to prefer calls that were delivered at high rates with longer durations (Gerhardt et al. 1996; Gerhardt and Brooks 2009), suggesting that environmental factors that influence the tradeoff of call-rate and call duration may potentially impact overall fitness over the long-term. Multiple related frog species have been shown to alter call amplitudes during motorbike noise exposure (Cunnington and Fahrig 2010). The energetic costs of calling increases exponentially with call amplitude with an approximate doubling in energetic cost for each 3 dB increase in amplitude (Parris 2002). Previous work suggests that increased energetic costs of calling may inhibit growth rate as a result of allocating more energy towards call effort (Given 1988). This may result in lower reproductive output (Gibbons and McCarthy 1986) and increased risk of desiccation (Heatwole et al. 1969 as referenced in Yi and Sheridan 2019) both of which can lead to decreases in population size. Potential changes in signal frequency could also reduce transmission distance and overall reduce signal efficiency. In bird species, adjustments in signal frequency can decrease song complexity which can profoundly affect reproductive success (Montague et al. 2013). Few studies have considered the long-term implications of adjusted signaling performance in anurans and more information is needed to understand how changes in signal characteristics may impact anuran populations over the long term.

California red-legged frogs may react to individual project related launch noise by startling or remaining immobile, making them more susceptible to predation or desiccation; they may also react to noise by diving into water or retreating away from the affected areas. In our 2017 SpaceX Falcon 9 boost-back biological opinion, we did not expect project-related noise to induce a behavioral response greater than momentary startling or freezing by individual frogs from noise levels as high as 146 dB, which are higher than the proposed project's levels (Service 2017a, p. 49). However, subjecting California red-legged frogs to more frequent and routine noise disturbance may result in novel adverse effects. The Service continues to review the growing body of available literature on the effects of noise pollution to surrogate species. The U.S. Army conducted a study on the response of Colorado checkered whiptail (*Aspidoscelis neotesselatus*) when exposed to intermittent noise disturbance from aircraft flyover noise. When exposed to a week of intermittent flyover noise up to 112.22 dB in comparison to a control week of no noise disturbance, the Colorado checkered whiptail was found to modify its behaviors by spending less time moving and more time eating, and also exhibited higher levels of corticosterone and ketone bodies (markers of stress) (Kepas et al. 2023). The study also suggests that noise disturbance that occurs during the breeding season may induce higher levels of impact when energy would otherwise be invested into developing offspring. Other available research documents cases of anuran spatial displacement in response to traffic noise playback experiments (Caorsi et al. 2017, pp. 9, 14), with different movement effects depending on land cover type (Nakano et al. 2018, entire). Somewhat conversely, it has been suggested that noise can trigger tonic immobility, a paralysis-like fear response, in anurans as a result of increased stress levels (Tennessen et al. 2014, p. 6), which may make them more vulnerable to predation. The proposed project will create frequent noise disturbance throughout the year, including the wet season, when California red-legged frogs are more active and breeding. Induced stress during this period may magnify effects of potential behavioral responses. However, no specific thresholds of disturbance level or frequency are known. The Service considers that although the project has the potential to result in routine stress production and associated effects on behavior, including feeding, reproduction, and dispersal behaviors, until the novel effects of the project activity are studied, we are unable to anticipate the specific response at this time.

The proposed project has the potential to contribute to long-term adverse effects that result from routine intermittent acute noise disturbance. The Service understands that the proposed project would contribute to the frequency of an existing launch disturbance baseline. Over the past five years, VSFB has supported an average of 4.4 rocket launches per year with a maximum of 7 launches in both 2017 and 2018. Other proponents have recently initiated several adjacent launch programs within the vicinity of SLC-5. Of these, those that will have noise impacts on Honda Creek of at least 100 dB include SpaceX Falcon 9 (SLC-4), Minotaur (SLC-8), ULA Vulcan (SLC-3), Blue Origin New Glenn (SLC-9), Relativity Terran 1 (SLC-11), and Phantom Daytona-E (SLC-8). If all these programs, including the proposed project, achieve full launch tempo by 2028, a combined total of up to 157 launch disturbance events of at least 100 dB L_{max} would impact Honda Creek each year as a result of launch and static fire. The proposed project would contribute to over half of this total. The Service understands the adjacent SLC-4 that now supports 36 SpaceX launches would have additional associated terrestrial sonic booms that would also contribute to the existing disturbance baseline within Honda Creek. Although no specific information is available on California red-legged frog response to specific launch disturbance thresholds at certain temporal frequency, using the best available information, the Service considers that related amphibians demonstrate sensitivity to noise disturbance at certain thresholds.

In certain frog species, acute stress has been shown to induce an immediate increase in stress hormone (corticosterone) production (Hammond et al. 2018). Chronic stress, such as frequent exposure to noise disturbance, can cause chronically high levels of stress hormone (Troïanowski et al. 2017). Prolonged elevated stress hormone concentrations can have deleterious effects on growth, survival, reproduction, and immune function (Sapolsky et al. 2000; Tennessen et al. 2014). Relatively recent research demonstrates that increases in advertisement calling rate may be correlated with stress hormone production, which can result in an overall tradeoff in energy otherwise allocated for immunocompetence (Troïanowski et al. 2017; Park and Do 2022). Collectively, if California red-legged frogs were startled at least once every 2 days as a result of the proposed project with the possibility of being disturbed even more frequently as a result of the collective 157 proposed launches annually, using the best available information, the Service anticipates the potential for long-term effects from chronic stress caused by routine intermittent acute noise disturbance. These may include long-term population level effects including reduced reproduction success, survival, and fitness. However, it is unknown how California red-legged frogs would specifically react to repetitive launch events of variable disturbance level with increasing frequency. There are no thresholds in the literature that quantify what level of noise or frequency of disturbance would elicit stress hormone responses that may lead to impacts to breeding and reproduction or other negative population level effects.

The Space Force provided preliminary audiogram analysis which suggests there would not be overlap in the species' hearing sensitivity and low frequency noise produced by rocket launches. Specifically, the provided audiogram analysis suggests that California red-legged frog may only be able to perceive a portion of the launch noise, hearing less than 25 dB across the entire launch event (MSRS 2022a, pp. 55-56). However, subject matter expert review indicates the provided hearing curve and corresponding weighting function are not established and there is still significant uncertainty around the hearing capabilities of California red-legged frog (J. Tennessen, pers. comm., 2022). Referencing current best available information, specific disturbance levels and frequency thresholds that may impact California red-legged frogs are unknown. Consequently, the Service cannot adequately determine the anticipated effects of the proposed project's 96 disturbance events on the residential and breeding California red-legged frog populations within Honda Creek. In addition, the Service cannot adequately determine how the proposed project's 96 disturbance events would contribute to the existing baseline of 61 permitted launch disturbance events annually. The Service considers that although the project has the potential to significantly contribute to the collective effects of the existing launch disturbance baseline and result in long-term population level effects, until the novel effects of the project activity are studied, we are unable to anticipate the specific response at this time.

Newly introduced persistent artificial night lighting associated with SLC-5 operations could have adverse physiological and behavioral effects on California red-legged frogs. The Space Force would authorize the installation of 36 light poles around the perimeter of SLC-5 for security and support of night operations. The light poles would have a maximum height of 40 feet. The Service assumes permanent operational site lighting will include ultra-violet artificial night lighting features that may newly illuminate some amount of adjacent natural habitat around SLC-5. The Space Force provided a preliminary lighting plan within the biological assessment. The proposed project would include lighting levels between 1- to 4-foot candle within SLC-5 facility (MSRS 2022a, p. 59; Figure 5.1-4). The Space Force indicates that newly introduced light will be contained within the work area (Evans, pers. comm., 2022b). Although we have no specific data on the response of California red-legged frogs to artificial night lighting exposure, laboratory and field studies of related anurans indicate artificial lighting can result in changes in hormone production and growth, as well as altered activity levels including movement and foraging (Baker and Richardson 2006; Wise 2007; Hall 2016; May et al. 2019). The introduction of artificial night lighting may consequently increase anuran predation rates if predators are able to better detect dispersing adult frogs that may move more in newly lit environments.

Numerous anurans have been shown to increase foraging activity surrounding permanent light sources (reviewed in Buchanan 2006), likely attributed to increased concentrations of prey levels resulting from insects' attraction to the presence of ultraviolet light (Longcore and Rich 2017a, p.

25). The number of insects attracted to a lamp is disproportionally affected by the emission of ultraviolet light, regardless of the proportion of ultraviolet radiation emitted (Barghini and Augusto Souze de Medeiros 2012, entire; B. Seymoure, pers. comm., 2023), indicating that even ‘low-UV’ lighting options attract insects. Permanent ultraviolet lighting adjacent to roadways or parking areas associated with SLC-5 launch facility may result in higher likelihood of vehicle strikes if California red-legged frogs increase foraging in these areas. Launch operations may physically injure or destroy California red-legged frog individuals if lighting surrounding the launch pad attracts them and they come within close vicinity of features including the flame bucket. Being that SLC-5 is only 0.1 mile north of the Honda Creek which is known to contain a consistently moderately sized population of California red-legged frogs, the Service reasonably anticipates that the introduction of artificial lighting associated with the project has the potential to result in sustained adverse effects. To attempt to minimize these effects, the Space Force will require development of a lighting plan for the proposed project (AM-22). This plan will require that the Project Proponent directs all light away from Honda Canyon and shield it to reduce scatter into natural, undeveloped areas. The Space Force will ensure that illumination lighting levels of 1-foot candle do not extend beyond the SLC-5 facility into natural habitats (MSRS 2022a, p. 59). The Space Force will require that the lighting plan design uses the minimum lumens necessary to accomplish lighting requirements. This requirement will be accomplished through strategic placement of lights, and the use of shields, timers, and motion sensors to the maximum extent possible to minimize potential effects associated with novel persistent artificial light at night (York, in litt., 2022, p. 6). The Project Proponent will limit all persistent artificial lighting at SLC-5 to the needs of providing site security during the hours of darkness (AM-21). Provided this language and that the Space Force will limit construction work to occur only during daylight hours (AM-14), the Service assumes that there will be very minimal or no construction lighting as a part of the proposed project, effectively avoiding the potential for associated lighting effects. The Project Proponent will also design the position of the flame buckets to direct flame and associated steam north of SLC-5, away from Honda Canyon, to help minimize potential direct physical injury to California red-legged frog that may be attracted to the area by lighting (AM-20).

Capture and relocation of California red-legged frogs during project operations (vegetation maintenance) could result in injury or death as a result of improper handling, containment, transport, or release into unsuitable habitat. Although we do not have an estimated survivorship for translocated California red-legged frogs, intraspecific competition, lack of familiarity with the location of potential breeding, feeding, and sheltering habitats, and increased risk of predation reduces survivorship of translocated wildlife in general. The Space Force will minimize effects by using Qualified Biologists as proposed, limiting the duration of handling, requiring proper transport of individuals, and identifying suitable relocation sites (AM-1, 15). The Service expects the relocation of individuals from work areas to greatly reduce the overall level of injury and mortality, if any, which would otherwise occur. The Space Force will also reduce any associated risk of spreading chytrid fungus during capture and relocation activities by requiring the implementation of DAPTF (AM-15).

Somewhat similarly, the proposed project's disturbance frequency has the potential to displace California red-legged frog populations, potentially stimulating migration away from noisy areas or attraction towards newly lit adjacent habitat as described above. Although we do not have an estimated survivorship of displaced California red-legged frog, this could result in injury or death to individuals as a result of increased intraspecific competition, lack of familiarity with new locations of potential breeding, feeding, and sheltering habitats, and increased risk of predation. All of which reduces survivorship of translocated wildlife in general.

Following review of the effects of the proposed action, the Service anticipates the proposed project would result in the sustained degradation in the quality of adjacent California red-legged frog aquatic habitat due to associated sensory pollutants caused by routine launching. In the event the Space Force observes California red-legged frog population declines from the established baseline within Honda Creek, the potential mitigation actions would include the creation of new breeding habitat at a 2:1 ratio (habitat enhanced: habitat affected) within the San Antonio Creek Oxbow Restoration 'expansion area' (Appendix A, Figure 4a). Mitigation actions that may occur as result of the project include site preparation via herbicide application, plowing, container plant installation, seeding, willow pole planting, and watering via water truck. These activities have the potential to effect California red-legged frog. An existing biological opinion (2016-F-0103; Service 2018) addresses the associated effects of this portion of the proposed action for California red-legged frog, and the Space Force will implement all required avoidance, minimization, and monitoring measures. The Space Force has formerly conducted restoration work over the past three years at the existing San Antonio Creek Oxbow Restoration site to improve San Antonio Creek California red-legged frog habitat. The Space Force indicates that restoration methods have proven successful at creating deep water aquatic habitat, suitable for California red-legged frog breeding and riparian woodland that simulate naturally occurring high-flow channels. However, previous survey efforts have not yet detected California red-legged frog at this site or demonstrated that California red-legged frog will newly colonize these areas for breeding (Evans 2022a, p. 4; Kephart 2022, p. 2). The Service considers that the Space Force will continue to develop restoration methods to ensure the objectives of proposed mitigation are met and able to clearly demonstrate that no net loss in occupied California red-legged frog habitat and population size will result from project activities (Kephart 2022, p. 2-3).

Effects of the Proposed Action on the Western Snowy Plover

<u>Construction</u>

Western snowy plovers do not occur within or adjacent to the proposed SLC-5 facility. The nearest observation of western snowy plover nesting is approximately 3.5 miles north of SLC-5, at the southern end of Surf Beach. Additionally, the proposed SLC-5 construction area is approximately 325 feet above sea level and out of sight of western snowy plover habitat. Based on these reasons, we do not anticipate adverse effects to western snowy plover from site construction activities.

Operations

Known western snowy plover nesting locations are located approximately 3.5 miles north of the proposed SLC-5 facility and extend within the northern portion of the Launch Noise Effect Area (Appendix A, Figure 2b). Western snowy plovers in this area would experience launch operation noise levels between approximately 100 to 108 dB L_{max} during Laguna-E launches and between approximately 100 and 104 dB L_{max} during Daytona-E launches. Static fire levels would reach less than 100 dB L_{max} for both launch vehicles. The Space Force proposes a staggered launch operation schedule until 2028 when the proposed project would attain full launch tempo with 48 launches and 48 static test fires (Table 1). Using the information provided, the Service assumes a launch related disturbance event would occur once every two days consecutively across 192 days annually at full launch tempo in 2028.

The Space Force conducted prior monitoring of western snowy plovers during individual launches to understand immediate impacts from launch related noise events. Biologists monitored nesting western snowy plovers on April 17, 2022, during a SpaceX Falcon 9 NROL-85 with boost-back at 137 dB SEL from SLC-4 East (4E), located approximately 0.9 mile from western snowy plover habitat. Although behavioral responses were not captured, the biologists reported no detectable effects on abundance or nest attendance of western snowy plover after this single launch (Point Blue Conservation Science 2022, p. 1). Biologists also monitored western snowy plovers during a Titan IV launch at 130 dBA from SLC-4E and observed no adverse reactions from western snowy plovers due to the launch (SRS 2006 as cited in Tetra Tech 2020, p. 40). However, after a launch event during the 1998 western snowy plover breeding season of a Titan II from SLC-4W at 119 dB, monitors found one of three eggs broken in the nest located closest to the launch facility. The cause of the damaged egg was not determined (Applegate and Schultz 1998, as cited in MSRS 2021, p. 54).

More recently, biologists monitored western snowy plover for the June 18, 2022 Falcon 9 SARah-1 mission with boost-back and first stage recovery at SLC-4 (Robinette and Rice 2022, entire). They noted that incubating western snowy plovers reacted to both the launch and sonic boom produced by the return flight of the first-stage with more intense reactions to the sonic boom (Robinette and Rice 2022, p. 1). They observed a startle effect in response to the sonic boom for all five western snowy plover nests with cameras, and two of the five incubating birds hunkered down on their eggs in response to the sonic boom. Biologists note that it is possible the startle and hunker behavior observed can lead to damage to one or more eggs. One western snowy plover egg at north Wall Beach (outside of the monitoring area) showed signs of potential damage in which it had a long crack. The damaged egg had an approximately three-week-old embryo that may have stopped developing around the time of the launch. However, it is common for one or more eggs from a successful nest to fail to hatch and there currently is no data on how often eggs undergo damage under normal (i.e., non-launch) circumstances. The nest with the damaged egg did not have a camera set on it, so biologists could not determine what caused the damage. Biologists reported no difference in nest attendance or bird abundance before and after launch and boost-back, and they concluded that this launch and boost-back did not significantly affect western snowy plover nesting on VSFB (Robinette and Rice 2022 pp. 1–2, 13).

Physiological responses of western snowy plover to launch noise disturbance may include an increased heart rate, altering of metabolism and hormone balance, and behavioral reactions, such as head raising, body shifting, moving short distances, and flapping of wings. These responses may cause energy expenditure, reduced feeding, habitat avoidance, reproductive losses, and bodily injury resulting in increased vulnerability to predation (Radle 2007, p. 5). Although more information is needed on specific noise level and frequency thresholds that may impact western snowy plover at various stages during the breeding season, the proposed project's noise disturbance is anticipated to be of short duration (1 minute during launches and 30 seconds during static test fire). Considering past monitoring results, we do not expect the proposed project's individual launch and static test fire events to result in short term observable effects, such as birds flushing from the nest. However, non-observable effects, such as increased heart rate or increased stress hormone levels could routinely occur. Consequently, the proposed project has the potential to contribute to long-term adverse effects that result from routine intermittent acute noise disturbance. The Service assumes a launch related disturbance event would occur once every two days consecutively across 192 days annually, at full launch tempo in 2028. Proposed project launch operations would consequently expose populations to routine intermittent acute noise disturbance at levels between 100 to 108 dB for 1 minute during launches and 30 seconds during static test fire. The Service understands that the proposed project would contribute to the disturbance frequency of the existing launch noise disturbance baseline. Existing noise disturbance events of at least 100 dB L_{max} currently occur across Surf Beach within the proposed project's Launch Noise Effect Area that affect the same populations of western snowy plover. This includes the SpaceX launch complex at SLC-4, approximately 1.8 miles north of SLC-5 (2017-F-0480; Service 2017b); the ULA Vulcan launch complex at SLC-3, approximately 3 miles north (2013-F-0430; Service 2015c); the Blue Origin New Glenn launch complex at SLC-9, approximately 4 miles north (2020-F-0427; Service 2020); and the Relativity Terran 1 launch complex at SLC-11, approximately 2.5 miles south (2022-0032755-S7; Service 2022c). The proposed project in combination with other planned and permitted launch programs would produce a total of 154 noise disturbance events of at least 100 dB annually that would impact South Surf Beach (estimated for 2028 to 2030; MSRS 2022a, p. 67).

Although no information is available on western snowy plover response to specific noise disturbance thresholds at certain temporal frequency, western snowy plovers do appear to demonstrate sensitivity to frequent noise disturbance. Biological monitors reported that a 20-minute fireworks display (lower levels of frequent acute noise; variable intermittent disturbances that ranged from 59 dB to 80 dB for 20 minutes) at Coal Oil Point Reserve in Goleta, California, visibly agitated western snowy plovers (BRC 2018, entire). Camera footage captured western snowy plovers displaying stress responses (i.e., shallow breathing, frantic head turning, flushing) during the noise events. Chronically elevated stress hormone concentrations can have deleterious effects on species. Responses may cause energy expenditure, reduced feeding, reproductive losses, bodily injury resulting in increased vulnerability to predation, and habitat avoidance

(Radle 2007, p. 5). Referencing current best available information, the Service cannot adequately determine the anticipated impacts of the proposed project’s 96 disturbance events annually on the western snowy plover population at Surf Beach. Similarly, the Service cannot adequately determine how the proposed project’s 96 disturbance events would contribute to the existing baseline of 61 permitted launch disturbance events annually. The Service considers that although the project has the potential to significantly contribute to the collective effects of the existing launch disturbance baseline and result in long term population level effects, until the novel effects of the project activity are studied, we are unable to anticipate the specific response at this time.

The proposed project’s disturbance frequency has the potential to displace western snowy plover populations, potentially stimulating migration away from noisy areas. Although we do not have an estimated survivorship of displaced western snowy plover, this could result in injury or death to individuals as a result of increased intraspecific competition, lack of familiarity with new locations of potential breeding, feeding, and sheltering habitats, and increased risk of predation. All of which reduces survivorship of translocated wildlife in general.

Potential mitigation actions for western snowy plover include predator control, including trapping, shooting, and tracking known western snowy plover predators with particular focus on raven removal at and adjacent to VSFB beaches. An existing biological opinion (8-8-12-F-11R; Service 2015b) analyzes and permits these actions, and the Space Force will implement all required avoidance, minimization, and monitoring measures. Additionally, the Space Force will continue pursuing other beneficial actions including recovery opportunities outlined in the western snowy plover recovery plan (Service 2007) and 5-year review (Service 2019) following mutual agreement by the Service and the Space Force annually (Kephart 2022, p. 3). The Service considers that the Space Force will continue to develop restoration methods to ensure the objectives of the mitigation are met and that no net loss in occupied western snowy plover habitat and population size has resulted from project activities (Kephart 2022, p. 3).

Due to the distant location of the proposed SLC-5 facility in relation to the subject western snowy plover nesting habitat on Surf Beach, we do not expect any significant visual disturbance from launch operations on western snowy plover. If western snowy plovers are able see launch operations, we expect effects would not be greater than the noise disturbance effects described above.

Effects on Recovery

<u>California Red-legged Frog</u>

We do not anticipate the proposed project to interfere with the specific recovery goals for Core Area 24 (Santa Maria-Santa Ynez River) provided in the Service’s 2002 recovery plan for the species. Although the function of Honda Creek is not specified within the recovery plan, the recovery plan states the goal to protect existing California red-legged frog populations within

Core Area 24 (Service 2002, p. 75). Direct effects from SLC-5 construction would impact approximately 60 acres of suitable dispersal and non-breeding aquatic habitat, a very small amount (less than 0.00009 percent) of the approximately 673,288 acres within Core Area 24. However, project operations create the potential for long-term effects that may result in overall habitat degradation across a larger portion of occupied California red-legged frog breeding habitat within Honda Creek. We are unable to anticipate the magnitude of potential effects of increased launch frequency at this time with the available information.

We expect that adverse effect are likely to occur to California red-legged frogs as a result of the proposed project. Construction activities, routine vegetation removal, routine and frequent launch operations, deluge water storage and release, and capture and relocation efforts may cause injury or mortality. However, based on the available information and minimization measures, including potential mitigation and the Space Force's commitment to ensure no net loss to the species, we expect adverse effects to the recovery of California red-legged frogs would be low. Although adverse effects are likely to occur as a result of the proposed action, we do not anticipate they will dimmish the contribution the population at VSFB makes to the recovery of the California red-legged frog at this time.

Western Snowy Plover

We do not currently anticipate that the proposed project would interfere with the recovery goals provided in the 2007 recovery plan for the species (Service 2007). Construction of SLC-5 will not remove any western snowy plover habitat; however, project operations create the potential for long-term effects that may result in overall habitat degradation across occupied western snowy plover breeding habitat at South Surf Beach. Although potential long-term effects of increased launch noise disturbance frequency may occur, we are unable to anticipate the magnitude of potential effects at this time with the available information. With mitigation actions ensuring no net loss in place if the Space Force detects a population decline, we do not anticipate the proposed action will diminish the VSFB population's contribution to the recovery of the western snowy plover.

Summary of Effects

California Red-legged Frog

In summary, we expect adverse effects to California red-legged frog are likely to occur due to the proposed action. During the proposed project's construction activities, California red-legged frogs may become entrapped, injured, or crushed. The Space Force will decrease risks by ensuring all holes or trenches are covered and by placing fencing around the project area during construction to prevent dispersing California red-legged frogs from entering the area (AM-10, 14). Furthermore, a Service Approved biologist will monitor all construction activities that may impact California red-legged frogs and attempt to capture and relocate any California red-legged frogs from the project area (AM-15).

Construction noise and vibration may result in behavior and physiological effects. Prolonged elevated stress hormone concentrations can have deleterious effects on survival and subsequent reproduction. The Service considers that although the project has the potential to result in effects to breeding success, until the novel effects of the project activity are studied, we are unable to anticipate the specific response at this time. The Space Force will attempt to minimize potential construction noise related effects by limiting work activities outside of peak vocalization periods during daylight hours and dry weather (AM-14). The Space Force will also implement erosion control measures wherever potential for project related sedimentation, potentially caused by vibration, into Honda Creek exists using weed-free biodegradable materials (AM-5).

Accidental spills of hazardous materials, careless fueling or oiling of vehicles and equipment, and associated runoff could impact California red-legged frogs if material enters adjacent aquatic habitat. The Space Force will ensure the work equipment and refueling occurs at least 0.1 mile away from California red-legged frog aquatic habitat, that spill containment equipment is present at all times on site, and daily inspections of equipment (AM-1, 8, and 14).

Construction site features that fill with storm or work water may attract California red-legged frogs for breeding which has the potential to result in the injury or death of any present California red-legged frog individuals or egg masses through crushing or desiccation. The Space Force will minimize effects by ensuring holes are covered (AM-10) and that a Qualified Biologist survey the site to capture and relocate any California red-legged frogs encountered (AM-1, 14, and 15).

During project operations, routine vegetation clearance that may be conducted at any point of the year may result in the injury or mortality of California red-legged frogs. Injury or mortality levels would likely be higher if the Space Force conducts activities when California red-legged frogs are expected to be moving across the landscape during the wet season (between November 15 and March 31). The Space Force will minimize effects by conducting work activities during daylight hours and in dry conditions, and by requiring that a Qualified Biologist survey work areas and relocate any encountered individuals (AM-14 and 15).

The Space Force would authorize a maximum of 552,000 gallons (1.69 acre-feet) of water per year to support the project sourced from four water wells located within the San Antonio Creek Basin. Using existing hydrological modeling, the Service does not anticipate measurable decline in the quality or overall extent of these associated habitats as a result of the annual extraction at this time based on existing water usage.

When filled, deluge water retention basins may serve as ephemeral breeding habitat for California red-legged frogs and water drainage has the potential to result in injury or death to any individuals or present egg masses. California red-legged frogs that come into contact with operational contaminated deluge water may also be injured or killed. The Service also assumes any required water basin feature maintenance could result in the injury or death of any life-stages of California red-legged frogs if present. However, the Space Force will require that the Project Proponent design retention basins and water storage features to prevent access by California red-legged frogs and minimize the amount of stormwater they receive (AM-17). The Space Force indicates that if total exclusion is determined not possible, the Space Force will require that all pumps be screened and that a Qualified Biologist check for California red-legged frogs prior to pumping daily (AM-16). Consequently, the Service assumes with implementation of avoidance and minimization measures, the SLC-5 water features will not serve as an attractive nuisance.

The proposed project's launches will produce soot biproduct that also has the potential to impact California red-legged frogs. The Space Force expects that the actual amount of soot produced would be diminutive being that it would subsequently burn up in the exhaust plume (Kaisersatt, pers. comm., 2022d). Consequently, the Service anticipates that the proposed project's launch biproducts are not likely to impact dispersing California red-legged frogs or their aquatic habitats.

The project's associated flame bucket and deluge system may produce temporary high intensity flame and steam that could result in the injury or mortality of any California red-legged frogs within the project area during launch or test fire events. To minimize potential impacts, the Project Proponent will design the position of the flame buckets and deluge system to direct flame and associated steam to the north of SLC-5 (AM-20) and maintain exhaust ducts to be free of water between launches.

Project operational noise and vibration from routine launching may induce long-term behavioral and physiological responses in California red-legged frog that may be present in the action area. The proposed project constitutes 96 disturbances events that would contribute to the disturbance frequency of the existing launch noise disturbance baseline. A current total of 61 existing permitted launch noise disturbance events of at least 100 dB occur within the proposed project's Launch Noise Effect Area. With the addition of the proposed project this would collectively total 157 disturbance events. Therefore, the proposed project would represent more than a twofold increase in overall potential annual launch disturbances on the residential and breeding California red-legged frog populations within Honda Creek. The proposed project would contribute to over half of this total. Using the best available information, the Service does not anticipate routine deafening of California red-legged frog population within Honda Creek but considers the population could experience negative effects that develop over the long term from routine exposure to sensory pollutants and subsequent stress. The Service cannot adequately determine the anticipated impacts of how the proposed project's noise disturbance events in combination with the existing launch related disturbance baseline in the near vicinity may affect residential and breeding California red-legged frog populations within features including Honda Creek. However, the Space Force will implement a phased approach prior to reaching full launch tempo to provide opportunity to detect any unanticipated effects. In the event that population or call-rate declines are observed, the Space Force would implement proposed mitigation and has ensured that no net loss of occupied California red-legged frog habitat and population size (Kephart 2022, p. 2-3).

Newly introduced persistent artificial night lighting associated with SLC-5 construction and operations could have adverse physiological and behavioral effects on California red-legged frogs. Migrating California red-legged frog may be affected by newly introduced artificial night lighting, which may also serve as an attractive nuisance. To attempt to minimize these effects, the Space Force will require the development of a lighting plan for the proposed project (AM-22) which requires that illumination lighting levels of 1-foot candle do not extend beyond the SLC-5 facility into natural habitats and that lighting design uses the minimum lumens necessary to accomplish lighting requirements.

Following review of the effects of the proposed action, the Service anticipates the proposed project has the potential to result in the sustained degradation in the quality of adjacent California red-legged frog aquatic habitat due to construction and launch associated sensory pollutants. In the event the Space Force detects an unanticipated decline in California red-legged frog distribution and abundance across Honda Creek not directly attributed to other factors (e.g., drought or wildfire), they will implement mitigation actions for California red-legged frog by creating new breeding habitat at a 2:1 ratio (habitat enhanced: habitat affected) within the San Antonio Creek Oxbow Restoration ‘expansion area’. The Service considers the Space Force’s commitment to ensure the objectives of proposed mitigation are met and able to clearly demonstrate that no net loss in occupied California red-legged frog habitat or population size have resulted from project activities (Kephart 2022, p. 2-3).

Based on the available information and minimization measures, including potential mitigation ensuring no net loss, we expect adverse effects to the recovery of California red-legged frogs would be low. Although adverse effects are likely to occur as a result of the proposed action, we do not anticipate they will dimmish the contribution the population at VSFB makes to the recovery of the California red-legged frog at this time.

Western Snowy Plover

In summary, we expect adverse effects to western snowy plover may occur due to the proposed project operations. We do not anticipate adverse effects to western snowy plover from site construction activities.

Project operation noise from routine launching may induce behavioral and physiological responses in western snowy plover that may be present in the action area. The Service cannot adequately determine the anticipated impacts of how the proposed project’s noise disturbance events in combination with the existing noise disturbance baseline from other launch operations in the near vicinity may affect breeding western snowy plover populations located across Surf Beach until the novel effects of the project activity are studied. However, with mitigation actions in place ensuring no net loss if the Space Force detects a population decline, we do not anticipate the proposed action will diminish the VSFB population’s contribution to the recovery of the western snowy plover at this time.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. We do not consider future Federal actions that are unrelated to the proposed action in this section because they require separate consultation pursuant to section 7 of the Act. We are unaware of any future State, tribal, local or private actions that are reasonably certain to occur in the action area.

CONCLUSION

The regulatory definition of "to jeopardize the continued existence of the species" focuses on assessing the effects of the proposed action on the reproduction, numbers, and distribution, and their effect on the survival and recovery of the species being considered in the biological opinion. For that reason, we have used those aspects of the California red-legged frog and the western snowy plover status as the basis to assess the overall effect of the proposed action on the species.

California Red-legged Frog

Reproduction

The proposed project would not result in the physical loss of California red-legged frog breeding habitat. However, the proposed project would likely constitute sustained degradation of breeding habitat within Honda Creek due to sensory pollutants (e.g., lighting, noise, vibration) associated with the proposed action's construction and operations. Until the novel effects of the project activity are studied, the Service is unable to anticipate the specific response at this time using available information. If the proposed project's increased launch frequency demonstrates a reduction in reproductive success in Honda Creek, the Space Force indicates they will implement mitigation as described at the San Antonio Creek Oxbow Restoration expansion area to ensure no net loss in California red-legged frog occupied breeding habitat and overall population size occurs. We expect the Space Force will demonstrate successful colonization and breeding within the San Antonio Creek Oxbow Restoration expansion area to offset potential project impacts to the portion of Honda Creek within the action area at a 2:1 ratio. Should the Oxbow Restoration site not meet mitigation acreage requirements depicted in the project description, we expect that the Space Force will implement other recovery objectives coordinated with the Service that quantifiably demonstrate no net loss to be consistent with this effects analysis. We consequently conclude that the proposed project would not reduce overall California red-legged frog reproduction on VSFB, in the Northern Transverse Ranges and Tehachapi Mountains Recovery Unit, or rangewide.

Numbers

We are unable to determine the exact number of California red-legged frogs that could occur in the action area that may be affected by proposed project because existing survey data are insufficient to estimate population numbers, and the numbers of individuals in the action area likely vary from year to year. Proposed project activities could affect individual California red-legged frogs to the point of injury or death. Project operations may result in sustained stress on the California red-legged frog population within Honda Creek that may reasonably cause cumulative sublethal effects that lead to gradual decline over the long term. Until the novel effects of the project activity are studied, the Service is unable to anticipate the specific response at this time using available information. However, the number of California red-legged frogs we expect may be affected at this point in time by the proposed activities is small relative to the total VSFB population and those across the entirety of the species' range. Additionally, if the proposed project's increased launch frequency demonstrates a reduction in California red-legged frog numbers in Honda Creek, the Space Force will implement mitigation as described at the San Antonio Creek Oxbow Restoration expansion area to ensure no net loss in the species abundance occurs. We expect the Space Force will demonstrate successful colonization and subsequent species abundance within the San Antonio Creek Oxbow Restoration expansion area to offset potential project impacts to the portion of Honda Creek within the action area at a 2:1 ratio. Should the Oxbow Restoration site not meet mitigation acreage requirements depicted in the project description, we expect that the Space Force will implement other recovery objectives coordinated with the Service that quantifiably demonstrate no net loss to be consistent with this effects analysis. Therefore, we conclude that the proposed project would not appreciably reduce the number of California red-legged frog on VSFB, in the Northern Transverse Ranges and Tehachapi Mountains Recovery Unit, or rangewide.

Distribution

The proposed project would likely constitute sustained degradation of occupied aquatic California red-legged frog habitat within Honda Creek due to sensory pollutants (e.g., lighting, noise, vibration) associated with the proposed action's construction and operations. Until the novel effects of the project activity are studied, the Service is unable to anticipate specific response in potential distribution of California red-legged frog at this time using available information. If the proposed project's increased launch frequency demonstrates a reduction in species abundance and distribution in Honda Creek, the Space Force indicates they will implement mitigation as described at the San Antonio Creek Oxbow Restoration expansion area to ensure no net loss in occupied habitat occurs. However, the proposed mitigation site is located in north base over ten miles from Honda Creek. In the event the proposed project results in reduced occupation of California red-legged frog within Honda Creek, this would constitute a reduction in the overall distribution of the species across south base and across the VSFB population as a whole. However, any observed reduction would not appreciably reduce the distribution across the Northern Transverse Ranges and Tehachapi Mountains Recovery Units, or rangewide. We consequently conclude that the proposed project may reduce California red-legged frog distribution in the action area and across VSFB but would not appreciably reduce distribution within the Northern Transverse Ranges and Tehachapi Mountains Recovery Unit, or rangewide.

Recovery

The proposed project is not anticipated to interfere with the specific recovery goals for Core Area 24 (Santa Maria-Santa Ynez River) provided in the Service's 2002 recovery plan for the species. Although the function of Honda Creek is not specified, the recovery plan states the goal to protect existing California red-legged frog populations within Core Area 24 (Service 2002, p. 75). Using the available information and considering minimization measures, including potential mitigation ensuring no net loss, we expect adverse effects to the recovery of California red-legged frogs on VSFB would be low. Therefore, we conclude that the proposed action would not appreciably reduce the likelihood of recovery of the California red-legged frog on VSFB, in the Northern Transverse Ranges and Tehachapi Mountains Recovery Unit, or rangewide.

Conclusion

After reviewing the current status of the California red-legged frog, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the California red-legged frog, because:

1. We anticipate that project effects could reduce the reproductive success of California red-legged frogs at the local population level. However, due to the Space Force's commitment to monitor and mitigate reductions of individuals to meet their proposed goal of no net loss, the project would not appreciably reduce numbers of the California red-legged frog locally across VSFB, or rangewide.
2. We anticipate that project effects could reduce the number of California red-legged frogs at the local population level. However, due to the Space Force's commitment to monitor and mitigate reductions of individuals to meet their proposed goal of no net loss, the project would not appreciably reduce numbers of the California red-legged frog locally across VSFB, or rangewide.
3. The project may reduce the species' distribution locally across VSFB but is not anticipated to appreciably reduce the distribution rangewide.
4. We do not anticipate the proposed project would interfere with the specific recovery goals for Core Area 24 because of the Space Force's commitment to monitor and mitigate reductions of individuals to meet their proposed goal of no net loss. Consequently, the project would not cause any effects that would appreciably preclude our ability to recover the species.

Western Snowy Plover

Reproduction

Monitoring of nesting western snowy plovers for past individual launches have reported no difference in nest attendance or hatching rates compared to previous years when no launches occurred. Construction of SLC-5 will not remove any western snowy plover habitat; however, project operations create the potential for long-term effects that may result in overall habitat degradation across occupied western snowy plover breeding habitat at South Surf Beach. Although potential long-term effects of increased launch noise disturbance frequency may occur, the Service is unable to anticipate the magnitude of potential effects at this time with the available information. In the event the Space Force detects a population decline, we expect the Space Force's proposed mitigation actions ensuring no net loss will demonstrate successful offset of impacts to reproductive success. Should the proposed predator management not meet mitigation objectives depicted in the project description, we expect that the Space Force will implement other recovery objectives coordinated with the Service that quantifiably demonstrate no net loss to be consistent with this effects analysis. Consequently, we do not anticipate the proposed action will appreciably reduce the reproductive capacity of western snowy plover populations locally on VSFB or rangewide.

Numbers and Distribution

RU5 comprises nearly 40 percent of breeding western snowy plovers rangewide, and we expect the Space Force to continue managing and monitoring the VSFB population within RU5. Monitoring of nesting western snowy plovers for past individual launches have not reported notable differences in abundance or distribution. Although potential long-term effects of increased launch noise disturbance frequency may occur, the Service is unable to anticipate the magnitude of potential effects at this time with the available information. In the event the proposed project results in reduced occupation of western snowy plover at South Surf Beach, this would constitute a reduction in the overall distribution of the species across south base and across the VSFB population. However, with mitigation actions ensuring no net loss in place, any observed reduction would not appreciably reduce the numbers or distribution within RU5 or rangewide. Should the proposed predator management not meet mitigation objectives depicted in the project description, we expect that the Space Force will implement other recovery objectives coordinated with the Service that quantifiably demonstrate no net loss to be consistent with this effects analysis. We consequently conclude that the proposed project may reduce western snowy plover distribution in the action area and across VSFB, but we do not anticipate the proposed action will appreciably reduce the numbers or distribution of western snowy plover populations within RU5 or rangewide.

Recovery

When reviewing breeding window survey numbers from 2014 to 2022, VSFB contributed an average of approximately 216 breeding adults, which is approximately 26 percent of RU5 and 10 percent of the range. Several sites do not record productivity data (fledglings per breeding male); however, larger sites within the range, including VSFB, meet or exceed the criteria of 1.0 fledgling per breeding male in most years. VSFB being a military installation is likely to continue having additional natural resource benefits as part of their Integrated Natural Resource Management Plan. The shape of the population trajectory of RU5 since 2007 is linear, positive, and gradual, with minimal annual fluctuation. With mitigation actions ensuring no net loss in place, we expect effects of the proposed action would not diminish these trends at VSFB, and consequences of the proposed action would not appreciably interfere with recovery goals or overall recovery of the western snowy plover. Should the proposed predator management not meet mitigation objectives depicted in the project description, we expect that the Space Force will implement other recovery objectives coordinated with the Service that quantifiably demonstrate no net loss to be consistent with this effects analysis.

Conclusion

After reviewing the current status of the western snowy plover, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the western snowy plover, because:

1. We anticipate that project effects could reduce the reproductive success of western snowy plover at the local population level. However, due to the Space Force's commitment to monitor and mitigate reductions of individuals to meet their proposed goal of no net loss, the project would not appreciably reduce numbers of the western snowy plover locally across VSFB, or rangewide.
2. We anticipate that project effects could reduce the number of western snowy plover at the local population level. However, due to the Space Force's commitment to monitor and mitigate reductions of individuals to meet their proposed goal of no net loss, the project would not appreciably reduce numbers of the western snowy plover locally across VSFB, or rangewide.
3. The project may reduce the species' distribution locally across VSFB but is not anticipated to appreciably reduce the distribution in RU5 or rangewide.
4. We do not anticipate the proposed project would interfere with the specific recovery goals for western snowy plover because of the Space Force's commitment to monitor and mitigate reductions of individuals to meet their proposed goal of no net loss. Consequently, the project would not cause any effects that would appreciably preclude our ability to recover the species.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened wildlife species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm in the definition of “take” in the Act means an act which actually kills or injures wildlife. Such [an] act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering (50 CFR 17.3). Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not the purpose of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

AMOUNT OR EXTENT OF TAKE

California Red-legged Frog

We anticipate that some California red-legged frogs could be taken as a result of the proposed action. We expect the incidental take to be in the form of capture, injury, harm and mortality. We cannot quantify the precise number of California red-legged frogs that may be taken as a result of the actions that Space Force has proposed because California red-legged frogs move over time; for example, animals may have entered or departed the action area since the time of pre-construction surveys. The protective measures proposed by Space Force are likely to prevent mortality or injury of most individuals during construction. In addition, finding a dead or injured California red-legged frog is unlikely. Consequently, we are unable to reasonably anticipate the actual number of California red-legged frogs that would be taken by the proposed project; however, we must provide a level at which formal consultation would have to be reinitiated. The Environmental Baseline and Effects Analysis sections of this biological opinion indicate that adverse effects to California red-legged frog would likely be low given the implementation of proposed avoidance and minimization measures and moderate detected abundance of California red-legged frog in the vicinity of SLC-5. We, therefore, anticipate that take of California red-legged frogs would also be relatively low. We also recognize that for every California red-legged frog found dead or injured, other individuals may be killed or injured that are not detected, so when we determine an appropriate take level, we are anticipating that the actual take would be higher, and we set the number below that level.

Similarly, for estimating the number of California red-legged frog that would be taken by capture, we cannot predict how many may be encountered for reasons stated earlier. While the benefits of relocation (i.e., minimizing mortality) outweigh the risk of capture, we must provide a limit for take by capture at which consultation would be reinitiated because high rates of capture may indicate that some important information about the species in the action area was not apparent (e.g., it is much more abundant than thought). Conversely, because capture can be highly variable, depending upon the species and the timing of the activity, we do not anticipate a number so low that reinitiation would be triggered before the effects of the activity were greater than what we determined in the Effects Analysis.

Therefore, the Space Force must contact our office immediately to reinitiate formal consultation if they observe any of the following scenarios during Construction (Table 6) and Operations (Table 7):

i. 3 adult or juvenile California red-legged frogs are found killed or wounded, including during capture and relocation, annually over the course of construction;
ii. 20 adults or juveniles are captured annually over the course of construction;
iii. the California red-legged frog established baseline (AM-23) within Honda Creek is more than 15 individuals and a greater than 15 percent (up to 5 frogs) decline is observed from the established baseline two years consecutively or on average across 5 years across operations;
iv. the California red-legged frog established baseline (AM-23) within Honda Creek is less than 15 individuals and a greater than 25 percent decline is observed from the established baseline two years consecutively or on average across 5 years of operations;
v. 3 years of consecutive negative finding of tadpoles of normal physiological condition across construction or operations;
vi. 2 adult or juvenile California red-legged frogs are found killed or wounded, including during capture and relocation, annually over the course of operations;
vii. and/or, 5 adults or juveniles are captured annually over the course of operations.

We do not anticipate any take of egg mass or tadpole life stage in association with basin features being that we assume these features will hold water for less than a day. Project activities that are likely to cause additional take should cease as the exemption provided pursuant to section 7(o)(2) may lapse and any further take could be a violation of section 4(d) or 9.

Construction

Table 6. Summary of incidental take for California red-legged frog life stages during the Construction phase of the proposed project.

Life Stage	***Quantity (per calendar year) during Construction***	***Type of Take***
Adults or juveniles	3	Killed or wounded (including during capture and relocation)
Adults or juveniles	20	Captures
Tadpoles	3 years of consecutive negative finding of tadpoles of normal physiological condition	Harm – Habitat modification impairing breeding success

Operations

Table 7. Summary of incidental take for the California red-legged frog life stages during the Operations phase of the proposed project.

Life Stage	***Quantity during Operations***	***Type of Take***
Adults or juveniles	Scenario 1- If the Established Baseline* greater than 15 individuals: 15% decline (up to 5 frogs) from established baseline two years consecutively or on average across 5 years. OR Scenario 2 – If the Established Baseline* is less than 15 individuals: 25% decline from established baseline two years consecutively or on average across 5 years.	Harm – Habitat modification disrupting sheltering
Tadpoles	3 years of consecutive negative finding of tadpoles of normal physiological condition	Harm – Habitat modification impairing breeding success
Adults or juveniles	2 per year	Killed or wounded (including during capture and relocation)
Adults or juveniles	5 per year	Captures and relocation

*Established Baseline within monitoring plan described in AM-24.

Western Snowy Plover

We anticipate that all western snowy plovers present in the action area could be taken as a result of the proposed action. We expect the incidental take only to be in the form of harm from the potential degradation of suitable habitat resulting from increased frequency of noise disturbance associated with routine launch activities. We cannot quantify the precise number of individuals that may be harmed due to fluctuations in population. Take may rise to a statistically significant level of decreased western snowy plover occupancy, nesting establishment, or nesting success from the established baseline across the entirety of Surf Beach. We anticipate that if the Space Force observes any decline that proposed mitigation efforts will be effective in offsetting the impact and will result in no net loss to the species.

However, in the event that mitigation efforts are not successful, the Space Force must contact our office immediately to reinitiate formal consultation if they observe any of the following scenarios:

i. Available western snowy plover monitoring data indicates that in any single year western snowy plover nesting establishment exhibits fewer than 80 nests within the Launch Noise Effect Area on Surf Beach without showing similar declines outside of the Launch Noise Effects Area on base;

ii. the Space Force observes a 10 percent reduction from the prospective 10-year baseline (AM-28b) of nest establishment consecutively across 3 years (see Term and Condition #4b below); or

iii. if more than 5 western snowy plovers of any life stage (egg, chick, or adult) are injured or killed as a result of project activities, including any camera-monitored nests on Surf Beach that indicate nest abandonment, injury, or mortality to eggs or chicks immediately following launch activities (see Term and Condition #6 below).

The Service considers a nest abandoned if the attending western snowy plover adults documented via camera monitoring do not return to the nest for more than eight hours. Project activities that are likely to cause additional take should cease as the exemption provided pursuant to section 7(o)(2) may lapse and any further take could be a violation of section 4(d) or 9.

REASONABLE AND PRUDENT MEASURES

The measures described below are non-discretionary and must be undertaken by the Space Force or made binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in section 7(o)(2) to apply. The Space Force has a continuing duty to regulate the activity covered by this incidental take statement. If the Space Force (1) fails to assume and implement the terms and conditions or (2) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the Space Force must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR 402.14(i)(3)].

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize the impacts of the incidental take of California red-legged frog and western snowy plover:

1. The Space Force must ensure that biologists used for survey, monitoring, training, and capture and relocation tasks are skilled and experienced.
2. The Space Force must reduce potential for injury or mortality of California red-legged frogs and western snowy plover.
3. The Space Force must monitor effects to ensure they are consistent with this analysis.

TERMS AND CONDITIONS

To be exempt from the prohibitions of section 9 of the Act, the Space Force must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline reporting and monitoring requirements. These terms and conditions are non-discretionary.

The following term and condition implements reasonable and prudent measure 1:

1. The Space Force must request Service approval of any biologist who will conduct activities related to this biological opinion at least 30 days prior to conducting any such activities. The Space Force must provide biologist resumes listing their experience and qualifications to conduct specific actions that could potentially affect listed species and their habitats (please refer to and use Appendix B, Biologist Authorization Request Field Experience Tracking Form). A Qualified Biologist(s) is more likely to reduce adverse effects based on their expertise with the covered species. Please be advised that possession of a 10(a)(1)(A) permit for the covered species does not substitute for the implementation of this measure. Authorization of Service Approved biologists is valid for this consultation only.

The following terms and conditions implement reasonable and prudent measure 2:

2. The Space Force must reduce the effects of ultraviolet lighting on California red-legged frogs on all external permanent site lighting. As referenced in the effects analysis, to accomplish this, the Space Force may choose lighting with either no ultraviolet emissions or equip fixtures with an ultraviolet filter on external permanent site lighting. These actions will help avoid attracting insects and subsequent California red-legged frog individuals to SLC-5 (refer to lighting best management practices in Longcore and Rich 2017b, entire).

3. The Space Force must attempt to reduce the potential for effects of frequent vibration on California red-legged frog breeding success. Options may include implementing minimization measures (refer to CalTrans Transportation and Construction Vibration Guidance Manual 2013; Chapter 8, p. 41) or proactively designing systems to attenuate vibration to the maximum extent possible. In the event the Space Force detects declines or physical abnormalities to the California red-legged frog population within Honda Creek, then the Space Force must conduct vibration monitoring next to occupied breeding habitat during construction activities if they are still occurring. If declines or physical abnormalities are observed during operations, the Space Force must conduct vibration monitoring to obtain experienced levels at least once during a launch event for each vehicle type within Honda Creek next to occupied breeding habitat.

The following terms and conditions implement reasonable and prudent measure 3:

4. The Space Force must implement long-term monitoring of annual population and distribution trends associated with western snowy plover along Surf Beach and California red-legged frog populations within Honda Creek to ensure they can detect novel effects of increased launch frequency across the action area over time. The Space Force must develop a comprehensive monitoring plan that adequately addresses potential short and long-term project effects that may develop from sensory pollutants. The Space Force must provide the Service the monitoring plan for review and approval at least 90 days prior to the construction of SLC-5 to ensure that potential project related short and long-term effects are detectable and clearly defined.
    a. The California red-legged frog monitoring plan must at a minimum clearly establish baseline California red-legged frog average population level prior to the start of the proposed project. The Space Force must conduct annual surveys with consistent methodology within the same sections of Honda Creek during the breeding season when California red-legged frogs are most likely to be encountered. The plan must provide a depiction of the survey area and a tentative survey schedule. The plan must also clearly state the established decline threshold criteria that would trigger proposed mitigation (refer to AM-25). During annual surveys, the Space Force must also monitor California red-legged frog egg masses and tadpoles to ensure no physiological effects may be occurring.
        i. As part of the proposed monitoring plan, the Space Force must include the bioacoustics monitoring design for review and approval by the Service. The Space Force must clearly define how they will establish California red-legged frog calling behavior baseline within Honda Creek using any necessary appropriate control sites (e.g., sites located outside of areas exposed to launch impacts) for purposes of comparison 90 days prior to project implementation. California red-legged frog calling behavior baseline must include applicable call characteristics (e.g., changes in signal rate, call frequency, amplitude, call timing, call duration, etc.). The Space Force must ensure that bioacoustic

monitoring is designed to address confounding factors in order to appropriately characterize impacts of frequent launch disturbance events on calling behavior. The Space Force must analyze results in conjunction with long term population data to help understand if observed changes in signal characteristics are correlated with observable declines.

b. The western snowy plover monitoring plan must include a clear, established baseline annual variation and decline threshold that would trigger proposed mitigation. AM-28b indicates the Space Force may calculate baseline annual variation in a variety of ways but likely will use 95 percent confidence intervals (Kephart 2022, p. 2).

c. The Space Force must also conduct noise monitoring during construction at Honda Creek and at least once for each vehicle type during a launch event at Surf Beach and Honda Creek to ensure noise levels assumed for the purposes of this analysis are equal to or less than experienced levels.

5. The Space Force must submit a comprehensive mitigation plan and provide it to the Service for approval prior to the construction of the project. The plan must include specific quantifiable success criteria the Space Force will obtain within 5 years' time from when the proposed project triggers mitigation that will serve to address the Space Force's goal of no net loss in species' distribution and abundance. In the event the Space Force does not obtain the success criteria, the Space Force must reduce project effects to align with our analysis until they achieve alternative effective mitigation.

    a. Within the California red-legged frog mitigation plan (AM-25), to determine mitigation acreages needed to meet proposed no net loss, the Space Force must clearly depict how they will calculate impacted acreages across unsurveyed portions of Honda Creek within the action area in the event they observe population declines within surveyed areas. In the event the Oxbow restoration area alone does not meet mitigation acreage required, the Space Force must include additional options where mitigation acreage needs would be met.

6. If the proposed project schedules 4 disturbance events over a 4-week period during the western snowy plover breeding season (March 1 through September 30), the Space Force must camera monitor at least 10 percent of the southernmost active western snowy plover nests located on Surf Beach within the Launch Noise Effect Area to assess potential novel effects that may result from frequent launching. The Space Force must employ camera technology that is capable of long-term recording and time marking the moment of disturbance events. The Space Force must review western snowy plover nest video recordings as soon as possible. The Space Force may discontinue nest camera monitoring if they observe no response within 2 years of full launch tempo.

7. The Space Force must rescue any western snowy plover eggs abandoned on Surf Beach during disturbance events. The Space Force must develop and/or fund a program to incubate any rescued abandoned eggs and release fledglings.

8. In the event the Space Force observes declines in the California red-legged frog population within Honda Creek over the course of the project, the Space Force must conduct water quality sampling in lower Honda Creek to ensure no project related biproducts (i.e., launch combustion residue, construction- and operations-related run-off, etc.) have entered the waterway in a manner not previously considered in this analysis. The Space Force must design water quality sampling to reasonably detect potential project related biproducts and any resulting associated changes in aquatic habitat (i.e., salinity, pH, etc.). Sampling must consider and utilize the most recent applicable advances in water quality sampling technology. The plan must include at least 1 annual sampling event for 3 years of project operations with maps depicting sampling locations. The Space Force must collect and clearly present data including any associated chemical and nutrient presence, dissolved oxygen, water temperature, turbidity, and any other pertinent observations regarding ecosystem condition for purposes of annual comparison.
9. Prior to project operation the Space Force must establish a pre-project baseline for hydrodynamic data within San Antonio Creek. During project operations the Space Force must collect hydrodynamic data annually using consistent data collection methodologies for purposes of comparison against the established baseline. The Space Force must use these data to ensure that the proposed project's water extraction is not measurably affecting flow rate or water level within San Antonio Creek.
10. If the Project Proponent cannot design water features to preclude California red-legged frog entry, then the Space Force must ensure SLC-5 water features, including deluge containment basins, passively or actively drain within 24 hours of a storm event to avoid the creation of an attractive nuisance.

REPORTING REQUIREMENTS

The Space Force must provide a written report due by January 30 for each fiscal year (October through September) that activities are conducted pursuant to this biological opinion. The annual report must include:

1. Documentation of the impacts of the proposed activities on California red-legged frog and western snowy plover; results of biological surveys and observation records; documentation of the number of individuals of California red-legged frogs or western snowy plovers captured, injured, or killed; the date, time, and location of any form of take; approximate size and age of those individuals taken; and a description of relocation sites or rehabilitation outcomes for captured individuals.
2. The schedule of launches and static test fires that occurred annually.
3. A discussion of annual monitoring of the populations of California red-legged frog within Honda Creek and western snowy plover within Surf Beach. This discussion must address any observed changes in population and distribution trends over time that may be associated with long-term effects of the project. The discussion must also address any potential improvements to the monitoring plan design efficacy, including advances in

technology that may aid in sublethal effects detection for consistency with the above analysis. The Space Force must include results requested within all term and condition requirements above including:

a. The California red-legged frog portion of the report must also include: (*i*) noise and vibration exposure levels in Honda Creek as depicted in T&C 3, 4c; (*ii*) documentation and analysis of any observed effects on California red-legged frog that occur during the experienced frequency of launching and may be related to the project's routine disturbance (effects may include, but are not limited to, changes to habitat use pattern, reproduction, or behavior over the long-term); (iii) discussion of bioacoustics monitoring results (T&C 4ai) conducted within Honda Creek and at appropriate control site(s) located outside of areas impacted by routine launching, software analysis methods (can refer to Higham et al. 2020, Kruger et al. 2016) used to analyze changes in signal characteristics and generate annual estimation of chorus size, and the results and discussion of any observed changes to California red-legged frog calling behavior (e.g., changes in signal rate, call frequency, amplitude, call timing, call duration, etc.) in conjunction with California red-legged frog annual population data within Honda Creek.

b. The western snowy plover portion of the report must also include: (*i*) date and times of launches and static test fires that impacted Surf Beach; (*ii*) visual or video monitoring results of birds and nests as well as acoustic monitoring results at Surf Beach colonies; (*iii*) documentation and an analysis of effects by the activities evaluated in this biological opinion, including observed effects that occur during the experienced frequency of launching; (*iv*) discussion of effects that result in take of western snowy plover as well as any observed changes to habitat use pattern or behavior of birds; and (*v*) any other pertinent information as required by this biological opinion.

c. Results from the annual habitat assessment and any supplemental water quality sampling performed.

d. Pre-project baseline comparison with annual hydrodynamic data results for San Antonio Creek water extraction.

e. In the event mitigation is triggered as a result of the project, implemented restoration methods, habitat acreages, and a discussion of mitigation success criteria.

f. If the Project Proponent cannot design water features to preclude California red-legged frog entry, the Space Force must include how many days in which they found deluge water retention basins held water and if water quality failed to pass RWQCB permit requirements.

The Space Force must submit federally listed species observations over the course of the project to the CNDDB. The report should also include a discussion of any problems encountered implementing the terms and conditions and other protective measures or recommendations to enhance the conservation of federally listed species, and any other pertinent information.

DISPOSITION OF DEAD OR INJURED SPECIMENS

As part of this incidental take statement and pursuant to 50 CFR 402.14(i)(1)(v), upon locating a dead or injured California red-legged frog or western snowy plover, initial notification within 3 working days of its finding must be made by telephone and in writing to the Ventura Fish and Wildlife Office (805-644-1766). The report must include the date, time, location of the carcass, a photograph, cause of death or injury, if known, and any other pertinent information.

The Space Force must take care in handling injured animals to ensure effective treatment and care, and in handling dead specimens to preserve biological material in the best possible state. The Space Force must transport injured animals to a qualified veterinarian. Should any treated California red-legged frog or western snowy plover survive, the Space Force must contact the Service regarding the final disposition of the animal(s).

The remains of California red-legged frogs and western snowy plovers must be placed with educational or research institutions holding the appropriate State and Federal permits, such as the Santa Barbara Natural History Museum (Contact: Paul Collins, Santa Barbara Natural History Museum, Vertebrate Zoology Department, 2559 Puesta Del Sol, Santa Barbara, California 93460, (805) 682-4711, extension 321), Western Foundation of Vertebrate Zoology (Contact: Linnea S. Hall, Ph.D., Executive Director, Western Foundation of Vertebrate Zoology, 439 Calle San Pablo Camarillo, CA 93012, (805) 388-9944), or the Cheadle Center for Biodiversity and Ecological Restoration (CCBER) (CCBER, Herpetological Collection, University of California, Santa Barbara, Harder South, Building 578, MS-9615 Santa Barbara, CA 93106-9615.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. The conservation recommendations below are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information and can be used by the Space Force to fulfill their 7(a)(1) obligations.

1. Due to the likelihood for sustained effects from sensory pollutants that will occur within Honda Creek during project operations, we recommend the Space Force proactively implement proposed mitigation. Advanced mitigation will provide assurances that restoration efforts will be successful at attaining no-net loss of California red-legged frog occupied habitat and population.

2. We recommend that the Space Force proactively conduct a small-scale California red-legged frog egg-mass relocation study into the existing Oxbow Restoration site. Previous survey efforts have not yet detected California red-legged frog at this site or demonstrated that California red-legged frog will newly colonize these areas for breeding (Evans 2022a, p. 4; Kephart 2022, p. 2). This study could help determine whether manual facilitation of California red-legged frog establishment to ensure no-net loss of species abundance is achievable.
3. We recommend that the Space Force proactively require their project proponents to design launch vehicles to attenuate sensory pollutants, similar to what is being done with aircraft at other installations (e.g., Edwards Air Force Base, X-59 Quiet SuperSonic Technology; NASA 2022, entire). Design considerations in combination with new sensory pollutant attenuation technologies may prove to be critical over the long-term based on a growing body of evidence that suggests light, noise, and vibration can have detrimental impacts on natural ecosystems as previously discussed.
4. We recommend that the Space Force coordinate with researchers familiar with study design involving short- and long-term ecological effects of sensory pollutants in the development of the effects monitoring plan for the project. We also recommend that the Space Force implement a basewide monitoring strategy to address the potential for compounding impacts of collective launches across the base.
5. We recommend that the Space Force work with researchers to develop a habitat suitability model that addresses launch disturbance frequency. The Space Force could use a model to inform the number, spacing, and distribution of collective launch scheduling to avoid altering the existing baseline of ‘intermittent acute noise disturbance’ to what would be more akin to ‘chronic acute’ noise disturbance. We also would recommend that sensitive time windows, such as breeding seasons, be strongly considered when scheduling launches in order to promote recovery goals.
6. We recommend that the Space Force install approved mufflers on mechanized equipment (particularly when using impact/pile drivers capable of generating over 100 dB noise levels) or install absorptive (non-reflective) sound walls during construction and operation to help reduce noise and vibrational disturbance to California red-legged frogs, western snowy plover, and other wildlife in the near vicinity.
7. We recommend that the Space Force install permanent fencing to exclude wildlife for the duration of project operations. We also recommend that the Space Force utilize fencing material that inhibits climbing and report on its efficacy.
8. We recommend that the Space Force survey for and lethally remove introduced non-native predatory species, including American bullfrog (*Lithobates catesbeianus*) and crayfish (*Cambarus* spp.), found within California red-legged frog habitat during surveys and other project related inspection activities.
9. We recommend that the Space Force advise Service Approved biologist(s) to relocate all wildlife and attempt to transplant or collect seed from non-federally listed (California

Native Plant Society) sensitive plants observed within the work areas to suitable habitat outside of project areas if such actions are in compliance with State laws and report all observations to CNDDB. Such relevant species with documented records within the Construction Effect Area and immediate vicinity may include *Erysimum suffrutescens, Lilium humboldtii* ssp. *ocellatum, Monardella undulata* ssp. *crispa, Mucronea californica,* and *Senecio blochmaniae* (Calflora 2022, entire).

10. We recommend that the Space Force install bat roost boxes or similar structures to encourage bat roosting outside of the project area if such actions are in compliance with State laws. We also recommend that the Space Force design project buildings to deter roosting.
11. We recommend the Space Force investigate the efficacy of capture and relocation of California red-legged frogs to determine if use of this minimization measure reduces adverse effects of project actions on the species. As part of this, the Space Force should note information on repeat capture and behavior of individuals post-movement.
12. We recommend the Space Force minimize movement of work equipment to the degree possible across the project area to further reduce transport of weeds. We recommend the Space Force designate equipment to work in specific areas and stage vehicles in laydown areas as close as possible to respective work areas.
13. We recommend the Space Force advise Qualified Biologists to relocate other native reptiles or amphibians found within work areas to suitable habitat outside of project areas if such actions are in compliance with State laws. Specifically for the southwestern pond turtle, we recommend following these suggested avoidance and minimization measures and reporting to the Service their efficacy:
    a. Service Approved Biologist(s) will be present on site during all construction activities occurring in southwestern pond turtle habitat.
    b. Prior to the start of daily construction activities, Service Approved Biologist(s) will survey the work sites for southwestern pond turtles, checking beneath all parked vehicles and heavy equipment before project activities commence.
    c. If biologist(s) observe a southwestern pond turtle within a designated work area and construction activities cannot avoid it, all work will stop in the immediate area (within 164 feet of the individual) until a Service Approved Biologist(s) can relocate the animal or until it has left the work area of its own accord.
    d. Service Approved Biologist(s) will relocate southwestern pond turtles captured during surveys or construction activities to the nearest suitable habitat outside of the project area but within the Honda Creek watershed and no more than 2 miles from the capture site. Service Approved Biologists may only capture southwestern pond turtles by hand or dip net and transport in buckets separate from other species. When capturing and removing southwestern pond turtles from the project area, the Service Approved Biologist(s) must minimize the amount of

time they hold animals in captivity. In addition, Service Approved Biologist(s) must maintain southwestern pond turtles in a manner that will not expose them to temperatures or any other environmental conditions that could cause injury or undue stress.

e. The Space Force will follow the Declining Amphibian Populations Task Force fieldwork code of practice to avoid conveying diseases between work sites (DAPTF 1998) and will clean all equipment between use following protocols that are also suitable for aquatic reptiles.

The Service requests notification of the implementation of any conservation recommendations so we may be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats.

REINITIATION NOTICE

This concludes formal consultation on the action(s) outlined in the request. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, the exemption issued pursuant to section 7(o)(2) may have lapsed and any further take could be a violation of section 4(d) or 9. Consequently, we recommend that any operations causing such take cease pending reinitiation.

If you have any questions about this biological opinion, please contact Sarah Termondt and Erin Arnold of my staff by electronic mail at sarah_termondt@fws.gov and erin_arnold@fws.gov.

Sincerely,

Stephen P. Henry
Field Supervisor

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APPENDIX A

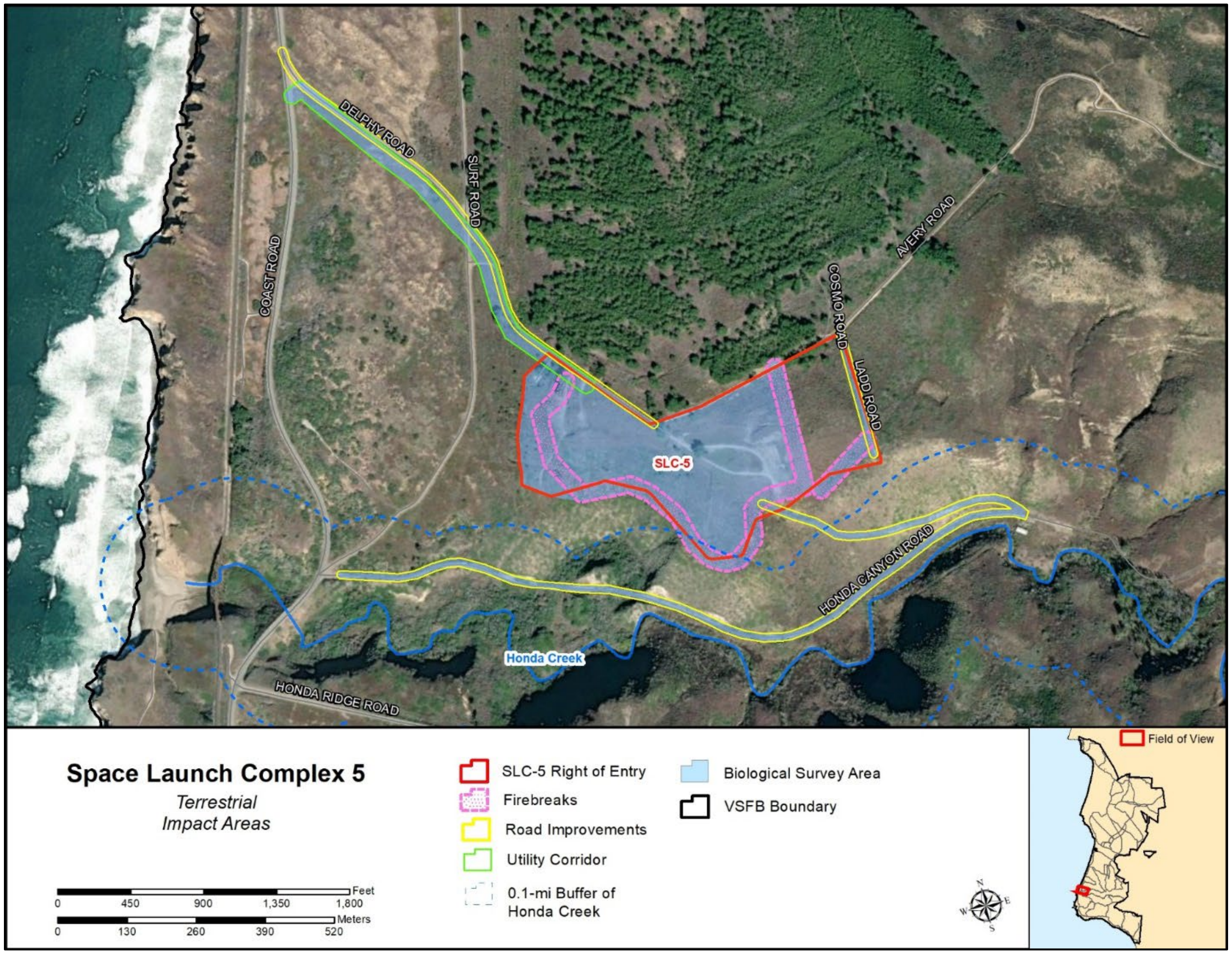

Figure 1. Construction Effect Area at SLC-5 within the South Base of VSFB.

Figure 2a. California red-legged frog occurrences and project Launch Noise Effect Area.

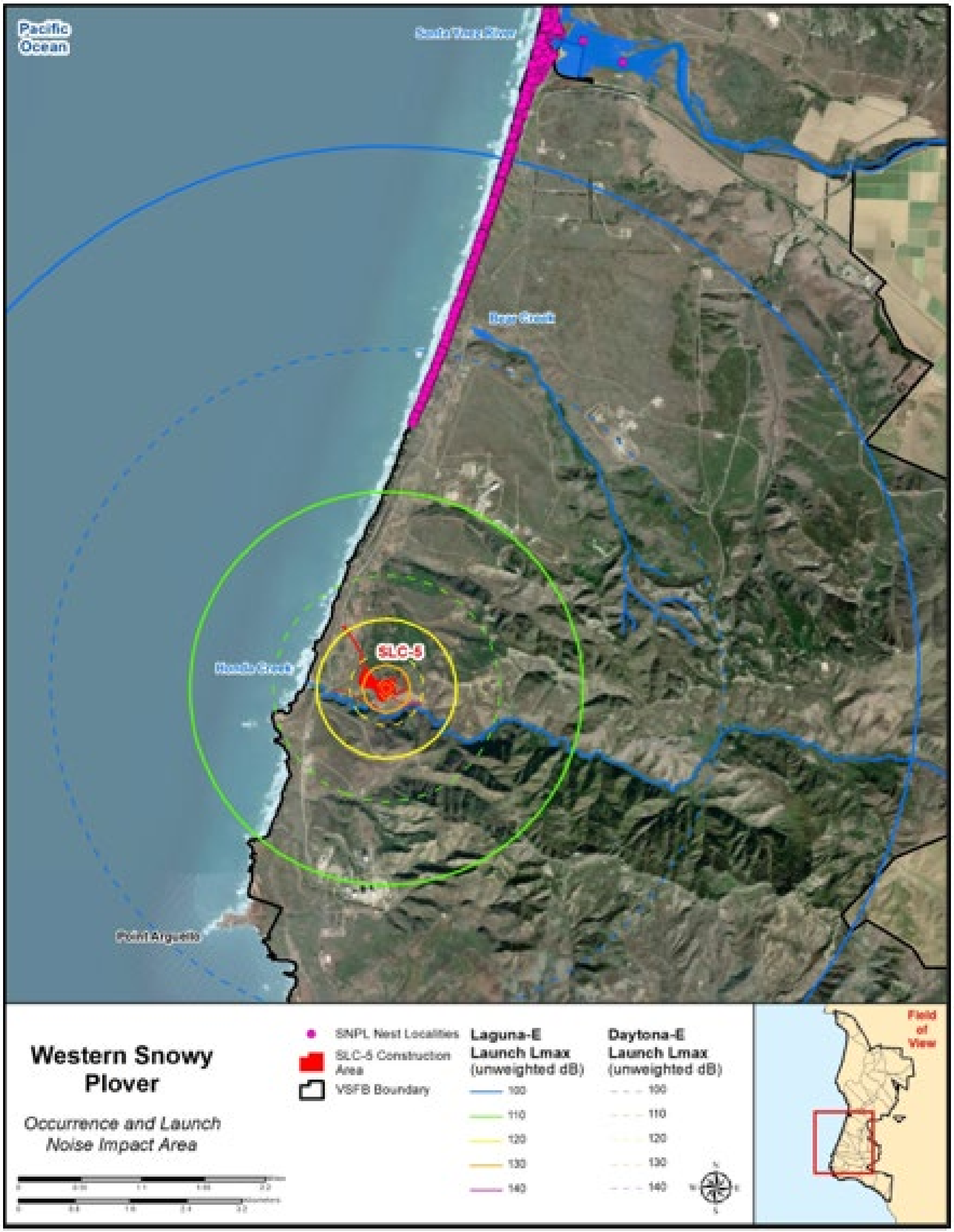

Figure 2b. Western snowy plover nesting occurrences and project Launch Noise Effect Area.

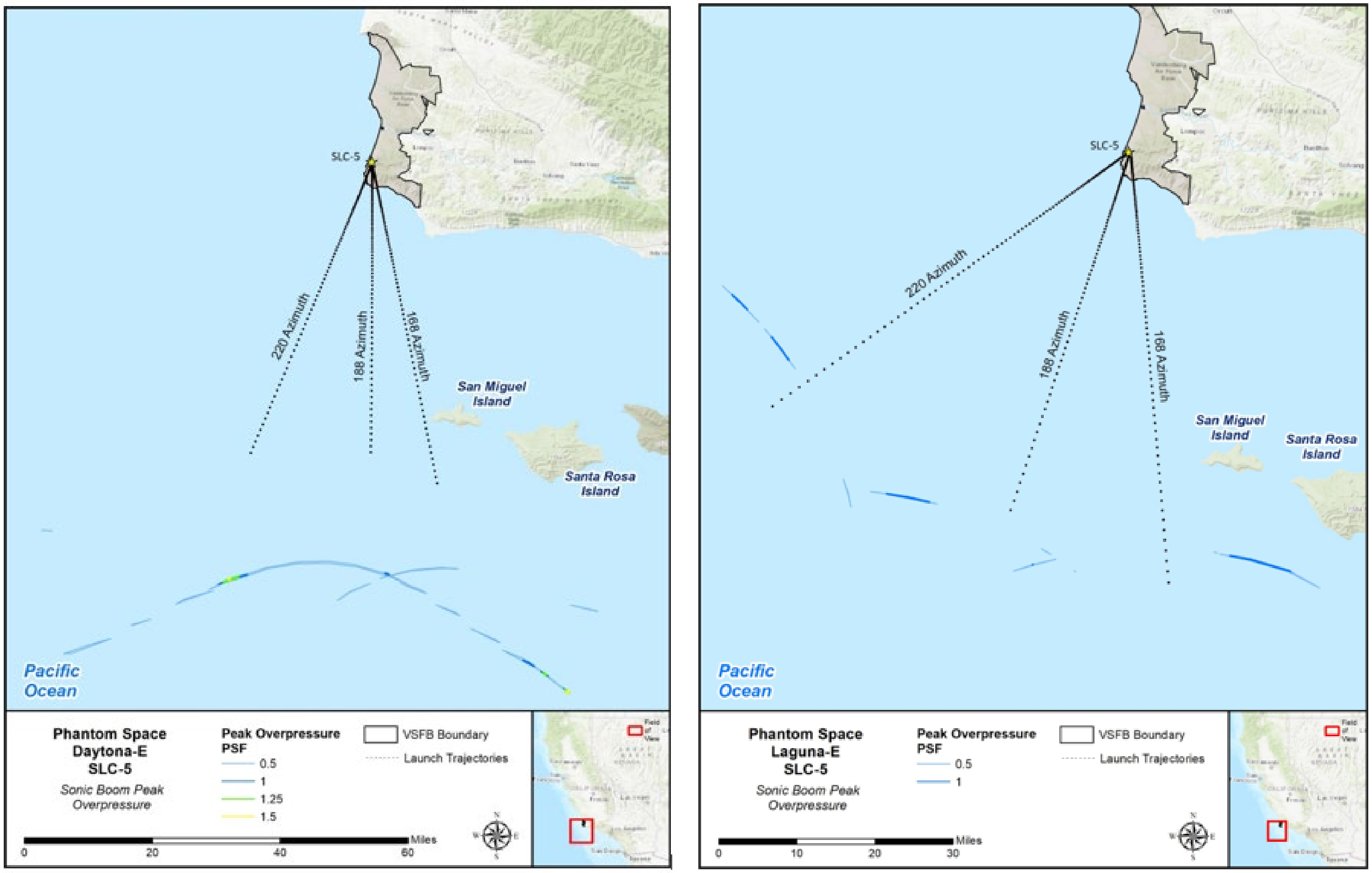

Figure 3. Sonic Boom Overpressure Effect Area and Vehicle Splashdown Effect Area (along azimuths) by vehicle type.

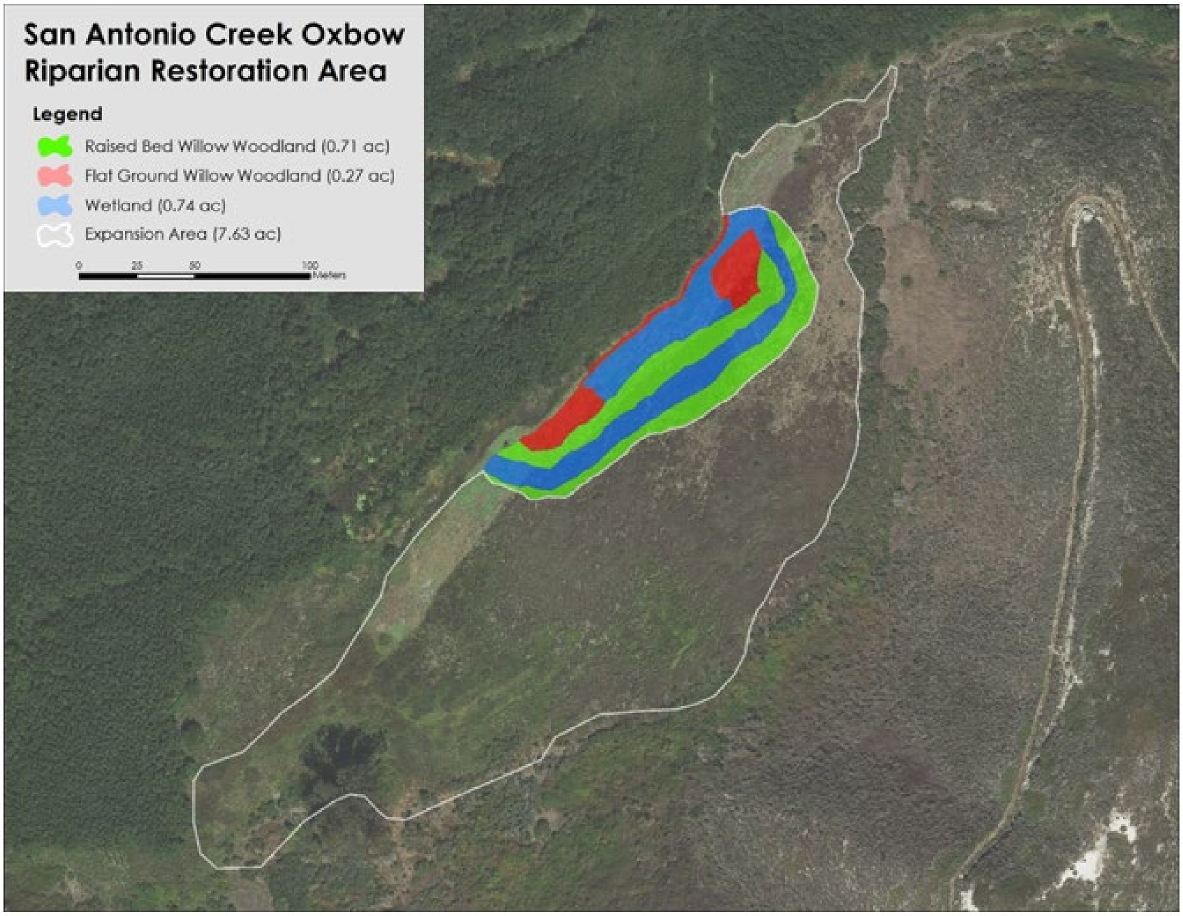

Figure 4a. Potential mitigation area (San Antonio Creek Oxbow Restoration Area) for California red-legged frog. Current restoration efforts depicted in green, red, and blue.

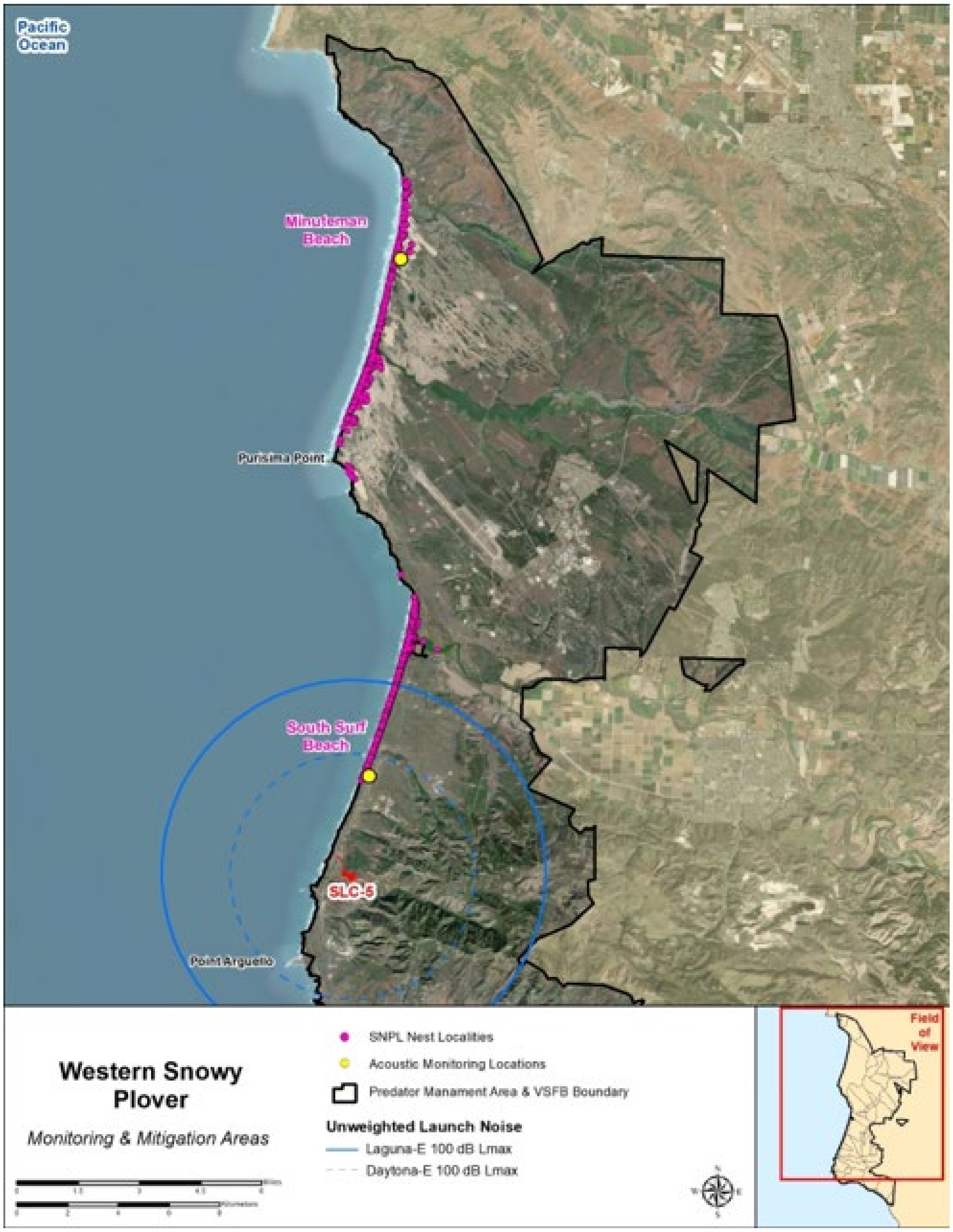

Figure 4b. Potential mitigation area (Predator Management Area) for western snowy plover.

APPENDIX B

Biologist Authorization Request

Field Experience Tracking Form

Please be as detailed as possible when submitting your qualifications with your resume. The Service must determine, based on the verifiable information you provide, that you have the expertise to conduct the requested activity with the target species under the applicable Biological Opinion. This field experience tracking document is provided to assist you in providing detailed information to support your overall qualifications.

Basic Information (to be filled in by the Action Agency)

Biologist Name

Activity Authorization Request Type (For Each Species Requested)

e.g., California red-legged frog relocation, Western snowy plover surveys and monitoring, etc.

Project Name and Biological Opinion #

Relevant Experience

Please Enter Recovery Permit:

OR populate table below as necessary to demonstrate adequate experience.

Project Name, approximate dates, and Survey or Activity Type	# of Hrs.	# of Individuals detected, handled, etc. (Please include lifestage as applicable)

Picture of the first page of the Biologist Authorization Request Field Experience Tracking Form.

Other pertinent notes or experience acquired. Include work under supervision by authorized individuals.

Service Assessment (to be completed by the Service)

- ☐ Individual is authorized to conduct requested activity
- ☐ Individual is authorized to conduct requested activity under direct supervision
- ☐ Individual is not authorized to conduct requested activity
- ☐ More information is needed
- ☐ Remarks (attach additional information)

Description of additional information needed and/or clarifying remarks

Electronic Signatures and Authorizations

Vandenberg SFB Official's Title and Office	Date	VFWO Title USFWS	Date

APPENDIX B
National Marine Fisheries Service Consultations

Biological Assessment of Launch Cadence Increase at Vandenberg Space Force Base, California, and Offshore Landing Locations to Support Endangered Species Act Section 7 Consultation with the National Marine Fisheries Service

16 December 2022

Prepared for

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ACRONYMS AND ABBREVIATIONS

°F	Fahrenheit
BA	Biological Assessment
BIA	Biologically Important Area
C	Celsius
CDFW	California Department of Fish and Wildlife
C.F.R.	Code of Federal Regulations
DAF	Department of the Air Force
DoD	Department of Defense
DPS	Distinct Population Segment
E	east
ESA	Endangered Species Act
ESU	Evolutionarily Significant Units
ft	foot or feet
ft^2	square feet
FR	Federal Register
km	kilometer(s)
km^2	square kilometers
LOC	letter of concurrence
m	meter(s)
mi.	mile(s)
MMPA	Marine Mammal Protection Act
NCI	norther Channel Islands
nm	nautical mile(s)
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
psf	pounds per square foot
SAR	Stock Assessment Report
SLD 30	Space Launch Delta 30
SLC	Space Landing or Launch Complex
SMI	San Miguel Island
UME	Unusual Mortality Event
U.S.	United States
U.S.C.	United States Code
USFWS	United States Fish and Wildlife Service
USSF	United States Space Force
VSFB	Vandenberg Space Force Base
W	west

1 Introduction

The purpose of this Biological Assessment (BA) is to address the potential effects of a proposed increase in launch and first stage recovery activities at Vandenberg Space Force Base (VSFB), California. The Proposed Action includes increasing the annual launch cadence at VSFB to approximately 110 rocket launches per year, increasing from 12 up to 36 SpaceX Falcon 9 first stage recoveries per year on autonomous droneships and maintaining up to 12 recoveries (i.e., landings) per year at Space Landing Complex 4 West [SLC-4W]; Figure 1.1-1) and expanding the Falcon 9 first stage landing and fairing recovery area in the Pacific Ocean (Figure 1.1-2). This Proposed Action is inclusive of all launch proponents on VSFB, including SpaceX Falcon 9 operations at Space Launch Complex 4 (SLC-4), which have previously been covered under separate consultations (see Section 1.2). The USSF is the lead agency for the purposes of this BA. The USSF and the project proponents have utilized the best available scientific and commercial data in the preparation of this BA.

1.1 Background

VSFB occupies approximately 99,100 acres (400 square kilometers [km^2]) of central Santa Barbara County, California, and is approximately halfway between San Diego and San Francisco (Figure 1.1-1). The Santa Ynez River and State Highway 246 divide VSFB into two distinct parts: North Base and South Base. SLC-4 is located on South Base. SLC-4 East (E) is the existing launch facility for the Falcon 9 program, located approximately 0.9 miles (mi) (1.4 kilometers [km]) east of the Pacific Ocean. SLC-4W is the existing landing facility for the Falcon 9 program, located approximately 0.5 mi (0.8 km) inland from the Pacific Ocean.

The Space Launch Delta 30 (SLD 30) at VSFB is the Department of the Air Force (DAF)/USSF organization responsible for Department of Defense (DoD) space and missile launch activities on the west coast of the United States (U.S.). Satellite launches destined for polar or near-polar orbit and ballistic missile testing are conducted at VSFB. VSFB supports launch activities for the DAF/USSF, DoD, Missile Defense Agency, National Aeronautics and Space Administration, foreign nations, and various private contractors. There are currently seven active SLCs at VSFB used for rocket launch of satellites into orbit and several more planned. SpaceX is currently operating the Falcon 9 Launch Vehicle Program at SLC-4 on VSFB, including up to 12 Falcon 9 launches from SLC-4E and 12 first stage recoveries either at SLC-4W or an autonomous droneship downrange in the Pacific Ocean within the currently approved landing area (Figure 1.1-2). Launches may occur from any launch facility on VSFB. As NMFS concurred (NMFS 2022a), the launch site and the launch proponent is irrelevant, and any and all VSFB launch actions can be considered similarly for impacts to NMFS ESA-listed species.

The USSF proposes to increase space launch activities on VSFB from 100 per year to approximately 110 launches annually. The USSF also proposes to increase the annual number of SpaceX Falcon 9 first stage recoveries per year to 36 and expand potential downrange landing and fairing recovery locations in the Pacific Ocean to accommodate new trajectories, beginning in 2023 (Figure 1.1-2). Space launch vehicles on VSFB have generally utilized azimuths from 140 to 210 degrees; however, the USSF proposes to utilize new northerly trajectories with azimuths of 305-325 degrees to support the SpaceX Falcon 9 program at SLC-4 (Figure 1.1-3).

This BA evaluates the potential effects of increasing the launch cadence at VSFB from 100 to 110, increasing SpaceX Falcon 9 first stage recoveries to 36 times per year, and expanding the Falcon 9 first stage and fairing recovery areas on NMFS ESA-listed species and designated critical habitat. Only those species and designated critical habitat that may be affected by the Proposed Action are discussed in this BA. Consistent with the NMFS requirements for ESA section 7 analyses, the spatial and temporal overlap of activities with the presence of listed species is assessed in this BA. The definitions used by the USSF in making the determination of effect under section 7 of the ESA are based on the United States Fish and Wildlife Service (USFWS) and NMFS Endangered Species Consultation Handbook (USFWS & NMFS 1998).

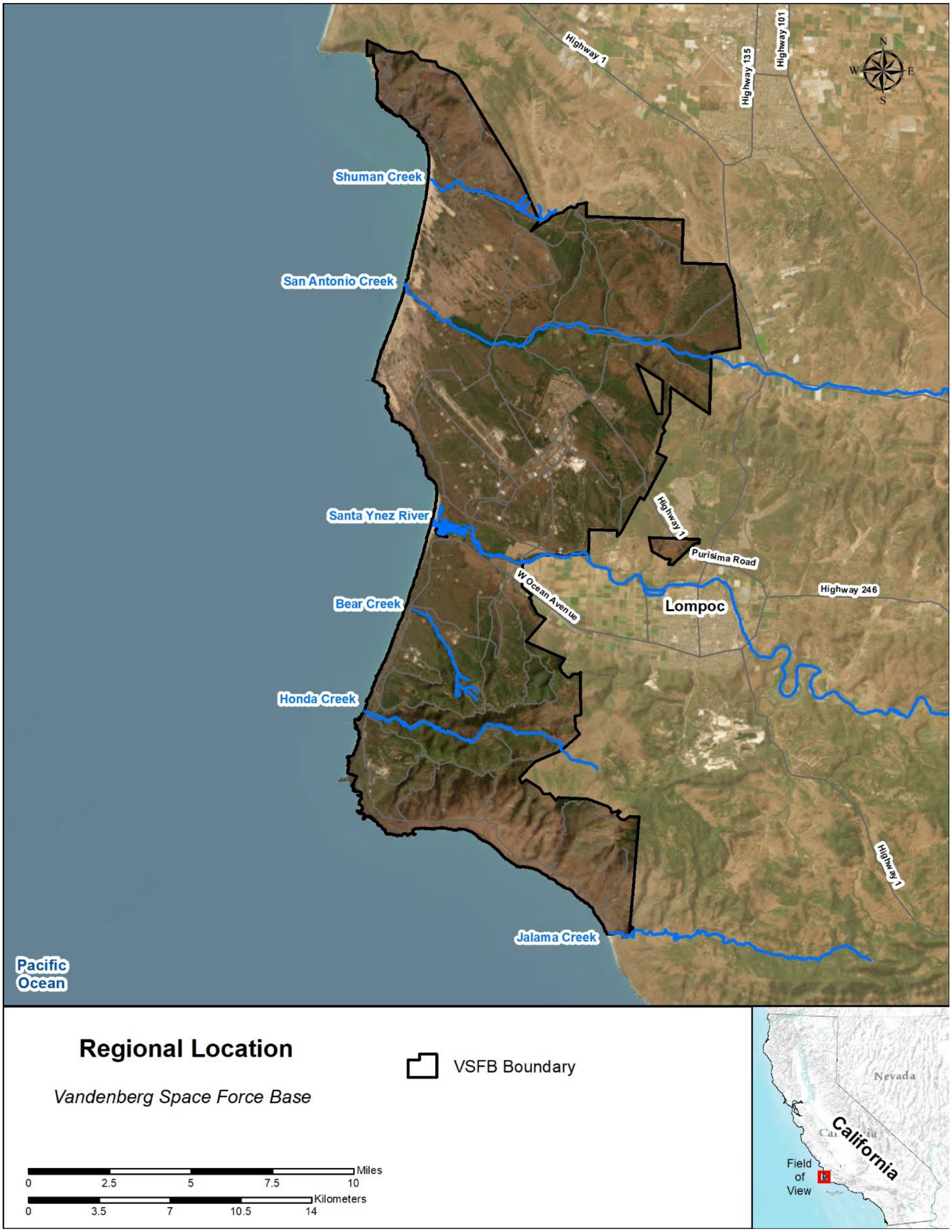

Figure 1.1-1. Regional Location of Vandenberg Space Force Base.

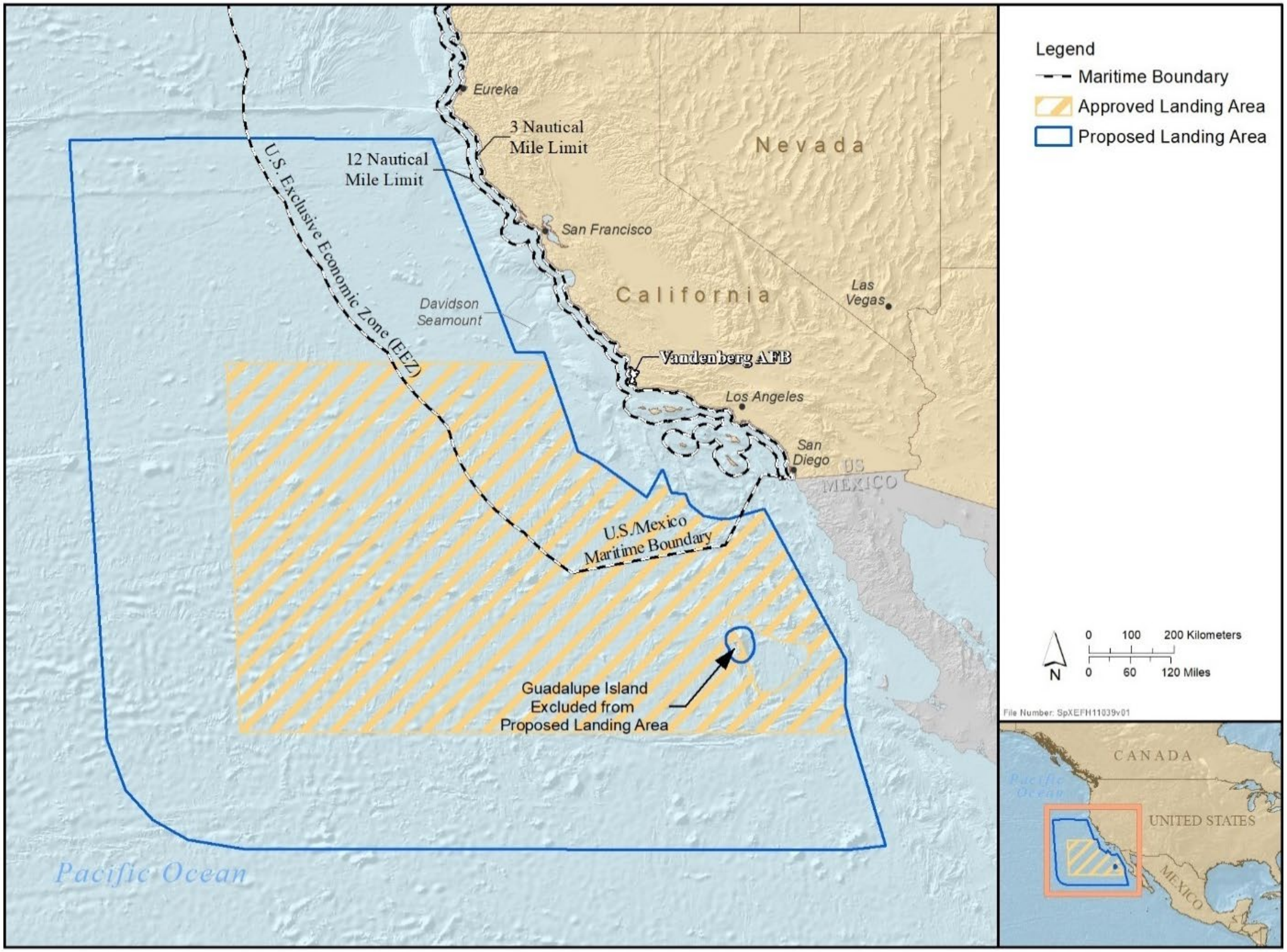

Figure 1.1-2. Approved and Proposed First Stage Landing and Fairing Recovery Areas.

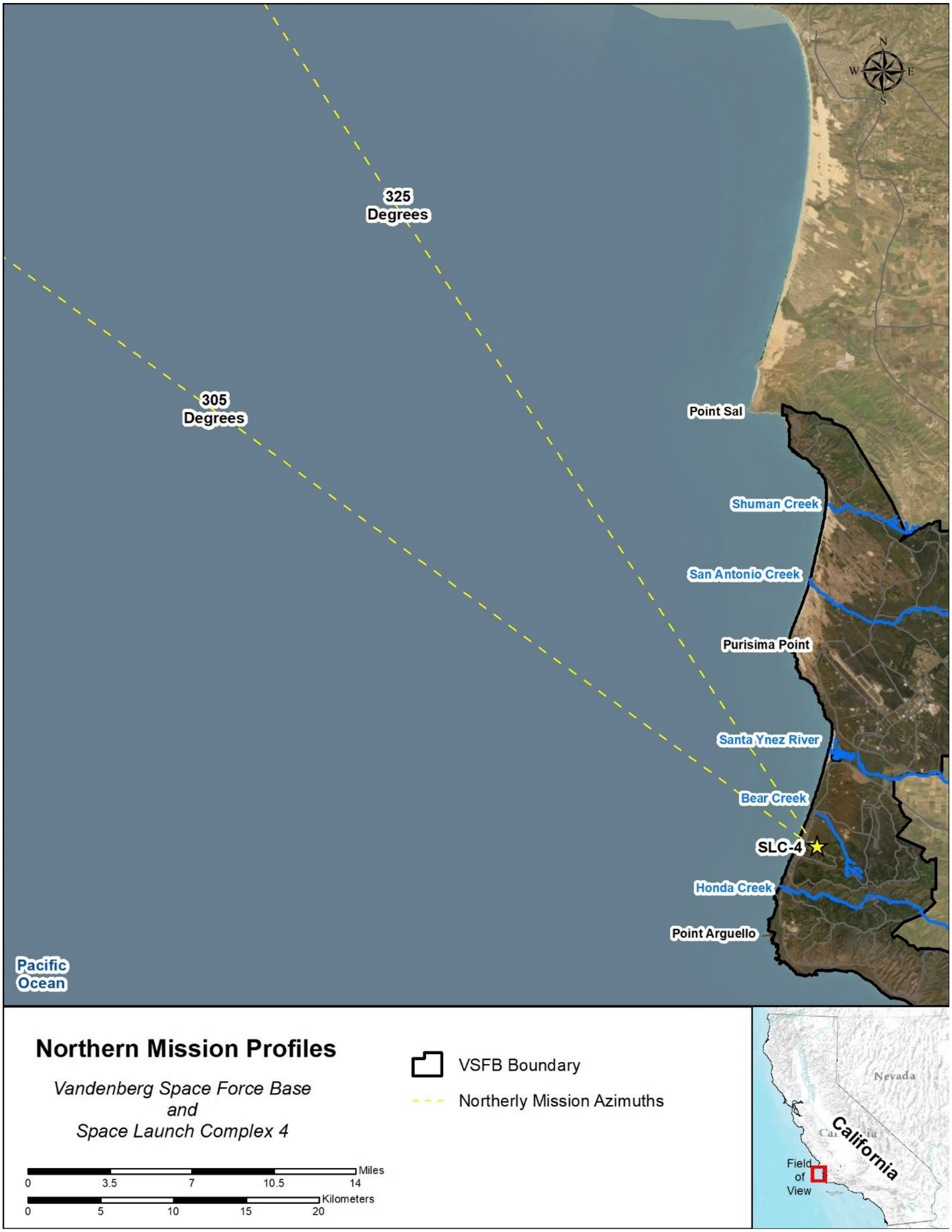

Figure 1.1-3. Northern mission azimuths.

1.2 Consultation History

In a letter dated 5 August 2015 (2015/3042; NMFS 2015), NMFS concurred that the SpaceX Boost-Back and landing of the Falcon 9 First Stage, including up to 6 launches and landings each year, was not likely to adversely affect Guadalupe fur seal (*Arctocephalus townsendi*), green sea turtle (*Chelonia mydas*), olive Ridley sea turtle (*Lepidochelys olivacea*), blue whale (*Balaenoptera musculus*), fin whale (*B. physalus*), gray whale (*Eschrichtius robustus*; Western North Pacific stock), humpback whale (*Megaptera novaeangliae*), sei whale (*B. borealis*), sperm whale (*Physeter macrocephalus*), hawksbill sea turtle (*Eretmochelys imbricata*), loggerhead sea turtle (*Caretta caretta*), leatherback sea turtle (*Dermochelys coriacea*), steelhead (*Oncorhynchus mykiss*), green sturgeon (*Acipenser medirostris*), and scalloped hammerhead shark (*Sphyrna lewini*). The reasoning for the above determinations included the low density of animals potentially present in the proposed project area, the low likelihood that the proposed project's impacts at the water's surface would reach a submerged animal, and the short duration of the proposed activity. Critical habitat had not been designated or proposed for the marine mammals and the green sea turtle, loggerhead sea turtle, olive ridley sea turtle, hawksbill sea turtle; therefore, none was analyzed. NMFS concluded that the proposed action was not likely to adversely affect critical habitat for the leatherback sea turtle or steelhead.

In 2016, NMFS provided a letter of concurrence (LOC; dated 29 August 2016; 2016/5369:DDL; NMFS 2016a) for this same SpaceX Falcon 9 proposed action with additional downrange landing areas. This LOC replaced all previous letters that have been issued for this project.

NMFS issued the USSF (formerly the United States Air Force), a LOC on 18 July 2016 (2016/5232; NMFS 2016b) that sonic booms produced by up to 30 launches per year at VSFB were not likely to adversely affect Guadalupe fur seals. The LOC intentionally omitted SpaceX and only applied to other space launch providers operating at VSFB.

On 4 May 2022, NMFS issued the USSF an LOC (WCRO-2022-00970; NMFS 2022a) that the launch site and the launch provider on VSFB were irrelevant, therefore all VSFB launch actions (SpaceX and all other providers) were covered under this LOC. In addition, NMFS concurred that an increase in number of launch activities at VSFB to a maximum of 100 cumulative launch actions per year from all providers on VSFB was not likely to adversely affect Guadalupe fur seals. The LOC replaced the July 2016 LOC for the proposed action.

SpaceX has proposed to increase launch cadence at VSFB to 36 launches and 36 Falcon 9 first stage recoveries per year. To accommodate the SpaceX proposal, the USSF requests reinitiation of the 4 May 2022 LOC (NMFS 2022a) to add an additional 10 launches per year, for a total of 110 launches from any provider at VSFB per year, up to 36 SpaceX Falcon 9 first stage recoveries per year. No more than 12 first stage recoveries per year would be performed at SLC-4. In addition, the USSF proposes to increase the size of the downrange first stage and fairing recovery areas to accommodate new trajectories proposed for the SpaceX Falcon 9 program at SLC-4.

2 Description of the Action and the Action Area

2.1 Action Area

The action area is defined in 50 Code of Federal Regulations (C.F.R.) §402.02 as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." In general, the action area includes the portions of the Pacific Ocean where launch, reentry, and recovery activities are anticipated (Figure 1.1-2). These activities occur in the marine environment in deep waters between approximately 46-400 nm off Rockport, California at the northern limit, and 158- 910 nm off Baja California, Mexico at the southern limit (Figure 1.1-2). No recovery activities would occur within 12 nm of islands. The only component of the Proposed Action that occurs less than 12 nm from the U.S. are marine vessels transiting to and from a port in support of first stage and fairing recovery activities. These nearshore vessel transit areas in the action area include marine waters that lead to the Port of Long Beach and the VSFB Harbor.

2.2 Proposed Action

The Proposed Action is to increase space launch activities from VSFB from 100 per year to 110 launches annually. The USSF also proposes to increase the annual number of first stage recoveries per year to 36 and expand potential downrange droneship landing and fairing recovery locations in the Pacific Ocean to accommodate new trajectories, beginning in 2023 (Figure 1.1-2). Launches and recovery operations would occur day or night, at any time during the year.

2.2.1 Launch Operations

Space launch vehicles (commonly termed rockets) at VSFB place a payload into space by vertical launch. Currently, most of the vertical launch vehicles operating at VSFB are expendable (i.e., stages are disposed of in the ocean or in outer space), except for the SpaceX Falcon 9 first stage, which is recovered by landing at a launch site on VSFB or on an autonomous droneship in the Pacific Ocean. First stage recovery operations are discussed below in Section 2.2.2.

For expendable launch vehicles, the first stage and fairing would fall into the Pacific Ocean after stage separation and sink to the ocean floor. The fairing consists of two halves which separate, allowing the deployment of the payload at the desired orbit. First stage boosters and fairings are composed of heavy-duty metal components but may also include some carbon composite components that may float for several days (10 days maximum) before becoming waterlogged and sinking. Both expendable and reusable rockets at VSFB use liquid oxygen and either kerosene or alcohol as propellants. Current and reasonably foreseeable launch vehicles at VSFB are listed in Table 2.2-1.

Launches may occur from any launch facility on VSFB. Engine noise produced during launches would primarily impact VSFB and the surrounding area. During ascent, a sonic boom (overpressure of impulsive sound) with a peak generated over a relatively small area, typically between 3.0 to 5.0 pounds per square foot (psf), but potentially as high as 8.0 psf, would be generated. Depending on the launch trajectory, the sonic boom may or may not impact the surface of the earth. For instance, approximately 24 percent (7 out of 29) of Falcon 9 launches from SLC-4 since 2017 have not produced sonic booms that impact the surface of the earth because the ascent of the rocket was too steep. When the sonic booms do impact the earth's surface, they primarily impact the Pacific Ocean, but may overlap the Northern Channel Islands (NCI; see example shown in Figure 2.2-1). Since 2017, 24 percent (7 out of 29) of Falcon 9 launches have produced sonic booms that have impacted the NCI. Sonic boom modeling determined that launches with northerly mission profiles will not result in sonic booms impacting the surface of the earth.

Table 2.2-1. Launch Vehicles that May Affect the Marine Environment.

Launch Vehicle	Operator	Type	Launch Site
Alpha	Firefly	Expendable	SLC-2
Daytona-E	Phantom	Expendable	SLC-5/SLC-8
Falcon 9	SpaceX	Reusable	SLC-4
Laguna-E	Phantom	Expendable	SLC-5
Minotaur IV/Peacekeeper	Northrop Grumman	Expendable	SLC-8
New Glenn	Blue Origin	Expendable	SLC-9
RSL	ABL	Expendable	LF-576E
Terran 1	Relativity	Expendable	SLC-11
Vulcan	ULA	Expendable	SLC-3

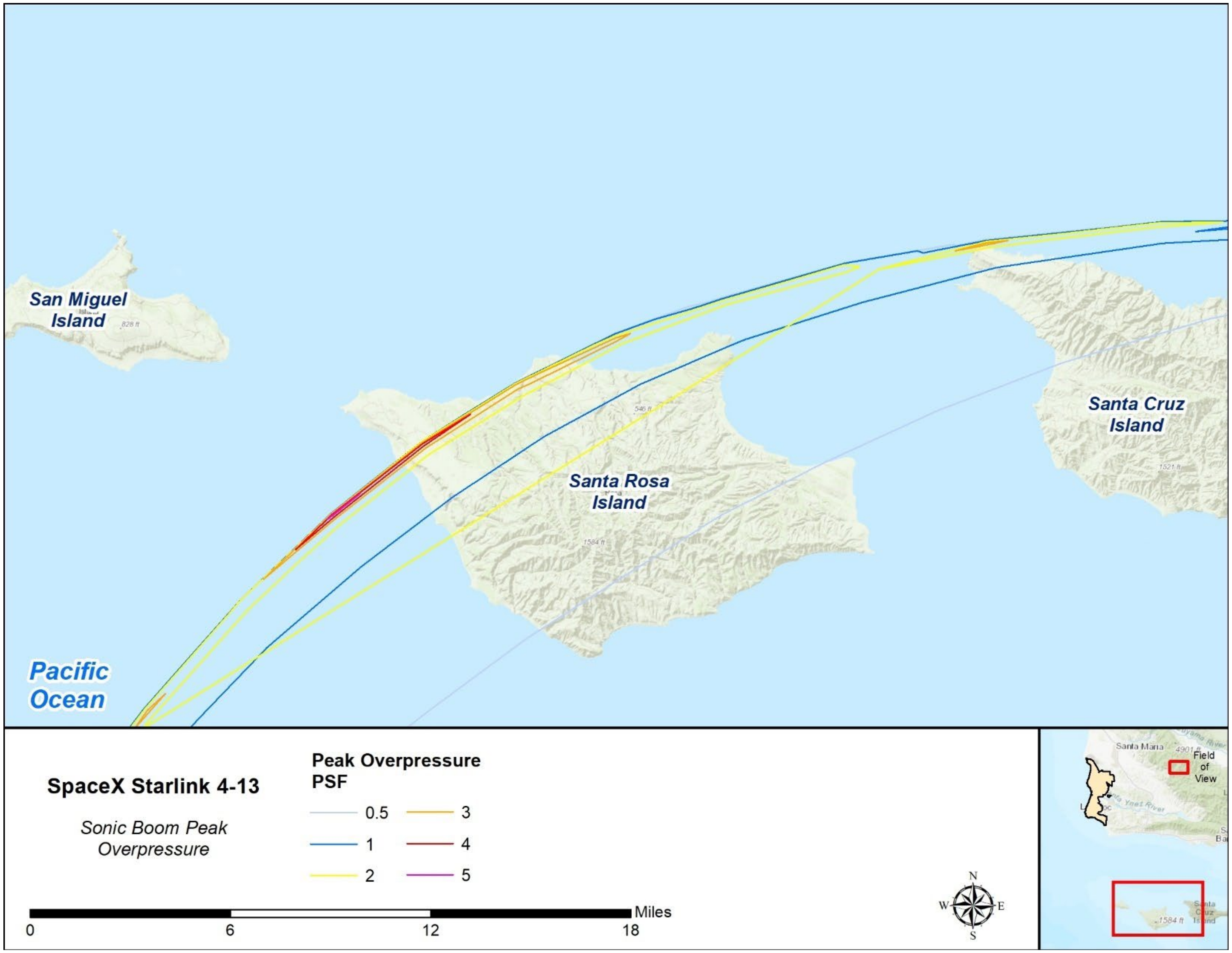

Figure 2.2-1. Sample Falcon 9 sonic boom profile generated during launch from Vandenberg Space Force Base.

2.2.2 First Stage Landing Operations

The Proposed Action includes conducting boost-back and landing of SpaceX Falcon 9 first stages on an autonomous droneship in the Pacific Ocean or at VSFB. Landing locations are specific to each mission. For each of the 36 launch attempts, the first stage will land downrange in the Pacific Ocean on a droneship within the proposed landing area (Figure 1.1-2) or at a landing complex on VSFB. Currently SLC-4W is the only active landing complex on VSFB. After the first stage engine cutoff and separation from the second stage, a subset of the first stage engines restart to conduct a reentry burn. Once the first stage is in position and approaching its landing target, the engines are cut off. A final burn is performed to slow the first stage to a velocity of zero for landing on the droneship or at VSFB.

During descent, the first stage will produce engine noise and sonic booms. Engine noise during downrange droneship landing operations would only impact open ocean and would not impact mainland or islands. Engine noise produced during landing operations at VSFB would primarily impact areas on VSFB (Figure 2.2-2). Landing engine noise follows launch and associated launch engine noise by approximately 5 to 7 minutes and typically occurs slightly before the sonic boom impacts land.

During descent, when the Falcon 9 first stage is supersonic, a sonic boom (overpressure of high-energy impulsive sound) would be generated. Sonic booms produced during landing may reach as high as 8.5 pounds per square foot (psf). When landing on VSFB, sonic booms are typically between 1.0 and 3.0 psf at VSFB pinniped haulout locations (Figure 2.2-3). During landing events at VSFB or in offshore areas near VSFB, sonic booms may impact the NCI (see examples in Figures 2.2-4 and 2.2-5). Although unlikely, the sonic boom received at San Miguel Island (SMI) could potentially be up to approximately 3.0 psf. However, during the majority of downrange droneship landings in the proposed landing areas, sonic booms would be directed entirely at the ocean surface without impacting any land (see examples in Figure 2.2-6 and 2.2-7).

The Proposed Action includes expanding the potential landing area in the Pacific Ocean to accommodate new trajectories proposed by SpaceX; first stage landing locations would be no closer than 12 nautical miles (nm) from either mainland or islands anywhere within the Proposed Landing Area (Figure 1.1-2). The proposed landing area is also no closer than 26 nm to the Davidson Seamount and no closer than 12 nm to Guadalupe Island (Figure 1.1-2).

During droneship landing events, wind speed in the landing area is measured using weather balloons. A radiosonde, which is approximately the size of a shoe box and is powered by a 9-volt battery, is attached to a weather balloon, and transmits data to the launch operator and to vehicle onboard predictive systems. The balloon, which is made of latex, rises to approximately 12 to 19 mi (19 to 30 km) and bursts. The balloon is shredded into many pieces as it falls back to Earth, along with the radiosonde, and lands in the Pacific Ocean. The radiosonde does not have a parachute and would not be recovered.

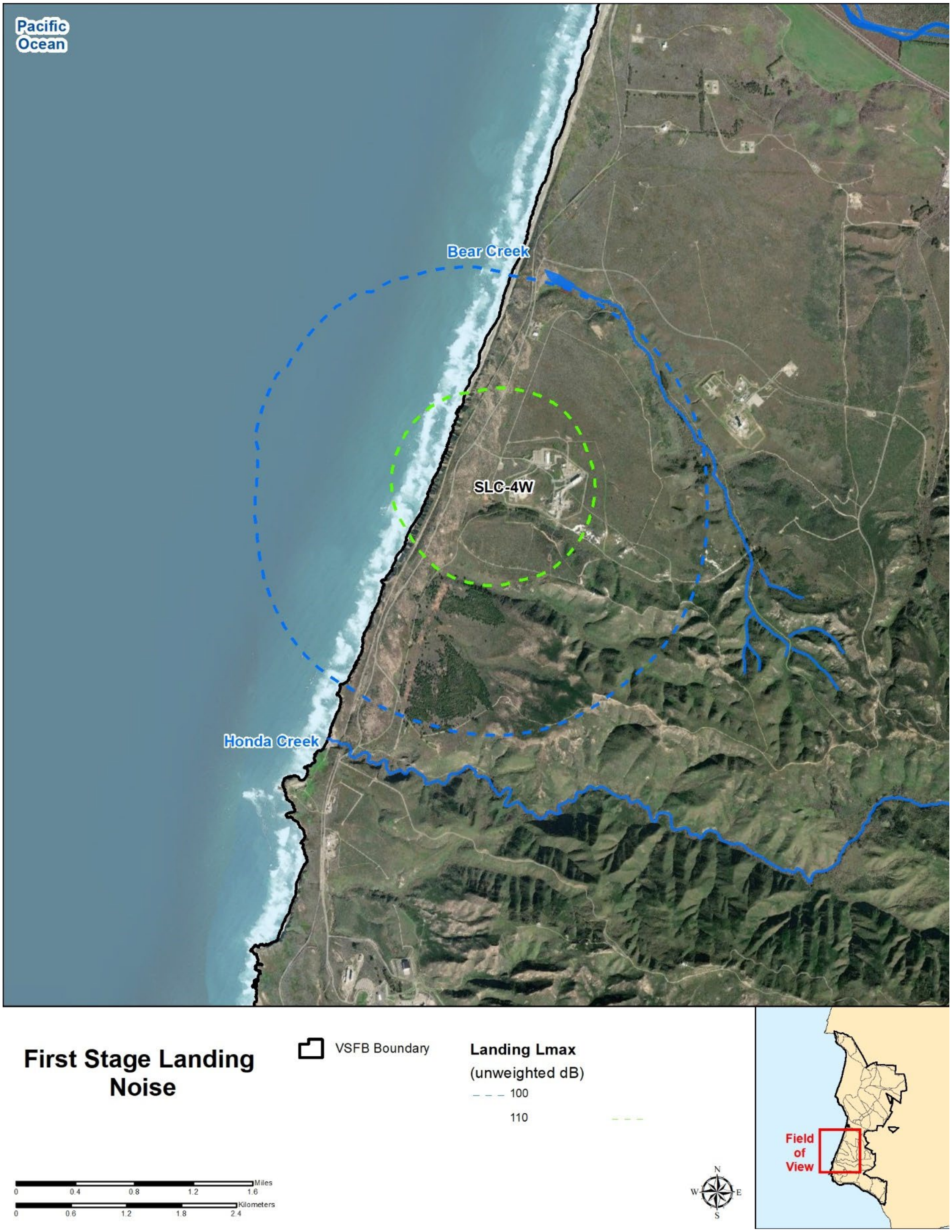

Figure 2.2-2. Falcon 9 first stage landing engine noise at SLC-4W.

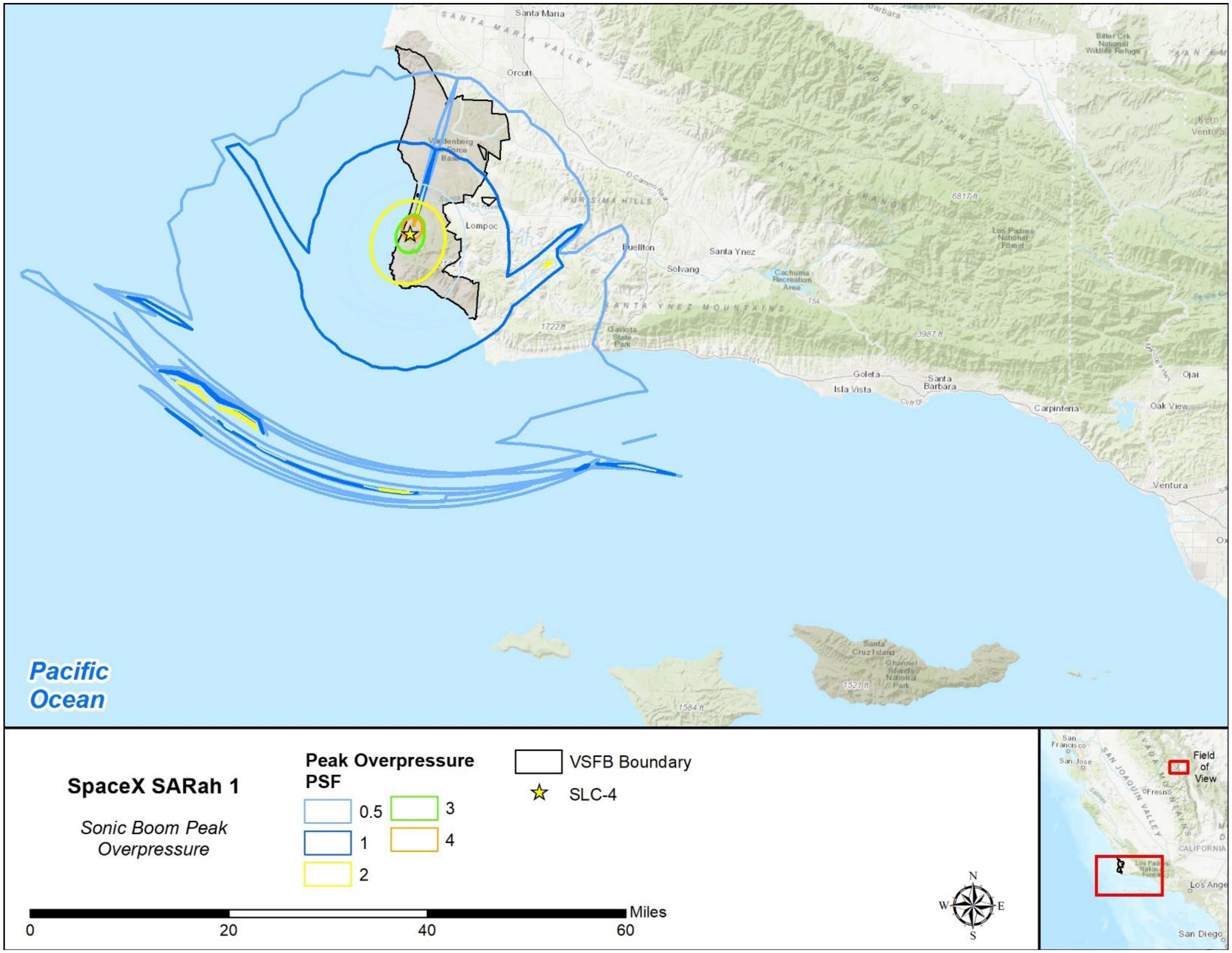

Figure 2.2-3. Example of a typical Falcon 9 sonic boom profile for first stage landing at SLC-4W.

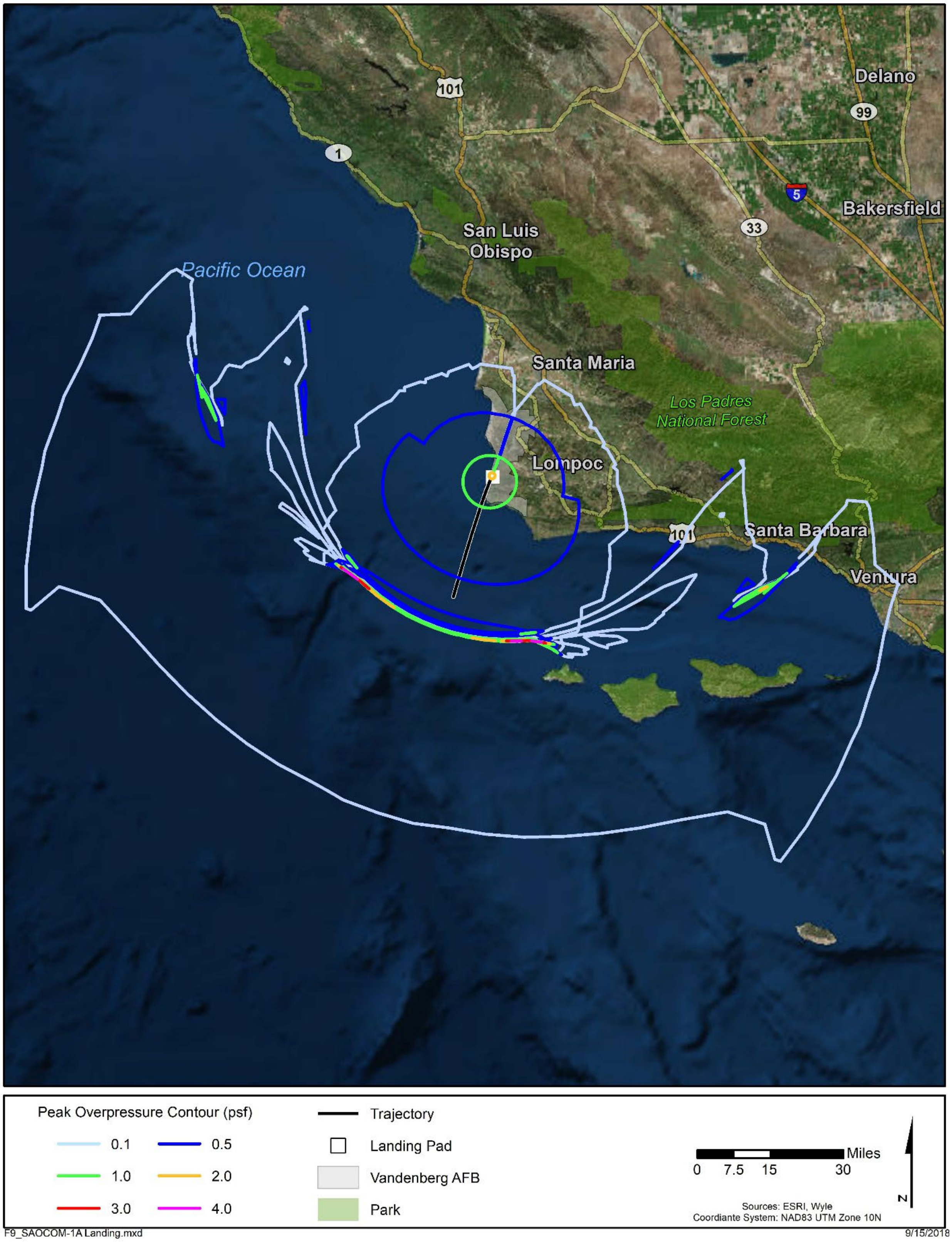

Figure 2.2-4. Sonic boom modeling results for first stage landing at SLC-4W for the Falcon 9 SAOCOM mission.

Figure 2.2-5. Sonic boom modeling results for first stage landing at an offshore droneship near VSFB for the Falcon 9 SSO-A mission.

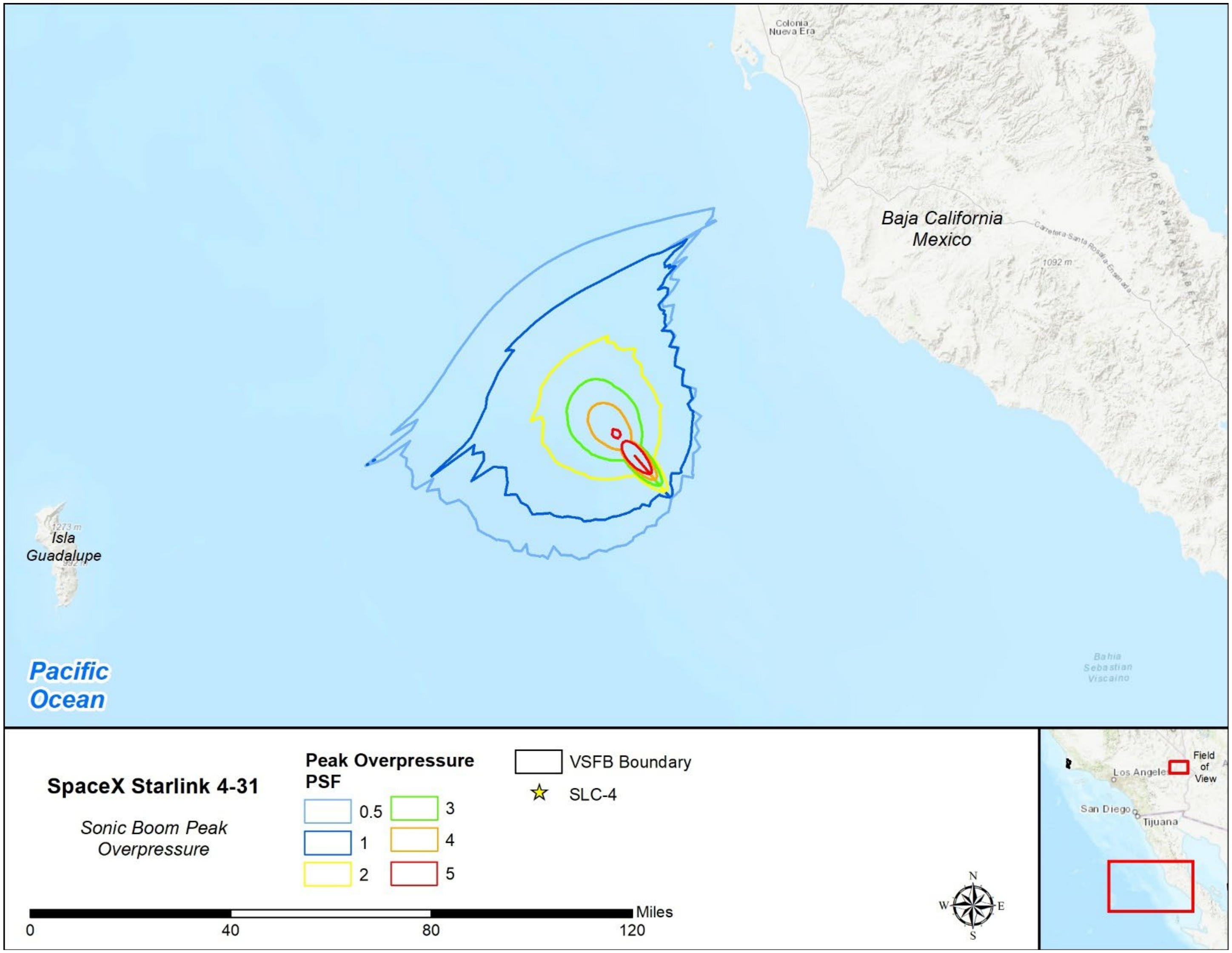

Figure 2.2-6. Example of a typical sonic boom profile for Falcon 9 first stage landing on a droneship in the proposed landing areas with a southerly mission profile.

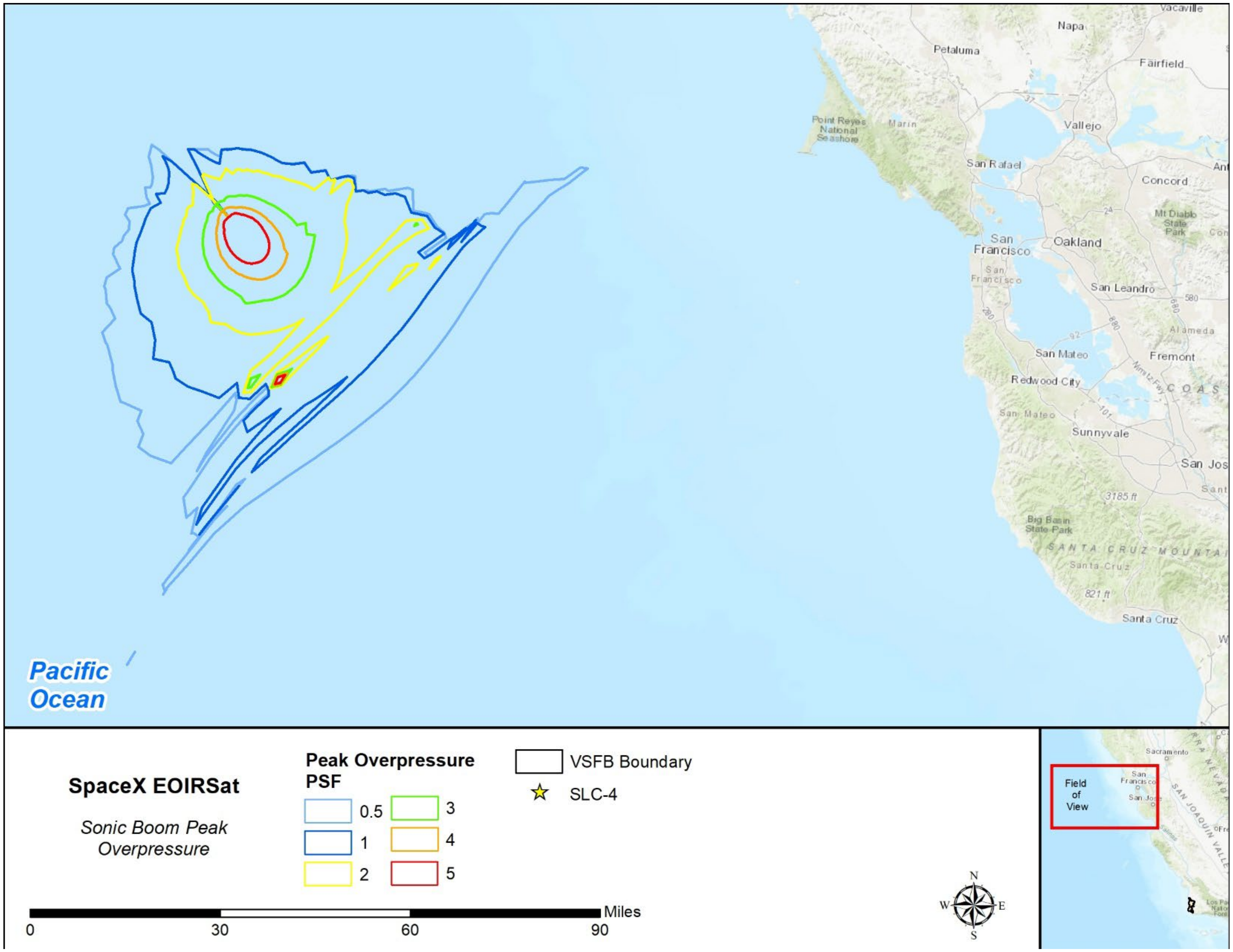

Figure 2.2-7. Example of a typical sonic boom profile for Falcon 9 first stage landing on a droneship in the proposed landing areas with a northerly mission profile.

2.2.3 Fairing Recovery Operations

SpaceX currently conducts fairing recovery operations for launches from VSFB. Each Falcon 9 fairing half contains a parachute system for recovery, which consists of one drogue parachute (hereafter "parachute") and one parafoil. The parachute system slows the descent of the fairing to enable a soft splashdown so that the fairing remains intact. Following re-entry of the fairing, the parachute deploys at a high altitude (approximately 50,000 feet [ft]) to begin the initial slow down and to extract the parafoil. The parachute cuts away following the successful deployment of the parafoil and lands in the ocean. The predicted impact points within desired recovery areas of the fairing, parafoil, and parachute are developed using modeling tools. The parachute canopy area is approximately 110 square feet (ft^2) and the fairing parafoils are approximately 3,000 ft^2. The parafoil suspension cables and risers are up to approximately 80 ft long and the parachute cables are up to approximately 60 ft long, but both may change with design improvements in the future. Both are made of Kevlar and approximately 1.75 inches in diameter.

For up to 36 first stage recoveries per year, up to 72 parachutes and 72 parafoils would land in the ocean annually. All parachutes and parafoils are meant to be recovered and they have been recovered during the majority of operations, but it is possible that some of the parafoils would not be recovered due to sea or weather conditions at the time of recovery. Parafoils are made of nylon and are expected to sink at a rate of approximately 1,000 ft in 145.5 minutes (NMFS 2022b). Recovery of the parachute assembly would be attempted if the recovery team can get a visual fix on the splashdown location. Because the parachute assembly is deployed at a high altitude, it is difficult to locate. In addition, based on the size of the assembly and the density of the material, the parachute assembly would saturate and begin to sink upon impact. This would make recovering the parachute assembly difficult and unlikely. Parachutes are made of nylon and Kevlar and are expected to sink at a rate of approximately 1,000 ft in 46 minutes (NMFS 2022b).

The fairing and parafoil would be recovered by a salvage ship stationed in the Proposed Landing Area near the anticipated splashdown site, but no closer than 12 nautical miles offshore (Figure 1.1-2). The salvage ship would be able to locate the fairing using GPS data from mission control and strobe lights on the fairing data recorders. Upon locating the fairing, a rigid hulled inflatable boat would be launched. Crew members would hook rig lines to the fairing and connect a buoy to the parafoil. Then the crew would release the parafoil riser lines and secure the canopy by placing it into a storage drum. If sea or weather conditions are poor, recovery of the fairing and parafoil may be unsuccessful.

2.2.4 Environmental Protection Measures

The USSF will ensure the following EPMs are implemented to reduce the risk of injury or mortality of ESA-listed species:

- The USSF will ensure that all personnel associated with vessel support operations are instructed about marine species and any critical habitat protected under the ESA that could be present in the proposed landing area. Personnel will be advised of the civil and criminal penalties for harming, harassing, or killing ESA-listed species.
- Support vessels will maintain a minimum distance of 150 ft (45 m) from sea turtles and a minimum distance of 300 ft (90 m) from all other ESA-listed species. If the distance ever

becomes less, the vessel will reduce speed and shift the engine to neutral. Engines would not be re-engaged until the animal(s) are clear of the area.

- Support vessels will maintain an average speed of 10 knots or less.
- Support vessels will attempt to remain parallel to an ESA-listed species' course when sighted while the watercraft is underway (e.g., bow-riding) and avoid excessive speed or abrupt changes in direction until the animal(s) has left the area.
- The USSF will immediately report any collision(s), injuries, or mortalities to ESA-listed species to the appropriate NMFS contact.

3 Description of the Species

The list of ESA-listed endangered and threatened species that may be affected by the Proposed Action were obtained from the NMFS endangered species web sites, species experts, and a review of available literature. Table 3.1-1 lists the ESA-listed species under NMFS jurisdiction that may be affected by the Proposed Action. Additional information regarding species distribution and presence within the Action Area is discussed in the sections following the table.

Table 3.1-1. ESA-listed Species Occurrence Within the Action Area.

Common Name	***Scientific Name***	***Distinct Population Segment or Evolutionarily Significant Units***	***ESA Status****	***Presence in Action Area***
Fishes				
Steelhead	*Oncorhynchus mykiss*	Southern California Coast	FE	Potentially present in the nearshore and offshore waters
Chinook salmon	*Oncorhynchus tshawytscha*	4 ESUs[1]	FT	Specific ESUs present or potentially present in the nearshore and offshore waters
Coho salmon	*Oncorhynchus kisutch*	2 ESUs[3]	FT	Present in the nearshore and offshore waters
Green sturgeon	*Acipenser medirostris*	Southern	FT	Likely present primarily along continental shelf waters of the West Coast
Oceanic whitetip shark	*Carcharhinus longimanus*	-	FT	Present in open ocean waters from Southern California to Peru
Scalloped hammerhead shark	*Sphyrna lewini*	Eastern Pacific	FE	Present in coastal and semi-oceanic water in temperate and tropical regions
Sea Turtles				
Green sea turtle	*Chelonia mydas*	East Pacific	FT	Present in offshore and nearshore subtropical waters
Leatherback sea turtle	*Dermochelys coriacea*	-	FE	Present in offshore and nearshore waters
Olive ridley sea turtle	*Lepidochelys olivacea*	Mexico Pacific coast	FE	Present in offshore and nearshore waters
Hawksbill sea turtle	*Eretmochelys imbricata*	-	FE	Present in offshore and nearshore waters of Mexico
Loggerhead turtle	*Caretta caretta*	North Pacific	FE	Present in small numbers in offshore waters generally north of Point Conception
Marine Mammals				
Blue whale	*Balaenoptera musculus*	-	FE	High densities during the summer and fall with single individuals in the winter and spring
Fin whale	*Balaenoptera physalus*	-	FE	Higher densities in the summer and fall although present year-round
Gray whale	*Eschrichtius robustus*	Western North Pacific	FE	Present during seasonal migration in the winter and spring

Humpback whale	*Megaptera novaeangliae*	Mexico	FT	Individuals present year-round with higher seasonal presence during the summer migrations from Mexico and Central America
		Central America	FE	
Killer whale	*Orcinus orca*	Southern Resident	FE	occasionally present offshore of Central and Southern California
Sei whale	*Balaenoptera borealis*	-	FE	Present year round with more likely presence in the winter and spring
Sperm whale	*Physeter macrocephalus*	-	FE	Present year round with a preference for deep waters and the continental shelf break and slope
Guadalupe fur seal	*Arctocephalus townsendi*	-	FT	Primarily present at NCI and between 50 and 300 km offshore seasonally when not at rookeries in Mexican waters

*Notes: ESU = Evolutionarily Significant Unit, FE = federally listed endangered, FT = federally listed threatened

[1] Chinook salmon ESUs include California Coastal (FT), Central Valley Spring-Run (FT), Lower Columbia River (FT), and Sacramento River Winter-Run (FT)

[2] Coho salmon ESUs include Central California Coast (FT) and Southern Oregon and Northern California Coasts (FT).

3.1 Fishes

3.1.1 Steelhead (Onchorhynchus mykiss)

3.1.1.1 Status and Trends

NMFS listed several Evolutionarily Significant Units of anadromous steelhead as endangered or threatened, including the Southern California Distinct Population Segment (DPS) of steelhead, which encompasses the populations occurring from the Santa Maria River in Santa Barbara County to the California-Mexico border, as endangered in 1997 (62 Federal Register [FR] 43937). In January 2012, NMFS issued a final Recovery Plan to stabilize and restore the southern California DPS steelhead trout populations (NMFS 2012).

Steelhead populations have experienced significant declines along the Pacific Coast of North America since the early 1900s. The Santa Ynez River in Santa Barbara County, California, once supported what was likely the largest steelhead run south of San Francisco Bay. The run size for the Santa Ynez, Santa Clara, and Ventura Rivers and Malibu Creek is estimated to have been between 32,000 and 46,000 individuals (Boughton & Fish 2003; Helmbrecht & Boughton 2005; Good et al. 2005; Williams et al. 2011). Even after the construction of Gibraltar Dam in 1920, 72 mi. upstream of the Santa Ynez River mouth, historic run sizes for the Santa Ynez River were estimated at 12,995 to 25,032 individuals (Shapovalov & Taft 1954; Busby et al. 1996). Runs remained large and supported a recreational fishing industry until the construction of Bradbury Dam in 1954 (Alagona et al. 2012). Bradbury Dam is located 48 mi (77 km) upstream from the Pacific Ocean on the mainstem of the Santa Ynez River. It is an impassable barrier that blocks two-thirds of the former steelhead spawning and rearing habitat (Alagona et al. 2012). Following Bradbury Dam's construction, runs of steelhead on the Santa Ynez River were reported at less than 100 individuals on an annual basis (Nehlsen et al. 1991; Reavis 1991). Between 2001 and 2011, an average of 3.4 adult steelhead were trapped per year at a lower Santa Ynez River monitoring station and no adults were observed between 2010 and 2016 (NMFS 2016d).

3.1.1.2 Distribution

The natural range of anadromous steelhead includes the U.S. Pacific Coast to Southern California (Good et al. 2005), but it has been introduced throughout the world. Spawning and rearing habitat are found outside of the Action Area in freshwater creek and river systems, where adults may migrate up to 930 mi (1,497 km) from their ocean habitats to reach their freshwater spawning grounds in high-elevation tributaries. Near the Action Area, the primary rivers that steelhead migrate into are the Santa Maria and Santa Ynez Rivers (Good et al. 2005). Steelhead hatch in freshwater streams, where they spend their first 1 to 3 years. They later move into the ocean, where most of their growth occurs. After spending between 1 and 4 years in the ocean, steelhead return to their home freshwater stream to spawn. Unlike other species of Pacific salmon, steelhead do not necessarily die after spawning and are able to spawn more than once. The name steelhead is used primarily for the anadromous form of this species.

There is considerable variation in this life history pattern within the population, partly due to Southern California's variable seasonal and annual climatic conditions. Some winters produce heavy rainfall and flooding, which allow juvenile steelhead easier access to the ocean, while dry seasons and periods of drought may close the mouths of coastal streams and rivers, limiting juvenile steelheads' access to marine waters (NMFS 1997) as well as adult access to spawning grounds (U.S. Bureau of Reclamation 2013).

3.1.1.3 Critical Habitat

In September 2005, the NMFS issued the final critical habitat designation for the Southern California Steelhead DPS (70 FR 52488). This critical habitat designation does not include VSFB because it was excluded under section 4(b)(2) and exempted under section 4(a)(3) of the ESA. In addition, designated critical habitat for steelhead in Southern California is restricted to rivers and estuaries and therefore does not overlap with the Action Area.

3.1.1 Chinook Salmon (Onchorhynchus mykiss)

3.1.1.1 Lower Columbia River ESU

The Lower Columbia River Chinook Salmon ESU was listed as threatened on 24 March 1999 (64 FR 14308), their status reaffirmed on 28 June 2005 (70 FR 37160), and status subsequently updated on 14 April 2014 (79 FR 20802). This ESU includes naturally spawned Chinook salmon originating from the Columbia River and its tributaries downstream of a transitional point east of the Hood and White Salmon Rivers, and any such fish originating from the Willamette River and its tributaries below Willamette Falls.

In general, the more abundant juvenile Lower Columbia River fall-run Chinook migrate north upon entering the Pacific Ocean (Fisher et al. 2014). However, the less-abundant juvenile Lower Columbia River spring-run Chinook, though more common beyond the continental shelf, with most migrating far offshore after their first year of marine residence (Quinn & Myers 2005; Sharma 2009), have been detected in the coastal waters of Oregon and Washington for much of the year (Fisher et al. 2014). Occurrence of chinook salmon from the Lower Columbia River ESU would be rare in the Action Area.

3.1.1.2 Central Valley Spring-Run ESU

The Central Valley Spring-Run Chinook Salmon ESU was listed as threatened on 16 September 1999 (64 FR 50394), their status reaffirmed on 28 June 2005 (70 FR 37160), and status subsequently updated on 14 April 2014 (79 FR 20802). This ESU includes naturally spawned spring-run Chinook salmon originating from the Sacramento River and its tributaries, and also spring-run Chinook salmon from the Feather River Hatchery Spring-run Chinook Program. This ESU does not include Chinook salmon that are designated as part of an experimental population (79 FR 20802).

Juvenile Central Valley spring-run Chinook salmon migrate downstream throughout spring of the same year they hatched, although a small portion remains through summer and enters the ocean the following spring. Central Valley spring-run Chinook have a relatively broad ocean distribution, ranging from central California to Cape Falcon (Oregon) (Satterthwaite et al. 2015). Return migrating adults enter San Francisco Bay and migrate up the Sacramento River from late January to early February, reaching spawning areas from March through June (NMFS 2019c). Central Valley Spring-Run Chinook salmon occurs within in the Action Area.

3.1.1.3 Sacramento River Winter-Run ESU

The Sacramento River Winter-Run Chinook Salmon ESU was listed as threatened on 4 August 1989 (54 FR 32085) and was reclassified as endangered in 1994 (55 FR 46515). This ESU includes all naturally spawned populations of winter-run Chinook salmon in the Sacramento River and its tributaries, as well as two conservation programs maintained at the Livingston-Stone National Fish Hatchery (79 FR 20802).

Juvenile fry and smolts emigrate downstream from July through March through the Sacramento River and reach the Delta from September through June (Satterthwaite et al. 2015). Due to limited data, Teel et al. (2015), combined this ESU with other California ESUs. They found that the distribution of these fish largely occurred in Oregon and California coastal waters, consistent with other authors (Hendrix et al., 2019; Moyle, 2002; Windell et al., 2017). Returning adults migrate through coastal waters and enter San Francisco Bay, then migrate up the Sacramento River in November and continue upstream from December through early August (California Department of Fish and Wildlife [CDFW] 2022a). Due to the coastal distribution of this ESU, Sacramento River Winter-Run Chinook salmon occur in the Action Area.

3.1.1.4 Critical Habitat

Designated critical habitat is restricted to rivers and estuaries and therefore does not overlap with the Action Area.

3.1.2 Coho Salmon (Oncorhynchus kisutch)

3.1.2.1 Southern Oregon and Northern California Coast ESU

The Southern Oregon and Northern California Coast Coho Salmon ESU was listed as threatened on 6 May 1997 (62 FR 24588), their status reaffirmed on 28 June 2005 (70 FR 37160), and status subsequently updated on 14 April 2014 (79 FR 20802). This ESU includes naturally spawned coho salmon originating from coastal streams and rivers between Cape Blanco, Oregon, and Punta Gorda, California (79 FR 20802).

Although juvenile behaviors, life histories, and habitat associations can be variable, the majority of coho juveniles reside about one year in fresh water before migrating to sea (NMFS 2019c). Upon entry into the open ocean, juvenile coho use nearshore marine habitats, with some fish remaining in local waters and others moving northward along the continental shelf to central Alaska (Fisher et al. 2014). In general, fish in this ESU exhibit a three-year life cycle, with adults entering natal streams and rivers from mid-November to January (NMFS 2019c). Due to prevalence of coho in Oregon coastal waters, Southern Oregon and Northern California Coast coho salmon are present in the Action Area.

3.1.2.2 Central California Coast ESU

The Central California Coast Coho Salmon ESU was listed as threatened on 31 October 1996 (61 FR 56138) and downgraded to endangered on 28 June 2005 (70 FR 37160). The ESU status was reaffirmed as endangered on 2 April 2012, (77 FR 19552) and subsequently updated on 14 April 2014 (79 FR 20802). This ESU includes naturally spawned coho salmon originating from rivers south of Punta Gorda, California, to and including Aptos Creek, as well as such coho salmon originating from tributaries to San Francisco Bay (79 FR 20802).

Coho smolts from this population begin migrating downstream to the ocean in late March or early April but can sometimes begin prior to March and persist well into July (CDFW 2022b). Once in the ocean, immature coho remain in in-shore waters, congregating in schools as they move north along the continental shelf (CDFW 2022b; Fisher et al., 2014). Adults in this ESU generally enter freshwater to spawn from September through January, with spawning mainly from November to January, although it can extend into February or March (CDFW 2022b). Due to prevalence of coho in central and northern California coastal waters, Central California Coast coho salmon occur in the Action Area.

3.1.2.3 Critical Habitat

Designated critical habitat is restricted to rivers and estuaries and therefore does not overlap with the Action Area.

3.1.3 Green Sturgeon (Acipenser medirostris)

3.1.3.1 Status and Trends

The Southern DPS of North American Green Sturgeon was listed as threatened on 7 April 2006 (71 FR 17757) and critical habitat for this DPS was designated on 9 October 2009 (74 FR 52300).

3.1.3.2 Distribution

Subadult green sturgeon leave their Californian natal rivers and disperse widely along continental shelf waters of the West Coast within the 360-ft (110-meter [m] contour (Erickson & Hightower 2007; Moyle 2002; NMFS 2005). This DPS preferentially distributes north of their natal river during fall and moves into bays and estuaries during summer and fall (Heironimus et al. 2022; Israel et al., 2009). Sub-adult and mature fish exhibit a narrow and shallow depth distribution in marine habitat of < 328 ft (100 m) within the 360-ft (110-m) contour of the continental shelf, typically occupying depths of 130 to 230 ft (40–70 m; Erickson & Hightower, 2007; NMFS 2005; Payne et al., 2015). While Huff et al. (2011) found that green sturgeon appeared to prefer marine areas with high seafloor complexity and boulder presence, Payne et al. (2015) found that that green sturgeon are also associated with flat, soft bottom habitats that lack high relief bottoms. Information regarding their preference for areas of high seafloor complexity and prey selection in coastal waters (benthic prey) indicate green sturgeon reside and migrate along the seafloor while in coastal waters. Huff et al. (2011) found that green sturgeon in the open ocean may also occupy the upper 65 ft (20 m) of the water column on a seasonal basis (July to November) and use deeper habitats throughout the rest of the year.

The primary concentration of sturgeon is estimated to be approximately 41–51.5° North within the 656-ft (200-m) isobath in the coastal waters of Washington, Oregon, and Vancouver Island (Huff et al. 2012). Additionally, Huff et al. (2011) suggested that green sturgeon occur at low densities in the coastal marine environment. Southern DPS are likely to be present in the Action Area.

3.1.3.3 Critical Habitat

Critical habitat includes coastal U.S. marine waters within 360 ft (110 m) depth from Monterey Bay, California north to Cape Flattery, Washington, including the Strait of Juan de Fuca, Washington, to the U.S. boundary. Critical habitat includes several rivers and estuaries along the U.S. West Coast (74 FR 52300).

For coastal marine areas, the physical or biological features of critical habitat designated for green sturgeon include food resources, migratory corridors, and water quality. Corresponding species life history events include subadult growth and development, movement between estuarine and marine areas, and migration between marine areas, as well as adult sexual maturation, growth and development, movements between estuarine and marine areas, migration between marine areas, and spawning migration (74 FR 52300). Green sturgeon critical habitat does not overlap the Action Area (Figure 3.1-1).

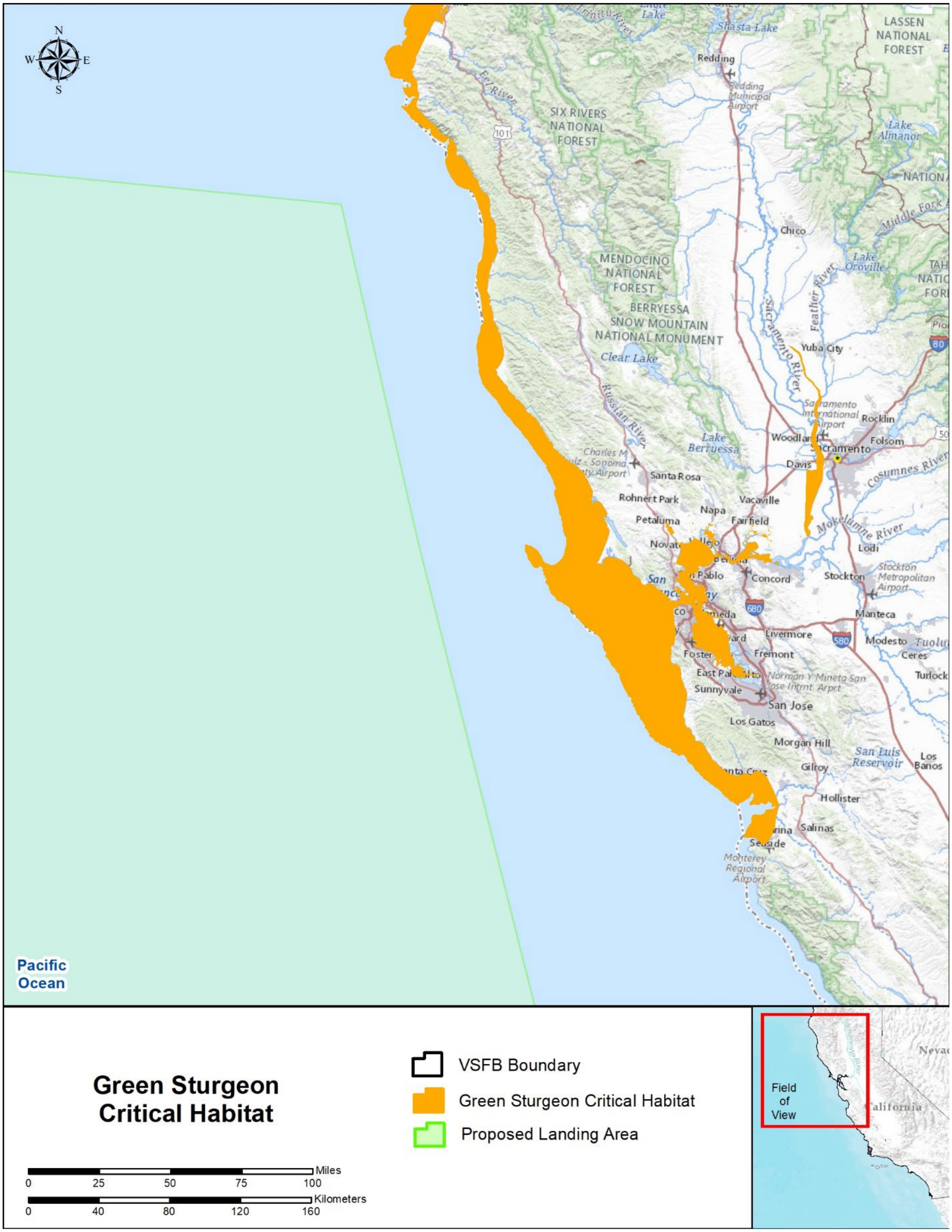

Figure 3.1-1. Green sturgeon critical habitat.

3.1.4 Oceanic Whitetip Shark (Carcharhinus longimanus)

3.1.4.1 Status and Trends

NMFS completed a comprehensive status review of the oceanic whitetip shark and based on the best scientific and commercial information available, including the status review report (Young et al. 2016), and listed the species as threatened on 1 March 2018 (83 FR 4153).

3.1.4.2 Distribution

Oceanic whitetip sharks are found worldwide in warm tropical and subtropical waters between the 30° North and 35° South latitude near the surface of the water column (Young et al. 2016). Oceanic whitetips occur throughout the Central Pacific, including the Hawaiian Islands south to Samoa Islands and in the eastern Pacific from Southern California to Peru, including the Gulf of California. This species has a clear preference for open ocean waters, with abundances decreasing with greater proximity to continental shelves. In terms of California fish fauna, Allen and Cross (2006) categorized oceanic white tip sharks as holoepipelagic and individuals would be found mostly far from shore. Preferring warm waters near or over 20°C (68°F), and offshore areas, the oceanic whitetip shark is known to undertake seasonal movements to higher latitudes in the summer (NOAA 2016) and may regularly survey extreme environments (deep depths, low temperatures) as a foraging strategy (Young et al. 2016).

Oceanic whitetip sharks could occur in deep open ocean areas in the California Current Large Marine Ecosystem. They are known to occur in Baja California and may be found in surface waters off the continental shelf (Baum et al. 2015). Oceanic whitetip sharks are therefore expected to occur within the Action Area.

3.1.4.3 Critical Habitat

Critical habitat has not been designated for this species.

3.1.5 Scalloped Hammerhead Shark (Sphyrna lewini)

3.1.5.1 Status and Trends

On 3 July 2014, four of six identified distinct population segments of scalloped hammerhead sharks were listed as endangered or threatened (79 FR 38214). The Eastern Pacific distinct population segment of the scalloped hammerhead population, which includes the west coast of the United States and the Southern California Range Complex, is listed as endangered under the ESA. The scalloped hammerhead shark has undergone substantial declines throughout its range (Baum et al. 2003a). There is evidence of population increases in some areas of the southeast U.S., such as the Gulf of Mexico (Ward-Paige et al. 2012), but because many catch records do not differentiate between the hammerhead species, or shark species in general, population estimates and commercial or recreational fishing landing data are unavailable in the Action Area. Most of the abundance data is from the Gulf of California, where it is estimated that the scalloped hammerhead population is currently decreasing by 6 percent per year (INP 2006).

3.1.5.2 Distribution

The scalloped hammerhead shark is a coastal and semi-oceanic species distributed in temperate and tropical waters (Froese & Pauly 2016). Distribution in the eastern Pacific Ocean extends from the coast of southern California (United States), including the Gulf of California, to Ecuador and possibly Peru (Compagno 1984) and off Hawaii in the central Pacific Ocean. A genetic marker study suggests that females remain close to coastal habitats, while males disperse across larger open ocean areas (Daly-Engel et al. 2012).

Juveniles rear in coastal nursery areas in the southern California portion of the Action Area (Duncan & Holland 2006), but rarely inhabit the open ocean (Kohler & Turner 2001). Sub adults and adults occur over shelves and adjacent deep waters close to shore and entering bays and estuaries (Compagno 1984). In the California Current Large Marine Ecosystem, records of the presence of scalloped hammerhead sharks in this area are very rare. Sighting and landings in the Action Area are documented to have occurred in San Diego Bay in 1981, 1996, and 1997 (Shane 2001).

3.1.5.3 Critical Habitat

Critical habitat has not been designated for this species.

3.2 Sea Turtles

3.2.1 General Background

Sea turtles are highly migratory, long-lived reptiles that occur throughout the open-ocean and coastal regions of the Action Area. Generally, sea turtles are distributed throughout tropical to subtropical latitudes (i.e., in warmer waters closer to the equator), with some species extending poleward into temperate seasonal foraging areas. In general, sea turtles spend most of their time at sea, with the notable exception of mature females returning to land, primarily beaches, to nest. The habitat preferred by sea turtles and their distribution at sea varies by species and life stage (i.e., hatchling, juvenile, adult).

3.2.2 Green Sea Turtle (*Chelonia mydas*)

3.2.2.1 Distribution

The green sea turtle is found in tropical and subtropical coastal and open ocean waters, between 30° North and 30° South. Green sea turtles are widely distributed in the subtropical coastal waters of southern Baja California, Mexico, and Central America (Cliffton et al. 1995; NMFS and USFWS 1998a). Another green sea turtle population resides in Long Beach, California, although less is known about this population (Eguchi et al. 2010). Ocean waters off southern California and northern Baja California are designated as areas of occurrence because of the presence of rocky ridges and channels and floating kelp habitats suitable for green sea turtle foraging and resting (Stinson 1984); however, these waters are often at temperatures below the thermal preferences of this primarily tropical species.

3.2.2.2 Critical Habitat

Critical habitat has not been designated in the Pacific Ocean.

3.2.3 Loggerhead Turtle (Caretta caretta)

3.2.3.1 Status and Trends

In September 2011, NMFS listed all three Pacific Ocean distinct population segments of loggerhead sea turtles as endangered (76 FR 588868). In the Pacific, there are two distinct population segments of loggerheads. The North Pacific Ocean DPS nests only on the coasts of Japan. This population has declined 50 to 90 percent during the last 60 years, however the overall nesting trend in Japan has been stable or slightly increasing over the last decade. The South Pacific Ocean DPS nests primarily in Australia with some nesting in New Caledonia. In 1977, about 3,500 females may have nested in the South Pacific—today there are only around 500 per year.

3.2.3.2 Distribution

Loggerhead turtles are found worldwide mainly in subtropical and temperate regions of the Atlantic, Pacific, and Indian Oceans, and in the Mediterranean Sea (Conant et al. 2009). In the eastern Pacific, the loggerheads primary range extends from offshore of Vancouver Island, south to Central America. The highest densities of loggerheads can be found just north of Hawaii in the North Pacific Transition Zone (Polovina et al. 2000). The North Pacific Transition Zone is defined by convergence zones of high productivity that stretch across the entire North Pacific Ocean from Japan to California (Polovina et al. 2001). The loggerhead turtle is known to occur at sea off of southern California, but does not nest on southern California beaches.

3.2.3.3 Critical Habitat

There is no critical habitat designated for the North Pacific Ocean DPS.

3.2.4 Olive Ridley Sea Turtle (Lepidochelys olivacea)

3.2.4.1 Status and Trends

The breeding population along the Pacific coast of Mexico was listed as endangered under the ESA in 1978 (43 FR 32800), because of extensive overharvesting of olive ridley turtles in Mexico, which caused a severe population decline (NMFS and USFWS 1998b). Olive ridleys offshore of California and Baja Mexico would likely belong to this population. All other populations are listed under the ESA as threatened. A five-year review was completed in 2014 (NMFS and USFWS 2014).

3.2.4.2 Distribution

Most olive ridley turtles lead a primarily open ocean existence (NMFS and USFWS 1998b). Individuals occasionally occur in waters as far north as California and as far south as Peru, spending most of their life in the oceanic zone (NMFS and USFWS 2007b). The olive ridley has a large range in tropical and subtropical regions in the Pacific Ocean, and is generally found between 40° North and 40° South. There are few documented occurrences of olive ridley sea turtles in waters off the west coast of the United States (NMFS and USFWS 1998b).

3.2.4.3 Critical Habitat

Critical habitat has not been designated for the olive ridley turtle.

3.2.5 Hawksbill Sea Turtle (Eretmochelys imbricata)

3.2.5.1 Status and Trends

The hawksbill turtle is listed as endangered throughout its range in 1970 under the ESA (35 FR 8491). A five-year review was completed in 2013 (NMFS and USFWS 2013a).

3.2.5.2 Distribution

Water temperature in the southern California offshore waters is generally too low for hawksbills, and their occurrence offshore of California would be considered rare. They are more common in nearshore foraging grounds, including coral reefs and mangrove estuaries from Baja California to South America (NMFS and USFWS 2013a). However, hatchlings utilize floating algal mats and drift lines in pelagic (open sea) habitat (NMFS and USFWS 2013a) and therefore may be found in the Action Area.

3.2.5.3 Critical Habitat

Critical habitat has not been designated for the hawksbill in the Pacific Ocean.

3.2.6 Leatherback Sea Turtle (*Dermochelys coriacea*)

3.2.6.1 Status and Trends

The leatherback sea turtle is listed as a single population and is classified as endangered under the ESA (35 FR 8491). Although USFWS and NMFS believe the current listing is valid, preliminary information indicates an analysis and review of the species should be conducted under the DPS policy (NMFS and USFWS 2013b). In early 2018, NMFS and the USFWS initiated a status review for the globally listed endangered leatherback sea turtles, to determine if DPS existed and if so, given their status, to consider whether the listing (currently “endangered”) should be changed for each DPS. The status review was completed in 2020 (NMFS and USFWS 2020). While seven populations of leatherbacks were found globally distinct due to their genetic discontinuity, spatial differences (i.e., marked separation of the seven populations at nesting beaches), and separation due to physical factors, including land masses, oceanographic features and currents, all populations were found to be at risk of extinction. This is as a result of reduced nesting female abundance, declining nest trends, and numerous, severe threats (NMFS and USFWS 2020). Therefore, the leatherback sea turtle remains globally endangered under the ESA.

Most leatherback nesting populations in the Pacific Ocean are faring poorly and have declined by more than 80 percent since the 1980s. The International Union for Conservation of Nature has predicted a decline of 96 percent for the western Pacific subpopulation and a decline of nearly 100 percent for the eastern Pacific subpopulation by the year 2040 (Sarti-Martinez et al. 1996; Clark et al. 2010; NMFS 2016c). Causes for the decline in the Pacific include the intensive human egg harvest at leatherback rookeries and high levels of mortality through the 1980s associated with bycatch in the gill net fisheries (NMFS 2016c).

3.2.6.2 Distribution

The leatherback sea turtle is the most widely distributed of all sea turtles, found from tropical to subpolar oceans. Because leatherback nest on tropical and occasionally subtropical beaches, it has the most extensive range of any turtle (Eckert 1995; Myers & Hays 2006; NMFS and USFWS

2013b; NMFS and USFWS 2020). Leatherbacks are also the most migratory sea turtles, with populations traversing the Pacific, Atlantic, and Indian oceans between nesting and foraging grounds, and migratory routes extending into subpolar regions (Spotila 2004; Bailey et al. 2012; Gaspar & Lalire 2017).

Pacific leatherbacks are split into western and eastern Pacific subpopulations based on their distribution and biological and genetic characteristics (Bailey et al. 2012). Eastern Pacific leatherbacks nest along the Pacific coast of the Americas, primarily in Mexico and Costa Rica, and forage throughout coastal and pelagic habitats of the eastern tropical Pacific. Western Pacific leatherbacks nest in the Indo-Pacific, primarily in Indonesia, Papua New Guinea, and the Solomon Islands, disperse after hatching into the central North Pacific along the North Pacific Transition Zone, and forage in the eastern North Pacific as juveniles and adults (Bailey et al. 2012; Gaspar & Lalire 2017; NMFS and USFWS 2020).

Leatherback sea turtles are regularly seen off the west coast of the U.S., with the greatest densities found in waters along Central California during summer and fall when sea surface temperatures are highest (Bailey et al. 2012). The Action Area does not include any known or suitable leatherback sea turtle nesting habitat (NMFS and USFWS 2020).

3.2.6.3 Critical Habitat

In 2012, NMFS designated critical habitat for the leatherback sea turtle in California waters from Point Arena to Point Arguello out to the 3,000-m isobath (77 FR 4169; Figure 3.2-1). Critical habitat for leatherback sea turtles does not overlap the Action Area (Figure 3.2-1).

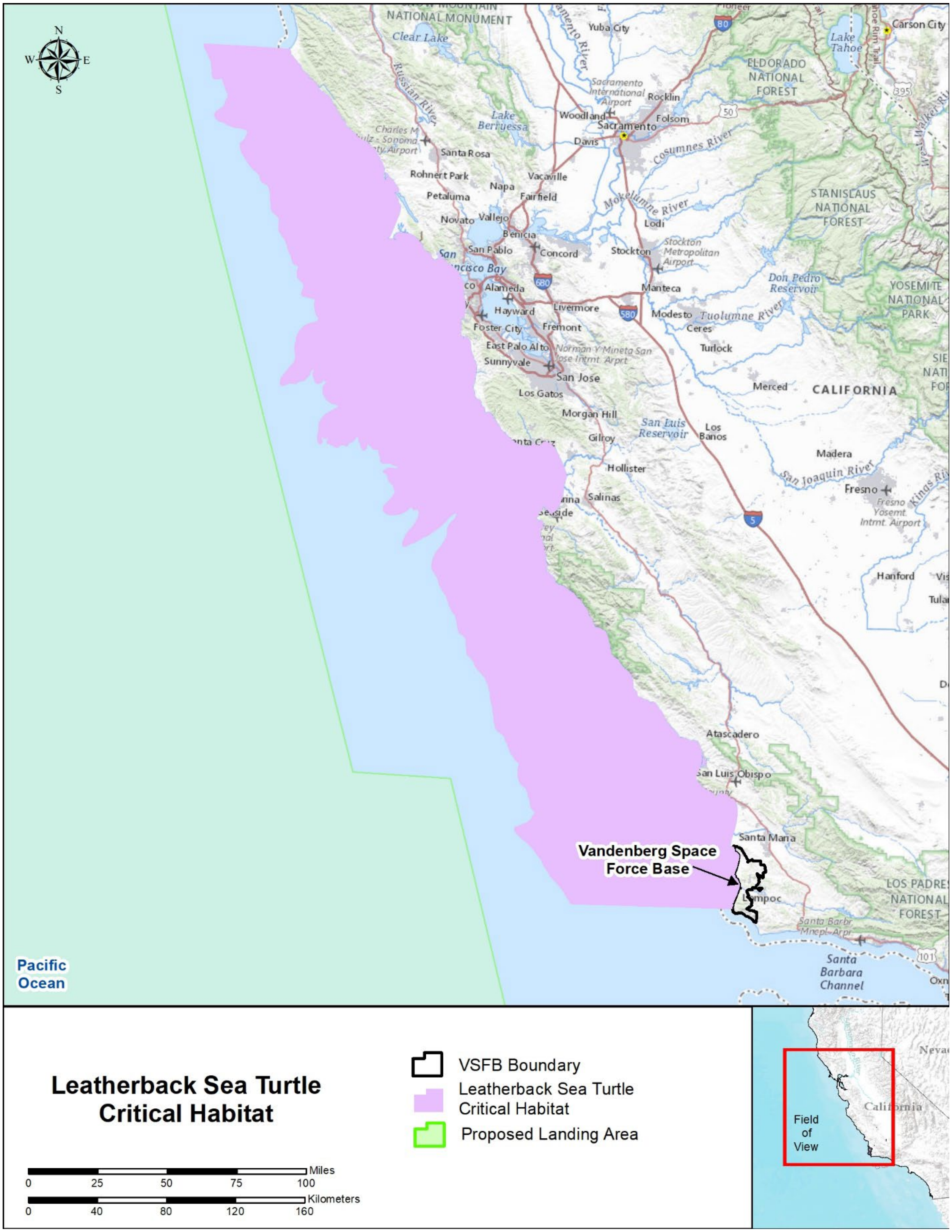

Figure 3.2-1: Leatherback sea turtle critical habitat.

3.3 Marine Mammals

3.3.1 Blue Whale (Balaenoptera musculus)

3.3.1.1 Status and Trends

The world's population of blue whales can be separated into three subspecies, based on geographic location and some morphological differences. Within the Action Area the subspecies *Balaenoptera musculus* is present. The blue whale is listed as endangered under the ESA and as depleted under the Marine Mammal Protection Act (MMPA) throughout its range (Carretta et al. 2018a; Muto et al. 2018; Carretta et al. 2019; Muto et al. 2019). A revised Recovery Plan was completed in 2020 (NMFS 2020).

Widespread whaling over the last century is believed to have decreased the global blue whale population to approximately 1 percent of its pre-whaling population size at its lowest point (Širović et al. 2004; Branch 2007; Monnahan 2013; Monnahan et al. 2014). Off the Pacific Coast, there was a documented increase in the blue whale population size between 1979–80 and 1991 (Barlow 1994) and between 1991 and 1996 (Barlow 1997). Calambokidis et al. (2009a) suggested that when feeding conditions off California are not optimal, blue whales may move to other regions to feed, including waters further north. In 2005–2006, during a period of cooler ocean temperatures, blue whales were found distributed more widely throughout Southern California waters than in previous years (Peterson et al. 2006). There had been a northward shift in blue whale distribution within waters off California, Oregon, and Washington (Calambokidis et al. 2009a; Bailey et al. 2009; Barlow 2010; Irvine et al. 2014; Širović et al. 2015; Barlow 2016; Abrahms et al. 2019; Santora et al. 2020).

Mark-recapture estimates reported on by Calambokidis et al. (2009a) "indicated a significant upward trend in abundance of blue whales" at a rate of increase just under 3 percent per year for the U.S. West Coast blue whale population in the Pacific (Calambokidis and Barlow 2013). The most current information suggests that the population in the Action Area may have recovered and has been at a stable level following the cessation of commercial whaling in 1971, despite the impacts of ship strikes, interactions with fishing gear, and increased levels of ambient sound in the Pacific Ocean (Monnahan 2013; Monnahan et al. 2014; Campbell et al. 2015; Carretta et al. 2015; Širović et al. 2015; International Whaling Commission 2016; NMFS 2018; Valdivia et al. 2019). The best overall estimate of abundance of blue whales along the U.S. West Coast has been provided by photo identification data gathered between 2015 and 2018 along the U.S. West Coast (Calambokidis & Barlow 2020). This estimate, which includes the Mexico DPS and the Central America DPS is 1,898 (Calambokidis & Barlow 2020).

3.3.1.2 Distribution

The blue whale inhabits all oceans and typically occur near the coast, over the continental shelf, though they are also found in oceanic waters (Stafford et al. 2001; Stafford et al. 2004; Ferguson 2005; Hamilton et al. 2009; Bradford et al. 2013; Klinck et al. 2015; Barlow 2016).

The Eastern North Pacific Stock of blue whales includes animals found in the eastern north Pacific from the northern Gulf of Alaska to the eastern tropical Pacific (Carretta et al. 2019). Relatively high densities of blue whales occur off Central and Southern California during the summer and fall (Barlow et al. 2009; Becker et al. 2010; Becker et al. 2012; Forney et al. 2012; Becker et al. 2016). Data from year-round surveys conducted off Southern California from 2004 to 2013 show that the majority of blue whales were sighted in summer (62 sightings) and fall (9 sightings), with only single sightings in winter and spring (Campbell et al. 2015).

Most baleen whales spend their summers feeding in productive waters near the higher latitudes and winters in the warmer waters at lower latitudes (Širović et al. 2004). Blue whales in the eastern north Pacific are known to migrate between higher latitude feeding grounds of the Gulf of Alaska and the Aleutian Islands to lower latitudes, including Southern California; Baja California, Mexico; and the Costa Rica Dome (Calambokidis & Barlow 2004; Calambokidis et al. 2009a; Calambokidis et al. 2009b; Mate et al. 2015b; Mate et al. 2016; Palacios et al. 2019). The West Coast is known to be a blue whale feeding area for the Eastern North Pacific stock during summer and fall (Bailey et al. 2012; Calambokidis et al. 2015; Mate et al. 2015b; Calambokidis et al. 2019; Palacios et al. 2019). Nine feeding areas for blue whales were identified by Calambokidis et al. (2015) along the U.S. West Coast, termed “Biologically Important Areas” (BIAs). These BIAs do not overlap the proposed landing area (Figure 3.3-1).

The blue whale feeding areas identified in waters extending from Point Conception to the Mexico border represent only a fraction of the total area within those waters where habitat models predict high densities of blue whales (Calambokidis et al. 2015; Ferguson et al. 2015). Additionally, while those identified areas tend to have the highest blue whale density from July through October when averaged over multiple years, the areas are associated with ephemeral prey distributions that are less predictable over the short term (Ferguson et al. 2015; Abrahms et al. 2019).

Blue whales have shown site fidelity, returning to their mother’s feeding grounds on their first migration (Calambokidis & Barlow 2004), and exhibit strong foraging site fidelity, even when conditions are not conducive to successful foraging in less than optimal years (Palacios et al. 2019; Cascadia Research 2019). However, a sufficient density of prey is necessary to balance the energy requirements of their lunge feeding strategy (Goldbogen et al. 2015; Hazen & Goldbogen 2015; Straley et al. 2017; Mate et al. 2019; Frisch-Jordan et al. 2019; Palacios et al. 2019; Irvine et al. 2019; Szesciorka et al. 2020), and there are daily, seasonal, interannual, and decadal variability in the locations and density of krill at a given feeding location (Brinton & Townsend 2003; Keister et al. 2011; Santora et al. 2011; Deutsch et al. 2015; Santora et al. 2017b; Zaba et al. 2018; Cimino et al. 2020; Fiechter et al. 2020; Rockwood et al. 2020; Santora et al. 2020), which influence how long they remain within a given feeding area.

3.3.1.3 Critical Habitat

There is no designated critical habitat for this species.

Figure 3.3-1: Blue whale Biologically Important Areas in the vicinity of the proposed landing area.

3.3.2 Fin Whale (Balaenoptera physalus)

3.3.2.1 Status and Trends

The fin whale is listed as depleted under the MMPA and endangered under the ESA throughout its range, but there is no designated critical habitat for this species. A Recovery Plan was completed for the fin whale in 2010 (NMFS 2010a). In the North Pacific, NMFS recognizes three fin whale stocks: (1) a Northeast Pacific stock in Alaska; (2) a California, Oregon, and Washington stock; and (3) a Hawaii stock. Although some fin whales migrate seasonally (Falcone et al. 2011; Mate et al. 2015b; Mate et al. 2016), NMFS does not recognize fin whales from the Northeast Pacific stock as being present in Southern California.

Based on a comparison of sighting records from the 1950s to 2012, (Smultea 2014) also showed an increase in the relative abundance of fin whales inhabiting Southern California. Širović et al. (2015) used passive acoustic monitoring of fin whale calls to estimate the spatial and seasonal distribution of fin whales in the Southern California Bight. An increase in the number of calls detected between 2006 and 2012 also suggests that the population of fin whales off the U.S. West Coast may be increasing. For the U.S. West Coast, Moore and Barlow (2011) predict continued increases in fin whale numbers over the next decade and suggest that fin whale densities are reaching "current ecosystem limits." Increasing numbers of fin whales documented in coastal waters between Vancouver Island and Washington State may reflect recovery of populations in the North Pacific (Towers et al. 2018). These findings and the trend for an increase in population, appear consistent with the highest-yet abundances of fin whales in the 2014 NMFS survey of the U.S. West Coast (Barlow 2016).

3.3.2.2 Distribution

The fin whale is found in all the world's oceans and is the second-largest species of whale (Jefferson et al. 2008). Fin whales prefer temperate and polar waters and are scarcely seen in warm, tropical waters (Reeves et al. 2002; Archer et al. 2019). This species has been documented from 60° North to 23° North. Fin whales have frequently been recorded in waters within Southern California and are present year-round (Širović et al. 2004; Barlow & Forney 2007; Mizroch et al. 2009; Jefferson et al. 2014; Smultea 2014; Campbell et al. 2015; Širović et al. 2015; Mate et al. 2016; Širović et al. 2016; Mate et al. 2017; Širović et al. 2017; Varga et al. 2018; Irvine et al. 2019).

Fin whales are not known to have a specific habitat and are highly adaptable, following prey, typically off the continental shelf (Azzellino et al. 2008; Panigada et al. 2008; Scales et al. 2017). Off the U.S. West Coast, fin whales typically congregate in areas of high productivity, allowing for extended periods of localized residency that are not consistent with the general baleen whale migration model (Scales et al. 2017).

Based on predictive habitat-based density models derived from line-transect survey data collected between 1991 and 2009 off the U.S. West Coast, relatively high densities of fin whales are predicted off Southern California during the summer and fall (Barlow et al. 2009; Becker et al. 2010; Becker et al. 2012; Forney et al. 2012; Becker et al. 2016). Aggregations of fin whales are present year-round in Southern and Central California (Forney et al. 1995; Forney & Barlow 1998; Douglas et al. 2014; Jefferson et al. 2014; Campbell et al. 2015; Scales et al. 2017), although their distribution shows seasonal shifts. In 2005–2006, during a period of cooler ocean temperatures, fin whales were encountered more frequently than during normal years (Peterson et al. 2006). Sightings from year-round surveys off Southern California from 2004 to 2013 show fin whales farther offshore in summer and fall and closer to shore in winter and spring (Douglas et al. 2014; Campbell et al. 2015).

As was done for other species, a scientific review process (Ferguson et al. 2015) was undertaken to identify BIAs for fin whales occurring along the U.S. West Coast. Survey and acoustic data indicate that fin whale distributions shift both seasonally as well as annually (Peterson et al. 2006; Douglas et al. 2014; Jefferson et al. 2014; Calambokidis et al. 2015; Širović et al. 2015; Širović et al. 2017; Rice et al. 2018; Baumann-Pickering et al. 2018; Calambokidis et al. 2019; Trickey et al. 2020). Definitive areas of biological importance for fin whales have not yet been identified due to poor knowledge of fin whale population structure and biases inherent in different sampling methods that revealed high concentrations of fin whales in both coastal and offshore regions (Calambokidis et al. 2015).

3.3.2.3 Critical Habitat

No critical habitat has been designated for the fin whale.

3.3.3 Western North Pacific Gray Whale (*Eschrichtius robustus*)

3.3.3.1 Status and Trends

There are two north Pacific populations of gray whales: the Western subpopulation and the Eastern subpopulation designated in the Pacific Stock Assessment Report (SAR) (Weller et al. 2013; Carretta et al. 2019; Cooke 2019; Muto et al. 2019). Both DPSs could be present in the Action Area during their northward and southward migration (Sumich & Show 2011; Weller & Brownell 2012; Calambokidis et al. 2015; Cooke et al. 2015; Carretta et al. 2019).

The Western North Pacific DPS is considered depleted (Weller et al. 2002; Weller et al. 2013; Cooke et al. 2015; Carretta et al. 2017b; Cooke 2019). This subpopulation is endangered and should be very few in number in the Action Area given the small population and their known wintering areas in waters off Russia and Asia (Weller & Brownell 2012; Moore & Weller 2013; Weller et al. 2013; Mate et al. 2015a). Analysis of the data available for 2005 through 2016 estimates the combined Sakhalin Island and Kamchatka populations are increasing (Cooke 2019). The Eastern North Pacific subpopulation has recovered and was delisted under the ESA in 1994 (Swartz et al. 2006; Carretta et al. 2020).

3.3.3.2 Distribution

Gray whales of the Western North Pacific DPS primarily occur in shallow waters over the U.S. West Coast, Russian, and Asian continental shelfs and are considered to be one of the most coastal of the great whales (Jefferson et al. 2008; Jones & Swartz 2009). Feeding grounds for the population are the Okhotsk Sea off Sakhalin Island, Russia, and in the southeastern Kamchatka Peninsula (in the southwestern Bering Sea) in nearshore waters generally less than 225 ft (68 m) deep (Jones & Swartz 2009; Weller & Brownell 2012). The breeding grounds consist of subtropical lagoons in Baja California, Mexico, and suspected wintering areas in southeast Asia (Urban-Ramirez et al. 2003; Alter et al. 2009; Jones & Swartz 2009; Weller et al. 2012; Mate et al. 2015a). At least 12 members of the Western North Pacific DPS have been detected in waters off the

Pacific Northwest (Weller & Brownell 2012; Mate 2013; Moore & Weller 2018). NMFS reported that 18 Western North Pacific gray whales have been identified in waters far enough south to have passed through Southern California waters (NMFS 2014).

Gray whales migrate along the Pacific coast twice a year between October and July (Calambokidis et al. 2015). Although they generally remain mostly over the shelf during migration, some gray whales may be found in more offshore waters to the west of San Clemente Island and the Channel Islands (Mate & Urban-Ramirez 2003; Sumich & Show 2011; Smultea 2014; Calambokidis et al. 2015; Schorr et al. 2019; Guazzo et al. 2019). In aerial surveys occurring in December and April each year, gray whales were the third-most encountered large cetacean in Southern California (Smultea 2014).

The main gray whale migrations that pass through the Action Area can be loosely categorized into three phases (Rugh et al. 2008; Calambokidis et al. 2015). Calambokidis et al. (2015) note these migration phases are not distinct, the timing for a phase may vary based on environmental variables, and a migration phase typically begins with a rapid increase in migrating whales, followed by moderate numbers over a period of weeks, and then slowly tapering off. A southward migration from summer feeding areas in the Chukchi Sea, Bering Sea, Gulf of Alaska, and the Pacific Northwest begins in the fall (Mate et al. 2013; Calambokidis et al. 2015; Mate et al. 2015a). This Southbound Phase includes all age classes as they migrate primarily to the nearshore waters and lagoons of Baja California, Mexico, as a destination. During this southward migration, the whales generally are within 10 km of the coast (Calambokidis et al. 2015), although there are documented exceptions where migrating gray whales have bypassed the coast by crossing sections of the open ocean (Rice & Wolman 1971; Mate & Urban-Ramirez 2003; Mate 2013; Mate et al. 2015a).

The northward migration for gray whales to the feeding grounds in Arctic waters, Alaska, the Pacific Northwest, and Northern California occurs in two phases (Calambokidis et al. 2015). Northbound Phase A consists mainly of adults and juveniles that lead the beginning of the north-bound migration from late January through July, peaking in April through July. Newly pregnant females go first to maximize feeding time, followed by adult females and males, then juveniles (Jones & Swartz 2009). The Northbound Phase B consists primarily of cow-calf pairs that begin their northward migration later (March to July) remaining on the reproductive grounds longer to allow calves to strengthen and rapidly increase in size before the northward migration (Urban-Ramirez et al. 2003; Jones & Swartz 2009).

The gray whale migration corridors (north of Point Conception), the potential presence buffer area, and the months (October through July) these four sections of the Pacific coastal waters were designated as cumulatively in use, were identified by Calambokidis et al. (2015) as BIAs for gray whales. The proposed landing area does not overlap these BIAs (Figure 3.3-2).

3.3.3.3 Critical Habitat

There has been no designated critical habitat for the Western North Pacific gray whale DPS.

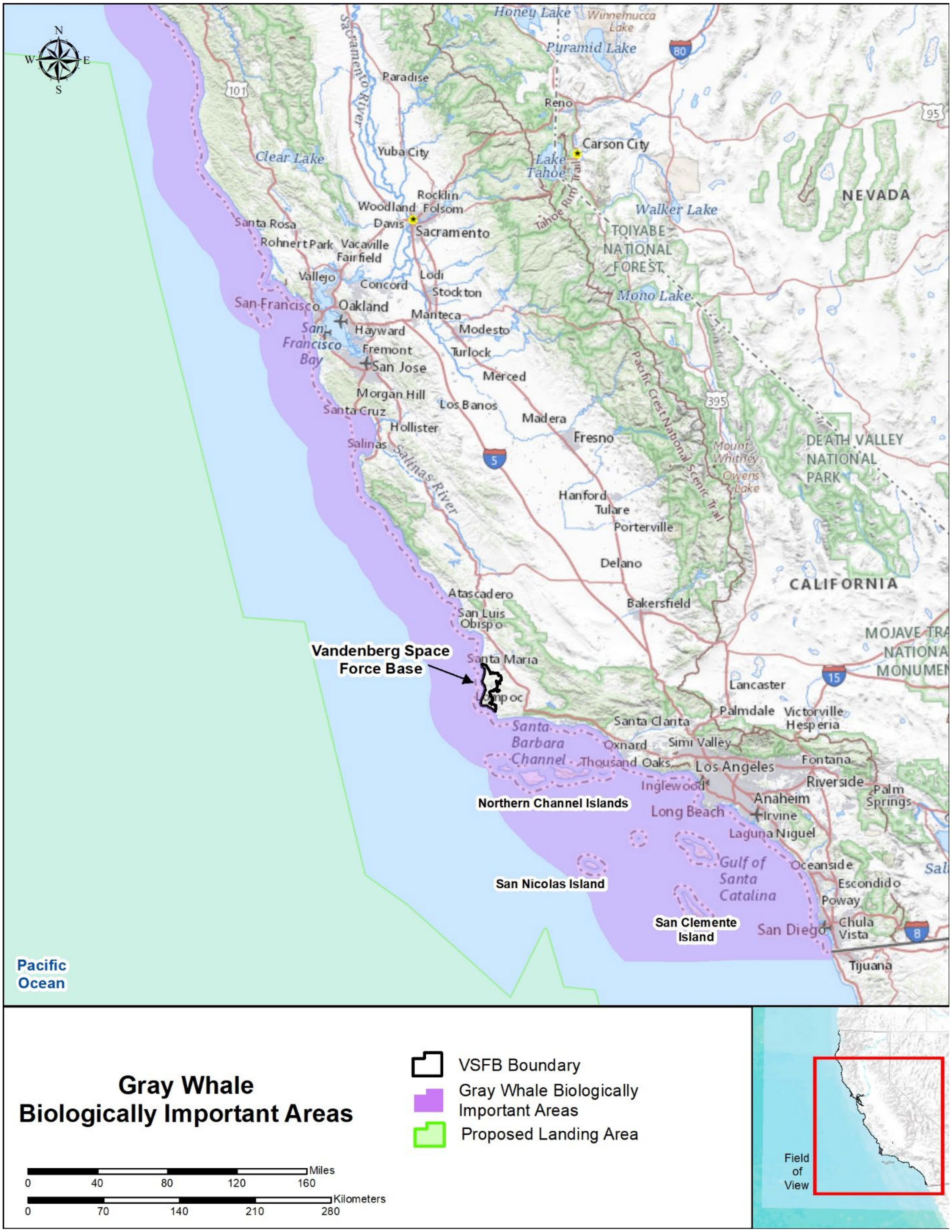

Figure 3.3-2. Gray whale Biologically Important Areas in the vicinity of the proposed landing area.

3.3.4 Humpback Whale (*Megaptera novaeangliae*), Mexico Distinct Population Segment and Central American Distinct Population Segment

3.3.4.1 Status and Trends

Humpback whales that are seasonally present in the Action Area are from two DPSs, given they represent populations that are both discrete from other conspecific populations and significant to the species of humpback whales to which they belong (NMFS 2016e). These DPSs are based on animals identified in breeding areas in Mexico and Central America (Bettridge et al. 2015; NMFS 2016f; Wade et al. 2016; Calambokidis et al. 2017; Carretta et al. 2019; Muto et al. 2019). Humpback whales of the Mexico DPS are listed as threatened, and those from the Central America DPS are listed as endangered under the ESA (NMFS 2016e).

Although estimates show variable trends in the number of humpback whales along the U.S. West Coast, the overall trend in the estimates is consistent with growth rate of 6–7 percent for the California, Oregon, Washington stock and appears consistent with the highest-yet abundances of humpback whales in the most recent 2014 survey of that stock (Smultea 2014; Barlow 2016; Calambokidis et al. 2017; Carretta et al. 2017b; Carretta et al. 2018a). For the DPSs in Mexico and in Central America, photo identification data collected between 2004 and 2006 are the main basis for the estimates for specific to those populations (Bettridge et al. 2015; NMFS 2016f; Wade et al. 2016). The new best overall estimate of abundance of humpback whales along the U.S. West Coast has been provided by photo identification data gathered between 2015 and 2018 along the U.S. West Coast (Calambokidis & Barlow 2020). This estimate, which includes the Mexico DPS and the Central America DPS, is 4,973, which is higher than the abundance (2,900) in the 2019 Pacific SAR (Calambokidis & Barlow 2020).

3.3.4.2 Distribution

The habitat requirements of wintering humpbacks appear to be controlled by the conditions necessary for calving, such as warm water (75–80° Fahrenheit [°F]) and relatively shallow, low-relief ocean bottom in protected areas, nearshore, or created by islands or reefs (Smultea 1994; Clapham 2000; Craig & Herman 2000). In breeding grounds, females with calves occur in significantly shallower waters than other groups of whales, and breeding adults use deeper, more offshore waters (Smultea 1994; Ersts & Rosenbaum 2003). Breeding and calving areas for the Mexico DPS and for the Central America DPS are both located in the southern portion of the ERCA II Action Area in waters off Mexico.

Off the U.S. West Coast, humpback whales are more abundant in shelf and slope waters (<2,000 m deep) and are often associated with areas of high productivity (Becker et al. 2010; Becker et al. 2012; Forney et al. 2012; Redfern et al. 2013; Campbell et al. 2015; Becker et al. 2016; Calambokidis et al. 2019). While most humpback whale sightings are in nearshore and continental shelf waters, humpback whales frequently travel through deep oceanic waters during migration (Dohl et al. 1983; Forney & Barlow 1998; Campbell et al. 2015). Humpback whales migrating from breeding grounds in Central America to feeding grounds at higher latitudes may cross the Action Area.

Peak occurrence during migration occurs in the Action Area from December through June (Calambokidis et al. 2015). In quarterly surveys undertaken in the 10-year period between 2004 and 2013 off Southern California, humpback whales were generally encountered in coastal and shelf waters, with the largest concentration occurring in relatively shallow waters, north of Point Conception (Campbell et al. 2015). During winter and spring, a substantially greater proportion of the humpback whale population is found farther offshore than during the summer, with (in all seasons) the majority of the population found north of the Channel Islands (Forney & Barlow 1998; Campbell et al. 2015; Becker et al. 2017; Calambokidis et al. 2017).

BIAs for humpback whales overlap the Action Area (Figure 3.3-3). Passive acoustic monitoring at Monterey Bay California from 2015 to 2018 demonstrated that the timing of humpback whales feeding and migration in that area is variable, with detections generally occurring from September through May (Ryan et al. 2019). Location data from satellite tags also has demonstrated that in some cases the feeding BIAs do not represent the core area of humpback whale presence, at least for the time and sample of the population represented by humpback whales that were tagged and otherwise present in or around the area (Mate et al. 2018). In 2014, 2015, and 2016, humpback whales were more commonly sighted in coastal waters of Santa Monica Bay, and from Long Beach south to waters off Dana Point (Calambokidis et al. 2017). The variable use of the Santa Barbara Channel–San Miguel feeding BIA was also evident, corresponding to the 2014–2016 increase in ocean temperatures off California that resulted in the changes to the nominal distribution and availability of krill and anchovy (Zaba et al. 2018; Fiechter et al. 2020; Santora et al. 2020) and the distribution of humpback whales in 2014, resulting in a much higher density off Central California than a nominal year (Becker et al. 2018). Similar high ocean temperatures in 2016 also corresponded to a documented scarcity of healthy humpback whales in the Santa Barbara Channel–San Miguel feeding BIA and vicinity. However, more humpback whales were found further north off Central California and in better condition, which investigators suggested was indicative of good feeding areas that were likely to be sustained in that region in that anomalous year (Oregon State University 2017).

3.3.4.3 Critical Habitat

A final rule to designate critical habitat for humpback whales for the endangered Central America DPS and the threatened Mexico DPS was published on 21 April 2021 (75 FR 21082) pursuant to Section 4 of the ESA. This action followed a 9 October 2019 proposed rule to designate critical habitat for the humpback whales within the U.S. EEZ in the Pacific for the endangered Central America DPS and the threatened Mexico DPS pursuant to section 4 of the ESA (84 FR 54378). In the proposal, NMFS considered 19 Regions/Units of habitat as critical habitat for the listed humpback whale DPSs. These 19 areas include almost all coastal waters off California, Oregon, Washington, and Alaska in the Pacific. Humpback whale critical habitat is depicted in Figure 3.3-4; as shown, there is overlap between the proposed landing area, vessel routes, and the critical habitat.

Region/Unit 17 has been referred to by NMFS in the proposed rule as the “Central California Coast Area,” which covers an area of 6,697 square nm extending from 36° 00' to 34° 30' north latitude. Within those north and south boundaries, Region/Unit 17 begins at the 98 ft. (30 m) depth contour out to the 12,139 ft. (3,700 m) depth contour. This region’s area includes waters off of southern Monterey, San Luis Obispo, and Santa Barbara counties. This region/unit of habitat is characterized by NMFS as having a very high conservation value (84 FR 54378).

The essential feature for the Central America DPS as defined by NMFS (2019b) is “Prey species, primarily euphausiids (Thysanoessa, Euphausia, Nyctiphanes, and Nematoscelis) and small pelagic schooling fishes, such as Pacific sardine (*Sardinops sagax*), northern anchovy (*Engraulis mordax*), and Pacific herring (*Clupea pallasii*), of sufficient quality, abundance, and accessibility within humpback whale feeding areas to support feeding and population growth. The Mexico DPS is very similar, but adds capelin (*Mallotus villosus*), juvenile walleye pollock (*Gadus chalcogrammus*), and Pacific sand lance (*Ammodytes personatus*) to the essential prey species lists. NMFS has noted that prey as an essential feature may require special management considerations or protections as a result of ecosystem shifts driven by climate change, commercial fisheries, and pollution (NMFS 2019b).

Humpback whales are generalists, taking a variety of prey while foraging and switching between target prey depending on what is most abundant in the system (Witteveen et al. 2014; Szabo 2015; Fleming et al. 2016). Consistent with the designated critical habitat, the humpback whales’ diet is dominated by euphausiids and small pelagic fishes, such as northern anchovy, Pacific herring, Pacific sardine, and capelin (Santora et al. 2010; Szabo 2015; Fleming et al. 2016; Keen et al. 2017; Gabriele et al. 2017; Straley et al. 2017; Witteveen & Wynne 2017). Like other large mysticetes, they are a “lunge feeder,” taking advantage of dense prey patches and engulfing as much food as possible in a single gulp. All feeding behavior seem to involve patches of prey with sufficient density to support feeding bouts (Mate et al. 2019; Frisch-Jordan et al. 2019). The size of individual krill seems to be an aspect of prey quality for the species (Santora et al. 2010; Szabo 2015; Burrows et al. 2016). For example, Santora et al. (2010) found that different species of baleen whales aggregated to krill hotspots that were differentiated by the size of individual krill, with humpback whales having preference for small (<35 mm) juvenile krill.

In the California Current Ecosystem, changing oceanographic factors (e.g., upwellings, temperatures, winds, salinity) result in seasonal, interannual, and decadal variability in the locations and density of krill and forage fish (Brinton & Townsend 2003; Keister et al. 2011; Santora et al. 2011; Deutsch et al. 2015; Santora et al. 2017a; Zaba et al. 2018; Cimino et al. 2020; Rockwood et al. 2020; Fiechter et al. 2020; Santora et al. 2020). As a result, the location, timing, and intensity of prey aggregations can vary greatly both seasonally and from year to year. Given that concentrations of prey tend to be spatially and temporally ephemeral at scales on the order of tens of meters to kilometers and hours to days (Zaba et al. 2018; Hazen et al. 2018; Rockwood et al. 2020; Fiechter et al. 2020; Santora et al. 2020), the presence of feeding humpback whales and prey as an essential feature of the critical habitat are also highly variable over these small spatial and temporal scales.

The critical habitat overlaps with the humpback whale feeding BIAs designated in 2015 (Calambokidis et al. 2015), but in the Action Area it extends farther offshore to incorporate the maximum extent of the predicted humpback abundance in cooler months (Becker et al. 2016; Becker et al. 2017) and farther inshore to incorporate distributions derived from satellite telemetry data for 13 humpback whales (Mate et al. 2018). Although the location, timing, and intensity of humpback whale prey vary greatly (Santora et al. 2011; Santora et al. 2017a; Zaba et al. 2018; Santora et al. 2020; Fiechter et al. 2020), static spatial management strategies such as the designation of critical habitat can effectively mitigate risks associated with fixed large and long-term actions such as established commercial vessel traffic lanes (associated with ship strikes) or within fishery regulations (associated with entanglement) (Rockwood et al. 2017; Moore & Weller 2018; Redfern et al. 2019; Redfern et al. 2020; Rockwood et al. 2020; Santora et al. 2020).

Figure 3.3-3. Humpback whale Biologically Important Areas in vicinity of the proposed landing area.

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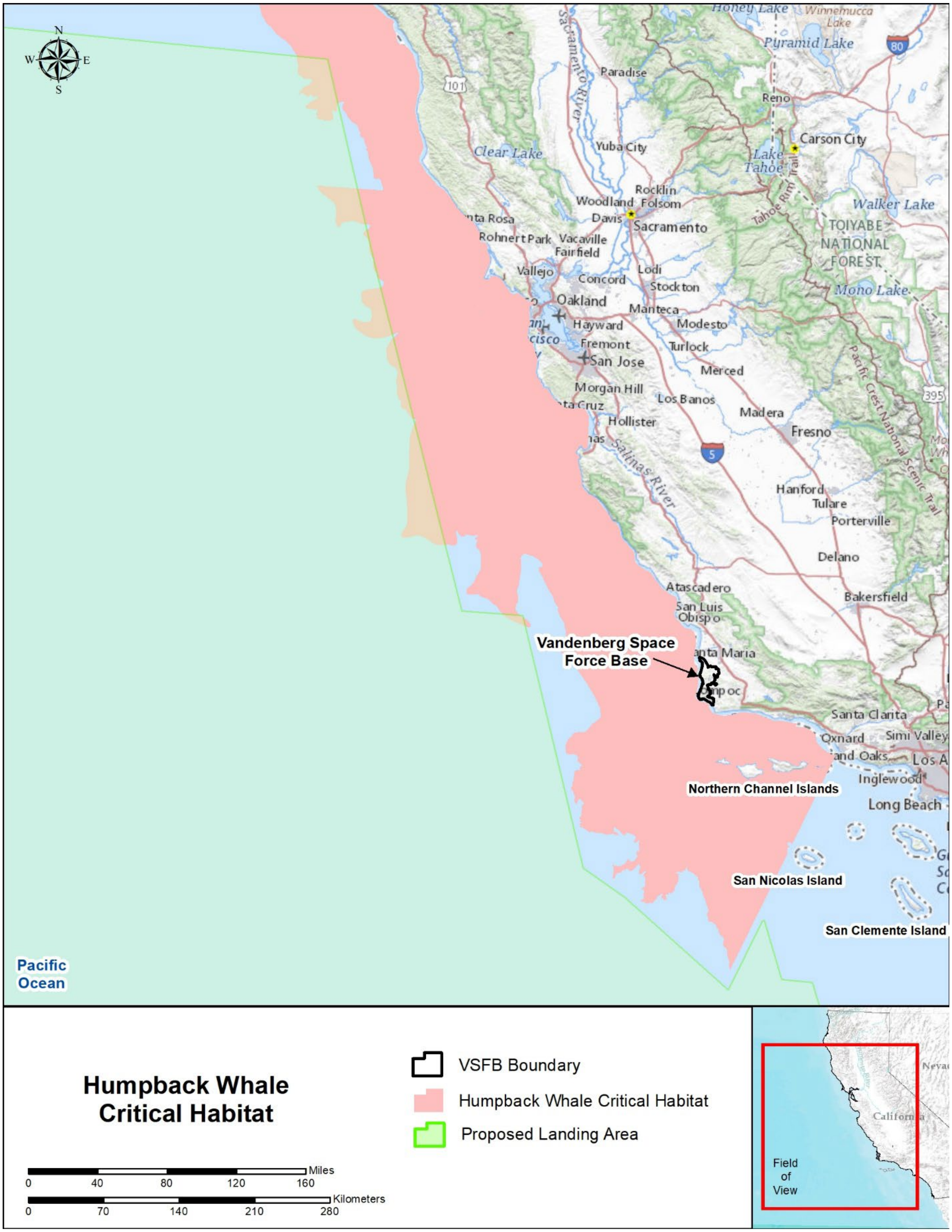

Figure 3.3-4. Humpback whale critical habitat.

3.3.5 Killer Whale (Orcinus orca)

3.3.5.1 Status and Trends

NMFS listed the Southern Resident killer whale DPS as endangered in 2005 (70 FR 69903) and adopted a recovery plan in 2008 (73 FR 4176; NMFS 2008). There are 73 Southern Resident killer whales in the DPS (Couture et al. 2022). The Southern Resident DPS is divided into three pods identified as J, K, and L (Carretta et al. 2021).

Concerns over impacts on the population from several sources have been raised in recent years, including disturbance from whale watching vessels (Ferrara et al. 2017; Holt et al. 2017; Lacy et al. 2017; NMFS 2021), commercial shipping noise (Cominellli et al. 2018; McWhinnie et al. 2021; Vagle et al. 2021; Veirs et al. 2016; Williams et al. 2019), and prey availability (Hanson et al. 2021; Shields et al. 2018; Wasser et al. 2017).

3.3.5.2 Distribution

Southern Resident killer whales occur mainly along the outer coast and inland waters of Washington and British Columbia, Canada. In recent years the population has shifted and expanded its range to areas up to hundreds of miles from Washington waters both north (as far as Southeast Alaska) and south as far as central California (Cogan 2015; Dahlheim et al. 2008; Ford et al., 2014; Hanson et al., 2021; Houghton et al., 2015a). Specifically, K-pod and L-pod have ranged widely along the coast and been sighted as far south as Monterey Bay in recent years; L-pod is known to have traveled as far north as Chatham Strait, Southeast Alaska. J-pod has largely remained in inland waters (Carretta et al. 2021).

Satellite-tag locations found that Southern Resident killer whales generally inhabit nearshore waters (Hanson et al. 2018; Hanson et al. 2017). Ninety-five percent of reported locations were within 18 nm (34 km) of shore, and 50 percent were within 5 nm (10 km) of shore. On the outer coast, 75 percent of tag locations were in a narrow corridor between 1.6 and 10 nm (3 and 19 km) offshore (Hanson et al. 2017). As noted in Section 2.1 (Action Area), the proposed landing and fairing recovery area is in deep waters between approximately 46-400 nm off Rockport, California in the north to 158- 910 nm off Baja California, Mexico in the south and no recovery activities would occur within 12 nm of islands (Figure 1.1-2). Therefore, relatively few killer whales are expected to occur in areas where these activities would be conducted.

3.3.5.3 Critical Habitat

NMFS amended and expanded the critical habitat designation for Southern Resident killer whales to include nearshore waters along the coasts of Washington, Oregon, and California in 2021. The elements of critical habitat essential for conservation of the Southern Resident killer whale are (1) water quality to support growth and development; (2) prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth; and (3) passage conditions to allow for migration, resting, and foraging (National Marine Fisheries Service: Northwest Region, 2006). The amended critical habitat designation extends along the entire Oregon coastline but is outside the Action Area (Figure 3.3-5).

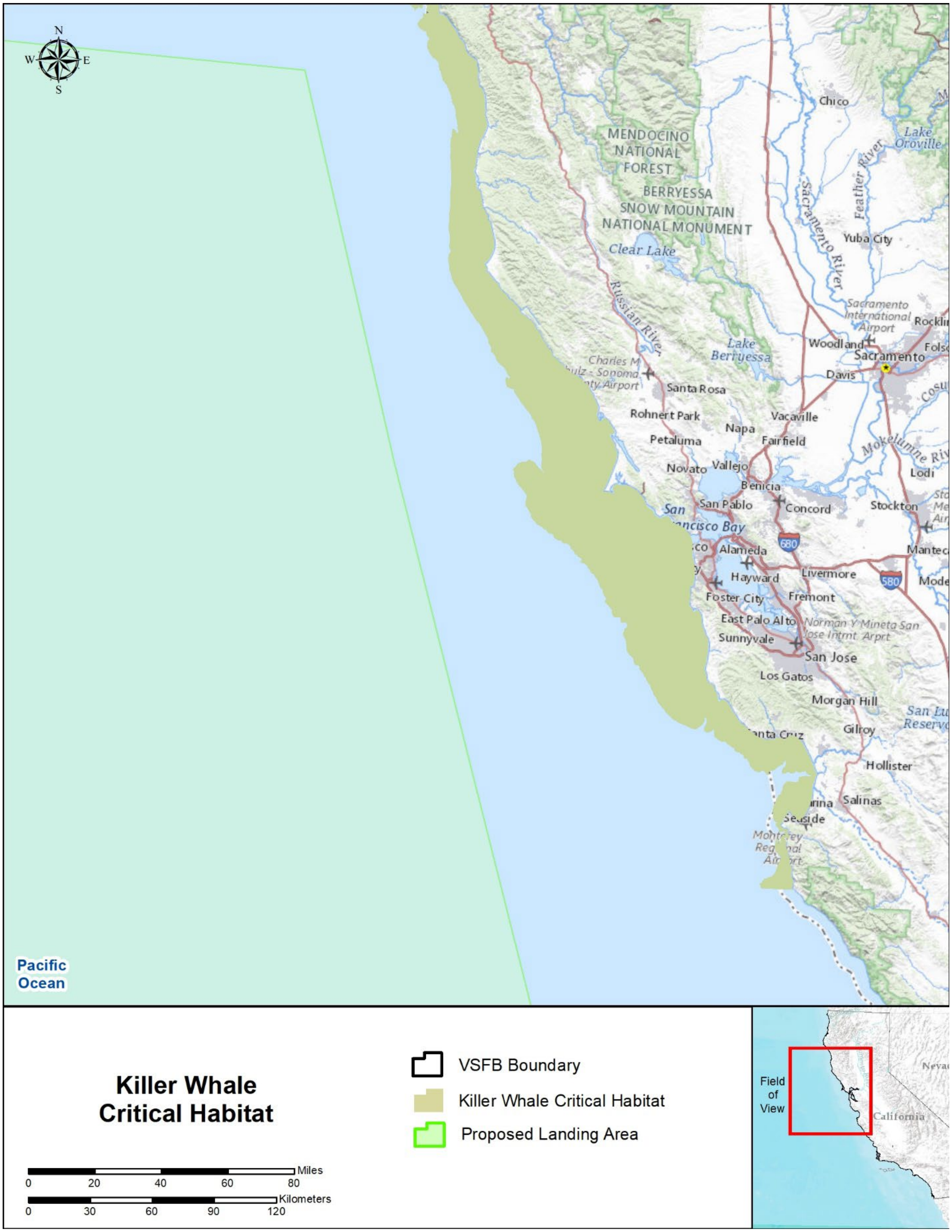

Figure 3.3-5. Killer Whale Critical Habitat.

3.3.6 Sei Whale (Balaenoptera borealis)

3.3.6.1 Status and Trends

The sei whale is listed as endangered under the ESA and as depleted under the MMPA throughout its range. A recovery plan for the sei whale was completed in 2011 and provided a research strategy for obtaining data required to estimate population abundance and trends, and to identify factors that may be limiting the recovery of this species (NMFS 2011). Sei whales along the U.S. West Coast are assigned to the Eastern North Pacific stock within the U.S. EEZ (Carretta et al. 2020). NMFS has determined that an assessment of the sei whale population trend will likely require additional survey data and reanalysis of all datasets using comparable methods (Carretta et al. 2018b). There are no data on Eastern North Pacific sei whale trends in abundance (Carretta et al. 2020).

3.3.6.2 Distribution

Sei whales have a worldwide distribution and are found primarily in cold temperate to subpolar latitudes. During the winter, sei whales are found in warm tropical waters. Sei whales are also encountered during the summer off California and the North America coast from approximately the latitude of the Mexican border to as far north as Vancouver Island, Canada (Masaki 1976; Horwood 2009; Smultea et al. 2010).

A total of 10 sei whale sightings were made during systematic ship surveys conducted off the U.S. West Coast in summer and fall between 1991 and 2008 (Barlow 2010), with an additional 14 groups sighted during a 2014 survey (Barlow 2016). Sei whales are expected to be present in offshore waters in the Action Area.

3.3.6.3 Critical Habitat

There is no designated critical habitat for this species.

3.3.7 Sperm Whale (Physeter macrocephalus)

3.3.7.1 Status and Trends

The sperm whale has been listed as endangered since 1970 under the precursor to the ESA (NMFS 2009) and is depleted under the MMPA throughout its range. In the North Pacific sperm whales are divided into three stocks in the Pacific; one (California/Oregon/Washington) occurs within the Action Area (Carretta et al. 2020). Based on genetic analyses, Mesnick et al. (2011) found that sperm whales in the California Current are demographically independent from animals in the rest of the tropical Pacific. A Recovery Plan was completed for the sperm whale in 2010 (NMFS 2010b).

Line-transect surveys conducted off the U.S. West Coast from 1991 to 2014 include a high level of uncertainty but indicate that sperm whale abundance has appeared stable, with some evidence for an increasing number of sperm whales (Moore & Barlow 2014; Moore & Barlow 2017; Carretta et al. 2020).

3.3.7.2 Distribution

This species is primarily found in the temperate and tropical waters of the Pacific (Rice 1989; Merkens et al. 2019). Its secondary range includes areas of higher latitudes up to and including the Gulf of Alaska (Whitehead & Weilgart 2000; Jefferson et al. 2008; Whitehead et al. 2008; Whitehead et al. 2009). This species appears to prefer deep waters and the continental shelf break and slope (Rice 1989; Whitehead 2003; Jefferson et al. 2008; Whitehead et al. 2008; Baird 2013). Typically, sperm whale concentrations also correlate with areas of high productivity, generally near drop offs and areas with strong currents and steep topography (Gannier & Praca 2007; Jefferson et al. 2008).

Sperm whales are found year-round in California waters, but their abundance is temporally variable, most likely due to the availability of prey species (Forney & Barlow 1993; Barlow 1995; Barlow & Forney 2007; Smultea 2014). Based on habitat models derived from line-transect survey data collected between 1991 and 2008 off the U.S. West Coast, sperm whales show an apparent preference for deep waters (Barlow et al. 2009; Becker et al. 2010; Becker et al. 2012; Forney et al. 2012). During quarterly ship surveys conducted off Southern California between 2004 and 2008, there were a total of 20 sperm whale sightings, the majority (12) occurring in summer in waters greater than 2,000 m deep (Douglas et al. 2014).

Sperm whales are somewhat migratory. General shifts in distribution occur during summer months for feeding and breeding, while in some tropical areas sperm whales appear to be largely resident (Rice 1989; Whitehead 2003; Whitehead et al. 2008; Whitehead et al. 2009). Pods of females with calves remain on breeding grounds throughout the year, between 40° North and 45° North (Rice 1989; Whitehead 2003), while males migrate between low-latitude breeding areas and higher-latitude feeding grounds (Pierce et al. 2007). In the northern hemisphere, “bachelor” groups (males typically 15 to 21 years old and bulls [males] not taking part in reproduction) generally leave warm waters at the beginning of summer and migrate to feeding grounds that may extend as far north as the perimeter of the arctic zone. In fall and winter, most return south, although some may remain in the colder northern waters during most of the year (Pierce et al. 2007).

3.3.7.3 Critical Habitat

There is no designated critical habitat for this species.

3.3.8 Guadalupe Fur Seal (Arctocephalus townsendi)

3.3.8.1 Status and Trends

The Guadalupe fur seal was listed as threatened under the ESA in 1985 (50 FR 51252) and depleted under the MMPA throughout its range. Guadalupe fur seals were hunted nearly to extinction during the 1800s. All individuals alive today are descendants from one breeding colony at Isla Guadalupe and Isla San Benito off Mexico and are considered a single stock (Pablo-Rodríguez et al. 2016; Carretta et al. 2017a; Carretta et al. 2020). A recovery plan has not been initiated for the Guadalupe fur seal. However, a status review of the Guadalupe fur seals was conducted in 2021, showing that the population has grown and increased in distribution since 1985 (McCue et al. 2021). Despite this, since 2010, there have been dramatic shifts in the species distribution and abundance, mass strandings, and Unusual Mortality Events (UME) of Guadalupe fur seals caused by prey limitations (McCue et al. 2021).

A SAR has not been completed for Guadalupe fur seals since 2010 (Carretta et al. 2020), which indicated a total estimated population size of approximately 20,000 animals and an average annual growth rate of 10.3 percent (Carretta et al. 2020). The ongoing UME involving Guadalupe fur seals (National Oceanic and Atmospheric Administration [NOAA] 2018; NMFS 2019a, 2020c) is likely to have impacted the recent population trend (Elorriaga-Verplancken et al. 2016a; Elorriaga-Verplancken et al. 2016b; Ortega-Ortiz et al. 2019). However, based on counts off Mexico in 2018 at Guadalupe Island and the San Benito Archipelago, the minimum population estimate was 29,747 Guadalupe fur seals at those locations (Norris 2019). Valdivia et al. (2019) has noted that since being ESA-listed in 1985, the population of the Guadalupe fur seal increased about nine-fold at a rate of approximately 15 percent per year. The dispersion of Guadalupe fur seal from rookeries off Mexico may be an indicator of potential species recovery (Ortega-Ortiz et al. 2019; Norris & Elorriaga-Verplancken 2020; D'Agnese et al. 2020).

3.3.8.2 Distribution

Before intensive hunting decreased their numbers, Guadalupe fur seals ranged from Monterey Bay, California, to the Revillagigedo Islands, Mexico (Aurioles-Gamboa et al. 2010). Guadalupe fur seals are most common at their primary breeding ground of Guadalupe Island, Mexico (Melin & DeLong 1999). A second rookery was found in 1997 at the San Benito Islands off Baja California (Maravilla-Chavez & Lowry 1999; Aurioles-Gamboa et al. 2010; Esperon-Rodriguez & Gallo-Reynoso 2012), and they have been found in La Paz Bay in the Southern Gulf of California (Elorriaga-Verplancken et al. 2016a). Adult and juvenile males have occasionally been observed at San Miguel Island, California since the mid-1960s, and in the late 1990s, a pup was born on the island. Rare sightings of individuals have also occurred at Santa Barbara, San Nicolas, and San Clemente Islands (Stewart 1981; Stewart & Yochem 1984; Stewart et al. 1993; Stewart & Yochem n.d.). In NMFS aerial surveys between 2011 and 2015, Guadalupe fur seals were not observed on any of the Channel Islands, other than at SMI (Lowry et al. 2017); Guadalupe fur seals have not been observed at VSFB.

Data from animals leaving Guadalupe Island indicate that Guadalupe fur seals primarily use habitats offshore of the continental shelf between 31 and 186 mi (50 and 300 km) from the U.S. West Coast, with approximately one-quarter of the population foraging farther out and up to 435 mi (700 km) offshore (Norris 2019). Satellite tags have documented the movement of females without pups at least as far as 808 mi (1,300 km) north of Guadalupe Island (waters offshore of approximately Point Cabrillo in Mendocino County, California) (Norris 2019). Adult males, juveniles, and nonbreeding females may live at sea during some seasons or for part of a season (Reeves et al. 2002) and can be expected to occur in both deeper waters of the open ocean and coastal waters within the Action Area (Hanni et al. 1997; Jefferson et al. 2008; Jefferson et al. 2019). Guadalupe fur seals may be establishing the extent of their previous range, as they are increasingly observed and tracked by satellite using offshore waters of the Pacific Northwest (Etnier 2002; Lambourn et al. 2012; Norris et al. 2015). There are no records of Guadalupe fur seals breeding or hauling out on VSFB beaches. Breeding does occur nearby at very low number on the NCI.

3.3.8.3 Critical Habitat

Critical habitat for the Guadalupe fur seal has not been designated given that the only areas that meet the definition for critical habitat are outside of U.S. jurisdiction (NOAA 1985).

4 Effects of the Action

4.1 Introduction

This chapter evaluates how, and to what degree, the activities described under the Proposed Action potentially impact ESA-listed species known to occur within the Action Area. The stressors vary in intensity, frequency, duration, and location within the Action Area. The stressors considered in this BA include the following:

- Impact by fallen objects: fairing and radiosonde
- Entanglement in unrecovered parachutes and parafoils
- Ingestion of materials from unrecovered parachutes, parafoils, and weather balloons
- Acoustic (in-air)
- Ship strike
- Indirect Effects (impacts on habitat, impacts on prey availability)
- Cumulative Effects

The potential direct, indirect, and cumulative impacts of the Proposed Action were analyzed based on these potential stressors interacting with the ESA-listed species and using the best scientific and commercial data available to assess potential impacts. Direct impacts are caused by the action and occur at the same time and place. Indirect impacts could result under two scenarios. First, ESA-listed species could be affected by the Proposed Action later in time; or secondly, they could be affected via an indirect pathway as a result of an impact on one resource inducing an impact on another resource.

Acoustic impacts as a result of the Proposed Action are limited to in-air noise as a result of sonic boom or rocket engine noise. Exceptionally little sound is transmitted between the air-water interface; thus, in-air sound would not have a significant effect on submerged animals (Godin 2008). Therefore, in-air noise would have no effect on ESA-listed fish species. In addition, cetaceans and sea turtles spend most of their time (>90% for most species) entirely submerged below the surface. When at the surface, their bodies are almost entirely below the water's surface, with only the blowhole or turtle's head exposed briefly to allow breathing. This minimizes in-air noise exposure, both natural and anthropogenic, essentially 100% of the time because their ears are nearly always below the water's surface. As a result, in-air noise caused by sonic boom and engine noise will not have an effect on ESA-listed sea turtles or cetacean species. Similarly, when at-sea, pinnipeds spend varying amounts of time underwater and the potential for disruption from in-air noise within the limited area of potential exposure during the brief moment of the sonic boom or engine noise is extremely unlikely for animals that are at sea. As a result, in-air noise would have no effect on Guadalupe fur seals that are at-sea. The Proposed

Action, however, will create in-air noise that may impact Guadalupe fur seals that are hauled out and these potential impacts are analyzed below.

Finally, indirect impacts resulting from the Proposed Action were considered. Indirect impacts result when a direct impact on one resource induces an impact on another resource. Indirect impacts would be reasonably foreseeable because of a functional relationship between the directly impacted resource and the secondarily impacted resource.

4.2 Fishes

This section evaluates how, and to what degree, the activities described in Chapter 2 potentially impact ESA-listed fishes (Southern California DPS steelhead, lower Columbia River Chinook ESU, Southern Oregon and Northern California Coast Coho ESU, Central California Coast Coho ESU, green sturgeon, oceanic whitetip shark, and scalloped hammerhead shark) occurring within the Action Area. The stressors considered for the ESA-listed fishes are:

- Physical disturbance and impacts by fallen objects
- Entanglement
- Ingestion
- Indirect Effects
- Cumulative Effects

The USSF has identified no interrelated or interdependent projects that would impact ESA-listed fish species within the Action Area.

4.2.1 Physical Disturbance and Impacts by Fallen Objects

Unrecovered fairings and radiosondes have the potential to directly strike fish as they hit the water surface and below the surface to the point where the objects lose momentum. Fishes at and just below the surface would be most susceptible to injury or death from strikes, because velocity of these materials would rapidly decrease upon contact with the water and as they travel through the water column. Consequently, most water column fishes would have ample time to detect and avoid approaching projectiles or fragments that fall through the water column. A low possibility exists that a small number of fish at or just under the surface may be directly impacted if they are in the impact area at the time of splashdown, but population-level impacts would not occur.

The proposed landing and first stage recovery area are very large and ESA-listed fish species occur in very low densities of species across this area. In addition, most ESA-listed fish do not spend much time near the surface. For those species that do spend time at the surface, the chances of being present at the surface in an impact area when the impact occurs is very unlikely. Therefore, the probability of a fairing or radiosonde striking an ESA-listed fish species is extremely low. Fairings and radiosondes strike on ESA-listed fish would be discountable due to (1) the limited number of individuals found directly at the surface of the ocean, (2) the rare chance that a fish might be directly struck while at the surface, and (3) the ability of most fishes to detect and avoid an object falling through the water below the surface. The potential for impacts to occur would be short term (seconds) and localized and are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction at the population level.

Therefore, the USSF has determined that physical disturbance and strike stressors introduced into the marine environment as a result of the Proposed Action may affect, but are unlikely to adversely affect ESA-listed fish species because the potential impacts are discountable.

4.2.2 Entanglement

Unrecovered parafoils, parachutes, and weather balloons can potentially become entangled with an ESA-listed fish, causing injury or death. While individual fish could encounter expended materials that may pose a risk of entanglement, the likelihood of entanglement is extremely small because: (1) the encounter rate for these expended materials is low, (2) the types of ESA-listed fishes that are susceptible to these items is limited, (3) there is restricted overlap with susceptible fishes, and (4) the physical characteristics of the expended materials reduce entanglement risk to fishes compared to monofilament used for fishing gear. For example, a latex weather balloon would burst after reaching its elastic limit at an altitude of 12 to 19 mi (19 to 30 km). The temperature at this altitude range can reach negative 40 degrees Fahrenheit (°F) and even colder. Under these conditions of extreme elongation and low temperature, the balloon undergoes "brittle fracture" where the rubber shatters along grain boundaries of crystallized segments. The resultant pieces of rubber are small strands comparable to the size of a quarter (Burchette 1989). The balloon fragments would be positively buoyant, float on the surface, and begin to photo-oxidize due to UV light exposure. In addition, unrecovered parafoils and parachutes would sink quickly through the water column, at 7 ft and 22 ft per minute, respectively, and settle (NMFS 2022b). These activities will typically occur far offshore in deep waters where they are not expected to be encountered by ESA-listed fish species potentially affected by the Proposed Action. Entanglement with parachutes, unrecovered parafoils, or weather balloons is therefore extremely unlikely and therefore the risk of entanglement is very low.

As a result, the USSF has determined that entanglement stressors introduced into the marine environment as a result of the Proposed Action may affect, but are unlikely to adversely affect ESA-listed fish species because the potential impacts are discountable.

4.2.3 Ingestion Stressors

Pieces of weather balloons, parachutes, or parafoils may pose an ingestion stressor to ESA-listed fish. Ingestion of expended materials by fishes could occur at or just below the surface, in the water column, or at the seafloor depending on the size and buoyancy of the expended object and the feeding behavior of the fish. Floating material is more likely to be eaten by fishes that feed at or just under the water’s surface (e.g., ocean sunfish, basking sharks, or flying fishes), while materials that sink to the seafloor present a higher risk to bottom-feeding fishes (e.g., rockfishes, skates, and flatfishes).

Parachutes and parafoils are made of nylon and Kevlar and thus do not degrade quickly. Photooxidation would break down nylon, however, the parachutes and parafoils would sink rapidly (discussed above) and settle on the ocean floor, typically far from shore at depths greater than the ESA-listed species discussed herein are expected to occur and where ultraviolet light would not penetrate. Because the degradation of these materials would be very slow and the presence of the ESA-listed fish species at these depths is unlikely, the risk of ingestion of parachute or parafoil materials by ESA-listed fish would be very low and discountable.

Weather balloons would burst at an altitude of 12 to 19 mi (19 to 30 km) where temperatures can reach negative 40 ^{o}F and even colder. As discussed above, the balloon would undergo "brittle fracture", and shatter into pieces approximately the size of a quarter (Burchette 1989). These pieces would become dispersed over a broad area as they fall to the surface of the ocean. The balloon fragments would be positively buoyant, float on the surface, and degrade over approximately 6 weeks as they photo-oxidize due to UV light exposure (Burchette 1989). After several weeks, the pieces of latex would be smaller and become neutrally buoyant (Ye and Andrady 1991; Lobelle and Cunliffe 2011). Because of the small amount of latex material expended, the dispersion of fragments as they descend to the ocean, and their limited amount of time on the surface, and low densities of ESA-listed fish species in the Action Area, the risk of ingestion of weather balloon material is very low and discountable.

Therefore, the USSF has determined that ingestion stressors introduced into the marine environment as a result of the Proposed Action may affect, but are unlikely to adversely affect ESA-listed fish species because the potential impacts are discountable.

4.2.4 Ship Strike

Support vessels which would be used during first stage and fairing recovery activities have the potential to strike ESA-listed fish species at or near the surface of the water. Salmonids (steelhead and salmon) and green sturgeon are rarely at the surface; however, oceanic whitetip sharks and scalloped hammerheads do spend time at the surface of the water. Vessels do not normally collide with adult fish since most species are capable of detection and avoidance. One study found that most adult fish exhibit avoidance responses to engine noise (Jørgensen et al. 2004), reducing the potential for vessel strikes. Misund (1997) found that fishes ahead of a ship showed avoidance reactions at ranges of 160 – 490 ft. (49 – 149 m). The salmonid ESA-listed species can sense pressure changes in the water column and swim quickly (Baum 1997; Popper and Hastings 2009) and are likely to avoid collision with vessels. Larger fish, including, oceanic whitetip sharks and scalloped hammerheads, may be more susceptible to strikes; however, the support vessels would maintain average speeds of 10 knots or less, providing ample time for recognition and avoidance by ESA-listed fish species. Additionally, ESA-listed fish species occur at low densities in the action area. The probability of a strike would be further reduced by implementation of the EPMs, discussed in Section 2.2.4. As a result, the USSF has determined that strike stressors as a result of the Proposed Action may affect, but are unlikely to adversely affect ESA-listed fish species because the potential impacts are discountable

4.2.5 Indirect Effects

Secondary stressors from the Proposed Action could pose indirect impacts on fishes via habitat or prey. For this analysis, indirect impacts via water could not only cause physical impacts, but prey might also be impacted by the Proposed Action. For example, the impact of expended materials on the ocean surface might cause injury or induce startle reactions and temporary dispersal of schooling fishes if they are within close proximity of the activity. The abundances of fish and invertebrate prey species could be diminished for a brief period of time before being repopulated by animals from adjacent waters. Secondary impacts such as these would be temporary, and no lasting impact on prey availability or the pelagic food web would be expected. Indirect impacts under the Proposed Action would not result in a decrease in the quantity or quality of fish populations or fish habitats in the Action Area.

Therefore, the USSF has determined that indirect effects of the Proposed Action may affect, but are not likely to adversely affect ESA-listed fish species because the potential impacts are insignificant.

4.2.6 Cumulative Effects

Cumulative effects on the ESA-listed fish species considered in this BA are those effects of future State or private activities, not involving federal activities, that are reasonably certain to occur within the Action Area (50 C.F.R. Part 402.02). For purposes of this BA and cumulative effects analysis, the USSF identified broad categories of activities that could affect ESA-listed fish, including commercial fishing and harvest, maritime traffic, coastal land development, ocean pollution, ocean noise, and offshore energy development. Any impacts that might occur could be additive to behavioral disturbance, injury, and mortality associated with other actions within the Action Area. Therefore, this section evaluates risks posed by non-federal activities in the Action Area that could result in cumulative adverse effects on ESA-listed fish populations.

Fish populations can be influenced by various human activities. There can be direct effects from commercial and recreational activities such as fishing, or indirect effects from reductions in prey availability or lowered reproductive success of individuals. Human-made impacts are widespread throughout the world's oceans, such that very few habitats remain unaffected by human influence (Halpern et al. 2008). Direct and indirect effects have shaped the condition of marine fish populations, particularly those species with large body size, late maturity ages, or low fecundity.

As discussed above, ESA-listed fish could be affected by physical disturbance, strike stressors, entanglement stressors, and ingestion stressors. Some stressors could also result in injury or mortality to a relatively small number of individuals, but the likelihood of these effects is discountable. It is anticipated that the Proposed Action may affect, but is not likely to adversely affect ESA-listed fish species within the Action Area.

Aggregate impacts associated with the other actions could result in injury and mortality. Many of these actions and their associated cumulative effects on fish cannot be determined with any specificity or certainty at this time. However, it can reasonably be assumed that there may be fish that could be affected by these other actions, but no specific details are known regarding the impacts or effects to individuals or populations. The Proposed Action may result in injury and mortality to fish from strikes, but the likelihood of these impacts is discountable. Injury and mortality that might occur under the Proposed Action would be additive to injury and mortality associated with other actions. However, the relative contribution of the Proposed Action to the overall injury and mortality would be low compared to other actions for the following reasons: (1) any impacts from the Proposed Action resulting in injury or mortality are very unlikely and would be limited to a relatively small number of individuals, and (2) no population-level impacts are anticipated.

The contribution of the Proposed Action to cumulative impacts would still be discountable and insignificant based on the reasons presented above. The incremental contribution of the Proposed Action would be insignificant relative to other stressors from non-USSF activities (e.g., commercial fisheries).

4.2.7 Critical Habitat

As discussed in Section 3.1, there is no overlap of the activities under the Proposed Action and designated critical habitat in the Action Area. Therefore, the Proposed Action would have no effect on critical habitat for any ESA-listed fish species.

4.3 Sea Turtles

This section evaluates how, and to what degree, the activities described in Chapter 2 potentially impact ESA-listed sea turtles (green, loggerhead, olive ridley, hawksbill, and leatherback) occurring within the Action Area. The stressors considered for the ESA-listed sea turtles are:

- Physical disturbance and impacts by fallen objects
- Entanglement
- Ingestion
- Ship Strike
- Indirect Effects
- Cumulative Effects

The USSF has identified no interrelated or interdependent projects that would impact ESA-listed sea turtle species within the Action Area.

4.3.1 Physical Disturbance and Impacts by Fallen Objects

If a fairing or radiosonde struck a sea turtle, it could result in injury or death. Once within the water column, disturbance or strike from an item falling through the water is possible, but its velocity would be greatly reduced (reducing the potential for serious injury) and the falling object could potentially be avoided by marine species once detected. A low possibility exists that a sea turtle would be at or just under the surface in the impact area at the time of splashdown, but population-level impacts would not occur. In addition, ESA-listed sea turtles occur in very low densities throughout the proposed landing area (U.S. Department of the Navy 2017), therefore, the probability of a strike would be very unlikely and discountable.

Therefore, the USSF has determined physical disturbance and potential strike as a result of the Proposed Action would be discountable and may affect, but is not likely to adversely affect the ESA-listed sea turtles.

4.3.1 Entanglement

Unrecovered parafoils, parachutes, and weather balloons can potentially become entangled with ESA-listed sea turtles, causing injury or death. While individual turtles could encounter expended materials that may pose a risk of entanglement, the likelihood of entanglement is extremely small because: (1) the encounter rate for these expended materials is low, (2) there is restricted overlap with susceptible turtles, and (3) the physical characteristics of the expended materials reduce entanglement risk to sea turtles compared to abandoned fishing gear. For example, latex weather balloons burst after reaching its elastic limit at an altitude of 12 to 19 mi (19 to 30 km). The temperature at this altitude range can reach negative 40 ^{o}F and even colder. Under these conditions of extreme elongation and low temperature, the balloon undergoes "brittle fracture" where the rubber shatters along grain boundaries of crystallized segments. The resultant pieces of rubber are small strands comparable to the size of a quarter (Burchette 1989). The balloon fragments would be positively buoyant, float on the surface, and begin to photo-oxidize due to UV light exposure. In addition, unrecovered parafoils and parachutes would sink quickly through the water column, at 7 ft and 22 ft per minute, respectively, and settle (NMFS 2022b). These activities will typically occur far offshore in deep waters where they are not expected to be encountered by ESA-listed sea turtles potentially affected by the Proposed Action. Entanglement with parachutes, unrecovered parafoils, or weather balloons is therefore extremely unlikely and therefore the risk of entanglement is very low.

As a result, the USSF has determined that entanglement stressors introduced into the marine environment as a result of the Proposed Action may affect, but are unlikely to adversely affect ESA-listed sea turtle species because the potential impacts are discountable.

4.3.2 Ingestion Stressors

Pieces of weather balloons, parachutes, or parafoils may pose an ingestion stressor to ESA-listed sea turtles. Ingestion of expended materials by turtles could occur at or just below the surface, in the water column, or at the seafloor depending on the size and buoyancy of the expended object and the feeding behavior of the turtle. Floating material is more likely to be eaten by a turtle that is feeding at or just under the water's surface.

Parachutes and parafoils are made of nylon and Kevlar and thus do not degrade quickly. Photooxidation would break down nylon, however, the parachutes and parafoils would sink rapidly (discussed above) and settle on the ocean floor, typically far from shore at depths greater than the ESA-listed sea turtles discussed herein are expected to occur and where ultraviolet light would not penetrate. Because the degradation of these materials would be very slow and the presence of the ESA-listed sea turtle species at these depths is unlikely the risk of ingestion of parachute or parafoil materials by ESA-listed sea turtle would be very low and discountable.

Weather balloons would burst at an altitude of 12 to 19 mi (19 to 30 km) where temperatures can reach negative 40 ^{o}F and even colder. As discussed above, the balloon would undergo "brittle fracture", and shatter into pieces approximately the size of a quarter (Burchette 1989). These pieces would become dispersed over a broad area as they fall to the surface of the ocean. The balloon fragments would be positively buoyant, float on the surface, and degrade over approximately 6 weeks as they photo-oxidize due to UV light exposure (Burchette 1989). After several weeks, the pieces of latex would be smaller and become neutrally buoyant (Ye and Andrady 1991; Lobelle and Cunliffe 2011). Because of the small amount of latex material expended, the dispersion of fragments as they descend to the ocean, and their limited amount of time on the surface, and low densities of ESA-listed sea turtle in the action area, the risk of ingestion of weather balloon material is very low and discountable.

Therefore, the USSF has determined that ingestion stressors introduced into the marine environment as a result of the Proposed Action may affect, but are unlikely to adversely affect ESA-listed sea turtle species because the potential impacts are discountable.

4.3.3 Ship Strike

Support vessels which would be used during first stage and fairing recover activities have the potential to strike of ESA-listed sea turtles that are at or near the surface of the water. Any of the sea turtle species found in the action area can occur at or near the surface in open ocean, whether feeding or periodically surfacing to breathe. However, sea turtles spend a majority of their time submerged (Renaud and Carpenter 1994; Sasso and Witzell 2006). Leatherback turtles are more likely to feed at or near the surface in open ocean areas. Green, hawksbill, olive ridley, and loggerhead turtles forage along the sea floor and are more likely to forage nearshore, outside of the proposed landing area. ESA-listed sea turtles occur in low densities in the action area and are widespread and scattered at sea. Therefore, ship strikes of ESA-listed sea turtles would be very unlikely. Additionally, the probability of a strike would be further reduced by implementation of the EPMs, discussed in Section 2.2.4. As a result, the USSF has determined that strike stressors as a result of the Proposed Action may affect, but are unlikely to adversely affect ESA-listed sea turtle species because the potential impacts are discountable.

4.3.4 Indirect Effects

Indirect effects (secondary stressors) on sea turtles would mainly be associated with the occurrence and availability of prey species and impacts on habitat. For example, the impact of expended materials on the ocean surface might cause injury or induce startle reactions and temporary dispersal of schooling fishes if they are within close proximity of the activity. The abundances of prey species could be diminished for a brief period of time before being repopulated by animals from adjacent waters. Secondary impacts such as these would be temporary, and no lasting impact on prey availability or the pelagic food web would be expected. Indirect impacts under the Proposed Action would not result in a decrease in the quantity or quality of prey species populations or sea turtle habitats in the Action Area.

Therefore, the USSF has determined that indirect effects of the Proposed Action may affect, but are not likely to adversely affect ESA-listed sea turtles because the potential impacts are insignificant.

4.3.5 Cumulative Effects

Cumulative effects on sea turtle species are those effects of future state or private activities, not involving federal activities, that are reasonably certain to occur within the Action Area (50 C.F.R. Section 402.02). For the purposes of this BA and cumulative effects analysis for sea turtles, the USSF identified broad categories of activities including commercial fishing and harvest, maritime traffic and vessel strikes, coastal land development, ocean pollution, ocean noise, and offshore energy development. Any impacts that might occur could be additive to behavioral disturbance, injury and mortality associated with other actions within the Action Area. Therefore, this section evaluates risks posed by non-federal activities in the Action Area that could result in cumulative adverse effects on sea turtles.

Based on the listing status of the sea turtle species within the Action Area, there is a clear indication that the current aggregate impacts of past human activities are significant for sea turtles. Bycatch, vessel strikes, coastal land development, and ocean pollution are the leading causes of mortality and population decline for sea turtles. Any incidence of injury and mortality that might occur under the Proposed Action, though unlikely and would affect a relatively small number of individuals, could be additive to injury and mortality associated with other actions in the region of influence.

As discussed above, ESA-listed sea turtles could be affected by physical disturbance, strike stressors, entanglement stressors, and ingestion stressors. Some stressors could also result in injury or mortality to a relatively small number of individuals but the likelihood of these effects is discountable. It is anticipated that the Proposed Action may affect, but is not likely to adversely affect ESA-listed sea turtle species within the Action Area. Effects from the Proposed Action to sea turtle food sources would be insignificant. Likewise, the stressors under the Proposed Action generally would not overlap other stressors in space and time as they occur as dispersed, infrequent, and isolated events that do not last for extended periods.

It is possible that the response of a previously stressed animal to impacts associated with the Proposed Action could be more severe than the response of an unstressed animal, or impacts from the Proposed Action could make an individual more susceptible to other stressors. Likewise, the Proposed Action could contribute incremental stressors to individuals, which would both compound effects on a given individual already experiencing stress which may further stress populations in significant decline. Although the aggregate impacts of past, present, and other reasonably foreseeable future actions continue to have significant impacts on all sea turtle species in the Action Area, the Proposed Action is not likely to incrementally contribute to declines in sea turtle populations within the Action Area.

In summary, the aggregate impacts of past, present, and other reasonably foreseeable future actions continue to have significant impacts on all sea turtle species in the Action Area. The Proposed Action could contribute incremental stressors to individuals, which may further stress populations in significant decline. However, the incremental stressors anticipated from the Proposed Action would be insignificant in light of the relative contribution from the Proposed Action in comparison to other actions and because the Proposed Action generally will not overlap in space and time with other stressors. Therefore, it is anticipated that the Proposed Action may affect, but are not likely to adversely affect ESA-listed sea turtles within the Action Area.

4.4 Marine Mammals

This section evaluates how, and to what degree, the activities described in Chapter 2 potentially impact ESA-listed marine mammals (blue whale, fin whale, western north Pacific gray whale, humpback whale, killer whale, sei whale, sperm whale, and Guadalupe fur seal) occurring within the Action Area. The stressors considered for the ESA-listed marine mammals are:

- Physical disturbance and impacts by fallen objects
- Entanglement
- Ingestion

- Ship Strike
- In-air noise (Guadalupe fur seal only)
- Indirect Effects
- Cumulative Effects

The USSF has identified no interrelated or interdependent projects that would impact ESA-listed marine mammal species within the Action Area.

4.4.1 Physical Disturbance and Impacts by Fallen Objects

If a fairing or radiosonde struck an ESA-listed marine mammal, it could result in injury or death. Once within the water column, disturbance or strike from an unrecovered fairing or radiosonde falling through the water is possible, but its velocity would be greatly reduced (reducing the potential for serious injury) and the falling object could potentially be avoided by marine species once detected. A very low possibility exists that an ESA-listed marine mammal would be at or just under the surface in the impact area at the time of splashdown, but population-level impacts would not occur. In addition, ESA-listed marine mammals occur in very low densities throughout the proposed landing area (U.S. Department of the Navy 2017), therefore, the probability of a strike would be very unlikely and discountable.

4.4.2 Entanglement

Unrecovered parafoils, parachutes, and weather balloons can potentially become entangled with an ESA-listed marine mammals, causing injury or death. While individual whales could encounter expended materials that may pose a risk of entanglement, the likelihood of entanglement is extremely small because: (1) the encounter rate for these expended materials is low, (2) there is restricted overlap with susceptible marine mammals, and (3) the physical characteristics of the expended materials reduce entanglement risk to marine mammals compared to abandoned fishing gear. For example, latex weather balloons burst after reaching its elastic limit at an altitude of 12 to 19 mi (19 to 30 km). The temperature at this altitude range can reach negative 40 ^{o}F and even colder. Under these conditions of extreme elongation and low temperature, the balloon undergoes "brittle fracture" where the rubber shatters along grain boundaries of crystallized segments. The resultant pieces of rubber are small strands comparable to the size of a quarter (Burchette 1989). The balloon fragments would be positively buoyant, float on the surface, and begin to photo-oxidize due to UV light exposure. In addition, all parachutes and parafoils are meant to be recovered and they have been recovered during the majority of operations. Even if the parachutes or a parafoil are not recovered, they would sink quickly through the water column, at 7 ft and 22 ft per minute, respectively, and settle and spend a short time passing through the water column (NMFS 2022b). Considering the low occurrence of parachutes or parafoils not being recovered, the limited time they would spend in the water column, and settling typically in the deep ocean, entanglement with parachutes and unrecovered parafoils is therefore extremely unlikely and therefore the risk of entanglement is very low.

As a result, the USSF has determined that entanglement stressors introduced into the marine environment as a result of the Proposed Action may affect, but are unlikely to adversely affect ESA-listed marine mammal species because the potential impacts are discountable.

4.4.1 Ingestion Stressors

Pieces of weather balloons, parachutes, or parafoils may pose an ingestion stressor to ESA-listed marine mammals. Ingestion of expended materials by marine mammals could occur at or just below the surface, in the water column, or at the seafloor depending on the size and buoyancy of the expended object and the feeding behavior of the marine mammal. Floating material is more likely to be inadvertently infested marine mammal that is feeding at or just under the water's surface.

Parachutes and parafoils are made of nylon and Kevlar and thus do not degrade quickly. Photooxidation would break down nylon, however, the parachutes and parafoils would sink rapidly (discussed above) and settle on the ocean floor, typically far from shore at depths greater than the ESA-listed marine mammal species discussed herein are expected to occur and where ultraviolet light would not penetrate. Because the degradation of these materials would be very slow and the presence of foraging ESA-listed marine mammal species at these depths is unlikely the risk of ingestion of parachute or parafoil materials by ESA-listed marine mammals would be very low and discountable.

Weather balloons would burst after an altitude of 12 to 19 mi (19 to 30 km) where temperatures can reach negative 40 ^{o}F and even colder. As discussed above, the balloon would undergo "brittle fracture", and shatter into pieces approximately the size of a quarter (Burchette 1989). These pieces would become dispersed over a broad area as they fall to the surface of the ocean. The balloon fragments would be positively buoyant, float on the surface, and degrade over approximately 6 weeks as they photo-oxidize due to UV light exposure (Burchette 1989). After several weeks, the pieces of latex would be smaller and become neutrally buoyant (Ye and Andrady 1991; Lobelle and Cunliffe 2011). Because of the small amount of latex material expended, the dispersion of fragments as they descend to the ocean, and their limited amount of time on the surface, and low densities of ESA-listed marine mammals in the action area, the risk of ingestion of weather balloon material is very low and discountable.

Therefore, the USSF has determined that ingestion stressors introduced into the marine environment as a result of the Proposed Action may affect, but are unlikely to adversely affect ESA-listed marine mammal species because the potential impacts are discountable.

4.4.2 Ship Strike

Support vessels which would be used during first stage and fairing recover activities have the potential to strike of ESA-listed marine mammals that are at or near the surface of the water. ESA-listed marine mammals spend time at the surface, but most of their time is spent submerged. Average vessel speeds would be very low (less than 10 knots) and therefore striking a marine mammal would be unlikely (Tejedor et al. 2007; Conn & Silber 2013; Cates et al. 2020). There have been no reported ship strikes with ESA-listed marine mammals for similar operations, per reports provided to NMFS during ESA section 7 consultations (NMFS 2020). In addition, all support vessels would comply with the EPMs listed in Section 2.2.4 to reduce risk ship collisions with ESA-listed marine mammals. Ship strikes with ESA-listed marine mammals would therefore be considered extremely unlikely to occur and discountable. As a result, the USSF has determined that ship strike stressors as a result of the Proposed Action may affect, but are unlikely to adversely affect ESA-listed marine mammal species.

4.4.3 In Air Noise Effects on Guadalupe Fur Seal

As noted in Section 4.1, in-air noise caused by sonic boom and engine noise will not have an effect on ESA-listed sea turtles, cetacean species, nor marine mammals that are at sea. In-air noise may impact Guadalupe fur seals that are hauled out and these potential impacts are analyzed below.

Sonic boom modeling of the planned trajectories predicts a maximum sonic boom up to 5 psf infrequently impacting the NCI. Noise and visual disturbance can cause variable levels of disturbance to pinnipeds that may be hauled out within the areas of exposure, depending on the species exposed and the level of the sonic boom. Typical reactions range from no response to raising head and moving from a resting position to flushing to water. Behavioral reactions to noise can be dependent on relevance and association to other stimuli. A behavioral decision is made when an animal detects increased background noise, or possibly when an animal recognizes a biologically relevant sound. An animal's past experience with the sound-producing activity or similar acoustic stimuli can affect its choice of behavior. Competing and reinforcing stimuli may also affect its decision. Other stimuli present in the environment can influence an animal's behavior decision. These stimuli can be other acoustic stimuli not directly related to the sound-producing activity; they can be visual, olfactory, or tactile stimuli; the stimuli can be conspecifics or predators in the area; or the stimuli can be the strong drive to engage in a natural behavior.

Competing stimuli tend to suppress behavioral reactions. For example, an animal involved in mating or foraging may not react with the same degree of severity to acoustic stimuli as it may have otherwise. Reinforcing stimuli reinforce the behavioral reaction caused by acoustic stimuli. For example, awareness of a predator in the area coupled with the acoustic stimuli may illicit a stronger reaction than the acoustic stimuli itself otherwise would have. The visual stimulus of the sonic boom would not be coupled with the sonic boom since the vehicles would be at significant altitude when the overpressure impacts the NCI. This would decrease the likelihood and severity of a behavioral response. Guadalupe fur seals are relatively insensitive to disturbance, occur in low numbers at SMI in isolated locations, and are adept at jumping into the water in the event that they do flee from a disturbance (Harris 2015).

Noise resulting from the Proposed Action is not expected to cause more than a temporary startle-response in Guadalupe fur seals. Therefore, USSF determined that in-air noise as a result of the Proposed Action may affect, but is not likely to adversely affect the Guadalupe Fur Seal.

4.4.4 Indirect Effects

Potential indirect impacts on ESA-listed marine mammals may occur as a result of impacts on their habitat (sediment or water quality) or prey. Indirect impacts on marine mammals via sediment or water quality that do not require trophic transfer (e.g., bioaccumulation) to be observed are considered here. Information from investigations at Navy testing and training ranges and sites where munitions were disposed of at sea following the end of World War II indicates that even in a variety of areas having concentrated expended military materials, there has been no significant impact on the immediate vicinity or the wider area as a result of those materials being present (Environmental Sciences Group 2005; University of Hawaii & Environet 2010; University of Hawaii 2014; Koide et al. 2016; Kelley et al. 2016; Briggs et al. 2016). Based on those data sources, the Proposed Action is unlikely to pose indirect impacts on ESA-listed marine mammals via habitat or prey as a result of expended materials.

Therefore, the USSF has determined that indirect stressors introduced into the marine environment as a result of the Proposed Action insignificant and may affect, but are not likely to adversely affect the ESA-listed marine mammals.

4.4.5 Effects to Humpback Whale Critical Habitat

As noted above, the humpback whale is the only species analyzed in this BA that has designated critical habitat which overlaps the Action Area. Section 3.3.4.3 of this document lists primary constituent elements for the species, emphasizing prey, especially euphausids and small schooling fish). Similar to the potential impacts discussed for ESA-listed fish species, humpback whale prey may experience direct and indirect effects as a result of potential debris strike, entanglement, ingestion stressors, and indirect effects.

4.4.5.1 Physical Disturbance and Strike Stressors

Physical disturbance and strike stressors that may impact humpback whale prey species are primarily from expended materials. Expended materials have the potential to directly strike fish and invertebrates as they hit the water surface and below the surface to the point where the projectile loses its forward momentum. Only humpback whale prey species present at and just below the surface would be most susceptible to injury or death from strikes, because velocity of these materials would rapidly decrease upon contact with the water and as they travel through the water column. Consequently, most water column fishes and invertebrates would have ample time to detect and avoid approaching projectiles or fragments that fall through the water column. A possibility exists that a small number of fish and invertebrates at or just under the surface may be directly impacted if they are in the target area and near the point of physical impact at the time an object strikes the surface, but population-level impacts would not occur as a result.

If prey items are killed within humpback whale critical habitat, it is likely that only a low number of individuals representing a very small portion of prey species' populations would be killed. Other prey items would be available to humpback whales in the immediate area surrounding the activity or would return to the area after the activity is complete. Although some individual prey items may be killed, long-term consequences for fish and invertebrate populations and the effect on overall quantity, quality, and availability of prey items for humpback whales would be insignificant.

4.4.5.2 Ingestion Stressors

Ingestion of expended materials by humpback whale prey species could occur at or just below the surface, in the water column, or at the seafloor depending on the size and buoyancy of the expended object and the feeding behavior of the fish and invertebrates. Floating material is more likely to be eaten by species that feed at or just under the water's surface. Parachutes and parafoils are made of nylon and Kevlar and thus do not degrade quickly. Photooxidation would break down nylon, however, the parachutes and parafoils would sink rapidly (discussed above) and settle on the ocean floor, typically far from shore at depths greater than most humpback whale prey species are expected to occur and where ultraviolet light would not penetrate. Because the degradation of these materials would be very slow and the presence of the humpback whale prey species at these depths is unlikely the risk of ingestion of parachute or parafoil materials by humpback whale prey species would be very low and discountable

Weather balloons would burst after an altitude of 12 to 19 mi (19 to 30 km) where temperatures can reach negative 40 °F and even colder. As discussed above, the balloon would undergo "brittle fracture", and shatter into pieces approximately the size of a quarter (Burchette 1989). These pieces would become dispersed over a broad area as they fall to the surface of the ocean. The balloon fragments would be positively buoyant, float on the surface, and degrade over approximately 6 weeks as they photo-oxidize due to UV light exposure (Burchette 1989). After several weeks, the pieces of latex would be smaller and become neutrally buoyant (Ye and Andrady 1991; Lobelle and Cunliffe 2011). It is possible that expended small fragments on the seafloor could be colonized by seafloor organisms and mistaken for prey or that expended small fragments could be accidentally or intentionally eaten during foraging. However, very few individuals would be affected. Because of the small amount of latex material expended, the dispersion of fragments as they descend to the ocean, and their limited amount of time on the surface, the risk of ingestion of weather balloon material by humpback whale prey species is very low. Therefore, long-term consequences of ingestion stressors for fish and invertebrate populations and the effect on overall quantity, quality, and availability of prey items for humpback whales would be discountable.

4.4.5.3 Indirect Effects

Secondary stressors could pose indirect impacts on humpback whale prey species via habitat, prey, sediment, and water quality. For example, the abundances of fish and invertebrate prey species could be diminished for a short period of time at any debris impact locations before being repopulated by animals from adjacent waters. Secondary impacts such as these would be temporary, and no lasting impact on prey availability or the pelagic food web would be expected. Indirect impacts under the Proposed Action would not result in a decrease in the quantity or quality of fish populations or fish habitats in the Action Area.

Secondary stressors can also involve impacts on habitat (sediment or water quality) or prey (i.e., impacting the availability or quality of prey) that have the potential to affect humpback whale prey species. Plastics could impact other species in the food web, including those that these species prey upon. Harmful chemicals in plastics interfere with metabolic and endocrine processes in many plants and animals (Derraik 2002). Potentially harmful chemicals in plastics are not readily adsorbed to marine sediments; instead, marine fishes would be most at risk via ingestion or bioaccumulation. Humpback whale prey species could be indirectly impacted by chemicals from plastics but, absent bioaccumulation, these impacts would be limited to direct contact with the material. In addition, as discussed in Section 4.4.5.2, ingestion of materials by humpback whale prey species is very unlikely. Because of these conditions, population-level impacts attributable to expended materials are likely to be insignificant and not detectable.

4.4.5.4 Conclusion

Given the frequency and short duration of the launch events and the relatively large number of prey items available throughout the critical habitat, we conclude that any impacts resulting from the Proposed Action on prey availability for the humpback whale would be discountable. In summary, although debris strike may result in injury and mortality to humpback whale prey species within critical habitat units, there would be no measurable impact on the occurrence of prey species of sufficient condition, distribution, diversity, abundance, and density necessary to support individual, as well as population growth, reproduction, and development of the Central America and Mexico DPSs. The effects of each potential stressor analyzed on the humpback whale prey species were found to be discountable. Therefore, the USSF has determined that the proposed action may affect, but is not likely to adversely affect critical habitat for the Central America and Mexico DPSs of humpback whales.

4.4.6 Cumulative Effects

Cumulative effects on ESA-listed marine mammals are those effects of future state or private activities, not involving federal activities, which are reasonably certain to occur within the Action Area (50 C.F.R. Section 402.02). For the purposed of this BA and cumulative effects analysis for ESA-listed marine mammals, the USSF identified broad categories of activities, including commercial fishing and harvest (including bycatch, hunting, and entanglement), maritime traffic and vessel strikes, ocean pollution, ocean noise, maritime debris, and ingestions. Any impacts that might occur could be additive to behavioral disturbance, injury and mortality associated with other actions within the Action Area. Therefore, this section evaluates risks posed by non-federal activities in the Action Area that could result in cumulative adverse effects on ESA-listed marine mammals.

If the health of an individual marine mammal were compromised, it is possible this condition could alter the animal's expected response to stressors associated with the Proposed Action. The behavioral and physiological responses of any marine mammal to a potential stressor, such as underwater sound, could be influenced by various factors, including disease, dietary stress, body burden of toxic chemicals, energetic stress, percentage body fat, age, reproductive state, and social position. Synergistic impacts are also possible; for example, animals exposed to some chemicals may be more susceptible to noise-induced loss of hearing (Fechter & Pouyatos 2005). While the response of a previously stressed animal might be different from the response of an unstressed animal, no data are available at this time that accurately predict how stress caused by various ocean pollutants would alter a marine mammal's response to stressors associated with the Proposed Action.

The Proposed Action could contribute incremental stressors to individuals, which would both further compound effects on a given individual already experiencing stress and in turn has the potential to further stress populations in significant decline or those that exhibit positive recovery trends within the Action Area. Although the aggregate impacts of past, present, and other reasonably foreseeable future actions continue to have significant impacts on ESA-listed marine mammals in the Action Area, the Proposed Action would be insignificant and is not likely to incrementally contribute to declines in ESA-listed marine mammal populations, reverse positive trends some marine mammals, or alter distributions of ESA-listed marine mammals.

5 Determination of Effects

Table 5.1-1 presents the DAF's overall effects determinations for ESA-listed species analyzed in this BA.

Table 5.1-1: Overall Species Effect Determinations Under the Proposed Action

Common Name	Distinct Population Segment or Evolutionarily Significant Units	ESA Status	Effect Determination
Steelhead	Southern California Coast	FE	NLAA
Chinook salmon	4 ESUs[1]	FT	NLAA
Coho salmon	2 ESUs[3]	FT	NLAA
Green sturgeon	Southern	FT	NLAA
Oceanic whitetip shark	-	FT	NLAA
Scalloped hammerhead shark	Eastern Pacific	FE	NLAA
Green sea turtle	East Pacific	FT	NLAA
Leatherback sea turtle	-	FE	NLAA
Olive ridley sea turtle	Mexico Pacific coast	FE	NLAA
Hawksbill sea turtle	-	FE	NLAA
Loggerhead turtle	North Pacific	FE	NLAA
Blue whale	-	FE	NLAA
Fin whale	-	FE	NLAA
Gray whale	Western North Pacific	FE	NLAA
Humpback whale	Mexico	FT	NLAA
	Central America	FE	
Humpback whale critical habitat	Mexico/Central America DPS	-	NLAA
Killer whale	Southern Resident	FE	NLAA
Sei whale	-	FE	NLAA
Sperm whale	-	FE	NLAA
Guadalupe fur seal	-	FT	NLAA

[1] Chinook salmon ESUs include California Coastal (FT), Central Valley Spring-Run (FT), Lower Columbia River (FT), and Sacramento River Winter-Run (FT)

[2] Coho salmon ESUs include Central California Coast (FT) and Southern Oregon and Northern California Coasts (FT).

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

January 20, 2023

Refer to NMFS No: WCRO-2023-00002

Beatrice L. Kephart
Chief, Installation Management Flight
30 CES/CEI
1028 Iceland Avenue
Vandenberg AFC, California 93437

Re: Endangered Species Act Section 7(a)(2) Concurrence Letter for increasing number of launches at the Vandenberg Space Force Base

Dear Mr. Kephart:

This letter responds to your December 19, 2022, request for concurrence from the National Marine Fisheries Service (NMFS) pursuant to Section 7 of the Endangered Species Act (ESA) for the subject action. Your request qualified for our expedited review and concurrence because it contained all required information on your proposed action and its potential effects to listed species and designated critical habitat.

We reviewed United States Space Force's consultation request document and related materials. Based on our knowledge, expertise, and your action agency's materials, we concur with the action agency's conclusions that the proposed action is not likely to adversely affect the NMFS ESA-listed species and/or designated critical habitat.

This letter underwent pre-dissemination review using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The concurrence letter will be available through NMFS' Environmental Consultation Organizer [https://appscloud.fisheries.noaa.gov]. A complete record of this consultation is on file at the NMFS Long Beach office.

Reinitiation of consultation is required and shall be requested by the United States Space Force or by NMFS, where discretionary Federal involvement or control over the action has been retained or is authorized by law and (1) the proposed action causes take; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the written concurrence; or (4) a new species is listed or critical habitat designated that may be affected by the identified action (50 CFR 402.16).

This concludes the ESA consultation.

Please direct questions regarding this letter to Chiharu Mori at Chiharu.Mori@noaa.gov.

Sincerely,

Dan Lawson
Long Beach Branch Chief
Protected Resource Division

cc: Rhys Evans, VAFB, rhys.evans@spaceforce.mil

Administrative Record Number: 151422WCR2023PR00013

Letter of Authorization

The 30th Space Wing, U.S. Air Force (USAF), is hereby authorized to take marine mammals incidental to those activities at Vandenberg Air Force Base (VAFB), California, in accordance with 50 CFR 217, Subpart G--Taking Of Marine Mammals Incidental To Rocket and Missile Launches and Aircraft Operations at Vandenberg Air Force Base (VAFB), California subject to the provisions of the Marine Mammal Protection Act (16 U.S.C. 1361 *et seq.*; MMPA) and the following conditions:

1. This Letter of Authorization (LOA) is valid for five years from the date signed.

2. This Authorization is valid only for rocket, missile, and aircraft activities activities at VAFB, California.

3. General Conditions

    (a) A copy of this LOA must be in the possession of the USAF, its designees, and personnel operating under the authority of this LOA.

    (b) The species authorized for taking by incidental harassment are: Pacific harbor seals (*Phoca vitulina richardsi*); California sea lions (*Zalophus californianus)*; northern elephant seals (*Mirounga angustirostris*); northern fur seals (*Callorhinus ursinus*); Guadalupe fur seals (*Arctocephalus philippii townsendi*); and Steller sea lions (*Eumetopias jubatus*).

    (c) The taking, by Level B harassment only, is limited to the species listed in condition 3(b). See Table 1 (attached) for numbers of take authorized.

    (d) The taking by injury (Level A harassment), serious injury, or death of any of the species listed in condition 3(b) of the Authorization or any taking of any other species of marine mammal is prohibited and may result in the modification, suspension, or revocation of this LOA.

4. The following activities are authorized to take, by incidental harassment only, the species of marine mammals identified in condition 3(b) above and will take place at space launch complexes, launch facilities, and test pads on VAFB:

    (a) Launching of no more than 15 missiles annually;

    (b) Launching of no more than 110 rockets annually;

    (c) Recoveries of no more than 12 Falcon 9 rockets annually;

(d) Unmanned aerial systems (UAS) operations.

5. Mitigation Measures. Unless constrained by human safety or national security the holder of this Authorization is required to implement the following mitigation measures:

   (a) Rocket launches must be scheduled to avoid launches which are predicted to produce a sonic boom on the Northern Channel Islands during the harbor seal pupping season of March through June, whenever possible.

   (b) Aircraft and helicopter flight paths must maintain a minimum distance of 1,000 ft (305 m) from recognized pinniped haulouts and rookeries whenever possible, except for one area near the VAFB harbor over which aircraft may be flown to within 500 ft of a haulout, and except in emergencies or for real-time security incidents.

   (c) For UAS, except during take-off and landing, the following minimum altitudes must be maintained over all known marine mammal haulouts when marine mammals are present: Class 0-2 UAS must maintain a minimum altitude of 300 feet; Class 3 UAS must maintain a minimum altitude of 500 feet; Class 4 or 5 UAS must not be flown below 1,000 feet.

   (d) If any incident of injury or mortality of a marine mammal discovered during post-launch surveys or indications of affects to the distribution, size, or productivity of the affected pinniped populations as a result of the authorized activities are thought to have occurred, launch procedures and monitoring methods must be reviewed, in cooperation with NMFS, If necessary, appropriate changes must be made through modification to this Authorization prior to conducting the next launch of the same vehicle.

6. Monitoring. The holder of this Authorization is required to conduct marine mammal monitoring and to conduct acoustic monitoring as described below:

   (a) The USAF must either use video recording, or, must designate a qualified on-site individual approved in advance by NMFS, with demonstrated proficiency in the identification of all age and sex classes of both common and uncommon pinniped species found at VAFB and the Northern Channel Islands and knowledge of approved count methodology and experience in observing pinniped behavior, to monitor and document pinniped activity as described in 6(b) through 6(k).

   (b) For any launches of space launch vehicles or recoveries of the Falcon 9 First Stage occurring from January 1 through July 31, pinniped activity at VAFB must be monitored in the vicinity of the haulout nearest the launch platform, or, in the absence of pinnipeds at that location, at another nearby haulout, for at least 72 hours prior to any planned launch, and continue for a period of time not less than 48 hours subsequent to the launch and/or recovery.

(c) For any launches of new space launch vehicles that have not been monitored during at least three previous launches occurring from August 1 through December 31, pinniped activity at VAFB must be monitored in the vicinity of the haulout nearest the launch or landing platform, or, in the absence of pinnipeds at that location, at another nearby haulout, for at least 72 hours prior to any planned launch, and continue for a period of time not less than 48 hours subsequent to launching.

(d) For any launches of existing space launch vehicles that are expected to result in a louder launch noise or sonic boom than previous launches of the same vehicle type occurring from August 1 through December 31, pinniped activity at VAFB must be monitored in the vicinity of the haulout nearest the launch or landing platform, or, in the absence of pinnipeds at that location, at another nearby haulout, for at least 72 hours prior to any planned launch, and continue for a period of time not less than 48 hours subsequent to launching.

(e) For any launches of new types of missiles occurring from August 1 through December 31, pinniped activity at VAFB must be monitored in the vicinity of the haulout nearest the launch or landing platform, or, in the absence of pinnipeds at that location, at another nearby haulout, for at least 72 hours prior to any planned launch, and continue for a period of time not less than 48 hours subsequent to launching.

(f) For any recoveries of the Falcon 9 First Stage occurring from August 1 through December 31 that are predicted to result in a sonic boom of 1.0 pounds per square foot (psf) or above at VAFB, pinniped activity at VAFB must be monitored in the vicinity of the haulout nearest the launch or landing platform, or, in the absence of pinnipeds at that location, at another nearby haulout, for at least 72 hours prior to any planned launch, and continue for a period of time not less than 48 hours subsequent to launching.

(g) For any launches or Falcon 9 First Stage recoveries occurring from January 1 through July 31, follow-up surveys must be conducted within two weeks of the launch.

(h) For any launches or Falcon 9 First Stage recoveries, if it is determined by modeling that a sonic boom of greater than 2.0 psf is predicted to impact one of the Northern Channel Islands between March 1 and July 31, greater than 3.0 psf between August 1 and September 30, and greater than 4.0 psf between October 1 and February 28, pinniped activity at the Northern Channel Islands must be monitored. Monitoring must be conducted at the haulout site closest to the predicted sonic boom impact area, or, in the absence of pinnipeds at that location, at another nearby haulout.

(i) Marine mammal monitoring must include multiple surveys each day that record the species, number of animals, general behavior, presence of pups, age class, gender and reaction to launch noise, sonic booms or other natural or human caused disturbances, in addition to environmental conditions such as tide, wind speed, air temperature, and swell.

(j) Marine mammal monitoring of activities that occur during darkness at VAFB must include night video monitoring, when feasible.

(k) For any launches or Falcon 9 First Stage recoveries for which marine mammal monitoring is required, acoustic measurements must also be made.

7. Reporting. The holder of this Authorization is required to:

(a) Submit a report to the Office of Protected Resources, NMFS, and West Coast Regional Administrator, NMFS, within 90 days after each monitored rocket launch, missile launch or rocket recovery. This report must contain the following information:

i. Date(s) and time(s) of the launch,

ii. Design of the monitoring program, and

iii. Results of the monitoring program, including, but not necessarily limited to:

A. Numbers of pinnipeds present on the haulout prior to commencement of the launch.

B. Numbers of pinnipeds that may have been harassed, as noted by the number of pinnipeds estimated to have moved greater than two times the animal's body length, or, if the animal was already moving and changed direction and/or speed, or, if the animal flushed from land into the water in response to launch noise or sonic boom.

C. For any marine mammals that entered the water, the length of time those animals remained off the haulout.

D. Description of observed behavioral modifications by pinnipeds that were likely the result of launch noise or the sonic boom.

E. Results of acoustic monitoring, including the intensity of any sonic boom (psf) and sound levels in SELs, SPL_{peak} and SPL_{rms}.

(b) Submit a draft annual report to the Permits and Conservation Division, Office of Protected Resources, NMFS at 1315 East-West Highway, Silver Spring, MD

20910 and the Assistant Regional Administrator, West Coast Region, NMFS. This report must contain detailed information on the following:

i. Date(s) and time(s) of each missile and rocket launch and/or recovery.

ii. Design of the monitoring program;

iii. Results of the monitoring programs described under conditions 7(a)iii including the following:

   A. Dates and times of all monitoring activities;

   B. Details of all marine mammal sightings, including the number of pinnipeds, by species and haulout location, that remained ashore and/or fled from the beach in response to authorized activities;

   C. The number of marine mammals, by species, returned to the haulout subsequent to the disruption (including estimates of the time it took for pinnipeds to return to haulouts), and estimates of the amount and nature of all instances of harassment; and

   D. Information on the weather, including tidal state and horizontal visibility.

   E. Date(s) and location(s) of any research activities related to monitoring the effects of launch noise and sonic booms on marine mammal populations; and

   F. A summary of observed effects of UAS operations on marine mammals at VAFB.

(c) Submit a final annual report, within 60 days of receipt of any recommendations made by NMFS following review of the draft annual report by the Permits and Conservation Division, Office of Protected Resources, NMFS.

(d) Submit a draft comprehensive report to the Permits and Conservation Division, Office of Protected Resources, NMFS at 1315 East-West Highway, Silver Spring, MD 20910 and the Assistant Regional Administrator, West Coast Region, NMFS, at least 180 days prior to the expiration of the current regulations. This report must:

i. Summarize the activities undertaken and the results reported in all previous reports;

ii. Assess the impacts at each of the major rookeries;

iii. Assess the cumulative impacts on pinnipeds and other marine mammals from VAFB activities; and

iv. State the date(s), location(s), and findings of any research activities related to monitoring the effects of launch noise and sonic booms on marine mammal populations.

(e) Submit a final comprehensive report, within 60 days of receipt of any recommendations made by NMFS following review of the draft comprehensive report by the Permits and Conservation Division, Office of Protected Resources, NMFS, and the West Coast Regional Administrator, NMFS.

(f) Reporting of injured or dead marine mammals:

i. In the event that the specified activity clearly causes the take of a marine mammal in a manner not authorized by this LOA, such as serious injury or mortality, the USAF shall immediately cease the specified activities and immediately report the incident to the NMFS Office of Protected Resources ((301) 427-8401) and the NMFS West Coast regional stranding coordinator ((562) 980-3230). The report must include the following information:
   A. Time, date, and location (latitude/longitude) of the incident;
   B. Description of the incident;
   C. Status of all sound source use in the 24 hours preceding the incident;
   D. Environmental conditions (*e.g.*, wind speed and direction, cloud cover, and visibility);
   E. Description of all marine mammal observations in the 24 hours preceding the incident;
   F. Species identification or description of the animal(s) involved;
   G. Fate of the animal(s); and
   H. Photographs or video footage of the animal(s).

   Activities shall not resume until NMFS is able to review the circumstances of the prohibited take. NMFS will work with the USAF to determine what measures are necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. The USAF may not resume their activities until notified by NMFS.

ii. In the event that the USAF discovers an injured or dead marine mammal, and determines that the cause of the injury or death is unknown and the death is relatively recent (*e.g.*, in less than a moderate state of decomposition), the USAF shall immediately report the incident to the NMFS Office of Protected Resources ((301) 427-8401) and the NMFS West Coast regional stranding coordinator ((562) 980-3230). The report must include the same information identified in condition 7(f)(i) of this LOA. Activities may continue while NMFS reviews the circumstances of the incident. NMFS will work with the USAF to determine whether additional mitigation measures or modifications to the activities are appropriate.

iii. In the event that the USAF discovers an injured or dead marine mammal, and determines that the injury or death is not associated with or related to the specified activities (*e.g.*, previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), the USAF shall report the incident to the NMFS Office of Protected Resources ((301) 427-8401) and the NMFS West Coast regional stranding coordinator ((562) 980-3230), within 24 hours of the discovery. The USAF shall provide photographs, video footage or other documentation of the sighting to NMFS.

8. This Authorization may be modified, suspended or withdrawn if the USAF fails to abide by the conditions prescribed herein or if the authorized taking is having more than a negligible impact on the species or stock of affected marine mammals.

Donna S. Wieting, Director
Office of Protected Resources

APR 10 2019

Date

Table 1. Numbers of takes authorized annually.

Species (stock)	2019	2020	2021	2022	2023	2024
Harbor seal	19,524	22,733	27,652	35,466	43,489	16,742
California sea lion	28,187	36,019	51,307	63,805	83,385	21,756
Northern elephant seal	4,170	5,283	7,434	9,253	12,036	5,481
Steller Sea Lion	134	168	221	302	387	105
Northern fur seal	1,190	1,530	2,210	2,721	3,571	26
Guadalupe fur seal	46	59	85	104	137	36

APPENDIX C
State Historic Preservation Office & Native American Tribal Consultations

Cultural Resource Investigations Supporting Section 106 Compliance for the Space Launch Complex 5 Phantom Space Project, Vandenberg Space Force Base, Santa Barbara County, California

VSFB Project ID: 813-21-052CR

Alex E. Morrison

with contributions by

Chantal Cagle, Joyce L. Gerber, Clayton G. Lebow, and Eric S. Nocerino

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April 2022

EXECUTIVE SUMMARY

On behalf of Phantom Space Corporation (Phantom), ManTech SRS Technologies, Inc. (ManTech) retained Applied EarthWorks, Inc. (Æ) to provide cultural resources support for the proposed Phantom Space Project (Project) on Vandenberg Space Force Base (SFB) in Santa Barbara County, California. Phantom proposes to construct a completely new orbital launch site (OLS) for operation of the Daytona-E and Laguna-E launch programs. The OLS would be built on an undeveloped area in the southern portion of Vandenberg SFB in Santa Barbara County, California. The proposed launch site was historically occupied by Space Launch Complex 5 (SLC)-5, which was previously demolished to bare earth around 2012, except for access roads, which still connect the site to Coast Road, a main thoroughfare

Because the Project is on federal property, it is an undertaking as defined in 36 CFR 800.16(y) and thus is subject to Section 106 of the National Historic Preservation Act of 1966 (as amended). Additionally, the Federal Aviation Administration (FAA) expects to receive an application from Phantom Space Corporation to conduct commercial launches at the launch site, and the FAA's proposed issuance of a launch license is also considered an undertaking as defined in 36 CFR 800.16(y). To support Section 106 compliance for the launch operations phase of the Project, Æ used a noise and vibration study prepared by ManTech in 2022 to assess Project effects on historic properties.

Based on information provided by Phantom Space Corporation and guidance from Vandenberg SFB, Æ defined the Area of Direct Impacts (ADI) as the footprint for all foreseeable project-related ground-disturbing activities, including launch pads and related infrastructure; the utility corridor; and roads, firebreaks, and vegetation management areas. The Area of Potential Effects (APE) is defined as the ADI plus the entirety of any cultural resources it contains or intersects. The APE for this Project also includes a nearly 3,200-foot radius around the proposed launch facility for noise vibration levels above 120 decibel (dB) and a sonic boom arc that would occur during launches and produce ground-level vibrations of 2 pounds per square foot (psf) or greater over open ocean. These are the lowest noise and vibration levels with the potential to affect certain types of historic buildings and rock walls or rock cairns, rock shelters, or rock art. Although the Project proposes to launch both the Daytona-E and Laguna-E vehicles, the Laguna-E would produce more noise and vibration than the Daytona-E. Therefore, the Laguna-E noise study results are used for this analysis and to define the APE.

Background research confirmed that no historic buildings or rock cairn, rock shelter, or rock art resources are within the 120-dB Laguna-E launch noise contour. One structure, the Honda Trestle, is within the 120-dB Laguna-E launch noise contour. Like military or launch support facilities, the railroad trestle was built to withstand concussive forces; thus, this structure does not have the potential to be adversely affected by rocket engine noise. Similarly, the Anza Trail (CA-SBA-3804) is within the launch noise contour but does not have any physical manifestation and therefore does not have the potential to be affected by rocket engine noise. Additionally, the 2-psf sonic boom arc would not occur over land. Thus, neither the Anza Trail nor the Honda Trestle are included in the APE; rather, the focus of this report is the ADI and APE related to the area of physical impacts.

Background research revealed that four archaeological sites (CA-SBA-538, -670, -2230, and -2934) were previously recorded within the ADI. CA-SBA-670 was previously determined eligible for the National Register of Historic Places (NRHP) (Keeper Letter E.O.11593). CA-SBA-538 and CA-SBA-2230 were previously determined ineligible for the NRHP (USAF110418A). The NRHP eligibility of CA-SBA-2934 was unevaluated prior to the current study.

For the current study, Æ performed a surface survey within the facility component of the ADI. Surface survey found one isolated artifact (VAFB-ISO-1049) near the Project but outside the APE. Additionally, Æ completed subsurface survey of the ADI except the areas where demolition of the previous SLC-5 facility, prior grading, and/or very steep topography precluded the presence of intact sites. Æ also tested to evaluate the eligibility of CA-SBA-2934; check for subsurface deposits near isolated artifact VAFB-ISO-1049; and check for subsurface deposits at three previously identified isolate locations near the Project but outside the APE (VAFB-ISO-258, -259, and -700). In consultation with Vandenberg SFB cultural resources personnel, no testing was performed in the portion of NRHP-eligible CA-SBA-670 within the ADI because Project activities within this site would be limited to clearing vegetation from the existing pavement.

Table E-1 summarizes the results of Æ's work. Briefly, surface and subsurface survey identified no previously unrecorded archaeological sites and one new isolated artifact. Subsurface survey revealed that, likely due to ground disturbance associated with the demolition of SLC-5, CA-SBA-2934 is no longer present. Subsurface testing also confirmed that all of the isolated artifacts are truly isolated and not part of archaeological sites. In summary, testing for the Phantom project did not yield any archaeological materials. With installation of protective fencing to ensure that Project activities do not leave the paved road through CA-SBA-670, the Project would have no adverse effect on historic properties.

Table E-1
Phantom Project Section 106 Study Results

Resource No.	Status	Project Element	Summary of Results
CA-SBA-538	Previously determined ineligible for the NRHP (USAF110418A)	Launch Site	No effect
CA-SBA-670	Previously determined eligible for the NRHP (Keeper Letter E.O.11593)	Honda Canyon Road (west end)	No adverse effect
CA-SBA-2230	Previously determined ineligible for the NRHP (USAF110418A)	Launch Site	No effect
CA-SBA-2934	Previously unevaluated; evaluated and recommended not eligible for the NRHP in this document	Launch Site	No effect
VAFB-ISO-258	Previously recorded isolated artifact; testing for Project confirms isolate status	N/A; north of Delphy Road	No effect
VAFB-ISO-259	Previously recorded isolated artifact; testing for Project confirms isolate status	N/A; north of Delphy Road	No effect
VAFB-ISO-700	Previously recorded isolated artifact; testing for Project confirms isolate status	N/A; east of Ladd Road	No effect
AE-ISO-4232-001	Isolated artifact discovered during current Project; testing confirms isolate status	N/A; south of Delphy Road	No effect

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ACKNOWLEDGMENTS

We would like to thank Vandenberg SFB Cultural Resource Manager Christopher Ryan for his assistance in guiding the cultural resources study for this Project and acknowledge Æ Production Manager Susan Rapp for her invaluable assistance during the preparation of this report. This study could not have been completed without the effort of Æ principal investigator Eric Nocerino; field supervisor Karin Pitts-Olmedo; and archaeologists Alexandria Bulato, Nathan Cruz, Rachel Irwin, Michelle Newcomb, Robert Newcomb, Lance Nielson, Ariel Ostroff, Dana Taggart, and Michelle Villalba. Thank you to the Santa Ynez Band of Chumash Indians for monitoring support provided by Andrew Mendoza and Raymond Padilla. Finally, we are grateful to ManTech SRS Technologies for giving Æ the opportunity to contribute to this Project.

1
INTRODUCTION

ManTech SRS Technologies, Inc. (ManTech) retained Applied EarthWorks, Inc. (Æ) to provide cultural resources support for the proposed Space Launch Complex 5 Phantom Space Project (Project) on south Vandenberg Space Force Base (SFB) in Santa Barbara County, California (Figures 1-1–1-3). The Project is on federal property, and it is therefore considered to be an undertaking as defined in 36 CFR 800.16(y) and is subject to Section 106 of the National Historic Preservation Act of 1966 (as amended). Additionally, the Federal Aviation Administration (FAA) expects to receive an application from Phantom Space Corporation (Phantom) to conduct commercial launches at the launch site. The FAA's proposed issuance of a launch license is also considered an undertaking as defined in 36 CFR 800.16(y). This report is intended to support U.S. Space Force and FAA compliance with Section 106 for the Project.

Figure 1-1 Overview of the Phantom project area, taken from the north side of the looped terminus of Delphy Road, facing east. Honda Canyon is at the far right of the frame.

To support Section 106 compliance for the construction phase of the Project, Æ completed background research to identify known cultural resources; surface and subsurface survey to identify previously unknown cultural resources; testing to investigate isolated artifacts and to evaluate the eligibility of one site for the National Register of Historic Places (NRHP); and assessment of Project effects on historic properties. To support Section 106 compliance for the launch operations phase of the Project, Æ used a noise and vibration study provided by ManTech (LaBonte and Wolski 2022) to assess Project effects on historic properties.

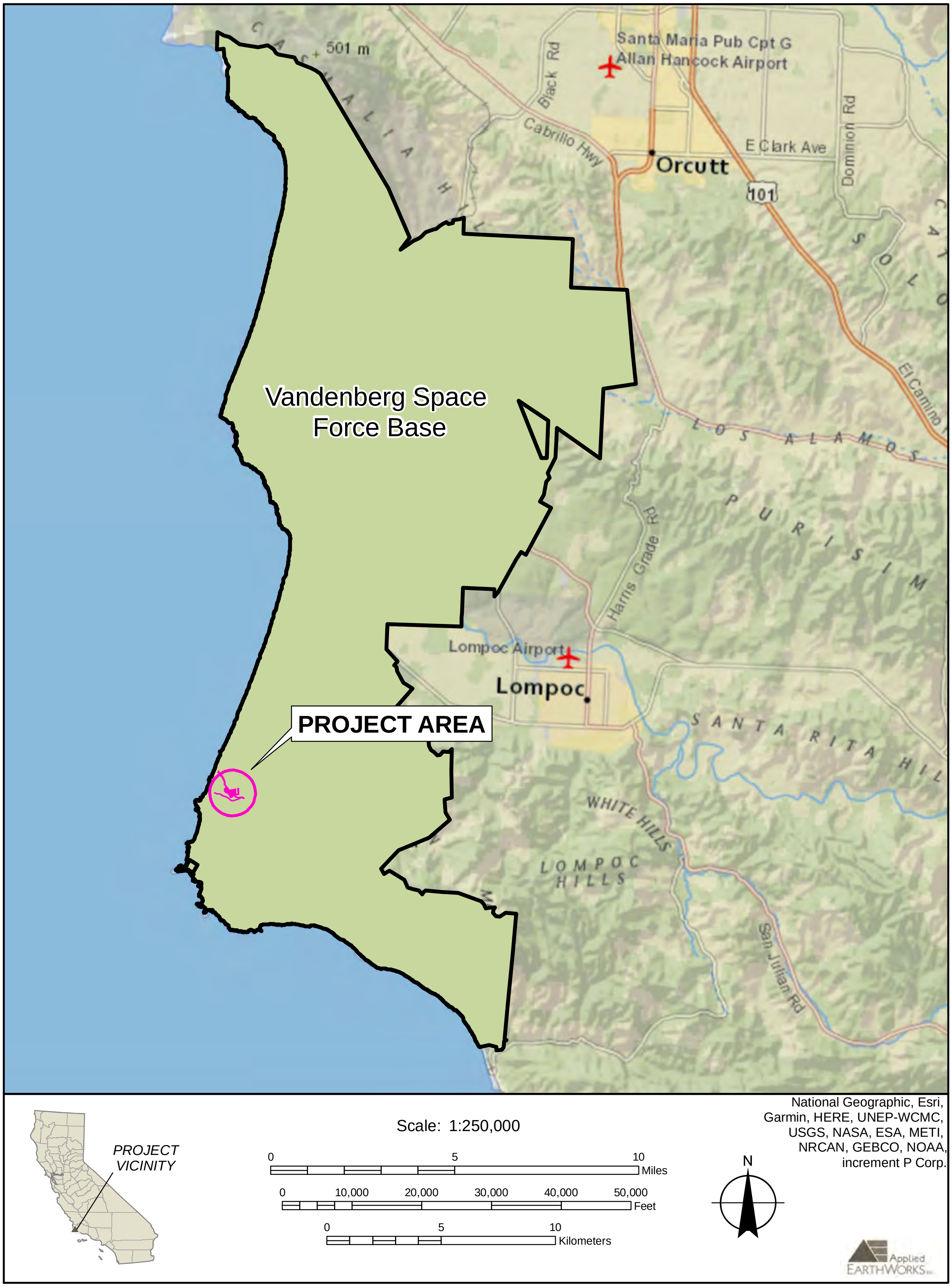

Figure 1-2 Project vicinity in Vandenberg Space Force Base, California.

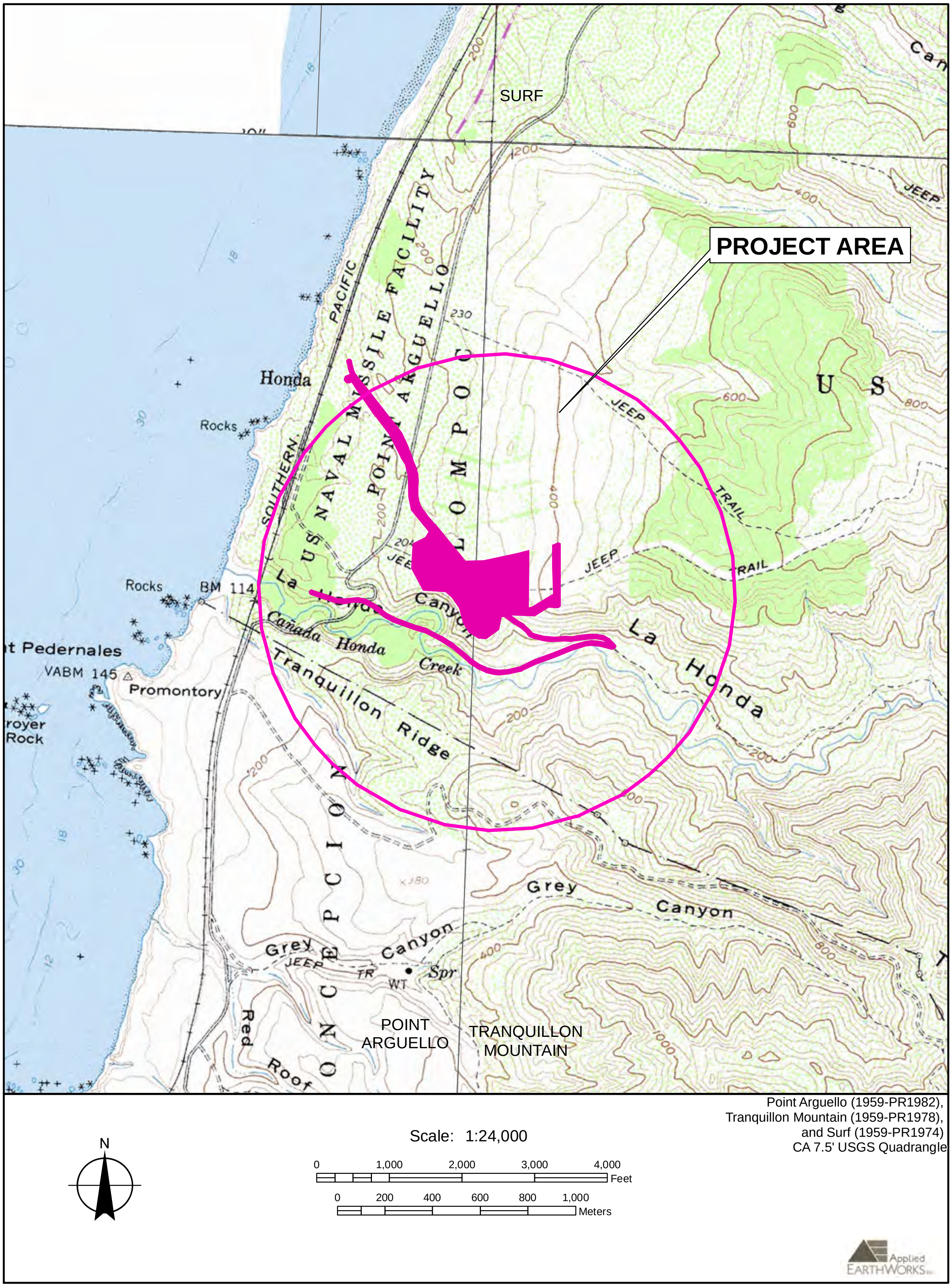

Figure 1-3 Project area on the Point Arguello and Tranquillon Mountain 7.5-minute quadrangles.

Descriptions of the proposed Project, scope and purpose of the current study, and organization of this report are provided below.

1.1 PROJECT DESCRIPTION

Phantom proposes to construct a completely new orbital launch site (OLS) for operation of the Daytona-E and Laguna-E launch programs. The OLS would be built on an undeveloped area in the southern portion of Vandenberg SFB in Santa Barbara County, California. The proposed launch site was historically occupied by Space Launch Complex 5 (SLC-5), which was demolished to bare earth around 2012, except for access roads, which still connect the site to Coast Road, a main thoroughfare.

The following project description is excerpted from the draft Description of Proposed Action and Alternatives for the Phantom Space Corporation Daytona-E and Laguna-E Launch Operations at Space Launch Complex 5, Vandenberg Space Force Base, California, dated November 23, 2021 (ManTech SRS Technologies 2021).

The SLC-5 launch site was used by NASA between 1962 and 1994 to launch Scout space launch vehicles. Upon completion of the Scout program in 1994, all facilities at SLC-5 were deactivated and then demolished between 2009 and 2012. Although prior infrastructure supporting the Scout launch program at SLC-5 was demolished and removed, additional demolition may be required if any remaining structures or materials are encountered during construction. Required infrastructure improvements to be completed during the construction phase of the Project are discussed below and shown in Figure 1-4. A description of the launch operations phase of the Project is also provided below, with noise and vibration contours shown in Figures 1-4 and 1-5.

1.1.1 Launch Site

The OLS facility footprint is an irregular polygon that measures 1,600 feet long (east–west) by 1,000 feet wide (north–south). The Project would include the construction of two new, approximately 1,500 square-foot concrete launch pads designated as SLC-5E and SLC-5W. An approximately 12 by 12 foot launch stool would be installed at each pad. Under each launch stool, an approximately 12.5-foot-deep flame deflector would be constructed that curves from vertical to horizontal to redirect at least 150,000 pounds of thrust and has the ability to contain up to 8,000 gallons of water deluge. Each deflector would have a short tunnel that would exit into an approximately 32-foot-wide by 52-foot-long by 2-foot-deep water deluge containment basin. After each launch, any contaminated water would be pumped and disposed of. Uncontaminated water would be discharged to an infiltration area or spray field. In addition to the pads, Phantom would construct a 7,500-square-foot horizontal integration facility and an instrumentation site. During launch operations, mobile trailers would supply fuel to on-site ground support equipment stationed over concrete surfaces approximately 150 feet from either launch pad. The total anticipated area of disturbance for construction of the OLS will be approximately 21 acres.

The entire SLC-5 complex would be secured by perimeter fencing generally comprised of 7-foot-tall chain link fence with 1-foot outriggers and three-strand barbed wire. Approximately 36 light poles would be installed around the perimeter of SLC-5 for security and support of night operations. The light poles would have a maximum height of 40 feet and be placed in holes dug down to approximately 20 feet below the surface.

1.1.2 Utility Corridor

New electrical power, fiber communication, water, and sewer lines would be extended from existing sources to SLC-5 within a 2,800-foot-long utility corridor. These utilities would be installed within the footprint of Delphy Road or within a 100-foot-wide utility corridor immediately south of the road. Electrical and fiber communication lines would be buried within this utility corridor or the road to establish new service connections at the launch complex.

1.1.3 Roads, Firebreaks, and Vegetation Management Areas

In total, 4,100 linear feet of firebreaks are proposed. Honda Canyon Road (26 feet wide), Avery Road (18 feet wide), and Ladd Road (10 feet wide) will also serve as firebreaks and fire access roads. During initial site clearing for launch site development, woody vegetation would be removed using a masticator, chainsaws, or similar equipment. Paved access roads would be installed between the pads and the support facilities. Delphy Road, which connects SLC-5 to Surf Road and Coast Road, is in fair condition but would require repairs, including repaving. Firebreaks 100 feet in width would be established along the western, southern, and eastern perimeter of SLC-5. Avery and Ladd roads to the north and northeast of the launch site would serve as firebreaks and fire access roads but would require repairs to meet fire-safety requirements. Removal of vegetation that has grown over and onto Honda Canyon Road, a decommissioned road south of SLC-5, as well an approximately 1,800-foot-long abandoned former access road connecting Honda Canyon Road to the SLC-5 site, also will be required. Vegetation on and along these roads would be cut regularly to enable emergency access for fire equipment. Routine maintenance would also be conducted by periodic discing or mowing along and within the fence line and along the firebreaks.

1.1.4 Launch Operations

Phantom proposes to launch its Daytona-E and Laguna-E vehicles from new launch pads developed at SLC-5 on Vandenberg SFB. To characterize the effects of potential launch engine noise and sonic booms on the surrounding environment, ManTech used RUMBLE v2.0, a launch vehicle acoustic simulation model, and PCBoom v4.99, a sonic boom modeling program, to predict the noise levels, peak overpressures, and affected geographic areas from the proposed launches of the Daytona-E and Laguna-E vehicles from Vandenberg SFB. The study assumed up to 48 launches and 48 static fire operations at SLC-5 per year.

At the direction of Vandenberg SFB, the 120 decibel (dB) noise and 2 pounds per square foot (psf) pressure contours are used as the areas within which a launch could have adverse effects to eligible rock art or built resources. Using the maximum sound level (Lmax) sound contour and the sonic boom overpressure threshold from the noise study (LaBonte and Wolski 2022), ManTech provided Æ with ArcGIS shapefiles depicting the 120-dB noise contours for static fire engine tests and launches (Figures 1-4 and 1-5). Note that the sonic boom overpressure threshold for the proposed launches, which is separate from the launch noise 120-dB contour, does not exceed 1.5 psf and occurs over the Pacific Ocean entirely away from land.

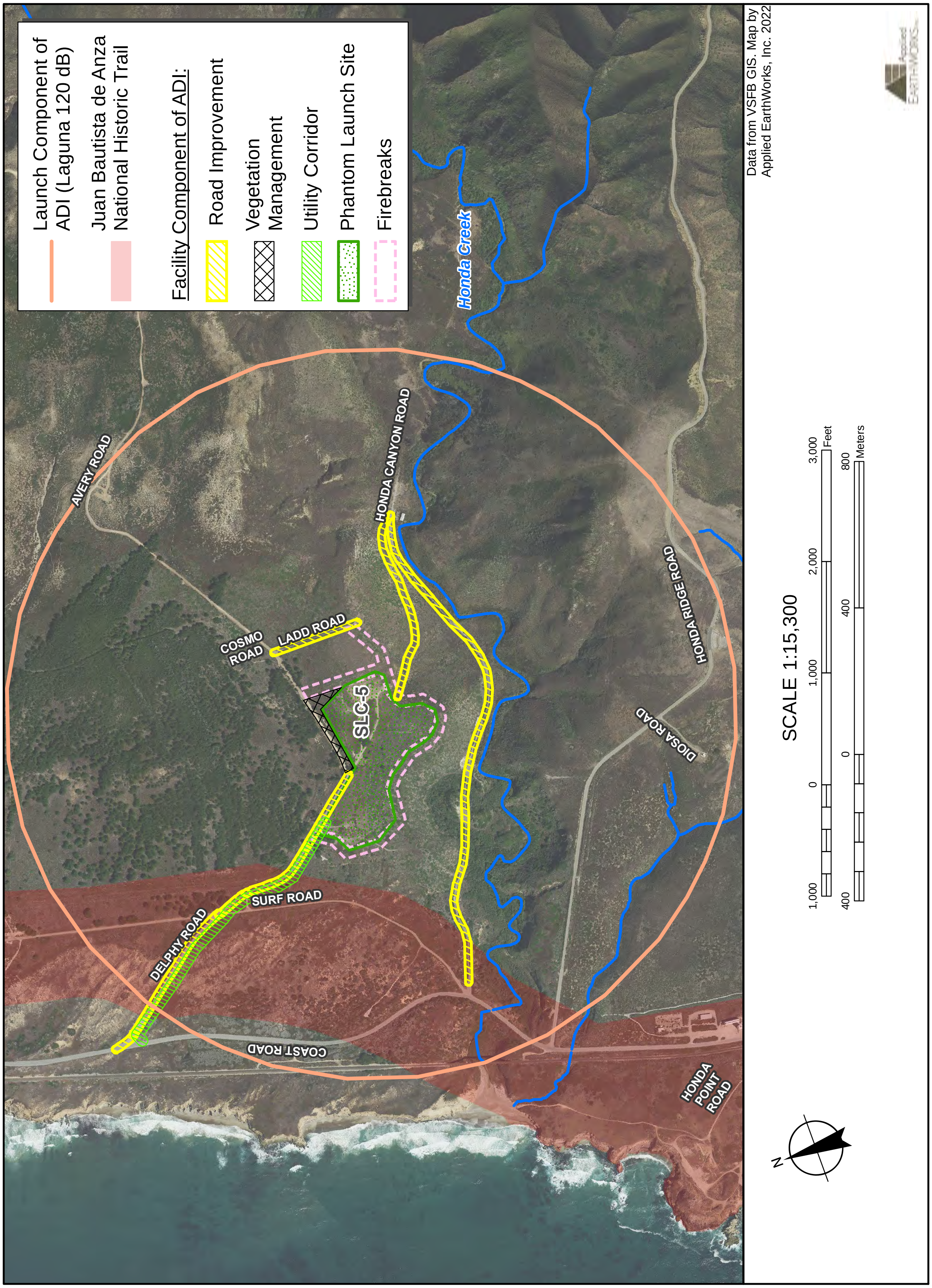

Figure 1-4 Aerial view of the ADI.

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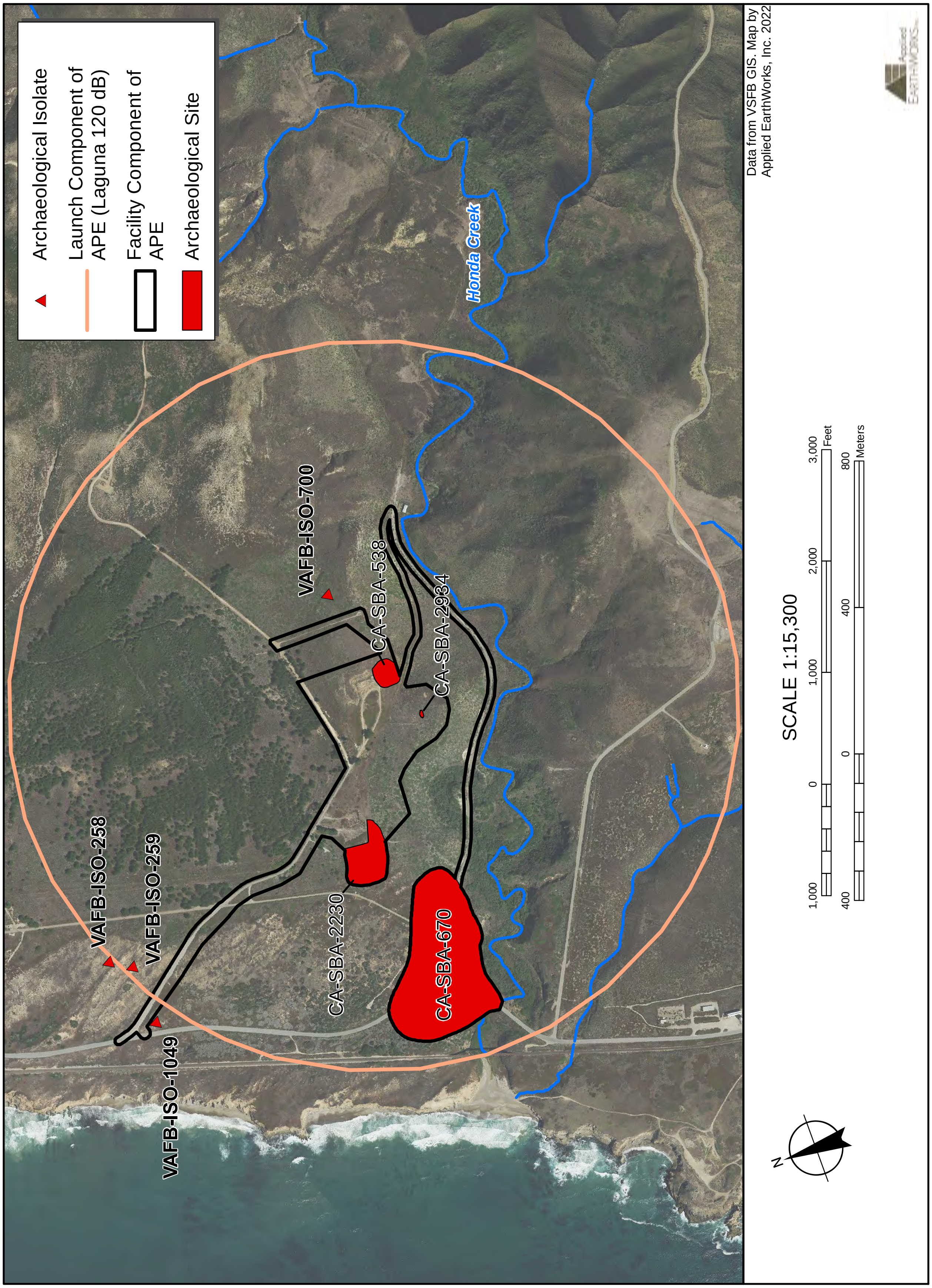

Figure 1-5 Aerial view of the APE.

1.1.5 Definition of the Area of Direct Impacts and Area of Potential Effects

Based on information provided by Phantom Space Corporation and guidance from Vandenberg SFB, Æ defined the Area of Direct Impacts (ADI) as the footprint for all foreseeable project-related ground-disturbing activities, including launch pads and related infrastructure; the utility corridor; and roads, firebreaks, and vegetation management areas (Figure 1-4). Together, the ADI components (launch site, utility corridor, roads, firebreaks, and vegetation management areas) total 21 acres.

The Area of Potential Effects (APE) is defined as the ADI plus the entirety of any cultural resources it contains or intersects. The APE for this Project also includes a nearly 3,200-foot radius around the proposed launch facility for noise vibration levels above 120 dB as well as a sonic boom arc that would occur during launches and produce ground-level vibrations of 2 psf or greater over open ocean (Figure 1-5). These are the lowest noise and vibration levels with the potential to affect certain types of historic buildings (those made of wood or adobe material) and rock resources such as cairns and rock art. Although the Project proposes to launch both the Daytona-E and Laguna-E vehicles, the Laguna-E would produce more noise and vibration than the Daytona-E. Therefore, the Laguna-E noise study results are used for this analysis and to define the APE.

Background research confirmed that no historic buildings, or rock cairn, rock shelter, or rock art resources, are within the 120-dB Laguna-E launch noise contour. One structure, the Honda Trestle, is within the 120-dB Laguna-E launch noise contour. Like military and launch support facilities, the railroad trestle was built to withstand concussive forces; thus, this structure does not have the potential to be adversely affected by rocket engine noise. Similarly, the Anza Trail is within the launch noise contour but does not have any physical manifestation and therefore does not have the potential to be affected by rocket engine noise. Additionally, the 2-psf sonic boom arc would not occur over land. Thus, neither the Anza Trail nor the Honda Trestle are included in the APE and the focus of this report is the ADI and APE related to the area of physical impacts.

1.2 SCOPE AND PURPOSE OF THE STUDY

The scope of work for the Phantom Project was developed based on information provided by ManTech and also reflects direction from Vandenberg SFB cultural resources personnel. Tasks necessary to meet Section 106 compliance obligations include: (1) background research to identify previously documented cultural resources within the ADI; (2) surface and subsurface archaeological surveys; (3) evaluation of the NRHP eligibility of identified resources; and (4) assessment of Project effects on historic properties.

Æ conducted background research to document previous archaeological survey coverage and to compile a list of all known archaeological and historical built environment resources within the APE and immediately surrounding area.

Background research indicated that all areas within the APE were previously systematically surveyed for cultural resources. No sites that could be adversely affected by launch vibration or noise (rock art or nonreinforced structures such as those constructed of wood or adobe) were identified within the launch component of the ADI. Four archaeological sites (CA-SBA-538, -670, -2230, and -2934) were previously recorded within the facility component of the ADI.

As discussed in Chapter 4, CA-SBA-670 was previously determined eligible for the NRHP; CA-SBA-538 and CA-SBA-2230 were previously determined ineligible for the NRHP; and the NRHP eligibility of CA-SBA-2934 had not been evaluated. Three previously recorded isolated artifacts, VAFB-ISO-258, -259, and -770, were noted near, but outside, the ADI.

Æ archaeologists completed surface and subsurface surveys of the facility component of the ADI to investigate the potential for unidentified sites, both on the surface and buried, and to confirm the location of previously identified sites. These surveys identified one previously unrecorded isolated artifact VAFB-ISO-1049) near but outside the ADI. Subsurface test excavations at CA-SBA-2934 were completed to gather information for evaluating its NRHP eligibility. In addition, the areas immediately surrounding the five isolated artifacts (VAFB-ISO-258, -259, -334, -770, and -1049) were tested to determine if the artifacts are truly isolated or if they represent the surface manifestations of archaeological sites.

Æ's effort for the Project was directed by Eric Nocerino, Ph.D., Registered Professional Archaeologist (RPA) 28577311. Christopher Ryan (M.A.) was project manager for the 30th Civil Engineer Squadron, Installation Management Flight, Environmental Section, Environmental Assets (30 CES/CEIEA). The work was completed under subcontract to ManTech SRS Technologies, Inc. The project manager for ManTech was John LaBonte (Ph.D.).

1.3 REPORT ORGANIZATION

This report documents Æ's archaeological investigations supporting Section 106 compliance for the Project. Chapter 1 introduces the Project and the scope of work. Chapter 2 presents a brief overview of the natural and cultural setting of the Vandenberg SFB region. Chapter 3 is an abbreviated research design that highlights research questions to establish archaeological context for evaluating data potentials to guide development of site treatment. Results of background research are presented in Chapter 4. Project-wide strategies and methods are described in Chapter 5. Chapter 6 presents the results of subsurface investigations within the ADI. Chapter 7 details the results of investigations at the isolated artifact locations, including a description of the isolates and fieldwork results. Chapters 8, 9, 10, and 11 present the results of investigations at archaeological sites CA-SBA-538, -670, -2230, and -2934, respectively, including a description of each site, a summary of past work at each site, results of the current fieldwork, documentation of NRHP eligibility and assessment of effects, and recommendations for additional work. Chapter 12 is a summary of the findings presented in the previous chapters, and Chapter 13 contains the references cited in the previous chapters.

Appendix A contains a Vandenberg SFB-specific research design developed by Æ through more than 24 years of archaeological investigations on Vandenberg SFB. Appendix B contains cultural resource records. The concurrence documentation for archaeological site NRHP eligibility status discussed in the report is provided in Appendix C. The provenience information log with information about the excavated shovel test pits is included as Appendix D.

2
NATURAL AND CULTURAL SETTING

This chapter provides context with a brief overview of the natural and cultural setting of the Project vicinity. Additional detailed information on the region's physical setting can be found in Chambers Consultants and Planners (1984), Glassow (1990), and Woodman et al. (1991). The prehistoric and ethnohistoric cultural setting for Vandenberg SFB has been detailed by Earle and Johnson (1999), Glassow (1996), and Lebow and Moratto (2005). Most of the following summary was originally prepared by Lebow and Moratto (2005); information concerning the area's history primarily derives from Palmer (1999).

2.1 NATURAL SETTING

Vandenberg SFB encompasses approximately 99,350 acres along California's Central Coast in northern Santa Barbara County (see Figures 1-1 and 1-2). The base extends south from Point Sal for approximately 30 miles to Jalama Creek, slightly north of Point Conception. Long and narrow, the base extends inland as far as 10 miles but narrows in some locations to as little as 2 miles. The city of Lompoc is approximately 3 miles east of the base's eastern boundary, and the city of Santa Maria is roughly 7 miles northeast of the base's northeastern corner. The base extends from sea level to a maximum of 2,159 feet above mean sea level at Tranquillon Mountain.

Modern terrestrial plant communities on Vandenberg SFB include coastal dunes, coastal sage scrub, chaparral, oak woodlands, oak savanna, bishop pine forest, annual grasslands, wetlands, marshlands, and riparian woodlands (Morgan et al. 1991:39–45). In the Project vicinity the vegetation is coastal sage scrub. Plants common in this plant community include manzanita (*Arctostaphylos purissima* and *A. rudis*), ceanothus (*Ceanothus ramulosus* and *C. impressus*), and coast live oak (*Quercus agrifolia*) in some areas. Plants that may have been important prehistorically include live oak, manzanita, chia (*Salvia columbariae*), blue dicks (*Dichelostemma pulchella*), soap plant (*Chenopodium californicum*), mariposa lilies (*Calochortus albus*, *C. clavatus*, and *C. venustus*), islay (*Prunus ilicifolia*), and toyon (*Heteromeles arbutifolia*). Mammal species found in the vicinity and known to be used by the prehistoric residents of this region include mule deer (*Odocoileus hemionus californicus*), desert cottontails (*Sylvilagus audubonii*), brush rabbits (*S. bachmani*), and jackrabbits (*Lepus californicus*) (Morgan et al. 1991:42–43).

Offshore habitats along Vandenberg SFB include both sandy and rocky bottoms. Rocky bottoms support kelp forests that provide habitat for sea otters (*Enhydra lutris*), various fishes, and invertebrates. Offshore fish species include rockfish (*Sebastes* spp.), surfperch (*Amphistichus* spp.), kelpfish (Clinidae), yellowtail (*Seriola lalandi*), Pacific sardine (*Sardinops sagax*), and flatfish (Pleuronectiformes) (Morgan et al. 1991:45). Various stretches of the Vandenberg SFB coastline have rocky intertidal habitats with California mussels (*Mytilus californianus*), acorn barnacles (*Tetraclita rubescens*, *Balanus glandula*, and *Chthamalus* sp.), goose barnacles (*Pollicipes polymerus*), rock crabs (*Cancer* spp.), limpets (Acmaeidae), chitons

(Polyplacophora), urchins (*Stronglyocentrotus* spp.), black abalone (*Haliotis cracheriodii*), red abalone (*H. rufescens*), and turban snails (*Tegula funebralis*) (Morgan et al. 1991:46–47).

2.2 CULTURAL SETTING

The prehistory of California's Central Coast spans the entire Holocene and may extend back to late Pleistocene times. Excavations on Vandenberg SFB reveal occupations dating back nearly 11,000 years (Lebow et al. 2014, 2015). These early occupants are thought to have lived in small groups that had a relatively egalitarian social organization and a forager-type land-use strategy (Erlandson 1994; Glassow 1996; Greenwood 1972; Moratto 1984). Human population density was low throughout the early and middle Holocene (Lebow et al. 2007). Cultural complexity appears to have increased around 3,000–2,500 years ago (King 1981, 1990). On Vandenberg SFB, that interval also marks the beginning of increasing human population densities and appears to mark the shift from a foraging to a collecting land-use strategy (Lebow et al. 2006; Lebow et al. 2007). Population densities reached their peak around 600–800 years ago, corresponding to the full emergence of Chumash cultural complexity (Arnold 1992).

People living in the Vandenberg SFB area prior to historic contact are grouped with the Purisimeño Chumash (Greenwood 1978; King 1984; Landberg 1965), one of several linguistically related members of the Chumash culture. In the Santa Barbara Channel area, the Chumash people lived in large densely populated villages and had a culture that "was as elaborate as that of any hunter-gatherer society on earth" (Moratto 1984:118). Relatively little is known about the Chumash in the Vandenberg region. Explorers noted that villages were smaller and lacked the formal structure found in the channel area (Greenwood 1978:520). About five ethnohistoric villages are identified by King (King 1984:Figure 1) on Vandenberg SFB, along with another five villages in the general vicinity. Diseases introduced by early explorers, beginning with the maritime voyages of Cabrillo in A.D. 1542–1543, substantially impacted Chumash populations more than 200 years before Spanish occupation began (Erlandson and Bartoy 1995, 1996; Preston 1996). Drastic changes to Chumash lifeways resulted from the Spanish occupation that began with the Portolá expedition in A.D. 1769.

Vandenberg SFB history is divided into the Mission, Rancho, Anglo-Mexican, Americanization, Regional Culture, and Suburban periods. The Mission Period began with the early Spanish explorers and continued until 1820. Mission la Purísima encompassed the Vandenberg area. Farming and ranching were the primary economic activities at the mission. The Rancho Period began in 1820 and continued until 1845. Following secularization in 1834, the Alta California government granted former mission lands to Mexican citizens as ranchos. Cattle ranching was the primary economic activity during this period. The Bear Flag Revolt and the Mexican-American War marked the beginning of the Anglo-Mexican Period (1845–1880). Cattle ranching continued to flourish during the early part of this period, but severe droughts during the 1860s decimated cattle herds. The combination of drought and change in government from Mexico to the United States caused substantial changes in land ownership. Sheep ranching and grain farming replaced the old rancho system. Increased population densities characterize the Americanization Period (1880–1915). Beginning in the late 1890s, the railroad provided a more efficient means of shipping and receiving goods and supplies, which in turn increased economic activity. Ranching and farming continued during the early part of the Period of Regional Culture (1915–1945) until property was condemned for Camp Cooke. The Suburban Period (1945–

1965) began with the end of World War II. In 1956, the U.S. Army transferred 64,000 acres of North Camp Cooke to the Air Force, and it was renamed Cooke AFB. In 1958 the base had its first missile launch, the Thor, and was renamed Vandenberg AFB (Palmer 1999). In May 2021, the installation name was changed to Vandenberg Space Force Base, reflecting its use as a major satellite launch range and military missile-testing facility.

3
RESEARCH DESIGN

Archaeological investigations for the Phantom Space Project include evaluating NRHP eligibility and to assess potential adverse effects at the four known sites. For most archaeological sites, NRHP eligibility and assessment of adverse effects is based on data potentials. This chapter presents a research design for prehistoric resources against which data potentials can be measured. First, however, criteria for evaluating NRHP eligibility are described.

3.1 CRITERIA FOR NATIONAL REGISTER ELIGIBILITY

Under Section 106 of the National Historic Preservation Act of 1966 (as amended), federal agencies are responsible for managing historic properties on their lands or those that are associated with undertakings permitted, licensed, or funded by the agency. Historic properties are cultural resources that have been evaluated as eligible for the National Register. Significance criteria for evaluating National Register eligibility are set forth in 36 CFR 60.4:

> The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and
>
> (a) that are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> (b) that are associated with the lives of persons significant in our past; or
>
> (c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> (d) that have yielded, or may be likely to yield, information important in prehistory or history [36 CFR 60.4].

If a resource is significant under one the National Register criteria, in order to be eligible for listing it must also have integrity. Consideration of integrity for cultural resources such as buildings must consider all seven aspects: location, design, setting, materials, workmanship, feeling, and association. For archaeological sites that are significant under Criterion D, all seven criteria need not be considered, and the emphasis is on integrity of setting and location, with particular emphasis on interspatial relationships.

Under Criterion D, information is considered important when it can be demonstrated to fill data gaps or provide alternative theories (National Park Service 1997:21). To make that evaluation it is necessary to measure the data potentials against a research design.

3.2 RESEARCH DESIGN FOR PREHISTORIC RESOURCES

A research design provides a specific framework of inquiry that guides and focuses an archaeological investigation. Æ has developed a substantial research design during the past 24 years of archaeological studies on Vandenberg SFB. The full version of that research design is provided as Appendix A; this chapter presents a brief synopsis.

3.2.1 Context for Research

Nine major studies on Vandenberg SFB provide a foundation for archaeological research, including (1) excavations during the 1970s at various sites on south Vandenberg SFB for the Space Transportation System; (2) investigations on the San Antonio Terrace for the MX program and associated test facilities as well as subsequent studies on the San Antonio Terrace; (3) studies associated with development of space launch complexes on south Vandenberg SFB; (4) excavations for the Union Oil of California pipeline project; (5) investigations for the Coastal Branch Aqueduct; (6) investigations associated with infrastructure development along Combar Road; (7) investigations for infrastructure development along Tranquillon Mountain Road; (8) excavations for the San Antonio Creek Stream Restoration Project; and (9) archaeological excavations at various eroding sites on the base performed under Section 110 of the National Historic Preservation Act.

Æ has been performing archaeological studies on Vandenberg SFB since 1995 and has compiled a substantial body of archaeological data. Importantly, all recovered materials were collected and examined by the same staff using the same protocols, ensuring that the datasets are consistent. Consequently, variations in the data can be attributed to prehistoric behavior and not variations in data collection and analyses. Following is a brief summary of the patterns evident in the compiled data, as reported by Lebow et al. (2006) and Lebow et al. (2007).

Subsistence data from 45 dated components reveal that shellfish were the primary dietary contributors during the early Holocene. Fish were nearly absent, but large mammals were almost as important as they were during the Late Period. Shellfish continued to be the primary dietary contributor until approximately 3,800 years ago (late Early Period), at which time their dominance began to decline. Fish remained a minor contributor during the Early Period as large terrestrial mammals increased in importance. Use of sea mammals showed a slight increase during this period compared to the early Holocene, and the contribution of rabbits to the diet appeared to decrease slightly. The Middle Period is marked by several changes in subsistence. For the first time, more sites than not have minor shellfish contributions. In the place of shellfish, inhabitants appear to have turned to both large terrestrial and marine mammals. Site location is a determining factor for which type of animal was targeted. The Late Period was a time of much variability. Shellfish remained an integral part of the diet, although not to the same extent as before about 4,000 years ago. Fish are the only subsistence resource that exhibited a clear increase during this time. The remaining subsistence taxa are highly variable in terms of frequency. Both large terrestrial and sea mammal hunting appear to have increased during the Late Period.

Lithic data from 29 components reveal that the early Holocene lithic assemblage fits perfectly with the expected technology among foragers in an environmental rich in tool stone. Unretouched and retouched flake tools dominate, bifaces are generalized, and biface stage profiles show incremental replacement. Early Period residential assemblages are similar except for the greatly increased use of bifaces as cores. By the Middle Period, stone tool technological organization had become much more centered at residential bases. Bifaces were used as cores and generalized tools, while task groups occupied special-use sites. At residences, bifaces were prepared and maintained, but the overarching technology invoked for on-site tasks was expedient. This cycle of biface production/use/repair that began at the residence, passed through specialized sites, and returned again to the residence clearly describes a logistical land-use system. It appears, therefore, that the land-use strategy shifted from foraging to collecting around the end of the Early Period and the beginning of the Middle Period.

Overall, the time around 3,000 years ago appeared to have been pivotal in the prehistory of the Vandenberg SFB region. Prior to that time, human population densities were low but with relatively limited variability; after that time, human population densities began to increase, and substantial variability is evident. Prior to 3000 B.P., California mussels appear to have consistently been procured through a stripping strategy, whereas after that time the procurement strategy was much more variable and included a plucking strategy that would have more efficiently maintained mussel beds. Prior to 3000 B.P., bivalves from sandy beaches and estuaries are more frequent than after 3,000 years ago, when they are nearly absent. This pivotal point at about 3000 B.P. coincides fairly closely with King's (1990) transition between the Early and Middle periods. Lebow et al. (2006) proposed that the period around 3,000 years ago represented a shift in land-use strategy from a residentially mobile system (i.e., foraging) to a logistically mobile strategy (i.e., collecting).

3.2.2 Research Issues and Questions

As detailed by Lebow and Moratto (2005:2-17–12-19), nearly all archaeological research completed in and around Vandenberg SFB since the 1960s has been either explicitly or implicitly oriented toward understanding cultural evolution and cultural processes. Important and interesting research issues within the overarching orientation of cultural evolution and cultural processes on the base include subsistence, settlement systems and land-use strategies, technology, trade and exchange, human population densities, and paleoenvironments. Each of these issues is developed in Appendix A.

Research questions specific to each issue can be distilled into fundamental queries.

- What subsistence resources were used by site occupants?
- What activities were completed by site occupants? Were occupants foragers or collectors?
- What lithic technology was used by site occupants? Are other technologies evident?
- Is evidence of trade and exchange apparent?
- How do site occupations fit in the model of human population densities?
- Do the sites provide paleoenvironmental data?

Addressing these fundamental questions requires various datasets, including but not limited to chronological information, lithic debris, faunal remains, and archaeobotanical remains. Site or component function, critical to understanding settlement systems and land-use strategies, can usually be determined through analysis of tool use, lithic technology, faunal and archaeobotanical remains, and cultural features. These data requirements are elucidated in Appendix A.

4
RESULTS OF BACKGROUND RESEARCH

Prior to fieldwork, Æ completed an archaeological site record and literature search at the 30 CES/CEIEA at Vandenberg SFB. The search included a review of site records, reports, and site condition assessments and identified previous archaeological studies and archaeological resources within the APE. Data sources examined included the Base Comprehensive Plan Geographic Information System (GIS) and U.S. Geological Survey topographic maps. Reports from identified studies were examined and are summarized below.

4.1 PREVIOUS INVESTIGATIONS

Background research found that all areas within the APE were previously systematically surveyed for cultural resources. Table 4-1 lists the previous cultural resource studies within the APE.

Table 4-1
Previous Cultural Resource Investigations within the Area of Potential Effects (Area of Physical Impacts) and Associated with CA-SBA-538, -670, -2230, and -2934

Author(s)/Year (in chronological order)	VAFB Report No.	Report Title	Site(s) (CA-SBA)
Spanne and Glassow (1974)	1974-01	*Air Force Space Transportation System, Vandenberg AFB, Santa Barbara County, California, Testing and Evaluation of Archaeological Sites: A Preliminary Report*	-538, -670
Spanne (1974)	1974-02	*Archaeological Survey of Vandenberg Air Force Base, Santa Barbara County, California 1971–1973*	-538, -670
Glassow et al. (1976)	1976-01	*Evaluation of Archaeological Sites on Vandenberg Air Force Base, Santa Barbara County, California*	-538, -670
Spanne (1980)	1980-06	*An Archaeological Evaluation of a Cable Trench at CA-Sba-670 and CA-Sba-1144 Honda Canyon, Vandenberg Air Force Base, Santa Barbara County, California*	-670
Stone and Glassow (1980)	1980-11	*Analysis of a Telephone Cable Trench, Sba-670, Sba-1144, Vandenberg Air Force Base, Santa Barbara County, California*	-670
Glassow (1981)	1981-10	*Preliminary Report, Archaeological Data Recovery Program in Relation to Space Shuttle Development, Vandenberg Air Force Base, California*	-670
Neff (1982)	1982-05	*Final Report, Vandenberg Air Force Base, California, 1982 Fuels Management Program, Cultural Resources Survey/Evaluation*	-538
U.S. Air Force Flight Test Center (1983)	1983-11	*An Archaeological Survey of Proposed Road and Minuteman Launch Facility Modifications for the Peacekeeper in Minuteman Silos Testing Program, Vandenberg Air Force Base, California*	-670

Table 4-1 (continued)
Previous Cultural Resource Investigations within the Area of Potential Effects (Area of Physical Impacts) and Associated with CA-SBA-538, -670, -2230, and -2934

Author(s)/Year (in chronological order)	VAFB Report No.	Report Title	Site(s) (CA-SBA)
Schilz (1985)	1985-03	*Archaeological Survey, Testing, and Evaluation: STS Power Plant No. 6 Natural Gas Pipeline, Vandenberg Air Force Base, Santa Barbara County, California*	-670
Gibson (1985)	1985-07	*Results of Archaeological Testing at Sba-212 and Sba-1145, Vandenberg Air Force Base, California*	-670
Harmsworth Associates (1987)	1987-14	*Preliminary Case Report in Support of the U.S. Air Force No Effect Determination, Gaseous Nitrogen Pipeline Project*	-670
Bergin (1988a)	1988-03	*Documentation in Support of U.S. Air Force No Adverse Effect Determination for Affected Historic Properties: Natural Gas Pipeline Project, Space Transportation System Project, Vandenberg Air Force Base, California*	-670
Bergin (1988b)	1988-04	*A Research Design and Treatment Plan for Historic Properties Affected by Installation of the Space Transport System Natural Gas Pipeline, Vandenberg Air Force Base, Santa Barbara County, California*	-670
Moore et al. (1988)	1988-05	*The Testing and Evaluation of Fourteen Archaeological Sites on South Vandenberg Air Force Base, Santa Barbara County, California*	-670
Ferraro et al. (1988)	1988-12	*Survey, Testing, and Evaluation of Fourteen Sites for the STS Power Plant No. 6 Natural Gas Pipeline Project, Santa Barbara County, California*	-670
Bergin and King (1989)	1989-12	*The Survey and Inventory of Archaeological Properties for the Backbone Fiber-Optic Transmission System Project, Vandenberg Air Force Base, Santa Barbara County, California*	-670
King et al. (1990)	1990-06	*Space Transportation System Natural Gas Pipeline and SLC-4 Security Fence Treatment Programs, Vandenberg Air Force Base, California*	-670
Schmidt and Bergin (1990)	1990-18	*The Testing and Evaluation of Five Archaeological Sites for the Space Launch Complex 4 Power Systems Upgrade, Vandenberg SFB, Santa Barbara County, California*	-2230
Glassow (1990)	1990-21	*Archaeological Investigations on Vandenberg Air Force Base in Connection with the Development of Space Transportation System Facilities*	-670
Environmental Solutions (1990a)	1990-22	*Documentation in Support of U.S. Air Force No Adverse Effect Determination for Phase II Backbone Fiber-Optic Transmission System, Vandenberg Air Force Base, Santa Barbara County, California*	-670
Dames & Moore (1994)	1994-25	*Draft Evaluation of the National Register of Historic Places Eligibility: The Anza Trail*	-3804
National Park Service (1994)	VAFBR-USDI07	*Draft Environmental Impact Statement: Juan Bautista de Anza National Historic Trail, Arizona and California, Comprehensive Management and Use Plan*	-3804

Table 4-1 (continued)
Previous Cultural Resource Investigations within the Area of Potential Effects (Area of Physical Impacts) and Associated with CA-SBA-538, -670, -2230, and -2934

Author(s)/Year (in chronological order)	VAFB Report No.	Report Title	Site(s) (CA-SBA)
Garate (1994)	VAFBR-JUANB01	*Juan Bautista de Anza, National Historic Trail. Booklet and Map*	-3804
National Park Service (1996)	VAFBR-USDI08	*Final Environmental Impact Statement: Juan Bautista de Anza National Historic Trail, Arizona and California Comprehensive Management and Use Plan and Environmental Impact Statement*	-3804
Woodman et al. (1995)	1995-12	*Final Report, Archaeological Survey and Evaluation of the Honda Beach Site, Sba-530*	-670
Wilcoxon (1998)	1998-10	*VAFB Specific Site Revisit Project, Brief Summary. August 3–26, 1998 Inclusive*	-2230
Lebow (2000)	2000-12	*Collection and Management of Radiocarbon Data during Fiscal Year 2000, Vandenberg Air Force Base, Santa Barbara County, California*	-670
Lebow (2002)	—	*Archaeological Studies Supporting an Evaluation of the Anza Trail, Vandenberg Air Force Base, Santa Barbara County, California*	-3804
National Park Service (2003)	VAFBR-USDOI-002	*The Juan Bautista de Anza National Historic Trail Arizona-California Comprehensive Management and Use Plan*	-3804
Lebow et al. (2003)	2003-11	*Archaeological Studies for the SLC-4 to SLC-6 Waterline Replacement Project, Vandenberg Air Force Base, Santa Barbara, California*	-670, -2230
Lebow (2004)	2004-01	*Archaeological Studies for the Encapsulated Payload Transfer Route, Vandenberg Air Force Base, Santa Barbara County, California*	-670, -2230
Bradley (2005)	2005-08	*Final National Register of Historic Places Evaluation of Eligibility for the Anza Trail, Vandenberg Air Force Base, Santa Barbara County, California*	-3804
Lebow et al. (2011)	2010-08	*Land-Use Strategies in Upper Honda Canyon: Middle and Late Holocene Adaptations at CA-SBA-215, CA-SBA-657, and CA-SBA-658, Archaeological Investigations on South Vandenberg Air Force Base for the Tranquillon Mountain Road Project, Santa Barbara County*	-670
Enright and Lebow (2011)	2011-02	*Archaeological Studies in Support of the N1, N3, and N6 Feeder Lines, Vandenberg Air Force Base, Santa Barbara County, California*	-670
Peterson and Ryan (2011)	2011-04	*Identification of Historic Properties and Assessment of Adverse Effects: N1, N3, N6 Feeder Lines Replacement Project, Vandenberg Air Force Base, Santa Barbara County, California*	-538, -670, -2230
Loetzerich (2019)	2019-06	*Identification of Historic Properties and Assessment of Effects: Repair and Replacement of SL-2 and ML/KL Powerlines Project, Vandenberg Air Force Base, Santa Barbara County, California*	-670, -2230

Table 4-1 (continued)
Previous Cultural Resource Investigations within the Area of Potential Effects (Area of Physical Impacts) and Associated with CA-SBA-538, -670, -2230, and -2934

Author(s)/Year (in chronological order)	VAFB Report No.	Report Title	Site(s) (CA-SBA)
Bienenfeld et al. (2019)	2019-07	*Archaeological Investigations Supporting Section 106 and 110 Compliance for the South Loop 2 and ML/KL Electrical Lines Replacement Project, Vandenberg Air Force Base, Santa Barbara County, California*	-670, -2230
Gerber et al. (2022)	N/A	*Cultural Resource Investigations Supporting Section 106 Compliance for the UPRR Honda Trestle Replacement Project, Vandenberg Space Force Base, Santa Barbara County, California*	-670, -3804, Honda Trestle

4.2 PREVIOUSLY RECORDED ARCHAEOLOGICAL RESOURCES

Table 4-2 summarizes all previously recorded cultural resources within the APE. Within the facility component of the APE, review of the Vandenberg SFB GIS layers and archaeological literature revealed four known archaeological sites (CA-SBA-538, -670, -2230, and -2934) within the area of physical impacts (Figure 1-5). In addition, three isolated artifacts were previously documented outside, but near, the facility component of the APE. Isolated artifacts are described in more detail in Chapter 7. Sites that could be impacted by Project construction are discussed further in Chapters 8–11.

Table 4-2
Summary of Previously Recorded Cultural Resources within the APE

Site No.	Description	Site Type[a]	NRHP Status[b]
CA-SBA-538	Lithic scatter	Location (chipping station)	Determined Ineligible (6Y) (USAF110418A)
CA-SBA-670	Low to moderate density shell midden and lithic scatter, with a cluster of fire-cracked rock	Long-term residence	Determined Eligible (2S2) (Keeper Letter E.O.11593)
CA-SBA-2230	Flaked stone and ground stone scatter	Location (chipping station)	Determined Ineligible (6Y) (USAF110418A)
CA-SBA-2934	Sparse lithic scatter with five flakes and a tabular fragment	Location (chipping station)	Unevaluated (7R)
VAFB-ISO-258	Secondary flake	Isolated artifact	N/A
VAFB-ISO-259	Battered cobble	Isolated artifact	N/A
VAFB-ISO-700	Core	Isolated artifact	N/A
CA-SBA-3804	Anza Trail		Recommended Eligible (3S)
N/A	Honda Trestle		Recommended Ineligible (6Z)

a - Site types defined by Lebow and Moratto (2005).
b - California Historical Resource Status codes (current as of 3/1/2020); 3S = appears eligible for NR as an individual property through survey evaluation; 6Z = found ineligible for NR through survey evaluation; 7R = Identified in reconnaissance level survey or in an APE: not evaluated.

As described in Section 1.1.5, the APE for this Project also includes a launch component comprised of: (1) a nearly 3,200-foot radius around the proposed launch facility that would experience noise vibration levels above 120 dB and (2) a sonic boom arc that would occur during launches and produce ground-level vibrations of 2 psf or greater over open ocean. These are the lowest noise and vibration levels with the potential to affect certain types of historic buildings and rock walls or rock cairns, rock shelters, or rock art.

Background research confirmed that no historic buildings or rock cairn, rock shelter, or rock art resources are within the 120-dB Laguna-E launch noise contour. One structure, the Honda Trestle, is within the 120-dB Laguna-E launch noise contour. Like military or launch support facilities, the railroad trestle was built to withstand concussive forces; thus, this structure does not have the potential to be adversely affected by rocket engine noise. Similarly, the Anza Trail (CA-SBA-3804) is within the launch noise contour but does not have any physical manifestation and therefore does not have the potential to be affected by rocket engine noise. Additionally, the 2-psf sonic boom arc would not occur over land. Thus, neither the Anza Trail nor the Honda Trestle are included in the APE or discussed further in this report. Rather, the focus of this report is the ADI and APE related to the area of physical impacts.

5
PROJECT-WIDE STRATEGIES AND METHODS

5.1 FIELD METHODS

Prior to fieldwork, shapefiles showing the launch facility, proposed firebreaks and bulldozer lines, subsurface utility line, and the recorded locations of CA-SBA-538, -670, -2230, and -2934 as well as isolated artifacts VAFB-ISO-258, -259, and -700 were uploaded to an Arrow Gold hand-held global navigation satellite system (GNSS) receiver. That device has submeter accuracy and allows precise location of the plotted site boundaries and isolated artifacts.

A crew of three to five Æ field technicians and a field supervisor conducted the fieldwork between May 3 and 12, 2021. Eric Nocerino (Ph.D., RPA 28577311) was the principal investigator and Karin Pitts-Olmedo (M.A., RPA 17221) was the field supervisor. Raymond Padilla and Andrew Mendoza served as Native American monitors representing the Tribal Elders' Council of the Santa Ynez Band of Chumash Indians.

The field crew completed surface and subsurface survey within the ADI to assess whether unknown buried archaeological sites were present. Subsurface testing also was completed to identify any subsurface deposits associated with isolated artifacts and to evaluate the NRHP eligibility of CA-SBA-2934.

Testing for the Project was performed using shovel test pits (STPs), which were 50 centimeters in diameter and excavated in 20-centimeter levels. For the launch facility, shovel test pits were continued until two sterile levels had been excavated, or to the depth of bedrock or impenetrable clay. Shovel test pits in the utility corridor were excavated to a maximum depth of 100 centimeters. Within areas of existing or planned firebreaks, shovel test pits were terminated at 40 centimeters below surface.

Fieldwork to support Section 106 compliance for the Phantom Space Project occurred in two phases. During the first phase, shovel test pits were excavated in a grid in 50-meter increments within accessible portions of the pad footprint and along the firebreak centerlines. A line of shovel test pits was also placed along the route of the proposed subsurface utility line corridor; these units were spaced 30 meters apart.

In the second phase, shovel test pits were placed as needed to determine if the mapped isolated artifact location represented a subsurface archaeological site. Additional shovel test pits were placed within CA-SBA-2934 to determine if the site was still present and, if so, to collect sufficient data for evaluating its NRHP eligibility.

Excavated soils were dry-screened through 1/8-inch mesh, and cultural or potentially cultural materials, if encountered, were noted on field forms and collected. Excavations were documented on standard field forms and unit locations were recorded using an Arrow hand-held GNSS receiver with submeter accuracy. All activities were photo-documented using a digital camera and recorded on photo logs. Units were backfilled upon completion.

5.2 POST-FIELD PROCESSING

No cultural or potentially cultural materials were encountered during fieldwork. Æ created a provenience information log (PIL) based on field forms to document the excavations. For each unit and excavated level, the PIL includes site number, if any; lot number (unique to each unit and level); unit number; unit size; screen mesh size; excavation volume; and excavation date. Comments, if any, are also included. Separate lines document the daily work records and photograph log. The PIL is provided in Appendix D.

5.3 NOISE AND VIBRATION ANALYSIS

Phantom/ManTech provided the 120-dB contour to define the area that could have an effect on historic properties. A threshold of 120 dB/2 psf has been established above which historic properties could be susceptible to damage. The FAA and Vandenberg SFB are required to comply with analysis within 120-dB or greater contour or 2-psf boom. In this analysis, these are referred to as the launch and sonic boom components of the ADI. The launch component of the ADI is defined as the area within the modeled 120-dB sound level for launches. The sonic boom component of the ADI is the area of modeled sonic boom overpressure of 2 psf.

Previous research regarding rocket engine noise/vibration effects to structures indicates that the 120-dB and 2-psf contours represent the lowest noise level at which cultural resources could potentially be affected by rocket engine noise/vibration. This is based on noise and vibration studies that assessed potential structural building damage associated with sound pressure, air overpressure, and ground-borne vibration generated by military and rocket launch activities (Guest and Slone 1972; Haber et al. 1989). The studies found no material effect below 120 dB or 2 psf.

Æ used the noise and vibration study provided by ManTech (LaBonte and Wolski 2022) to assess Project effects on historic properties. ManTech provided ArcGIS shapefiles depicting the 120-dB noise contours for the Daytona-E and Laguna-E launches. Their study assumed that 48 vertical launches would occur each year.

Given these considerations, the rocket engine noise/vibration analysis APE for this Project follows the thresholds described above. For vehicle launches, the 120-dB and greater contours were used to develop the launch component of the ADI. The sonic boom component of the ADI was defined as the 2-psf contour. Since the Laguna-E vehicle would produce the greatest amount of noise and vibration, the Laguna-E contours were used for this analysis. The sonic boom threshold for the Laguna-E vehicle does not exceed 1.5 psf and occurs entirely over the Pacific Ocean in the vicinity of the Channel Islands.

The potential for damage to archaeological resources and historical built resources was assessed based on their susceptibility to damage caused by rocket engine noise/vibration. Archaeological sites that consist of only surface and/or buried archaeological material have no potential to be affected by rocket engine noise because soils would protect materials in place. Therefore, these site types were excluded from the launch component of the APE. Meanwhile, archaeological sites containing stacked rock walls or rock cairns, rock shelters or rock art where the host rock is unstable could be susceptible to 120 dB or greater noise vibrations. No resources of this type are recorded within the 120 dB or greater noise vibration contour. Additionally, when assessing the built environment, buildings that were clearly made for launch or military support activities, and which were constructed to withstand explosive or concussive forces, were excluded from this study as they would not be affected by rocket engine noise/vibration. No additional historic-era resources are within the launch component of the ADI.

6
SUMMARY OF SUBSURFACE TESTING

As discussed in Chapter 1, proposed Project development would involve development of a new launch facility at SLC-5; installation of underground utilities (placed within Delphy Road or a designated 100-foot-wide corridor along the south margin of Delphy Road); creation of new and maintenance of existing firebreaks and fire access roads; and improvements to existing roads.

As summarized in Chapter 5, Æ completed surface and subsurface survey (testing) within the ADI to assess whether unknown buried archaeological sites were present. The surface survey identified a previously unrecorded isolated artifact (AE-4232-ISO-001) outside but near the ADI. At the request of Vandenberg SFB cultural resources personnel, Æ also performed presence/absence testing at this and three additional previously recorded isolated artifacts, all outside but near the ADI.

Subsurface survey revealed that CA-SBA-2943 is no longer present, likely due to ground disturbance associated with the demolition of SLC-5; thus, no additional NRHP-eligibility testing was necessary. Neither CA-SBA-538 nor CA-SBA-2230, which were previously evaluated as ineligible for the NRHP, were tested during the current investigation. Since Project activity within CA-SBA-670 would be limited to clearing vegetation from existing pavement, no additional shovel test pits were excavated within that site during the current fieldwork effort.

Figure 6-1 provides an overview of the ADI showing the shovel test pits that were excavated for both past and current efforts. Table 6-1 lists all the shovel test pits excavated for the Project and includes depth, volume, site affiliation (if any), and Project element. The following sections describe the testing performed for each Project element. Excavations at isolated artifacts and individual sites are described in more detail in Chapter 7 and Chapters 8–11, respectively.

6.1 LAUNCH SITE

Æ excavated 22 shovel test pits within the launch site portion of the ADI (Table 6-1; Figures 6-1 and 6-2). These shovel test pits were placed in areas that, based on background research, had not been previously investigated. Additionally, Æ did not test in areas where, based on examination of historic aerial photographs and current topography, development and demolition of the previous SLC-5 facility precluded the presence of intact deposits.

The Project area is underlain by the closely related Tangair and Baywood series soils in the east part and west parts of the Project area, respectively. These soils consist of deep, very well-drained soils that formed in old sand dunes near the coast (Soil Survey Staff 1997, 2014). Excavated soils within the launch site shovel test pits were brown loamy sands with minor gravel inclusions within the upper 40 centimeters of the subsurface. Sandstone was more common at depths between 40 and 80 centimeters. In many locations, dense clay was encountered at around 80 centimeters below the surface. This hard, dense clay deposit represents an argillic horizon that predates human occupation in this area. Most of the tested locations showed no obvious evidence of disturbance. No cultural materials were encountered during testing.

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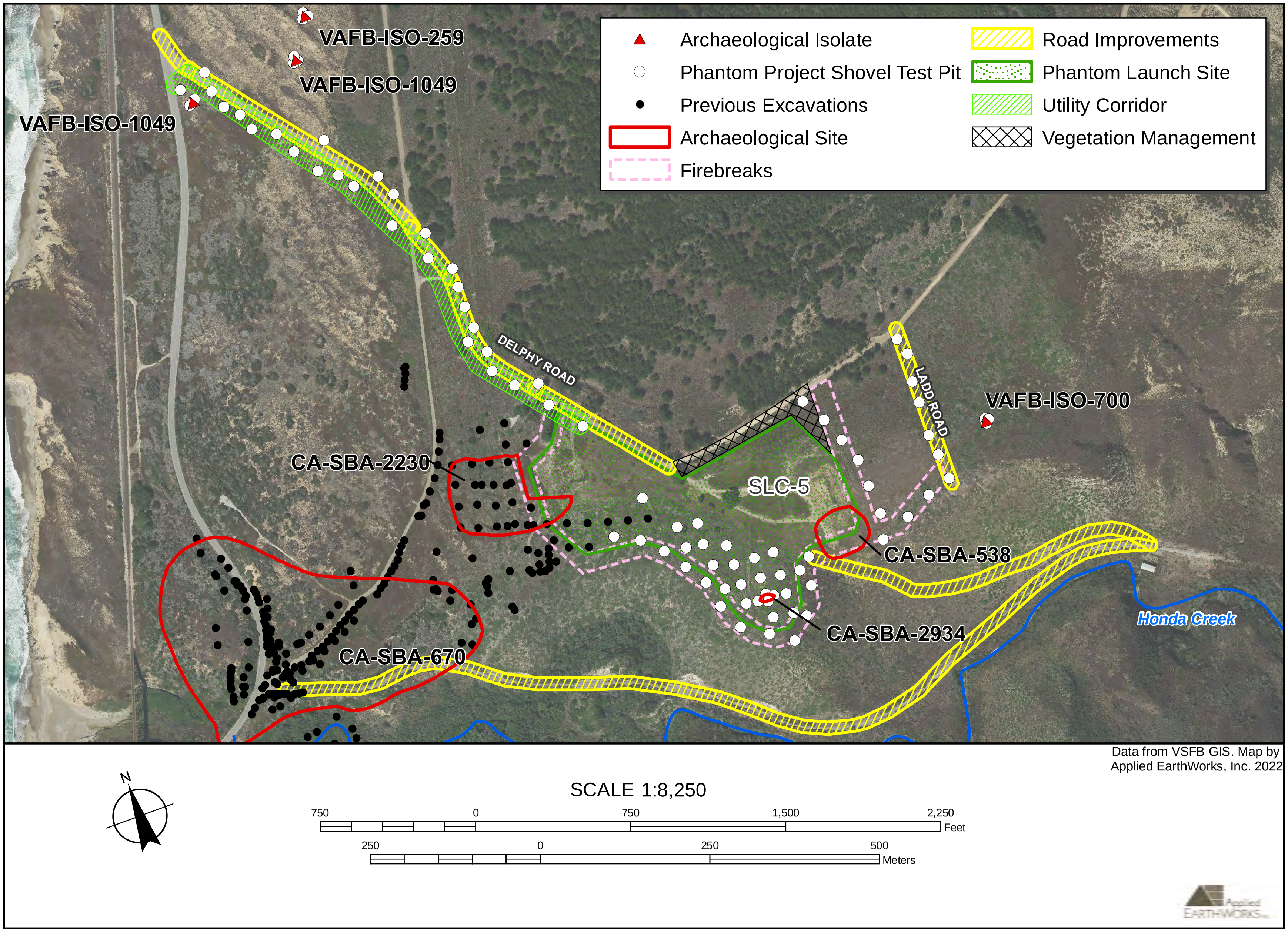

Figure 6-1 Facility components of ADI and current and previous excavations.

Table 6-1
Summary of Shovel Test Pits within the Utility Corridor

Unit[a]	Maximum Unit Depth (cm)	Site Association	Volume (m^3)	Project Element
STP 1	40	N/A	0.078	Road Improvements
STP 2	80	N/A	0.156	Road Improvements
STP 3	100	N/A	0.195	Road Improvements
STP 4	100	N/A	0.195	Road Improvements
STP 6	80	N/A	0.156	Road Improvements
STP 7	100	N/A	0.195	Road Improvements
STP 8	80	N/A	0.156	Road Improvements
STP 9	40	N/A	0.078	Vegetation Management
STP 10	40	N/A	0.078	Vegetation Management
STP 11	40	N/A	0.078	Vegetation Management
STP 12	40	N/A	0.078	Vegetation Management
STP 13	40	N/A	0.078	Vegetation Management
STP 14	40	N/A	0.078	Vegetation Management
STP 15	40	N/A	0.078	Vegetation Management
STP 16	40	N/A	0.078	Vegetation Management
STP 17	40	N/A	0.078	Vegetation Management
STP 18	40	N/A	0.078	Vegetation Management
STP 19	40	N/A	0.078	Vegetation Management
STP 20	100	CA-SBA-2934	0.195	Launch Facility
STP 21	100	N/A	0.195	Launch Facility
STP 22	100	N/A	0.195	Launch Facility
STP 23	100	N/A	0.195	Launch Facility
STP 24	20	N/A	0.039	Launch Facility
STP 25	95	N/A	0.185	Launch Facility
STP 26	100	N/A	0.195	Launch Facility
STP 27	100	N/A	0.195	Launch Facility
STP 28	95	N/A	0.185	Launch Facility
STP 29	80	N/A	0.156	Launch Facility
STP 30	85	N/A	0.165	Vegetation Management
STP 31	100	CA-SBA-2934	0.195	Launch Facility
STP 32	20	N/A	0.039	Vegetation Management
STP 33	20	CA-SBA-2934	0.039	Launch Facility
STP 34	95	CA-SBA-2934	0.185	Launch Facility
STP 35	100	CA-SBA-2934	0.195	Launch Facility
STP 36	40	N/A	0.078	Vegetation Management
STP 37	40	N/A	0.078	Vegetation Management
STP 38	40	N/A	0.078	Vegetation Management
STP 39	40	N/A	0.078	Launch Facility
STP 40	80	N/A	0.156	Vegetation Management
STP 41	80	N/A	0.156	Launch Facility

Table 6-1 (continued)
Summary of Shovel Test Pits within the Utility Corridor

Unit[a]	Maximum Unit Depth (cm)	Site Association	Volume (m^3)	Project Element
STP 42	40	N/A	0.078	Vegetation Management
STP 43	40	N/A	0.078	Vegetation Management
STP 44	40	N/A	0.078	Vegetation Management
STP 45	40	N/A	0.078	Vegetation Management
STP 46	40	N/A	0.078	Vegetation Management
STP 47	40	N/A	0.078	Vegetation Management
STP 48	100	N/A	0.195	Launch Facility
STP 49	100	N/A	0.195	Launch Facility
STP 50	70	N/A	0.137	Launch Facility
STP 51	80	N/A	0.156	Launch Facility
STP 52	80	N/A	0.156	Launch Facility
STP 53	80	N/A	0.156	Launch Facility
STP 56	40	VAFB-ISO-700	0.078	N/A
STP 57	40	VAFB-ISO-700	0.078	N/A
STP 58	40	VAFB-ISO-700	0.078	N/A
STP 59	70	N/A	0.140	Utility Corridor
STP 60	80	N/A	0.156	Utility Corridor
STP 61	100	N/A	0.195	Utility Corridor
STP 62	80	N/A	0.156	Utility Corridor
STP 63	80	N/A	0.156	Utility Corridor
STP 64	90	N/A	0.176	Utility Corridor
STP 65	100	N/A	0.195	Utility Corridor
STP 66	100	N/A	0.195	Utility Corridor
STP 67	100	N/A	0.195	Utility Corridor
STP 68	100	N/A	0.195	Utility Corridor
STP 69	100	N/A	0.195	Utility Corridor
STP 70	100	N/A	0.195	Utility Corridor
STP 71	100	N/A	0.195	Utility Corridor
STP 72	100	N/A	0.195	Utility Corridor
STP 73	100	N/A	0.195	Utility Corridor
STP 74	100	N/A	0.195	Utility Corridor
STP 75	100	N/A	0.195	Utility Corridor
STP 76	100	N/A	0.195	Utility Corridor
STP 77	100	N/A	0.195	Utility Corridor
STP 78	100	N/A	0.195	Utility Corridor
STP 79	80	N/A	0.156	Utility Corridor
STP 80	100	N/A	0.195	Utility Corridor
STP 81	100	N/A	0.195	Utility Corridor
STP 82	100	N/A	0.195	Utility Corridor
STP 83	100	N/A	0.195	Utility Corridor
STP 84	100	N/A	0.195	Utility Corridor
STP 85	100	N/A	0.195	Utility Corridor

Table 6-1 (continued)
Summary of Shovel Test Pits within the Utility Corridor

Unit[a]	Maximum Unit Depth (cm)	Site Association	Volume (m^3)	Project Element
STP 86	100	N/A	0.195	Utility Corridor
STP 87	40	VAFB-ISO-259	0.078	N/A
STP 88	40	VAFB-ISO-259	0.078	N/A
STP 89	40	VAFB-ISO-259	0.078	N/A
STP 90	40	VAFB-ISO-258	0.078	N/A
STP 91	40	VAFB-ISO-258	0.078	N/A
STP 92	40	VAFB-ISO-258	0.078	N/A
STP 93	60	AE-4232-ISO-001	0.117	N/A
STP 94	40	AE-4232-ISO-001	0.078	N/A
STP 95	40	AE-4232-ISO-001	0.078	N/A

a - STP 5 was originally planned and laid out but not excavated because it was in dense poison oak. STP numbers 54 and 55 were inadvertently skipped (not assigned).

6.2 UTILITY CORRIDOR

The Project includes a 100-meter-wide utility corridor, within which all future underground utility-related disturbance will occur. Æ excavated 27 shovel test pits within this portion of the ADI along Delphy Road (Figures 6-1 and 6-3; Table 6-1). Soils in these shovel test pits were predominantly gray and brown medium-grained sand encountered from 0 to 40 centimeters below surface. Subsurface strata included angular gravels in small amounts. No obvious evidence of disturbance was observed. All shovel test pits were negative for cultural material.

6.3 ROADS, FIREBREAKS, AND VEGETATION MANAGEMENT AREAS

Æ excavated 21 shovel test pits within firebreak and vegetation management areas and seven shovel test pits along the road improvement area east of the launch site (Figures 6-1 and 6-2; Table 6-1). Excavated soils were generally brown loamy sand with angular gravels in strata found 0–40 centimeters below the surface. Abundant sandstone fragments were found in many of the shovel test pits at depths of up to 60 centimeters below the surface. Compacted clay was also encountered at depths of around 80 centimeters below the surface. No obvious evidence of disturbance was observed. All shovel test pits were negative for cultural material.

Based on the Project description provided by Phantom/ManTech, activities associated with access improvements along Delphi and Ladd roads (shown in Figure 6-1) would occur only on existing pavement and within previously disturbed road margins. Therefore, after discussions with Vandenberg SFB Cultural Resource Manager Christopher Ryan, Æ did not place any shovel test pits within these areas of the ADI. Similarly, the portion of Honda Canyon Road that is within CA-SBA-670 will not need improvement, and the only Project activities there will be removal of vegetation from existing pavement; thus, no shovel test pits were excavated along Honda Canyon Road. Finally, Æ did not test along the abandoned dirt road connecting Honda Canyon Road with the southeast part of the SLC-5 pad because it was created by cutting into a steep slope and thus could not contain intact archaeological deposits.

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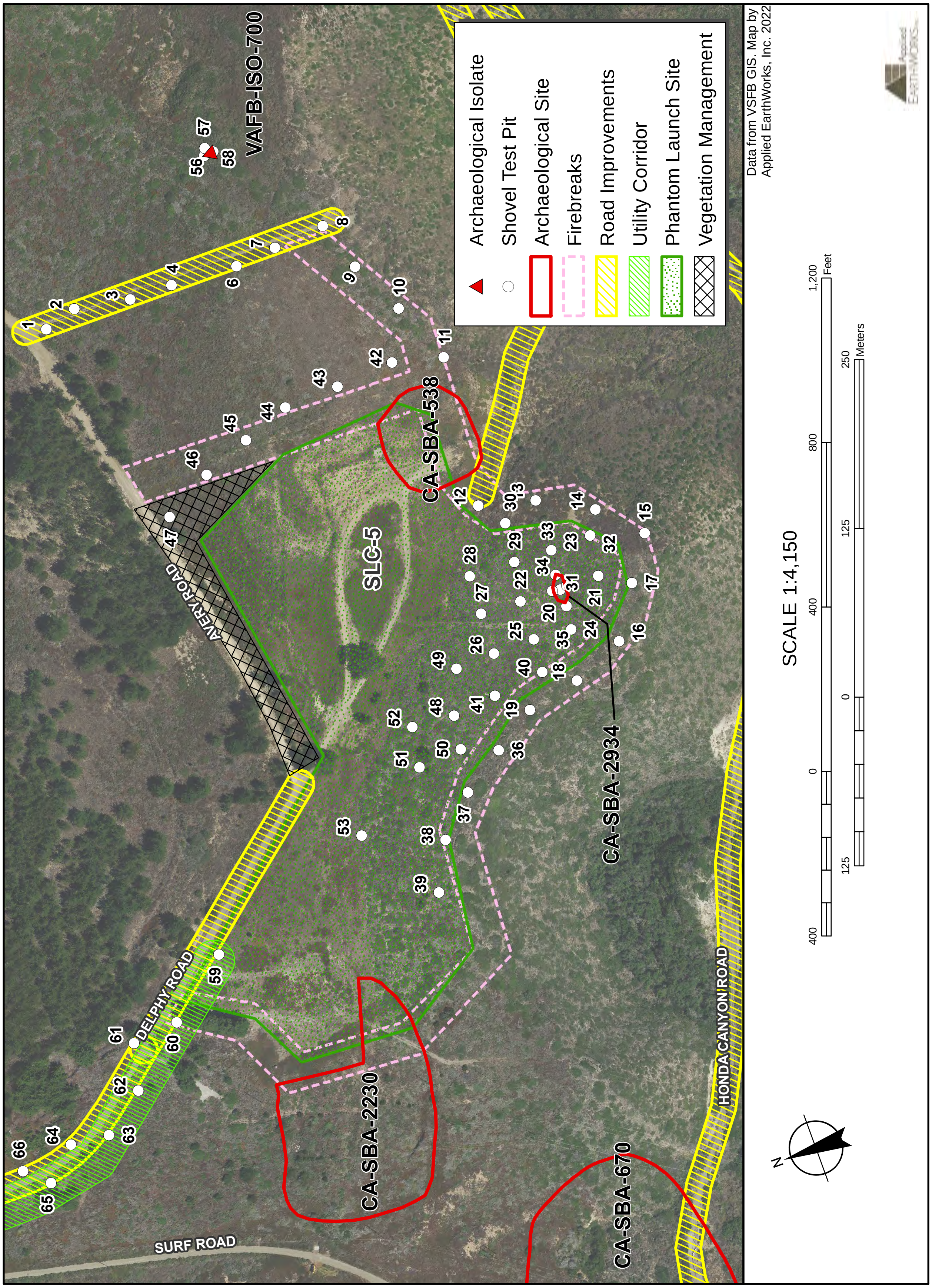

Figure 6-2 Shovel test pits excavated within the launch site, firebreak, vegetation management, and road improvement areas.

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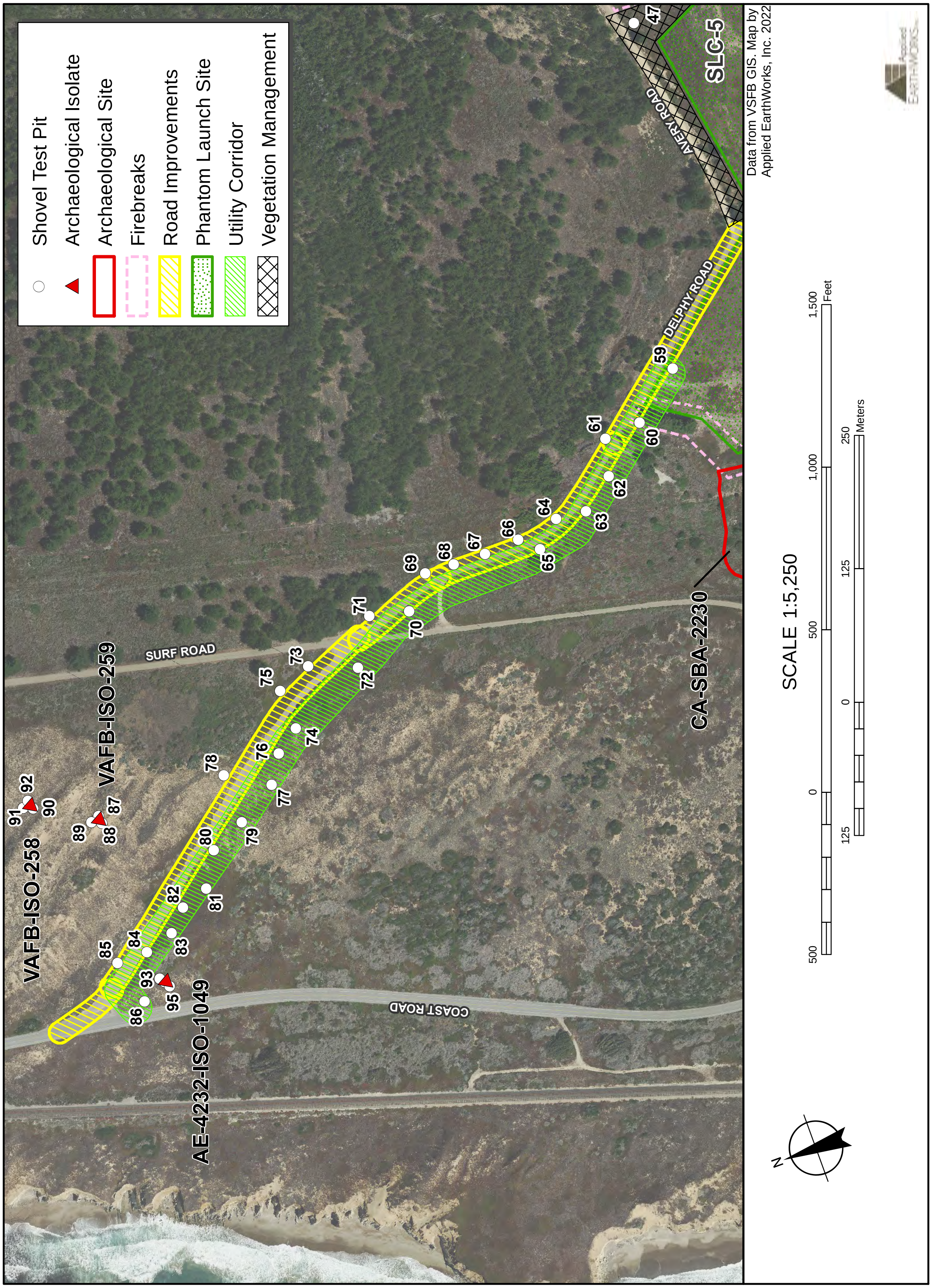

Figure 6-3 Shovel test pits excavated within the utility corridor.

6.4 SUMMARY

Æ excavated 92 shovel test pits for the Phantom Project. No cultural materials were encountered within any of the shovel test pits. All of the areas planned for ground disturbance were tested with the exception of previously tested areas; portions of the ADI that were too steep to contain archaeological sites; and areas where construction and demolition of the prior SLC-5 facility clearly precluded the presence of intact cultural deposits. In general, shallow strata were characterized by medium sands with a minor contribution of gravel inclusions. Depths below 40 centimeters often contained a higher abundance of fragmented sandstone. In many locations, dense compacted clay was encountered at approximately 80 centimeters below the surface. Clear signs of disturbance were uncommon.

7
ISOLATED ARTIFACTS

Æ excavated shovel test pits at the locations of three previously recorded isolates (VAFB-ISO-258, -259, -700) and one newly recorded isolated artifact (VAFB-ISO-1049) to check for the presence of subsurface cultural deposits (Figures 7-1, 7-2, and 7-3). This chapter describes each of these isolated artifacts and the results of the associated subsurface investigations.

7.1 VAFB-ISO-258

VAFB-ISO-258 is a black and tan banded Monterey chert secondary flake previously recorded east of Honda Canyon Road and north of the utility corridor along Delphy Road (Figure 7-1). The flake measures approximately 6.0 by 3.7 by 1.2 centimeters. Æ excavated three shovel test pits (STPs 90, 91, and 92) surrounding the mapped location of the isolate, which was not relocated (Figure 7-1). All three shovel test pits were dug to a maximum depth of 40 centimeters below the surface for a total excavated volume of 0.236 cubic meters. Soil in STP 90, 91, and 92 consisted of loose light brown sand with a well-developed organic soil horizon characterized by active vegetation.

No artifacts were recovered during excavation of the shovel test pits, and it is Æ's opinion that no subsurface archaeological deposits are associated with VAFB-ISO-258. Isolated artifacts are not eligible for the NRHP, and no further treatment is warranted at this location.

7.2 VAFB-ISO-259

VAFB-ISO-259, a slightly triangular battered sedimentary cobble, was recorded just south of VAFB-ISO-258 (Figure 7-1). Both the proximal and distal ends show signs of alteration. The cobble measures approximately 11.3 by 5.9 centimeters. Æ excavated three shovel test pits (STPs 87, 88, and 89) surrounding the location of the isolate, which was not relocated. All three shovel test pits were dug to a maximum depth of 40 centimeters below the surface for a total excavated volume of 0.236 cubic meters. Soils in STP 87, 88, and 89 were loose light brown sand with a well-developed overlying organic soil horizon characterized by active vegetation growth. No obvious disturbance was observed.

No artifacts were recovered during excavation, and it is Æ's opinion that no subsurface archaeological deposits are associated with VAFB-ISO-259. Isolated artifacts are not eligible for the NRHP, and no further treatment is warranted at this location.

7.3 VAFB-ISO-700

VAFB-ISO-700 is a core that was previously recorded east of the launch facility area, outside the ADI. Æ excavated three shovel test pits (STPs 56, 57, and 58) surrounding the mapped location of the isolate, which was not relocated (Figure 7-2). All three shovel test pits were dug to a maximum depth of 40 centimeters below the surface for a total excavated volume of 0.236 cubic meters. Soils in STP 56, 57, and 58 were predominately loose light brown sandy loam with a

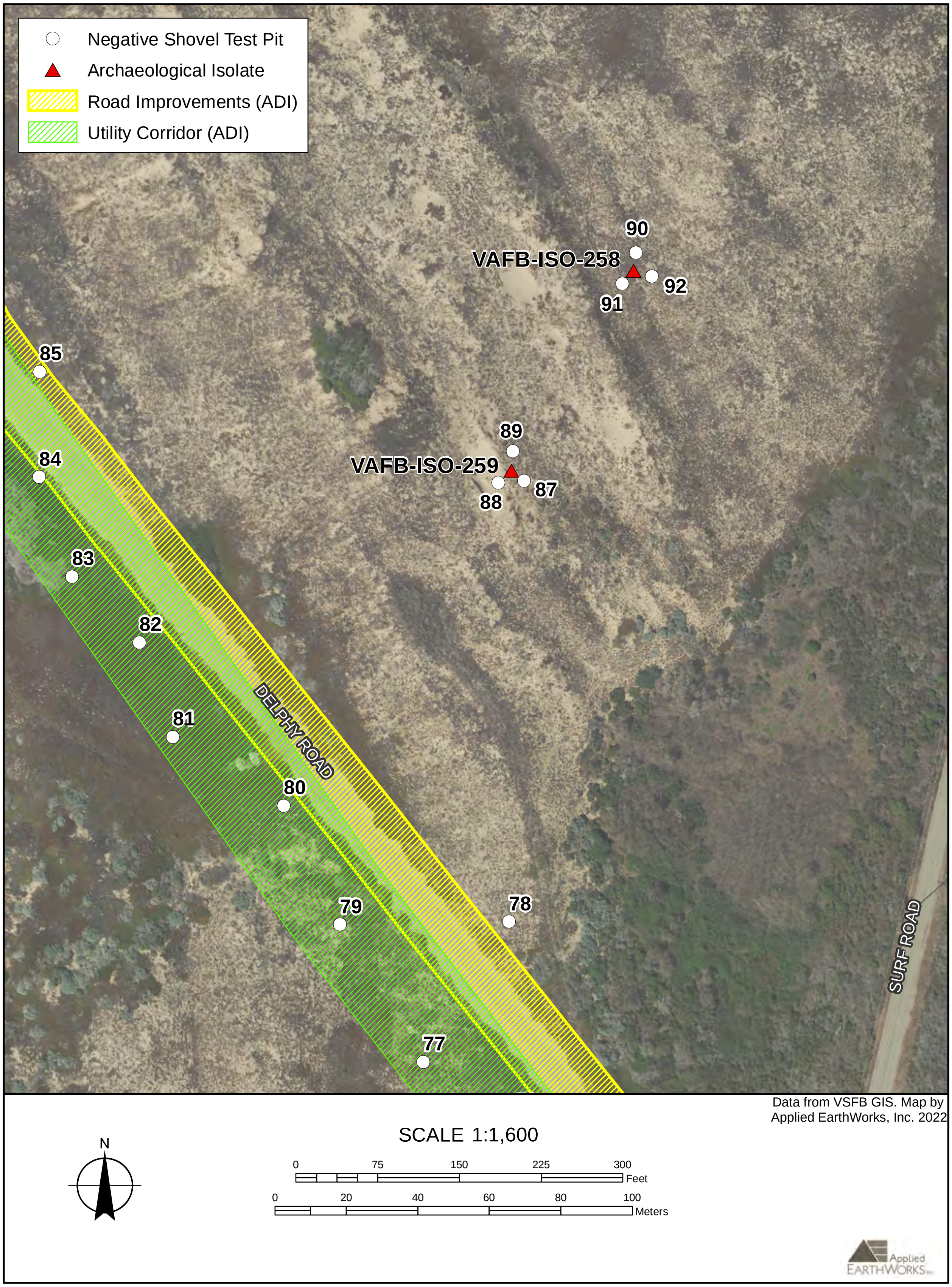

Figure 7-1 Shovel test pits excavated at the recorded locations of VAFB-ISO-258 and VAFB-ISO-259.

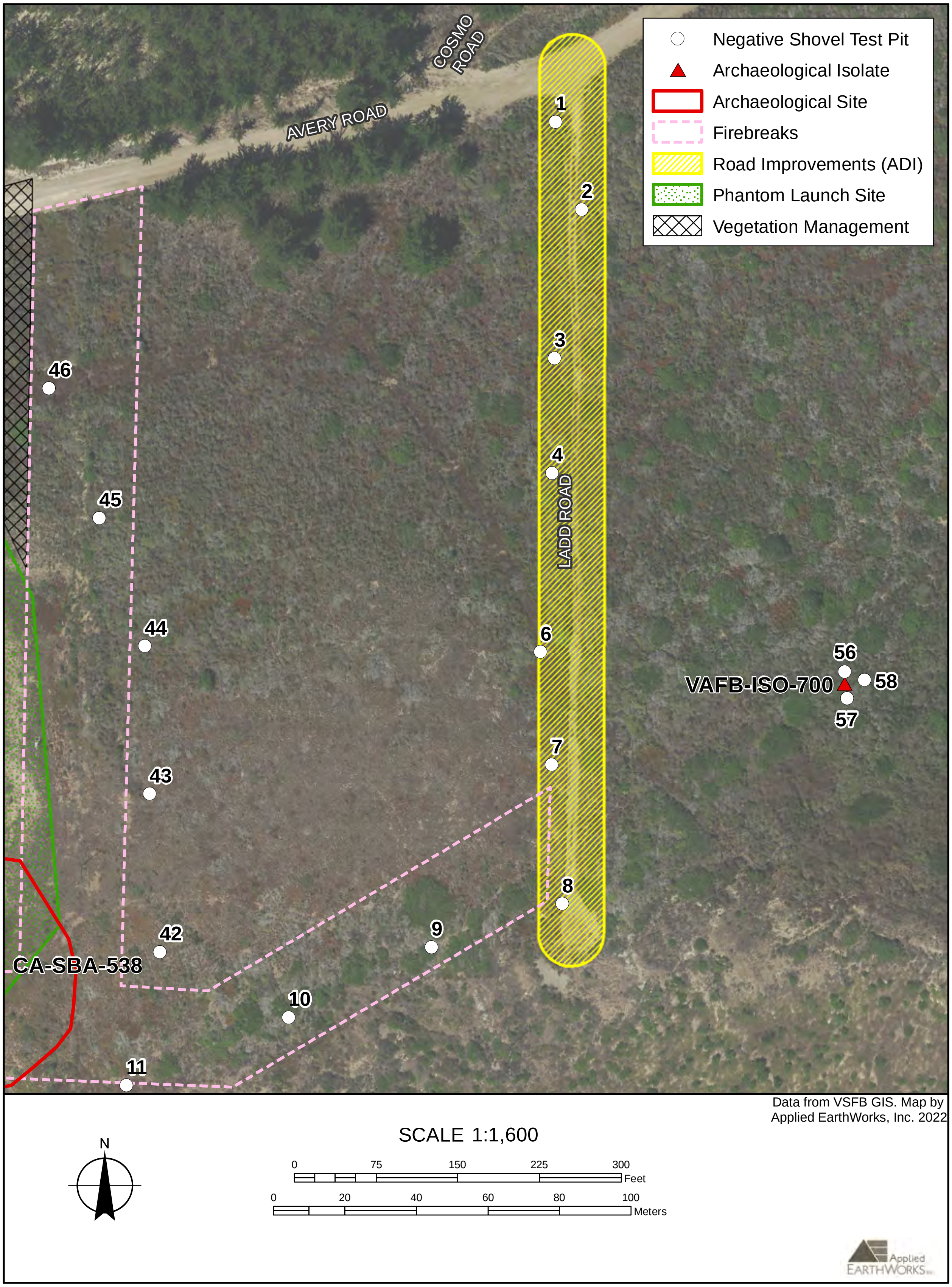

Figure 7-2 **Shovel test pits excavated at the recorded location of VAFB-ISO-700.**

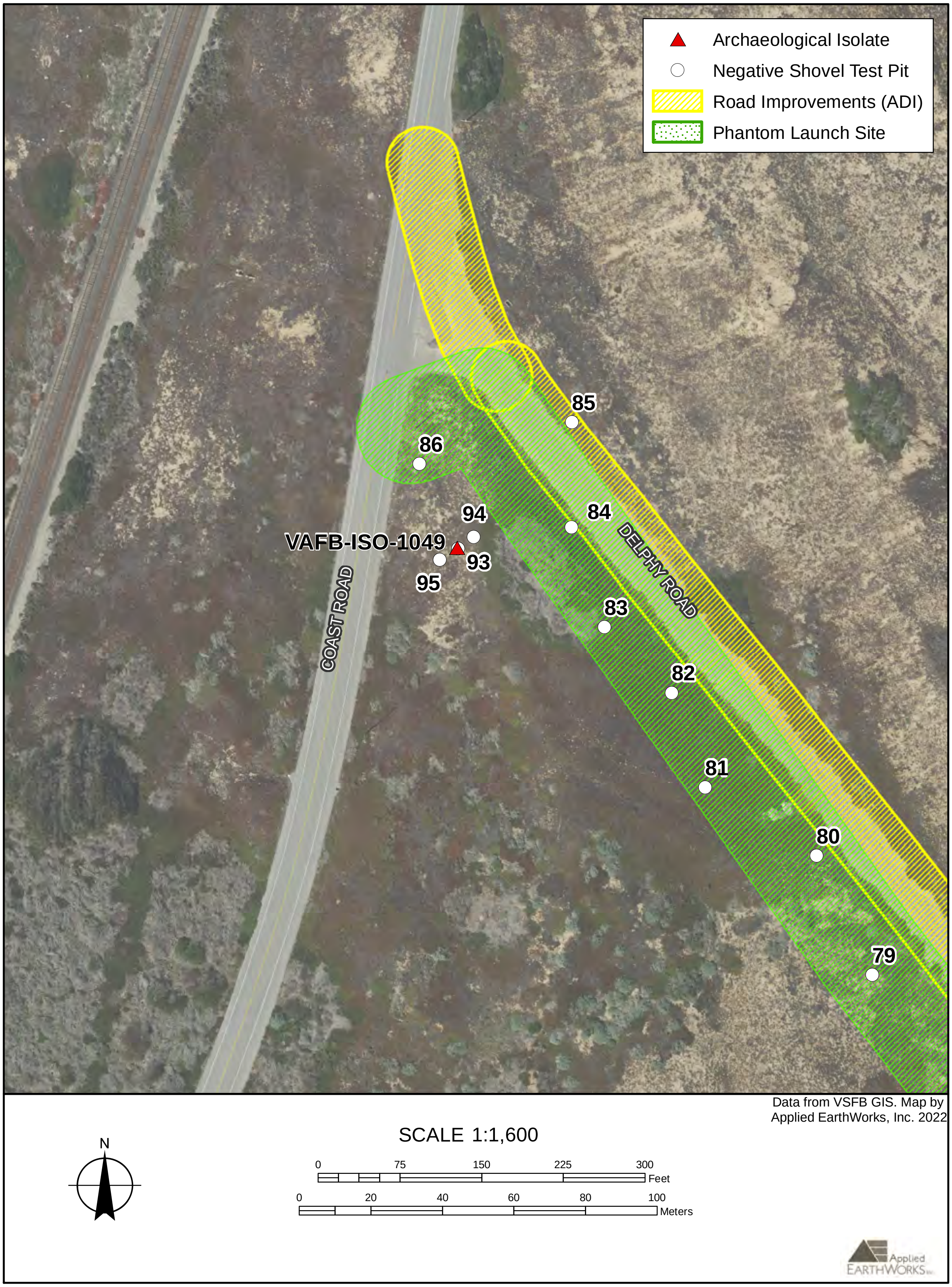

Figure 7-3 Shovel test pits excavated at the recorded location of VAFB-ISO-1049.

well-developed overlying organic soil horizon characterized by active vegetation on the surface. No obvious disturbance was observed.

No artifacts were recovered during excavation, and it is Æ's opinion that no subsurface archaeological deposits are associated with VAFB-ISO-700. Isolated artifacts are not eligible for the NRHP, and no further treatment is warranted at this location.

7.4 VAFB-ISO-1049

VAFB-ISO-1049 is an approximately 3.0 by 1.5-centimeter biface thinning flake made of light-colored chert with orange and white inclusions. Æ excavated three shovel test pits (STPs 93, 94, and 95) surrounding the isolate (Figure 7-3). All three shovel test pits were dug to a maximum depth of 40 centimeters below the surface for a total excavated volume of 0.236 cubic meters. Soils in STPs 93, 94, and 95 were largely loose light brown sand with a well-developed overlying organic soil horizon characterized by active vegetation growth.

No artifacts were recovered during excavation, and it is Æ's opinion that no subsurface archaeological deposits are associated withVAFB-ISO-1049. Isolated artifacts are not eligible for the NRHP, and no further treatment is warranted at this location.

8
CA-SBA-538

CA-SBA-538 is on south Vandenberg SFB within the southeastern portion of the SLC-5 ADI, approximately 1,200 meters east of the Pacific Coast and 1,600 meters northeast of Point Pedernales (Figures 8-1 and 8-2). Past studies concluded that the site likely no longer exists because of prior construction work and erosion and, as such, it was determined ineligible for the NRHP (SHPO-CON-17/USAF110418A; see Appendix C).

Figure 8-1 CA-SBA-538 site overview, facing southeast.

8.1 PREVIOUS INVESTIGATIONS

When first recorded in 1950, Lathrop described CA-SBA-538 as a sand blowout with artifacts on the surface, including a core scraper, cobble scraper, and a blade fragment. Spanne updated the site record in 1970 and noted that the site was destroyed during the construction of the Scout Launch Facility. A subsequent survey report (Glassow et al. 1976) describes the site as "situated on the northern rim of Honda Canyon where the Scout Launch Facility now exists. The site, recorded in the 1950s, was apparently destroyed by construction of that facility" (Glassow et al. 1976:87). No previous excavations have been conducted at CA-SBA-538.

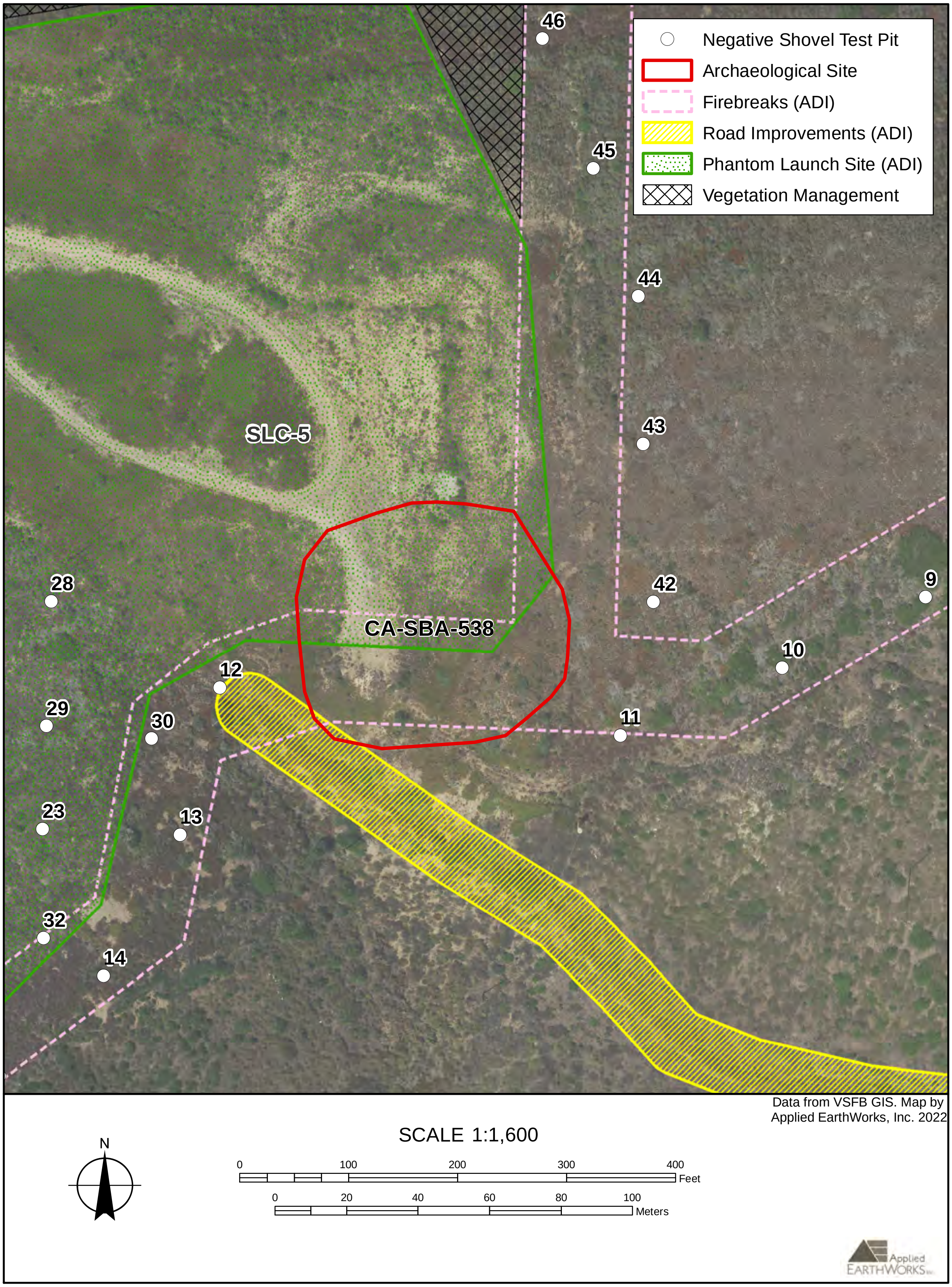

Figure 8-2 CA-SBA-538 in relation to the ADI.

8.2 CURRENT INVESTIGATION

Survey did not identify any surface artifacts at the previously recorded site location. No testing was conducted as part of the current investigation. Figure 8-2 shows units excavated for firebreak testing near the site, all of which were negative.

8.3 ASSESSMENT OF EFFECTS

CA-SBA-538 was determined ineligible for the NRHP (SHPO-CON-17/USAF110418A) and thus is not an historic property; therefore, the Project would have no effect on this site.

8.4 RECOMMENDATIONS

It is Vandenberg SFB policy to require monitoring of "potentially destructive construction activities within and adjacent to all known archaeological sites" (Lebow and Moratto 2005:x). To ensure that potentially significant site deposits can be treated appropriately if identified during construction near this site, Æ recommends archaeological and Native American monitoring during Project activities within or near CA-SBA-538. No other treatment strategies are recommended.

9
CA-SBA-670

A portion of CA-SBA-670 is within the southwestern area of the Phantom Project ADI (Figures 9-1 and 9-2). The site was determined eligible for NRHP in 1979 (Keeper Letter E.O.11593; see Appendix C). The site is at an elevation of 180 to 190 feet above sea level, approximately 200 meters east of the Pacific Coast and 645 meters northeast of Point Pedernales. Project activities within the site would be limited to removal of vegetation from the existing pavement of Honda Canyon Road.

Figure 9-1 CA-SBA-670 site overview, facing north from CA-SBA-539.

9.1 PREVIOUS INVESTIGATIONS

The following summary is taken primarily from the Æ N-lines report (Enright and Lebow 2011). Encompassing approximately 82,300 square meters, CA-SBA-670 was recorded during an early base-wide survey and classified as a seasonal village or intermittently occupied habitation site (Spanne and Glassow 1974). It lies at the junction of three roads and consequently has been the subject of numerous archaeological studies associated with infrastructure development. It was first tested in 1974 in conjunction with the Space Transportation System (STS) (Glassow et al. 1976), an effort that found dense concentrations of marine shell, vertebrate faunal remains, lithic debitage, flaked stone tools, and fire-altered rock. Following that effort, the site was determined eligible for the NRHP in 1979.

Extensive data recovery excavations were completed for the STS during 1978–1980 (Glassow 1981, 1990, 1996); the total excavated volume, including testing, was 52.73 cubic meters (Glassow 1990:Table 10.11). That effort was focused on the edge of Coast Road. Two midden strata were identified. The lower midden was radiocarbon dated between 4585 and 3175 cal B.P., corresponding to the last half of the Early Period, while the upper midden deposit dated between 490 and 335 cal B.P., corresponding to the later part of the Late Period. Temporally diagnostic artifacts, including shell beads and projectile points, supported the radiocarbon data. Bifaces and lithic debitage were abundant in the lower midden. Other cultural remains associated with this deposit included 13 projectile points, 124 flake tools, five cores, four tarring pebbles, two mano fragments, two metate or mortar fragments, a globular mortar fragment, animal bones, and marine shell. Artifacts recovered from the upper midden included four projectile points, three cores, four shell fishhooks, five tarring pebbles, animal bones, and marine shell. Fewer bifaces were recovered from the lower midden, and lithic debitage was present in much lower frequencies.

Other archaeological studies have been completed at CA-SBA-670. Spanne (1980) examined a trench south of Honda Canyon Road that had been inadvertently excavated within the site. Complex cultural stratigraphy was apparent, and 5–10 cultural strata were observed. Glassow and his students from University of California, Santa Barbara subsequently examined backhoe trenches excavated in the site for a telephone cable (Stone and Glassow 1980). Two midden deposits also were identified in a trench south of Honda Canyon Road, but these were determined to be redeposited materials. Schilz (1985) reports excavation of 15 shovel test pits along Surf Road in conjunction with an STS gas pipeline (Schilz 1985:22–23, Figure 27). Marine shell and flaked stone were recovered from the shovel pits. Additional testing was subsequently completed along Coast, Surf, and Honda Canyon roads for two gas pipelines associated with the STS (Ferraro et al. 1988; Moore et al. 1988). The work was focused along Coast Road and only extended for short distances along Surf and Honda Canyon roads. Excavations included eight 1 by 1 meter units and 19 auger borings. Intact portions of the site's lower midden were sampled, revealing a moderately dense deposit of lithic debitage, biface fragments, utilized flake tools, and other lithic artifacts. A stone-lined hearth also was discovered (Moore et al. 1988:7-8–7-9). Ferraro et al. (1988) concluded that the site contains three distinct occupations. Because significant cultural deposits would be impacted, seven auger borings, four 1 by 1 meter units, and four 9 by 0.5 meter trenches were excavated to recover data from the pipeline rights-of-way, primarily along the east side of Coast Road (Environmental Solutions 1990b). Five additional 1 by 1 meter units were excavated to recover data from the stone-lined hearth. The initial site occupation was found to date to about 6500–6000 B.P.

Æ tested portions of CA-SBA-670 for multiple projects. Lebow (2001) reported excavations for utility pole installation associated with the Encapsulated Payload Transfer Route. That effort included four test excavation units placed near the eastern boundary of the site, an effort that yielded only 34 flakes and a single core.

Æ excavated 31 shovel test pits and four 1 by 1 meter units (a total volume of 11.54 cubic meters) along Surf Road within CA-SBA-670 for the SLC-4 to SLC-6 Waterline Replacement Project (Lebow et al. 2003). Although archaeological materials were common, few were found in intact sediments. Instead, most of the recovered materials appeared to be redeposited as a result of road construction.

For the N1, N3, and N6 Feeder Lines Project (Enright and Lebow 2011), Æ excavated three shovel test pits to a depth of 100 centimeters along Surf Road. These excavations did not yield any cultural material. The shovel test pits were described as containing road fill and road gravels in the upper layers with loose sand in the lower levels.

Table 4-1 lists prior studies associated with CA-SBA-670. Figure 9-2 shows excavation units associated with all previous studies at the site, and Figure 9-3 shows prior excavations at the site within the Project ADI.

9.2 CURRENT INVESTIGATION

No testing was performed to assess Project effects along the portion of Honda Canyon Road within CA-SBA-670 because no ground disturbance within the site is planned as part of the Project.

9.3 ASSESSMENT OF EFFECTS

The proposed Phantom Project would require improvements to existing roads to provide improved fire safety and access. NRHP-eligible site CA-SBA-670 is bisected by Honda Canyon Road, which provides access to the launch site. However, the portion of Honda Canyon Road within CA-SBA-670 would not require improvements, and Project activities within the site would be limited to removal of vegetation from the existing paved road segment. Based on this information and discussions with Vandenberg SFB cultural resources personnel, no testing was performed at this site. However, based on prior excavation results along the south side of Honda Canyon Road just east of the intersection of Coast, Surf, and Honda Canyon roads, intact buried deposits associated with CA-SBA-670 almost certainly exist along Honda Canyon Road. Placement of protective fencing along the road through the site would prevent accidental incursion into these deposits; with implementation of this measure, activities associated with this Project would have no adverse effect on a historic property.

9.4 RECOMMENDATIONS

In order to avoid inadvertent damage to intact portions of CA-SBA-670 adjacent to Honda Canyon Road, Æ recommends placement of protective fencing along both sides of the road through the site. Because the eastern site boundary has not been ascertained via testing, extension of fencing 60 meters (200 feet) beyond the site's mapped eastern boundary is also recommended.

It is Vandenberg SFB policy to require monitoring of "potentially destructive construction activities within and adjacent to all known archaeological sites" (Lebow and Moratto 2005:x). To ensure that potentially significant site deposits can be treated appropriately if identified during work near this site, Æ recommends archaeological and Native American monitoring during any road improvements adjacent to CA-SBA-670.

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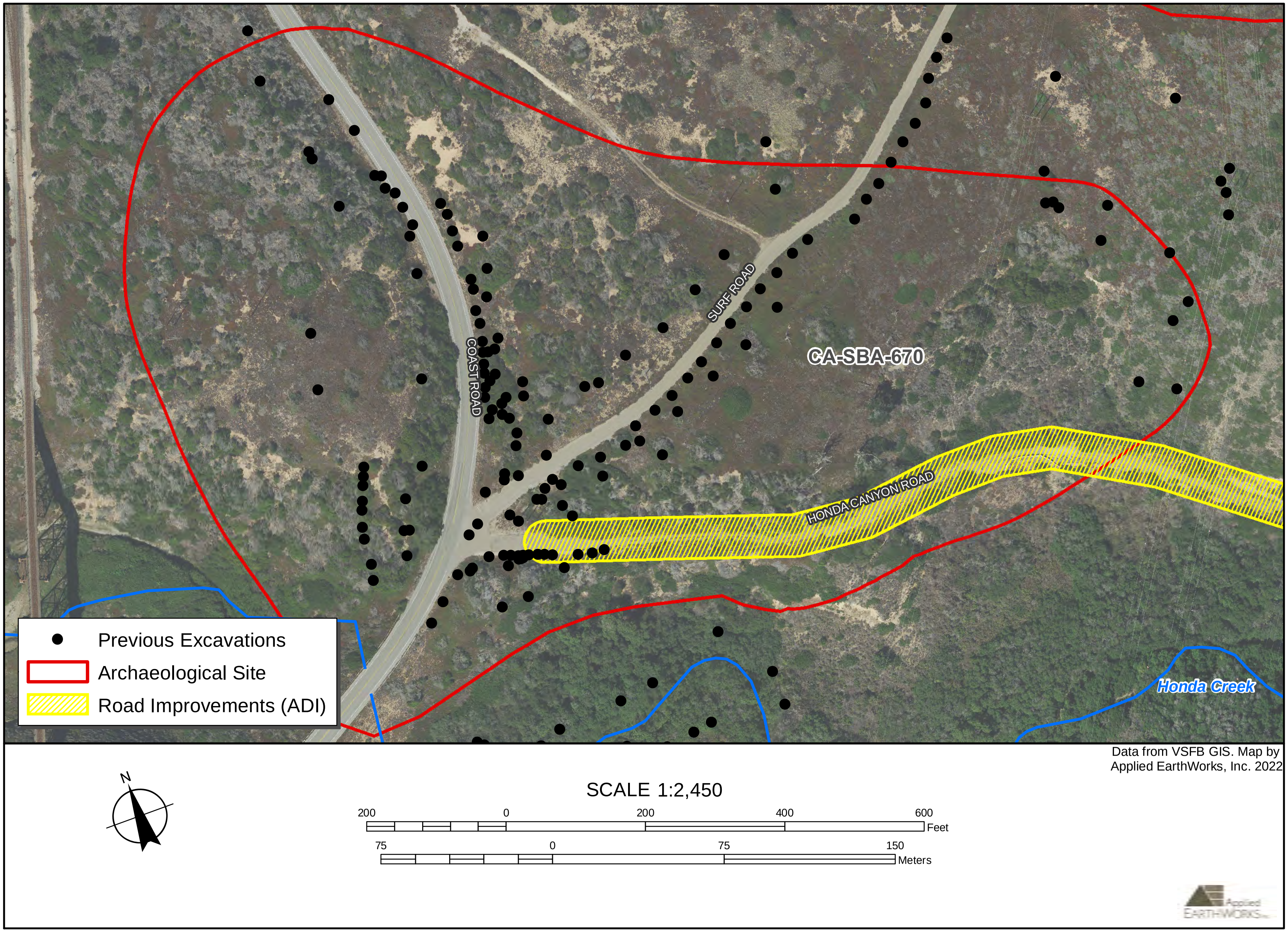

Figure 9-2 Previous excavations at CA-SBA-670.

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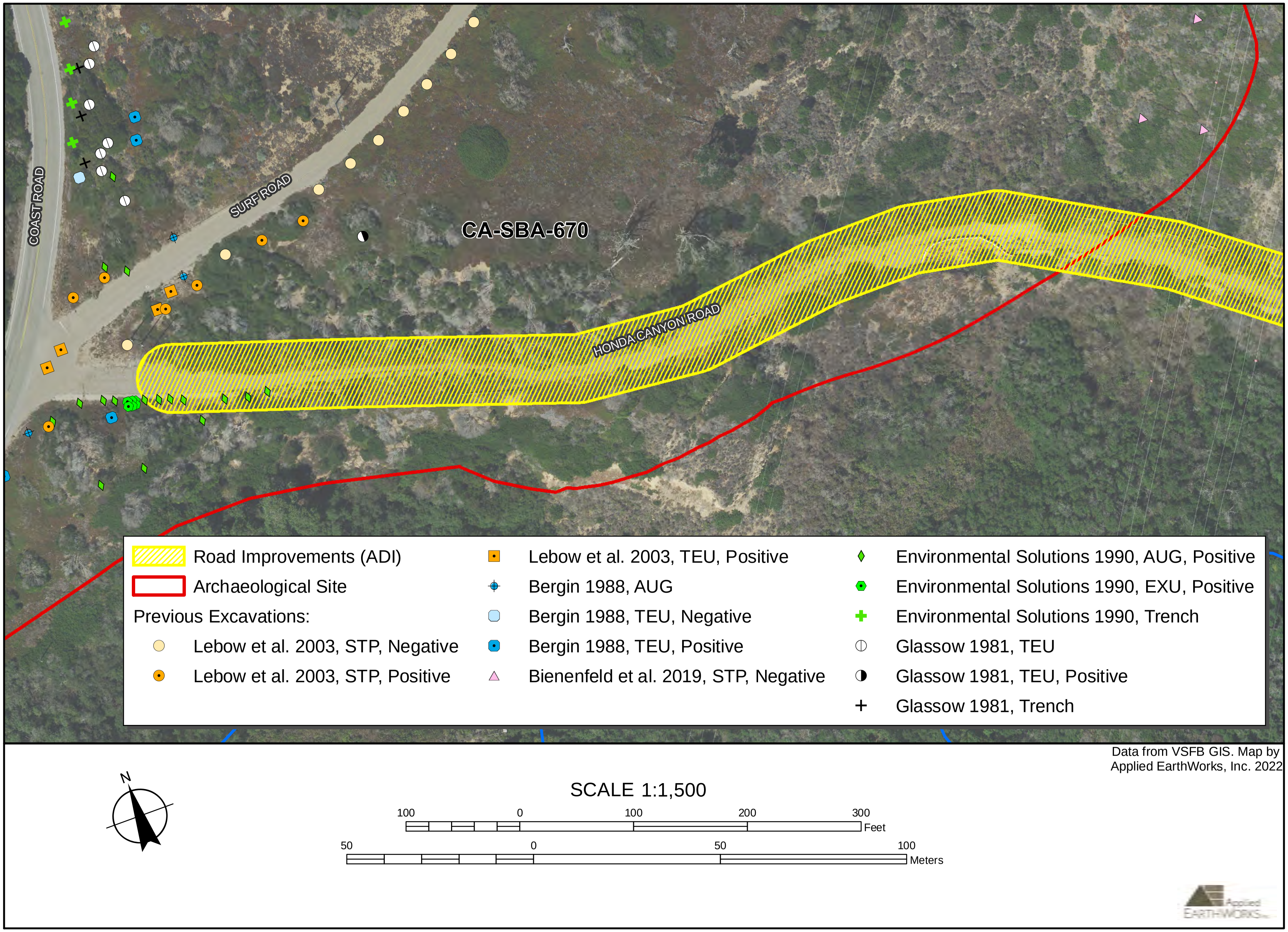

Figure 9-3 Previous excavations at CA-SBA-670 within and near the ADI.

10
CA-SBA-2330

CA-SBA-2230 is within the launch site and firebreak portions of the Phantom ADI, between Delphy and Surf roads. The site was originally recorded in 1988 as a low-density scatter of flaked stone and ground stone east of Surf Road. The site was re-recorded and tested during a survey for the SLC-4 Power System Upgrade Project (Schmidt and Bergin 1990). That testing identified two artifact concentrations encompassing approximately 30,150 square meters (Lebow 2004:5.8).

Figure 10-1 Overview of CA-SBA-2230, facing south.

A SHPO concurrence letter dated June 20, 2011 (SHPO-CON-17/USAF110418A; see Appendix C) indicates that the site was determined ineligible for the NRHP as it appears to contain only sparse, disturbed, and homogenous archaeological remains with limited data potentials. A recent SHPO concurrence letter (SHPO-CON-351/USAF_2019_0510_001 dated June 12, 2019; see Appendix C), affirms the initial determination of site ineligibility.

10.1 PREVIOUS INVESTIGATIONS

Several previous subsurface and surface investigations have occurred at CA-SBA-2230 (Figure 10-2). The initial surface survey conducted in 1989 determined the dimensions of the site

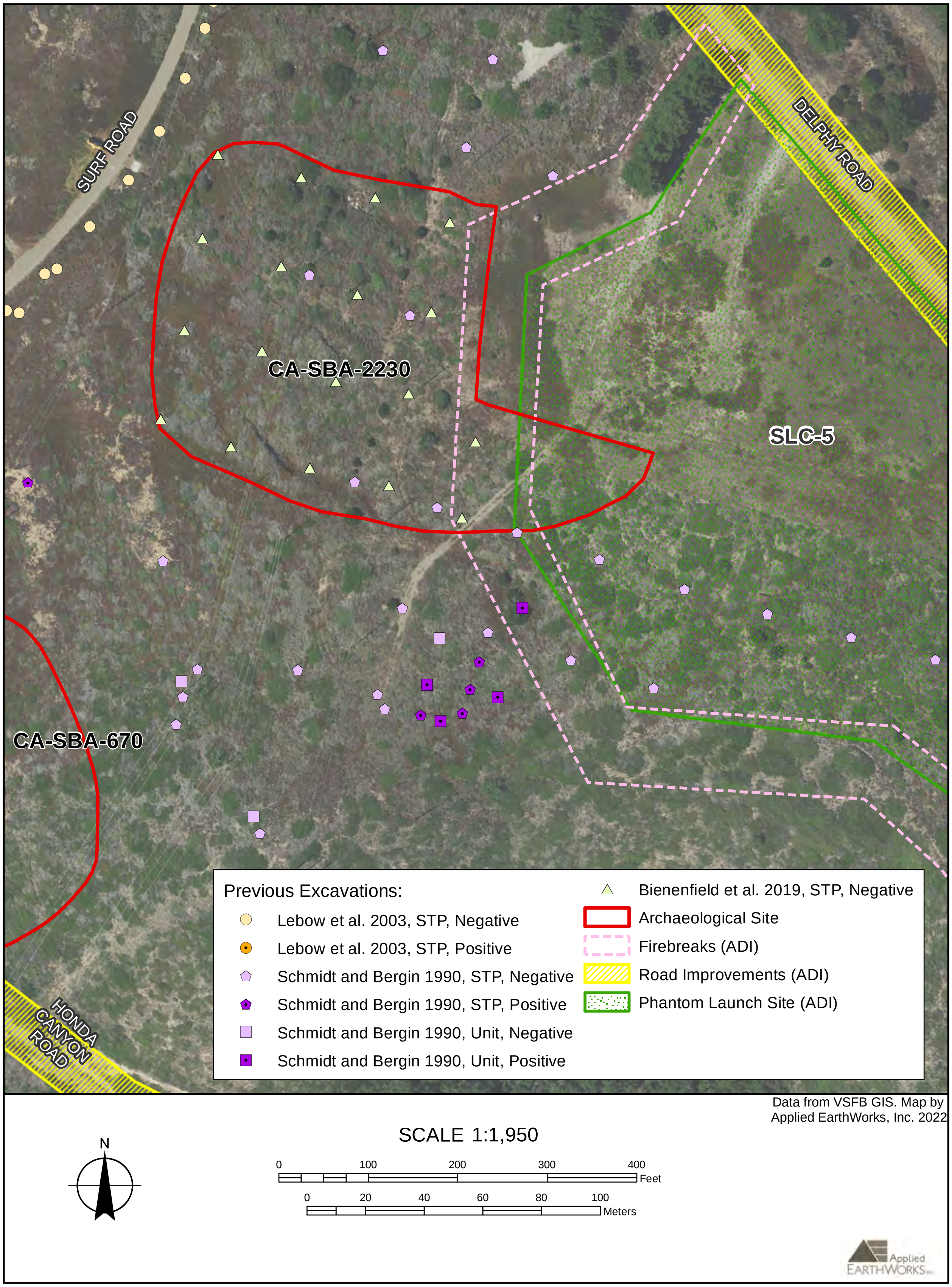

Figure 10-2 Previous excavations at CA-SBA-2230.

to be approximately 335 by 120 meters. Further work in 1990 reduced the site area to 45 meters in diameter (Schmidt and Bergin 1990). Cultural materials observed at that time included lithic debitage, a biface, and shell remains. Past development from the installation of two power lines and the construction of a service road impacted the area around the site. As a result of these past impacts coupled with the sparse amount of cultural material recovered, the site was recommended ineligible for listing on the NRHP.

Bienenfeld et al. (2019) conducted additional testing at CA-SBA-2230, which included the excavation of 18 shovel test pits extending to a maximum of 100 centimeters below surface in most locations. No cultural material was encountered.

10.2 CURRENT INVESTIGATION

No testing was conducted at CA-SBA-2230 during the current Project because it was previously determined ineligible for listing in the NRHP. Additionally, recent testing demonstrated that most locations within the recorded site boundaries do not contain subsurface cultural deposits (Bienenfeld et al. 2019).

10.3 ASSESSMENT OF EFFECTS

CA-SBA-2230 was determined ineligible and thus is not a historic property. Therefore, the Project would have no effect on this site.

10.4 RECOMMENDATIONS

It is Vandenberg SFB policy to require monitoring of "potentially destructive construction activities within and adjacent to all known archaeological sites" (Lebow and Moratto 2005:x). To ensure that potentially significant site deposits can be treated appropriately if identified during construction in or near this site, Æ recommends archaeological and Native American monitoring during demolition activities within or near CA-SBA-2230. No other treatment strategies are recommended.

11
CA-SBA-2934

CA-SBA-2934 is within the south-central portion of the launch facility area of the ADI (Figure 11-1). The site was recorded in 1994 by H. Calicher during a base-wide pedestrian survey as a sparse lithic scatter with five flakes and a tabular fragment. The site record describes it as approximately 20 meters southwest of the terminus of Dart Road on a terrace on the north side of lower Honda Canyon. CA-SBA-2934 has not been evaluated for NRHP eligibility.

Figure 11-1 Overview of CA-SBA-2934 at STP 20, facing north.

11.1 PREVIOUS INVESTIGATIONS

With the exception of condition assessments in 2009 and 2017 that give the site an extremely low score but provide no additional information (Lebow 2009; Murphy 2017), no past studies have been conducted at CA-SBA-2934. The initial site record notes that the area is very disturbed due to previous development, most notably SLC-5 and Dart Road.

11.2 CURRENT INVESTIGATION

The surface survey conducted for the Project did not identify any artifacts in the mapped location of CA-SBA-2934. Æ excavated five shovel test pits within the recorded site location to test for the presence of subsurface deposits (Figure 11-2; Table 11-1). Excavators observed disturbance

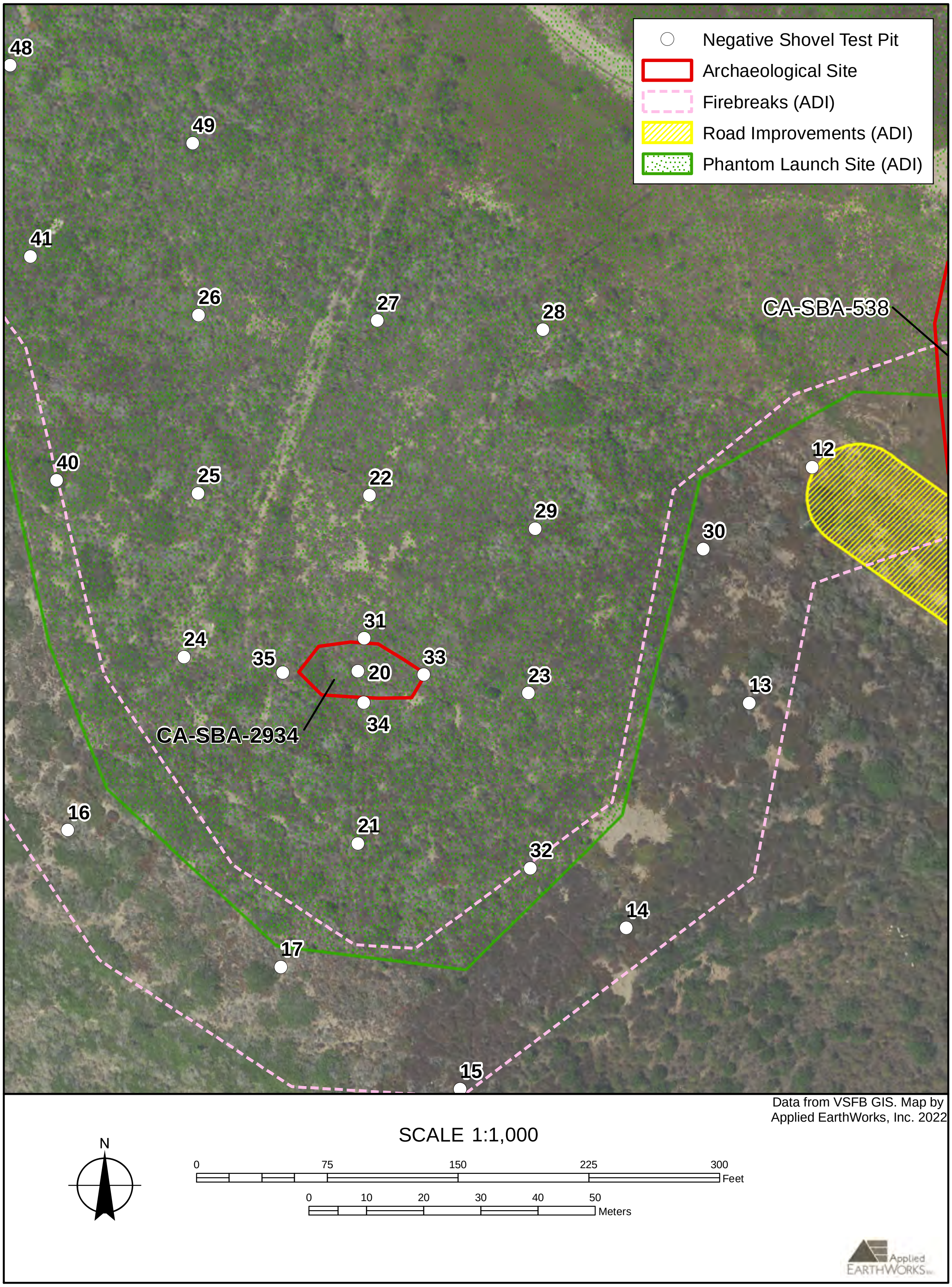

Figure 11-2 Shovel test pits excavated at CA-SBA-2934.

in the upper levels of soil, and imported gravels were present in some locations. Light brown sand and sandstone also characterize deeper stratigraphic layers, and dense compact clay was present at the bottom of most units. Shovel test pits were excavated to 100 centimeters below the surface unless obstructed by dense sandstone or impenetrable clay. No cultural materials were encountered in any of the shovel test pits. Based on this work, the site appears to have been destroyed during construction and/or demolition for SLC-5. An updated site record for CA-SBA-2934 is included as Appendix B of this report.

Table 11-1
Summary of Shovel Test Pits within CA-SBA-2934

Unit	Max. Unit Depth (cm)	Max. Depth of Cultural Remains (cm)	Material Summary (number/type)[a]	Volume (m^3)
STP 20	100	N/A	None present	0.195
STP 31	100	N/A	None present	0.195
STP 33	20	N/A	None present	0.039
STP 34	95	N/A	None present	0.185
STP 35	100	N/A	None present	0.195

11.3 EVALUATION OF NATIONAL REGISTER ELIGIBILITY

Based on application of the eligibility criteria summarized below, it is Æ's opinion that CA-SBA-2934 is not significant under any of the NRHP criteria and, therefore, is not a historic property eligible for inclusion in the NRHP.

Criterion A

No data observed or recovered from the site indicate that CA-SBA-2934 is associated with events that have made a significant contribution to the broad patterns of our history. CA-SBA-2934 is not significant under Criterion A.

Criterion B

No data observed or recovered from the site indicate that CA-SBA-2934 is associated with a person or persons significant in the past. CA-SBA-2934 is not significant under Criterion B.

Criterion C

There are no historic-era buildings or structures within CA-SBA-2934, nor is there any evidence of distinctive methods of construction or materials that represent the work of a master or possess high artistic value. Therefore, CA-SBA-2934 is not significant under Criterion C.

Criterion D

Based on the current investigations at CA-SBA-2934, which documents that site deposits are no longer present, the site has not yielded, nor is it like to yield, information important to understanding prehistory. Past studies document a low density and diversity of artifacts, and no chronological data were recovered during past investigations. Consequently, due to a lack of data potential, the site is not significant under Criterion D.

11.4 RECOMMENDATIONS

It is Vandenberg SFB policy to require monitoring of “potentially destructive construction activities within and adjacent to all known archaeological sites” (Lebow and Moratto 2005:x). To ensure that potentially significant site deposits can be treated appropriately if identified during construction in or near this site, Æ recommends archaeological and Native American monitoring during demolition activities within or near CA-SBA-2934. No other treatment strategies are recommended.

12
SUMMARY OF FINDINGS

The proposed SLC-5 Phantom Space Project would develop a launch facility in the approximate footprint of the decommissioned SLC-5 on south Vandenberg SFB in Santa Barbara County, California. ManTech retained Æ to provide cultural resources support for the Project. Because the Project is on federal property, it is an undertaking as defined in 36 CFR 800.16(y) and thus is subject to Section 106 of the National Historic Preservation Act. Additionally, the FAA expects to receive an application from Phantom to conduct commercial launches at the launch site, and the FAA's proposed issuance of a launch license is also considered an undertaking as defined in 36 CFR 800.16(y). This report is intended to support U.S. Space Force and FAA compliance with Section 106 for the Project.

Based on information provided by Phantom Space Corporation and guidance from Vandenberg SFB, Æ defined the ADI as the footprint for all foreseeable project-related ground-disturbing activities, including launch pads and related infrastructure; the utility corridor; and roads, firebreaks, and vegetation management areas. The APE is defined as the ADI plus the entirety of any cultural resources it contains or intersects. The APE for this Project also includes a nearly 3,200-foot radius around the proposed launch facility for noise vibration levels above 120 dB as well as a sonic boom arc that would occur during launches and produce ground-level vibrations of 2 psf or greater over open ocean. These are the lowest noise and vibration levels with the potential to affect certain types of historic buildings, rock walls or rock cairns, and rock shelters or rock art. Although the Project proposes to launch both the Daytona-E and Laguna-E vehicles, the Laguna-E would produce more noise and vibration than the Daytona-E. Therefore, the Laguna-E noise study results are used for this analysis and to define the APE.

Background research confirmed that no historic buildings or rock cairn, rock shelter, or rock art resources are within the 120-dB Laguna-E launch noise contour. One structure, the Honda Trestle, is within the 120-dB Laguna-E launch noise contour. Like military and launch support facilities, the railroad trestle was built to withstand concussive forces; therefore, this structure does not have the potential to be adversely affected by rocket engine noise. Similarly, the Anza Trail (CA-SBA-3804) is within the launch noise contour but does not have any physical manifestation and therefore does not have the potential to be affected by rocket engine noise. Additionally, the 2-psf sonic boom arc would not occur over land. Thus, neither the Anza Trail nor the Honda Trestle are included in the APE. Rather, the focus of this report is the ADI and APE related to the area of physical impacts.

Background research revealed that four archaeological sites (CA-SBA-538, -670, -2230, and -2934) were previously recorded within the ADI. CA-SBA-670 was previously determined eligible for the NRHP (Keeper Letter E.O.11593). CA-SBA-538 and CA-SBA-2230 were previously determined ineligible for the NRHP (USAF110418A). The NRHP eligibility of CA-SBA-2934 was unevaluated prior to the current study.

Æ completed surface and subsurface surveys in support of the Phantom Project. Surface survey found one isolated artifact (VAFB-ISO-1049) near the Project but outside the APE. Æ also performed testing to evaluate the eligibility of CA-SBA-2934 and check for subsurface deposits at VAFB-ISO-1049 and three previously identified isolates (VAFB-ISO-258, -259, and -700) near the Project but outside the APE. In consultation with Vandenberg SFB cultural resources personnel, no testing was performed in the portion of NRHP-eligible CA-SBA-670 within the ADI because Project activities within this site would be limited to clearing vegetation from the existing pavement. Additionally, no testing was performed in areas of the APE that were too disturbed from facility demolition or other grading or too steep to contain intact subsurface deposits.

Surface and subsurface survey identified no previously unrecorded archaeological sites and one isolated artifact. Subsurface survey revealed that, likely due to ground disturbance associated with the demolition of SLC-5, CA-SBA-2934 is no longer present. Subsurface testing also confirmed that all of the isolated artifacts are truly isolated and not surface manifestations of archaeological sites.

In summary, testing for the Phantom Project did not yield any archaeological materials. With installation of protective fencing to ensure Project activities do not occur off the road and encroach into the portion of CA-SBA-670 within the ADI, the Project would have no adverse effect on historic properties.

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APPENDIX A

Research Design for Prehistoric Resources, Vandenberg Space Force Base

RESEARCH DESIGN FOR PREHISTORIC RESOURCES
VANDENBERG SPACE FORCE BASE

By
Clayton G. Lebow

October 2017

This research design for investigating prehistoric archaeological resources on Vandenberg Space Force Base (Vandenberg SFB or Base; previously Vandenberg Air Force Base [AFB]) was originally adapted from Lebow and Moratto (2005) and has been periodically updated as new data are available. First is a context for research. Specific research issues within those contexts that are relevant to data potentials are then examined and data requirements necessary to address those research issues are discussed.

CONTEXT FOR RESEARCH

Although numerous archaeological projects have been completed on and near Vandenberg SFB, none major studies provide a substantial foundation and context for other research on the base. In chronological order, these nine studies are: (1) excavations during the 1970s at various sites on south Vandenberg SFB for the Space Transportation System; (2) investigations on the San Antonio Terrace for the MX program and associated test facilities, as well as subsequent studies on the San Antonio Terrace; (3) studies associated with development of space launch complexes on South Base; (4) excavations for the Union Oil of California pipeline project; (5) investigations for the Coastal Branch Aqueduct; (6) investigations associated with infrastructure development along Combar Road; (7) investigations for infrastructure development along Tranquillon Mountain Road; (8) excavations for the San Antonio Creek Stream Restoration Project; and (9) archaeological excavations at various eroding sites on the base performed under Section 110 of the National Historic Preservation Act. Each of these studies is summarized below.

Applied EarthWorks, Inc. has been completing archaeological studies on the Base since 1995 and has compiled a large volume of data relevant to prehistory. The concluding discussion of research context is a summary of temporal patterns evident in the data from more than 28 well-dated archaeological assemblages.

Space Transportation System Project

During the early 1970s, the Air Force selected Vandenberg AFB as part of the Space Shuttle Program, formally known as the Space Transportation System (STS). Cultural resource studies for proposed STS facilities were started in a corridor 21 miles long and 3,000 feet wide (encompassing approximately 13 square miles) between the Santa Ynez River and a location south of Point Arguello. Working under a National Park Service contract, UCSB surveyed the project area for cultural resources in 1974 and identified 80 archaeological sites in the project area, including 40 previously unknown sites. Thirty-one of the 80 sites most likely to be affected by STS facilities were tested to evaluate their eligibility for the National Register (Glassow et al. 1976; Spanne and Glassow 1974).

In their examination of site distributions resulting from the survey, Glassow et al. (1976:49–50) noticed that settlement patterns varied depending on the type of coastline. Where the coastal environment was characterized by sandy beaches, such as around the mouth of the Santa Ynez River, population centers were located several miles inland, presumably because the dunes associated with sandy beaches contained relatively few resources. Glassow et al. (1976) inferred that people from these population centers made periodic trips to rocky coastal areas to gather shellfish. Conversely, where the coastline faces south and a rocky foreshore is more typical, population centers were located on the coastal plain because marine resources there were more abundant. Populations in such areas appeared to be more sedentary as compared to those of interior groups.

Additional planning for the STS narrowed the Area of Potential Effects to the point that only three of the sites considered eligible for the National Register would be impacted. Still under a National Park Service contract, data recovery excavations began at CA-SBA-539, -670, and -931 in November 1978. The results of both testing and data recovery excavations are reported in detail by Glassow (1990) and subsequently summarized in a published case study (Glassow 1996).

Guiding the data recovery investigations at the three STS sites were five research topics, all subsumed within the general theme of cultural adaptations to environmental changes and fluctuations in human populations. These topics included: (1) the relationship among subsistence change, human population growth, and long-term environmental fluctuations; (2) the relationship between settlement patterns and seasonal and geographic variations in resource distributions and shelter; (3) the relationship between emphasis on food resource types and population growth; (4) the relationship between tool form and tool use; and (5) the relationship among economic exchange, population growth, and status differentiation (Glassow 1990:3-4–3-9).

Using frequencies of 61 radiocarbon ages in 250-year increments as a proxy for activity intensity, and thus human population, Glassow (1990:6-2) identified a period of high population between 9250 and 6500 B.P., with a noticeable peak in radiocarbon dates at the 8000–7750 B.P. interval. A gap was evident between 6250 and 5000 B.P. Another decline existed at the 3250–3005 B.P. interval, but frequencies on either side of this decline were too low to provide much confidence in the accuracy of the decline. An obvious peak appeared between 2500 and 2000 B.P., followed by a sharp decline in date frequencies. The latest and highest peak existed at the 750–505 B.P. interval.

These patterns in the date frequencies were then correlated with paleoenvironmental data. The earliest peak population frequencies corresponded to a period of rapidly improving climatic conditions following the Pleistocene (Glassow et al. 1988). Climatic conditions appeared to have been cooler and wetter, and wetlands were probably more extensive. Low radiocarbon frequencies between 6500 and 5000 B.P. occurred within a period of warm sea temperatures, which Glassow correlated with warm and dry climatic conditions. A period of varying population density between 5000 and 2000 B.P. was associated with overall cooler conditions, but sea temperatures fluctuated considerably during this period. Glassow inferred that the terrestrial environment during this time was relatively xeric. A depression in radiocarbon frequencies around 3000 B.P. corresponded to a brief period of very warm sea temperatures between 3500 and 3200 B.P. Moderate sea temperatures were evident after 2000 B.P., when the numbers of radiocarbon dates increased.

In his report to the National Park Service, Glassow (1990) inferred that low human populations between 6500 and 5000 B.P. resulted from xeric climatic conditions. Before that time, terrestrial resources and the most accessible marine resources were the focus of subsistence activities, with seeds and shellfish being particularly important. By 5000 B.P., acorns had replaced other seeds, and fish and sea mammals were more important subsistence resources for prehistoric inhabitants than they had been previously. Elsewhere, Glassow et al. (1988) inferred that these changes reflected adaptations to lower food productivity resulting from changing environmental conditions. After 5000 B.P., no cultural developments could be linked to environmental changes, although such changes were evident. Noting the severe xeric conditions at 3000 B.P. and the corresponding population decrease, Glassow (1990:13-31) suggested that perhaps “cultural systems of the Vandenberg region responded to the period of aridity largely within the social and political realms, which are not evident in the data at hand, whereas subsistence systems remained largely unchanged.” Increased bead manufacture was evident during this time at CA-SBA-210, perhaps reflecting those social and political changes. No significant changes in subsistence were evident during the cooler and more mesic conditions corresponding with increased population around 2500–2000 B.P., although fish and sea mammals continued to become increasingly important (Glassow 1996:134). Population growth during the Late Period did not correspond to significant, long-term environmental change, prompting Glassow to propose two alternative explanations for the population growth: human manipulation of the environment (i.e., burning) allowed increased productivity, or subsistence expanded to include a greater variety of resources as suggested by the increased number of sites in diverse settings during the Late Period.

Increased proportions of black turban shells in Late Period assemblages from CA-SBA-210/552, as well as increased species diversity, were seen as evidence of increased use of a variety of resources during the Late Period. In other words, more emphasis was placed on secondary species as the use of shellfish intensified. Because the overall proportions of shellfish in the diet did not increase relative to fish or mammals during this period, intensified use of black turban and other secondary shellfish "very well may be the product of Late Period population density being higher than that of earlier periods" (Glassow 1990:13-32). Additional supporting evidence was found in the settlement system expansion to include more diverse habitats as well as exploitation of an increased variety of resources, particularly plants and estuarine waterfowl. Overall, Late Period populations on south Vandenberg SFB appeared to have adjusted their subsistence to include relatively costly (i.e., difficult to obtain and/or process) food resources.

Issues of trade and exchange also were examined. Project data were unclear as to the extent to which shell beads were used in trade; three sites evinced shell bead manufacture, dating back as far as 3000 B.P. It was not clear if bead manufacture decreased during the Late Period as production became specialized among the island Chumash. After examining the STS chert biface preforms and acknowledging the presence of bifaces on the Channel Islands made from Vandenberg chert despite the presence of local chert, Arnold (1990:8-86) inferred that preform production for trade was an important industry at sites on the base, although it was "never a legitimate craft specialization." She speculated that Vandenberg bifaces were part of a broad exchange network. Glassow (1990) noted that biface preforms were most abundant in the terminal Early Period levels at CA-SBA-210 and -670, suggesting that trade was perhaps more prevalent during this time period. Obsidian in project assemblages derived primarily from the Coso volcanic field on the northern edge of the Mojave Desert, similar to obsidian found in the Santa Barbara Channel sites. Thus, it appeared that Vandenberg's populations were tied into the same trade networks as groups in the channel region. Obsidian flakes were found in deposits of all ages, but they appeared most frequently in Middle and Late Period deposits (Glassow 1990:13-26–13-30).

MX Facilities/Peacekeeper Rail Garrison/Small ICBM Facilities and Subsequent Studies on San Antonio Terrace

Beginning in the late 1970s and continuing through the 1980s, the Air Force pursued development of the MX program, the Peacekeeper Rail Garrison program, and the Small Intercontinental Ballistic Missile (ICBM) program in the Western Missile Test Range on the San Antonio Terrace, north Vandenberg AFB. Each of these programs required substantial archaeological studies. Additional studies have been completed on the San Antonio Terrace since the various missile projects.

MX Facilities

Archaeological investigations associated with development of MX facilities began in the late 1970s with a flurry of reports variously documenting work at CA-SBA-1176 for the MAB-2 Construction Project (Bixler et al. 1980), testing at CA-SBA-1036 for the gatehouse on El Rancho Lateral Road (Snethkamp 1980), and survey and testing at six sites for various missile systems (Haley and Serena 1980). Craig (1980) prepared a management report that presented the results of various surveys and other archaeological studies completed for MX facilities. That report was supplemented by a research design prepared to guide mitigation efforts at project sites (Snethkamp 1981). A second research design subsequently was prepared as an addendum (Moore and Snethkamp 1982).

Chambers Consultants and Planners (1984) reported the culmination of archaeological studies completed for the MX facilities. Altogether, work for the project included surveys of nearly 6 square kilometers in irregularly shaped blocks for project facilities and surveys of another 24 kilometers for utility corridors. Thirty-eight sites were located or relocated; 24 of these were tested. Data recovery excavations were completed at eight sites. This project was unusual for its time in that it focused on the smaller, lower-density lithic scatters that usually received little attention. This work demonstrated the importance of small sites in understanding overall subsistence and settlement systems. In addition, the project made pioneering efforts with an extensive geomorphological study of the San Antonio Terrace and detailed consideration of the effects of postdepositional processes on archaeological interpretations.

Detailed geomorphological studies provided baseline soil and geologic data to support the archaeological investigations (Johnson 1984). Among the most widely cited contributions of Johnson's work was a dune chronology specific to the base. Modern Dunes are active, whitish colored, and limited to the nearshore. Intermediate Dunes are less than 2,000 years old, brownish colored, exhibit little soil development, and evince fresh dunal morphology. They can be difficult to distinguish from Modern Dunes. Old Dunes were thought to be early to middle Holocene in age. They are widely distributed, have subdued dunal morphology, and exhibit soil development. Older Dunes have more strongly developed soils and are reddish colored. They are inferred to be of Late Pleistocene age. Ancient Dunes are presumed to be formed of reworked Orcutt sands and older than 125,000 years (Johnson 1984:4-32–4-36).

Johnson (1984:4-48–4-79) also examined the postdepositional effects of burrowing rodents, a study that was subsequently published in *American Antiquity* (D. Johnson 1989). He found that, over time, burrowing pocket gophers will lower stones that exceed 6–7 centimeters in diameter to create a "stone zone" that is about 40 centimeters thick at the maximum burrowing depth.

Bamforth (1984) analyzed lithic artifacts in the MX collections. Although acknowledging that the sample of sites was biased by project parameters and that the samples of artifacts were frequently small, he concluded that tools from all sites, regardless of age, were directed toward procuring and processing large game. However, settlement organization appeared to have changed through time. Prior to A.D. 500, sites at the terrace edge were similar to sites on the terrace interior. After A.D. 500, tool manufacturing and maintenance occurred along the terrace edge, suggesting that terrace edge sites were small-scale base camps, while sites on the terrace interior were more temporary and task specific. Overall, Bamforth felt that all sites on the San Antonio Terrace were field camps, which implied that the subsistence and settlement system was logistically organized, or, in a Binford (1980) sense, that the prehistoric inhabitants of the region both before and after A.D. 500 were collectors rather than foragers. Differences between the two periods, however, suggested that the system became more organized through time (Bamforth 1984:9-94–9-95).

Bamforth (1984:9-96–9-98) also examined correlates between lithic technology and hunter-gatherer mobility. The MX collections appeared to reflect a curated technology through all time periods, with few flake tools, high proportions of artifact retouch, little relationship between manufacturing debris and discarded tools, and infrequently discarded tools with remaining use life. However, the assemblages appeared to reflect increasingly expedient technology after A.D. 500, with higher frequencies of flake tools and minimal resharpening or retouch. Rates of retouched and broken tools were higher in the earlier deposits, while flake tools and tool retouch were more common in the recent contexts. Bamforth noted that this relationship between technological organization and hunter-gatherer mobility was opposite that predicated by Binford (1977) in that a curated technology appears to be associated with logistical mobility. Bamforth argued that hunters on the San Antonio Terrace had to balance the technological requirements of hunting with the requirements of mobility in the dunes. He inferred that curation reflected tool stone availability more than it reflected settlement systems. While tool stone was readily available in the region, a curatorial technology was employed to reduce the amount of equipment that was carried through the dunes themselves. The relatively expedient technology employed after A.D. 500 reflected the use of residential base camps at the terrace edge, where stockpiled tool stone or bifaces reduced the need for curation.

Faunal remains from the MX project sites revealed a similar picture of land-use strategies on the San Antonio Terrace. Shellfish diversity suggested that sites along terrace margins were occupied for relatively long periods, as expected of base camps, while sites toward the center of the terrace were occupied only briefly (Serena 1984). Vertebrate remains indicated that sites on the terrace reflected a series of small, temporary hunting and butchering locations. The hunting strategy appeared to be opportunistic, with both large and small game utilized (Hudson 1984).

Glassow (1984b:10-24) noted that all three MX sites classified as seasonal residential bases were occupied during the post-A.D. 500 period. He suggested that residential sites on the terrace edge during this period reduced the need for overnight camps on the terrace interior. Glassow also correlated use of the San Antonio Terrace during the last 2,000 years with paleoenvironmental conditions and dune formation. Arguing a dry period between 1500 and 800 B.P., Glassow suggested that the resulting dune movement and decreased bioproductivity may account for the greater mobility suggested by Bamforth prior to A.D. 500. When conditions improved, residential bases were established at the terrace edge to access resources on the terrace interior (Glassow 1984b:10-27).

Peacekeeper Rail Garrison/Small ICBM Facilities

Archaeological studies in conjunction with construction of test facilities for the Peacekeeper Rail Garrison and Small ICBM programs were completed by Tetra Tech, Inc. In addition to 12 miles of road and railroad corridors, 97 acres designated for facility construction were included in the study area. Surveys began in 1987 (Tetra Tech 1987) with additional surveys, testing, data recovery excavations, and construction monitoring continuing through 1989 (Tetra Tech 1990, 1991). Twelve previously unknown prehistoric sites were identified during the surveys, in addition to the 26 previously recorded sites within the project area. Investigations beyond recordation (i.e., mapping, testing, or data recovery excavations) were completed at 28 sites (Tetra Tech 1990:1-5–1-6).

Prior to beginning field work, Tetra Tech (1988) prepared a Historic Preservation Plan (HPP) for the San Antonio Terrace National Register District, meeting the requirements of a cultural resources management plan for the district. Archaeological investigations for the Peacekeeper Rail Garrison and Small ICBM programs were guided by the HPP and by previous research completed for the MX program. With 22 radiocarbon dates from seven sites and eight additional radiocarbon dates for geomorphic studies, Tetra Tech's data had much greater chronological control than did the MX project, which had only three radiocarbon-dated sites. Tetra Tech's analyses contradicted the previous study in important ways.

> The present study resulted in the collection of data, which, in several ways, raises questions about the results of previous analyses of dune sites on the San Antonio Terrace. Geomorphic conditions suggest that the concept of site assemblage is problematic, casting some doubt on analyses of site function and related interpretations of subsistence and settlement behavior. The equivocal nature of the data for hunting on the San Antonio Terrace, even from previous studies (Bamforth 1984), suggest that earlier models were overly simplistic. The structure of the natural environment makes it more likely that plant gathering was a major activity in the dunes. Moreover, use of the central dunes was probably quite different from use of the terrace edge, which is actually in a valley margin/riverine setting. Patterns identified during MX studies, derived from the latter area, do not appear to adequately reflect use of the terrace as a whole [Tetra Tech 1990:9-1].

Tetra Tech (1990) also suggested that the previous study failed to adequately account for postdepositional processes when characterizing archaeological assemblages. Furthermore, the Tetra Tech study revealed that when Bamforth's (1984) sample of sites was subdivided into periods and location (terrace edge versus center), his sample was too small to make meaningful inferences. For example, two of Bamforth's four categories were represented by a single site. The Tetra Tech report also questioned Bamforth's use of projectile points to make chronological assignments, noting that projectile points were exceptionally poor temporal markers on Vandenberg SFB. In addition, Tetra Tech questioned use of the terrace for hunting large mammals, suggesting instead that botanical resources associated with the wetlands rather than large game were what attracted people to the terrace.

> As an alternative working hypothesis, it may be suggested that the central dunes of the San Antonio Terrace constituted a marginal environment, which was episodically and differentially exploited, probably on a seasonal basis, primarily for plant procurement. We submit that the rich ethnobotanical record supports such a view. While opportunistic hunting may have occurred from time to time, we do not believe that organized group stalking and hunting were the principal prehistoric activities in the central dunes of the terrace. In our view, people went into the dunes to procure various plants for use as food, medicine, and construction material. Morgan and Scott-Cummings (1990) have noted that the climate of the Vandenberg region became cooler and more moist about 600 B.P. The radiocarbon dates reported by the present study indicate use of the dunes occurred between 300 and 760 B.P. Quite possibly such usage was an adaptive response to these cooler, more moist conditions and the ecological resources they facilitated [Tetra Tech 1990:9-57].

Subsequent Studies in and near the San Antonio Terrace

Two substantial archaeological studies have been completed in the San Antonio Terrace Archaeological District since the MX and Peacekeeper/Rail Garrison projects. As reported by Lebow, Harro, McKim, and Denardo (2005), investigations at CA-SBA-1037 and -1565 for the Missile Transport Bridge revealed evidence of four different occupations, with the earliest use between 2200 and 1680 B.C. and the latest between A.D. 1430 and 1690. Two of the occupations were associated with short-term residences; two were associated with special-use locations. Dietary remains included plants as well as large and small terrestrial mammals. Data from the Missile Transport Bridge sites (Lebow, Harro, McKim, and Denardo 2005) indicate that residential occupation at the edge of the San Antonio Terrace is substantially older (2200–1680 B.C.) than considered in the previous model (A.D. 500) and thus did not support the temporal dichotomy in settlement systems proposed by Bamforth (1984) and Glassow (1984b).

As part of a base-wide undertaking to demolish selected missile facilities, in 2004 Applied EarthWorks excavated in each of 10 artifact concentrations that compose CA-SBA-1070/1071 (Lebow, Haslouer et al. 2005), a component of the San Antonio Terrace Archaeological District. This site was part of the basis for Glassow's (1984b) settlement model of the San Antonio Terrace. Applied EarthWorks obtained 17 radiocarbon assays, which revealed that all parts of the site were occupied during a relatively brief period between A.D. 1160 and 1630. The initial occupation, which appears to be associated with Locus 3, occurred during the Middle-Late Transitional Period. Most occupations, however, took place during the Late Period.

Six of the loci at CA-SBA-1070/1071 sampled by Applied EarthWorks contained artifact assemblages sufficiently diverse to qualify as short-term residential sites. However, given their small size and the relatively low density of the cultural deposit when compared with other sites on Vandenberg SFB, Lebow, Haslouer et al. (2005) inferred that each of these loci was occupied once and only for a brief period. The remaining four loci lack diversity and fire-altered rocks and appear to have functioned as special-use locations. However, Glassow's (1984b) settlement model for the San Antonio Terrace developed during studies for the MX project suggests that CA-SBA-1070/1071 functioned as a seasonal residential base. That assessment was based on excavation results from the southwest corner of the site (where the archaeological deposit was densest and atypical of the remainder of the site) that were apparently projected site wide. Lebow, Haslouer et al. (2005) proposed that site function was more accurately defined on a locus-by-locus basis and suggested that the individual loci are too small and have insufficient artifact densities to have functioned as seasonal residential bases. In a different study, Lebow (2002a) found that the remaining two sites (CA-SBA-706 and -980) classified by Glassow (1984b) as seasonal residential bases at the edge of the San Antonio Terrace are similar—each comprises multiple spatially distinct artifact concentrations that were lumped together as a single occupation by Glassow. Consequently, Lebow, Haslouer et al. (2005) question the presence of any seasonal residential bases along the edge of the San Antonio Terrace. However, reclassification of these sites as composites of short-term residential sites and special-use locations does not necessarily change the basic premise of Glassow's settlement model, which is that people were residing at the terrace edge and that they temporarily ventured from these bases into the terrace interior to hunt.

As noted above, Tetra Tech (1990) used data from the Peacekeeper/Rail Garrison projects to infer that the terrace interior was used for plant gathering and processing rather than hunting. However, Applied EarthWorks' investigations at CA-SBA-1070/1071 included microscopic edge-wear analysis of flake tools and found only evidence of hunting and meat processing. If Applied EarthWorks had used Tetra Tech's analytical strategy (i.e., no microscopic edge-wear analysis), evidence of hunting and meat processing would have been missing from CA-SBA-1070/1071. Consequently, Tetra Tech's inference of an emphasis on plant processing at sites in the San Antonio Terrace interior is suspect (Lebow, Haslouer et al. 2005).

Development and Maintenance of Space Launch Complexes on South Vandenberg SFB

Beginning in the mid-1980s, a series of archaeological investigations was associated with development, maintenance, and repairs at Space Launch Complexes (SLCs) 4, 5, and 6 on South Base (Environmental Solutions 1990a, 1990b, 1990c, 1990d; Environmental Solutions et al. 1988; Ferraro et al. 1988; Moore et al. 1988). Altogether, these investigations generated substantial archaeological data.

Fourteen prehistoric archaeological sites in and adjacent to Spring Canyon were tested and their National Register eligibility evaluated after a Titan 34D space launch vehicle exploded at SLC-4 in 1986 (Moore et al. 1988). The area appears to have been used most extensively between A.D. 1000 and 1400. Tool-to-debitage ratios suggested that the Spring Canyon sites were more similar to residential sites than to temporary campsites, although the ratios varied considerably between sites. Similarly, shell densities differ between sites. Overall shell densities suggested that these sites were not permanently settled base camps or villages; they contained higher densities than campsites on the San Antonio Terrace but less than known ethnohistoric villages such as *Nocto* (CA-SBA-210). Short-term occupation sites and resource procurement/processing sites also were evident in Spring Canyon (Moore et al. 1988).

Overall, use of Spring Canyon appeared to be part of a Late Period land-use strategy that included seasonal movements between residential bases and short-term occupation sites. Logistical mobility was inferred from this pattern. Four environmental variables in the vicinity of Spring Canyon were thought to influence the local settlement system: (1) the coastal habitats are less varied than in other areas; (2) the nearshore fisheries are poor due to the absence of kelp beds; (3) resources in the terrestrial environments are not closely packed; and (4) significant portions of the area are covered by active dunes. Thus, overall biotic productivity and diversity would have been relatively low in the area. Lower population densities and greater settlement mobility resulted, particularly when compared with the channel region (Moore et al. 1988:13-2–13-4).

Ferraro et al. (1988) report archaeological studies associated with a natural gas pipeline connecting the city of Lompoc with SLC-5, located on the north edge of Honda Canyon. Most of the project crossed the Lompoc Mesa, encompassing Bear Creek and Spring Canyons in addition to Honda Canyon. Fourteen prehistoric archaeological sites were tested to evaluate National Register eligibility. Using the same research design and methods employed for the investigations in Spring Canyon, Ferraro et al. (1988) found low site densities on the mesa away from the canyon rims. Those few sites not in the canyons were small and associated primarily with lithic reduction. The types of cultural remains in the canyon sites suggested that the association between the canyon sites and the canyons themselves may relate more to the presence of water than to other resources.

Cultural assemblages associated with Intermediate Dunes dating to the Middle and Late periods were dominated by lithic material from tool manufacture and maintenance, with little evidence of subsistence. A single site from this period contained bone and shell. These sites were on top of the coastal bluff within 1 kilometer of the coastline, in areas exposed to prevailing winds. The limited evidence suggested that subsistence was oriented more toward shellfish than toward terrestrial mammals. Early-stage biface production appeared to be a primary activity on Lompoc Mesa during this period. Assemblages in Old Dunes contained less evidence of marine-based subsistence, and biface assemblages contained higher proportions of nearly finished tools. Deer and rabbits were better represented in these faunal assemblages. These older sites also were farther from the coast and the apparent differences in subsistence may simply reflect the greater distance to the coast (Ferraro et al. 1988:7-22–7-24).

Ferraro et al. (1988:7-22–7-33) also developed a model of ecological change for the Lompoc Mesa. At the end of the Late Pleistocene, the shoreline was about 4 kilometers west of the modern shoreline. The sea level rose about 2 meters and moved inland to within 1.1–2.3 kilometers of its current position during the early Holocene (10,000–8500 B.P.). The Santa Ynez River system had not yet downcut, and the river meandered across the floodplain. Lagoons and estuaries formed at the canyon mouths, and wetland plant communities dominated the floodplains. Coastal erosion created shellfish habitats, and the coastal plain featured a coniferous forest. During the middle Holocene (8500–3500 B.P.), the sea level was initially stable but gradually climbed to its current level by circa 3500 B.P. The Santa Ynez River aggraded at its mouth causing upstream cutting; the floodplain water table dropped and wetlands diminished. Sloughs formed in remnant channels. Coniferous forests retreated upslope, to be replaced by oak woodland or chaparral. A marsh formed at Bear Creek around 4,000–5,000 years ago. Long-term residential bases shifted from the terrace overlooking the Santa Ynez River onto the floodplain as a response to diminished water supplies. Shellfish habitats disappeared as the sea level climbed but were reestablished as the sea level stabilized and the bedrock eroded at the end of the middle Holocene. Coastal sites during this period reflect shellfish collection while inland sites reflect use of terrestrial resources. During the late Holocene (post 3500 B.P.), Intermediate Dunes began forming in response to the stabilized sea level as coastal erosion supplied increasing amounts of sand. The sea cliffs were high enough by 1600 B.P. that eroded sand was not easily deposited on top, and the dunes stabilized. The Santa Ynez River floodplain was stable during this period. Biotic productivity was low and human use of the area was limited while the dunes were forming. Shellfish habitats varied depending on the bedrock geology. The Tranquillon Volcanic Formation at the mouth of Honda Canyon was resistant to erosion and thus provided shellfish habitat that was exploited throughout the period.

Work in the Lompoc Mesa continued with excavations at seven sites by Environmental Solutions (1990b). Technological analysis of the resultant collections revealed that direct percussion was more common than biface reduction. Large biface flakes were used for cutting and scraping. Technological organization and tool stone procurement did not appear to change through time; the nearest chert source was used during all time periods. Tool stone procurement was considered an incidental activity (Environmental Solutions 1990b:14-6). Both large and small game were exploited, with varying levels of relative importance. Either rabbits or deer dominated all assemblages. The importance of marine resources varied, but these resources were generally less important than terrestrial resources.

Union Oil Pipeline Project

Twenty-three archaeological sites were examined on and adjacent to Vandenberg SFB when the Union Oil of California pipeline was constructed in the Santa Ynez River valley (Woodman et al. 1991). Project research focused on subsistence and settlement systems, including the relationship between environmental change and settlement systems. Analyses of site distribution patterns revealed that the Santa Ynez River valley was occupied by mobile family groups during the Early Period, but use of the area increased during the Middle Period as the climate became warmer and drier. Habitat diversity increased, which resulted in use of a greater range of habitats, although settlement system structure remained much the same. This trend continued into the Late Period. The increased number of sites in a greater range of settings during the Late Period corresponds to the trend noted by Glassow (1990) throughout Vandenberg SFB. Overall, however, project sites conformed to a single generalized subsistence and settlement system that evidently remained relatively unchanged despite regional climatic and population variations.

Site type diversity was examined as a means of assessing temporal variability in settlement systems. Given Binford's (1980) model of land-use strategies among foragers and collectors and Glassow's (1990, 1996) land-use model of increased site type diversity in the region during the Late Period, the range of site types was expected to be greatest during the Late Period when the settlement system should have been most complex. Instead, the data suggested that a generalized forager-type land-use strategy characterized by short-term occupations was used in the Santa Ynez River valley throughout the Holocene, perhaps in association with a more complex land-use strategy outside the project area (Woodman et al. 1991).

> Occupation [of the Santa Ynez River Valley] began during the Early Period (ca. 7750–1050 B.C.), but there was a substantial increase during the Middle Period (ca. 1050 B.C.–A.D. 1100) that coincided with a climatic shift to warmer and drier conditions. This shift seems to have triggered a region-wide intensification of resource use as well as a diversification of their diet. The resultant changes in land use are seen on the coast as an increase in the number of large base camps; in the nearby San Antonio Terrace as an increase in the logistical organization of camps; and in the Union project area as a broadening of the range of environmental settings of short-term foraging camps. This pattern of increased land use continued until European contact affected population levels at the close of the Late Period (A.D. 1100–1752). Foraging in the Union project area may have been a seasonal activity embedded within an overall logistical strategy aimed at transporting surplus resources to main base camps and villages. At other times, activities may have been longer term as a response to environmental stress. Despite temporary fluctuations, the foraging pattern of land use did not change substantially throughout prehistory.
>
> Reasons for this adaptive continuity revolve around the nature of environmental change, the structure of the environment, and the resiliency of the family group. Palynological and geomorphological data strongly indicate that, while Holocene climatic changes probably affected the boundaries of local vegetation communities, they did not substantially alter the types of vegetation communities. Resource predictability and distribution, the structure of those vegetation communities, and the faunal resources that depend upon them are most likely responsible for the generalized pattern we see in the Santa Ynez River Valley. Resources in this area are clustered, but still within close proximity. The valley is a mosaic of ecotone situations that allowed the exploitation of many resources within the foraging radius of a site. This pattern of resource clustering makes a foraging strategy the most efficient means of exploiting local resources. The short-term nature of the sites suggests that these resources were not particularly abundant or predictable from one year to the next. In these circumstances, the successful strategy is one that is highly flexible and resilient. Foraging by small family groups is a resilient strategy that can adjust to changes in resource abundance and location [Woodman 1991:i–ii].

Coastal Branch Aqueduct

Two legs of the Coastal Branch Aqueduct intersected on the Base. Archaeological studies for the Santa Ynez/Mission Hills Extension began in 1994 (Science Applications International Corporation 1994a, 1994b), while work on Reach 6 began in 1995 (Orlins and Hines 1995).

Substantial archaeological excavations were completed at two prehistoric archaeological sites discovered during construction on the Base. Three well-preserved and stratigraphically distinct occupations were identified at CA-SBA-2696, located on the banks of San Antonio Creek (Colten et al. 1997). The site was initially occupied between 370 B.C. and A.D. 45, briefly abandoned, and then reoccupied between A.D. 105 and 340 before being abandoned again. The site was subsequently reoccupied and abandoned for the last time by A.D. 590. Data from the site suggest that its use varied directly with changing environmental conditions. Initial use of the site was most intensive and corresponded to the wettest conditions and, presumably, more abundant resources. As conditions became drier, use of the site decreased. Abandonment was correlated with a dry period between circa 1600 and 600 B.P. (Colten et al. 1997:11-14–11-15).

The site apparently functioned as a seasonal residential base during the earliest occupation associated with the wetter period. Abundant large mammal remains present in the assemblage from this occupation appear to support Glassow's (1984b) model of hunters on the San Antonio Terrace using residential bases established outside the terrace. During the second occupation, lower densities of cultural remains suggest less intensive use of the site associated with drier conditions. Large mammal bones were less frequent while lagomorph bones were more frequent, indicating a more generalized, opportunistic procurement strategy. However, the lithic assemblage from this occupation was very diverse, suggesting that the site continued to function as a residential base. The last occupation was the least intensive, with low artifact densities and an emphasis on procurement of both large and small mammals. This occupation appears to reflect short-term use of the site (Colten et al. 1997).

The second site discovered during aqueduct construction on the base, CA-SBA-2767, is a single-component special-use site on the northeast edge of the San Antonio Terrace (Lebow and Harro 1998). It was used for a brief period between A.D. 1205 and 1460, corresponding to Arnold's (1992a) Middle-Late Transitional Period. Although containing few artifacts, the site is notable for numerous rock features, including two earth ovens, six fire-altered rock concentrations, and nine scatters of fire-altered rock. Particularly intriguing was the presence of abundant yellow nut grass tubers in the large earth ovens, reflecting mass processing of a resource previously unidentified in the region's paleoethnobotanical assemblages.

Data from CA-SBA-2767 support previous models of settlement systems on and near the San Antonio Terrace (Lebow and Harro 1998). The lithic assemblage was characterized by relatively high frequencies of biface production debris, and bifacial tools characterize the lithic assemblage. Such assemblages are typically associated with curatorial behavior, as observed by Bamforth (1984) for sites on the San Antonio Terrace interior. Flake and tool densities were also extremely low at CA-SBA-2767, similar to special-use sites on the terrace thought to be associated with large mammal hunting (Bamforth 1984, 1986, 1991b). Both CA-SBA-2767 and Bamforth's San Antonio Terrace sites evidently were specialized procurement and processing loci—the former for plant foods, the latter for game. Although Tetra Tech (1990, 1991) suggested that sites on the terrace interior are more likely associated with plant procurement than hunting, technological signatures of special-use locations on the terrace nonetheless remain the same. Both CA-SBA-2767 and the San Antonio Terrace sites are in areas where exploitable tool stone is not immediately available. Bamforth (1986) concluded that tools on the San Antonio Terrace were curated, not because of mobility constraints, but because of scheduling conflicts that effectively reduced the immediate availability of lithic raw materials. The technological organization expressed in the lithic assemblage of CA-SBA-2767 may have been shaped by similar forces. Groups may have proactively “geared up” at residential field camps or bases in anticipation of accessing very specific resources not located near tool stone sources. The tool assemblage at CA-SBA-2767, characterized by bifaces and limited flaking debris, is an expression of economizing behavior and tool stone conservation. Viewed in this way, this economizing behavior is ultimately best suited to a highly specialized logistic land-use strategy. The CA-SBA-2767 data suggest that task groups dispatched to acquire resources as diverse as large mammals and plant foods generated technologically similar lithic assemblages.

Use of CA-SBA-2767 may reflect environmental change and/or population pressure. Citing a recent paleoenvironmental study that identified the period between 850 and 200 B.P. as cool and moist (Morgan, Cummings, and Rudolph et al. 1991) and noting that yellow nut grass requires moist conditions, Lebow and Harro (1998) suggested that increasingly mesic conditions may have allowed proliferation of the tubers and thus mass harvesting and processing. At the same time, human population was expanding, and use of the site corresponds to the highest population peak during the entire Holocene (Glassow 1990:6-2). Thus, processing yellow nut grass at the site may reflect dietary expansion due to population pressure.

Combar Road Archaeological Study

Archaeological studies for proposed infrastructure developments along Combar Road near the northern end of the Base were completed by Applied EarthWorks in 2002 (Lebow et al. 2006). Excavations revealed evidence of 10 spatiotemporally distinct occupations dating between 7120 B.C. and A.D. 1470.

Previous studies of human population densities in the Vandenberg region indicate that densities were relatively low until around 2,800 years ago. They began to increase gradually after that time and jumped dramatically around 1,200–1,400 years ago. However, data from the Combar Road Project did not support that pattern—the increase in population densities after 2,800 years ago was not evident, suggesting that factors associated with the human population increase elsewhere did not apply to that particular area.

Lagomorph indices provided a means of examining paleoenvironmental conditions by measuring the relative proportions of cottontails and jackrabbits—cottontails require relatively dense ground cover associated with mesic conditions, while jackrabbits require open habitat associated with more xeric conditions. In the Combar Road project data, the lagomorph indices steadily increased through time, reflecting increasing proportions of cottontails and suggesting increasingly mesic conditions. Two exceptions with low lagomorph indices, one dated to the Middle-Late Transitional Period and the other to the mid-Early Period, coincided with periods known to have been warmer and drier.

Analysis of lithic assemblages revealed temporal variation. Early occupants were collecting tool stone from on-site or nearby sources and the lithic assemblages have quarry-like characteristics. Those characteristics decreased through time and were lacking in the Late Period assemblages. Given the lack of tool-quality lithic material currently evident in the project area, it appeared that the source was depleted before the Late Period. Distinct tool kits associated with the Early Period occupations included not only the well-known mano/metate grinding set but also specific types of planes, grinders, gravers, and drills that were often used in conjunction with the metates. A temporal trend of decreasing manos and metates corresponding to increasing stone projectile points was apparent.

Vertebrate faunal remains in the Combar Road project data revealed clear temporal differences. Early Period occupations had roughly equal emphasis (by weight) of small and large animals, while Middle and Late Period occupations emphasized large animals (primarily sea mammals). During the Early Period occupations, small subsistence animals were primarily rabbits and birds, whereas fish had greater importance during the Middle and Late periods. Bird bones are almost completely absent from the Middle and Late Period assemblages. Early Period occupants relied much more on large terrestrial mammals when compared to the subsequent occupants; large terrestrial mammal bone was nearly absent from Late Period occupations.

Dietary reconstruction revealed that shellfish provided the bulk of the protein for all occupations, with proportions ranging between 72.3 and 96.2 percent. All shellfish assemblages were dominated by California mussel when compared by weight. When compared by minimum number of individuals (MNI), California mussel dominated all assemblages but one occupied during the Middle-Late Transitional Period, where black turban snail was more prevalent. An examination of mussel shell sizes suggested that all prehistoric occupants in the Combar Road project area were stripping mussel beds. Elsewhere in the Vandenberg SFB region, stripping of mussel beds was consistently used prior to about 3,000 years ago, but a plucking strategy became more common after that time.

Previous studies suggested that the relative importance of California mussel decreased through time and that shellfish assemblages became increasingly diverse as diet breadth expanded due to population pressure. However, analysis of shellfish assemblage diversity and relative proportions based on MNI using the Combar Road project data combined with data from other sites on Vandenberg SFB did not indicate decreased use of California mussels through time. Instead, the data suggested that mussel sizes decreased during the Late Period, and since previous studies made comparisons based on weight, the diminished mussel sizes gave the appearance of decreased importance.

All Combar Road project occupations contained evidence of habitation (i.e., dietary residue and fire-altered rock) and were interpreted as either short-term or long-term residences. The overall distribution of site types in the Vandenberg region is weighted heavily toward special-use locations, a distribution pattern not evident in the Combar Road project area. The project location—midslope in the Casmalia Hills—would have offered access to both upland and coastal resources and it appeared that occupants resided at project sites to take advantage of both upland and coastal settings.

Tranquillon Mountain Road Archaeological Study

Proposed infrastructure upgrades associated with the then-abandoned Tranquillon Mountain Road in the bottom of upper Honda Canyon on South Base prompted archaeological investigations at three sites (Lebow, McKim et al. 2011). Although located well inland, all three sites contained dense to moderately dense shell midden. Excavations revealed that the project area was initially and intensively occupied between 5970 and 5450 years ago. The area was then abandoned for more than 4,000 years, a surprising hiatus given the intensity of the initial occupation. Beginning around 1,070 years ago the project area was briefly and peripherally reoccupied. Interestingly, though, the area was again intensively occupied during the interval between 600 and 1,000 years ago, corresponding primarily to the known droughty interval associated with the Middle-Late Transitional Period. Occupations continued, albeit less intensively, into the early Late Period.

Lagomorph indices were low during occupations associated with the Middle-Late Transitional Period, as expected given the known xeric conditions. The initial occupation at 5970–5450 B.P. also had a correspondingly low lagomorph index, suggesting an occupation also associated with a period of drought. The more recent occupations (i.e., post Middle-Late Transitional Period) had higher lagomorph indices, suggesting that drought conditions had ameliorated. Artiodactyl indices are high during the droughty periods, indicating that despite the poor climatic conditions upper Honda Canyon had water, browse, and cover that attracted deer and consequently human hunters (Lebow, McKim et al. 2011).

Vertebrate faunal assemblages revealed that residents associated with all occupations were focusing on marine mammals, deer, and shellfish for their protein. It appeared that during all occupations, access to large terrestrial mammals and coastal resources was a prime determinate of site location, even though project sites are at least 5.5 kilometers inland. Despite the distance, hunters returning from successful forays along the coast were carrying mostly complete sea mammal carcasses, including low meat-utility elements. Similarly, occupants carried small mussel shells from the coast, rather than selecting and transporting only the higher-yield larger specimens. Given the high proportion of sea otters in the faunal assemblages, it appears that the coast south of the Tranquillon Mountain Road Project was used frequently, although the presence of cormorants and otariid remains indicates that the coast west of the project area was also used. Deer were apparently hunted locally as complete carcasses were returned to project sites for butchery.

Not only were coastal resources carried relatively great distances back to the project sites, but raw tool stone was also imported. A source about 4.3 kilometers east of the project area appears to contain stone similar to that found in project sites.

All prehistoric occupations associated with the Tranquillon Mountain Road Project reflect short-term residences except one that appears to have functioned as a village. Relative proximity to large mammals and a tool stone source in upper Honda Canyon as well as proximity to coastal resources appear to have been the primary determinates of site location. These determinates appear to have been particularly important during xeric climatic conditions, when it appears that upper Honda Canyon remained well watered and supported relatively large deer populations.

San Antonio Creek Stream Restoration Project

Erosion along a reach of San Antonio Creek on the Base was threatening mission-critical infrastructure. Simple, short-term solutions proved ineffective. Long-term stabilization measures required substantial modifications to the creek banks. Pervious archaeological studies along San Antonio Creek had revealed buried archaeological deposits (e.g., Colten et al. 1997; Lebow 2000a). To determine whether stabilization of San Antonio Creek might impact archaeological deposits, Applied EarthWorks mechanically bored 23 cores to an average depth of 40 feet below the modern surface. That effort revealed three previously unknown buried archaeological deposits and confirmed the presence of other, previously recorded sites (Lebow, Hodges et al. 2008). Two sites, CA-SBA-3607 and CA-SBA-3932, could not be avoided during stabilization and were the subject of extensive data recovery excavations while a third buried site, CA-SBA-4002, was discovered during construction and also subject to data recovery excavations (Lebow, McKim et al. 2014).

Excavations at CA-SBA-3932 revealed 11 artifact concentrations that represent spatiotemporally distinct occupations. Initial occupation occurred around 8400–8580 calibrated years before present (cal B.P.), when people camped adjacent to San Antonio Creek where they hunted terrestrial mammals with a focus on rabbits and hares. Little connection to the coast is evident. The site was used again between 7140 and 7310 cal B.P., but this time the site functioned as a hunting/gathering location rather than as a campsite. An occupation around 5440–5660 cal B.P. was relatively intensive as people again camped adjacent to the creek. Post molds suggest that structures of some sort were erected. Rabbits and hares were consumed but deer were very important. Between 4050 and 4340 cal B.P. the site was again used as a campsite, but much less intensively and/or for a shorter period of time. People primarily consumed rabbits and hares, although fish from the coast were important. The site’s final occupation period was between 2870 and 3380 cal B.P. when four spatially distinct but roughly contemporaneous campsites were established. All four appear to be associated with a severe drought that attracted deer and elk to the wetlands along the creek, and subsistence clearly focused on artiodactyls. Substantial quantities of marine shellfish in two of the four loci indicate a strong connection to the coast (Lebow, McKim et al. 2014).

CA-SBA-3607 was initially occupied between 8600 and 8360 years ago, corresponding to the initial occupation at CA-SBA-3932. During that time, the site served as a short-term residence where people hunted and consumed rabbits and hares. Deer and elk were also important, more so than at CA-SBA-3932. Coastal resources are minimally represented. The lithic tool assemblage is both large and diverse, indicating that various activities requiring stone tools were completed. After a hiatus of about 5,000 years, CA-SBA-3607 was occupied again between about 3,830 and 3,470 years ago. This occupation has no temporal equivalent at CA-SBA-3932. During that period, people camped adjacent to San Antonio Creek but relatively low densities of archaeological constituents indicates that the occupation was not intensive or of long duration. Subsistence was strongly oriented toward rabbits and hares, although deer were also important. Use of coastal resources was minimal. Lithic reduction was extensive (Lebow, McKim et al. 2014).

CA-SBA-4002 was occupied between 1410 and 1590 cal B.P. and represents the youngest known occupation on the floor of the San Antonio Creek valley. The site served as a short-term residence, with subsistence focused on rabbits and hares, and marine mammals. The stone tool assemblage is diverse, indicating that various tasks were completed by site occupants. A cache of fire-altered rock was found; many of them had been used to work pigment into hides. Obsidian was unusually prevalent in the site, suggesting greater participation in trade and exchange networks (Lebow, McKim et al. 2014).

Lebow, McKim et al. (2014:Chapter 14) used data from the San Antonio Creek Stream Restoration Project and from other nearby archaeological studies to examine the prehistory of the San Antonio Creek valley. Deep coring (Lebow, Hodges et al. 2008) revealed that prior to about 8,600 years ago the valley floor was likely not suitable for human occupation due to high energy alluvial activity that deposited around 4 meters of sediment in just over 1,000 years. Analysis of pollen from the project and surrounding area reveals that when the valley floor was first occupied around 8,500 years ago, vegetation in the area was characterized by coastal sage scrub with chaparral. Oaks and conifers were nearby (Anderson et al. 2015). Wetland taxa reflect the presence of a riparian plant community along San Antonio Creek. In this setting, people camped while hunting rabbits, hares, deer, and elk. Plant resources were gathered, processed, and consumed. Little connection to the coast is evident.

By the Early Period, starting around 7,450 years ago, sediment accumulation on the valley floor was substantially slowed and pollen indicates that coastal sage scrub was present but without the chaparral elements. Human occupation of the valley floor intensified, with large quantities of animal bone, flaked stone tools, and fire-altered rock. Post molds found at CA-SBA-3932 dating to about 5,500 years ago reflect a relatively high degree of permanence. Connection to the coast remained limited but instead people focused on hunting with increased use of deer and elk. Around 4,200 years ago, marine resources appear in the diet and it may be that people from the coast were making brief sojourns to the valley. At about this same time the first evidence of human occupation along the valley edge appears as an intensively used short-term residence (Lebow, McKim et al. 2014).

The final part of the Early Period was markedly different, with intensified use of the in the San Antonio Creek valley between 2,870 and 3,380 years ago (Lebow, McKim et al. 2014:Chapter 14). Patterns evident in lagomorph and artiodactyl indices indicate this interval corresponds to a period of severe drought during which the valley’s riparian corridor served as a magnet for deer and elk, and correspondingly, for human hunters. Archaeological assemblages during this period are characterized by high proportions of large mammal remains. Also during this interval, and for the first time in the San Antonio Creek valley, large quantities of marine shellfish are evident indicating that people were necessarily diversifying their diet. Data from the San Antonio Creek valley indicate that the drought was over by the end of the Early Period, although intensified use of the valley floor continued into the first half of the Middle Period. Use of coastal resources diminished although hunting of deer and elk continued to be a focus.

Another drastic change occurred around 1,200 years ago as people stopped inhabiting the valley bottom. Elsewhere on Vandenberg SFB—including along the coast near the mouth of San Antonio Creek—human population densities dramatically increased beginning around that time. Use of the San Antonio Terrace also erupted at about that time. For the San Antonio Creek valley, human occupation appears to have stopped because dunes that blanketed the San Antonio Terrace also dammed the creek near its mouth and created an uninhabitable wetland upstream from the dam. By 800 years ago, human occupations were limited to elevated sandy surfaces above the valley floor (Lebow, McKim et al. 2014:Chapter 14).

Section 110 Projects

Beginning in the mid-1990s, the Base began to proactively manage cultural resources following requirements of Section 110 of the NHPA (as amended), which makes federal agencies responsible for preserving historic properties under their jurisdiction (Integrated Cultural Resources Management Plan 2005). As part of this mandate, Thorne (1993) examined and recommended preservation measures at five archaeological sites eroding from natural causes. Archaeological excavations were subsequently completed at all five sites (Bamforth et al. 1997; de Barros 1994; Weber 1994; Woodman et al. 1995). Preservation concerns also prompted studies at six rock art sites on the base (Hyder et al. 1996), including excavations at Swordfish Cave (Lebow, Harro et al. 2000; Lebow, Harro, McKim, Munns et al. 2005; Lebow and Onken 1997).

Beginning in 1996, Vandenberg established a program to monitor the condition of all previously recorded sites on the base. Excavations to recover data being lost to erosion at various sites identified during condition monitoring began in 1997 and continue to this day. To date, 21 sites on Vandenberg SFB have been excavated to recover data that would otherwise be lost to erosion. Most of these were substantial shell middens. When considered together, the reports of excavations under the Section 110 program represent a considerable body of data. Unlike Section 106 compliance-driven projects that typically avoid substantial cultural deposits, the Section 110 projects have focused on these types of sites simply because they *are* substantial deposits that are eroding.

The following summary focuses on the Section 110 excavations that yielded particularly interesting data. It is ordered chronologically by the time of excavation, with the oldest studies first.

CA-SBA-224 and CA-SBA-225

CA-SBA-224 and CA-SBA-225 are both large and complex shell middens on the coast (de Barros 1994). One of these two sites is probably the ethnohistoric village of *Nucsuni*. Five burials eroding from CA-SBA-225 also were excavated. The southern and central portions of CA-SBA-224 contained a diverse cultural assemblage, including flaked stone tools and evidence of both biface and core manufacturing, tarring pebbles and asphaltum suggesting basket making or maintenance, abundant fire-altered rock, human remains, and shell beads. Cultural remains were present in relatively high densities. This area appeared to have functioned as a major residential center during the Late Period. The northern part of CA-SBA-224 contained stratified deposits reflecting multiple occupations. The uppermost deposit dated to the Late Period and appeared to represent a less intensive occupation than in the southern and central part of the site. Samples from the lower deposits in the northern area were very small, but it appeared that this area was used as a residential base during the Middle-Late Transitional Period (de Barros 1994:5-36–5-37).

The structure of CA-SBA-225 was very complex and included at least 16 separate loci. Stratified deposits were evident in some loci. It was not possible to retrieve a sample from each locus, but it appeared that, overall, the site represented various activities that ranged from field camps to seasonal residential bases. Radiocarbon dates indicated that the site was used from the early Middle Period through the terminal Late Period (de Barros 1994).

CA-SBA-671, CA-SBA-677, and CA-SBA-2961

Three eroding sites (CA-SBA-671, -677, and -2961) were excavated and reported by Lebow et al. (1998). CA-SBA-671 is a long, linear site along the coast just north of the mouth of Honda Canyon. Two periods of use are evident at the site. A single episode of use during the late Early Period was associated with a hearth feature; limited cultural debris associated with the feature indicates that the occupants made or maintained basketry and worked bone or wood. The site was used again at circa A.D. 1285, corresponding to the Middle-Late Transitional Period. This occupation, associated with shell midden, reflected use of the site as a short-term residence during the summer months. The second site, CA-SBA-677, was much more substantial and parts of the site contained midden that was nearly 1 meter thick. CA-SBA-677 occupies the coastline on South Base, about 1 kilometer north of the mouth of Honda Canyon. Although midden development was relatively substantial, the site was used only during a brief period that spans the end of the Middle Period and the beginning of the Late Period, thus encompassing the Middle-Late Transitional Period. At least two different occupations were apparent in the stratified deposits. The lower occupation, dating between A.D. 1020 and 1145, had higher densities of bone and shell but lower densities of lithic debris. Small terrestrial mammals, particularly cottontail rabbit, were best represented in the faunal assemblage. The upper occupation, dating to circa A.D. 1290, was associated with more fish, larger mammals, and a relatively high proportion of jackrabbits compared to cottontails. Although the density of faunal remains was lower, the faunal assemblage was more diverse (Lebow et al. 1998:7-1–7-3). The third site, CA-SBA-2961, lies on top of a high tertiary ridge just north of Honda Canyon, at about 1,000 feet above mean sea level. This site was characterized by a small spatially discrete lithic reduction feature associated with three bifaces. Excavation of the feature and analysis of the debris revealed that occupants carried early- to mid-stage bifaces to the site for reduction, rather than using chert available in nearby terrace gravels (Lebow et al. 1998:7-1–7-3).

Overall, assemblages from the three sites reported by Lebow et al. (1998) reveal that a collector-type land-use strategy was employed by site occupants between the end of the Middle Period and the beginning of the Late Period. Evidence of subsistence stress thought to be associated with the Middle-Late Transitional Period was examined with mixed results. Emphasis on lower-value faunal resources, such as rabbits, and a corresponding lack of higher-value large mammals, such as deer, were thought to possibly reflect subsistence stress. This tendency for increased use of lower-value resources during this period has been observed elsewhere on the base (Glassow and Gregory 2000; Lebow and Harro 1998).

CA-SBA-650

CA-SBA-650 is a moderately dense shell midden and artifact scatter approximately 600 meters north of Point Arguello. The shell midden portion of the site contained a stratified deposit. The older stratum included an earth oven that was eroding into the ocean. This feature was characterized by high densities of fire-altered rock, charcoal-stained sediments, and charred wood that dated to A.D. 975. The overlying midden dated to A.D. 1530. The midden associated with both occupations is restricted to a relatively small area. California mussel shell dominates both occupations; lithic detritus, marine mammal bone, fish bone, and terrestrial faunal remains also are present. A third occupation containing much lower densities of marine shell and dated to circa A.D. 110 is spatially distinct (Lebow et al. 1999).

CA-SBA-1010

CA-SBA-1010 was investigated as part of the Section 110 program. Testing to evaluate National Register eligibility was completed in 1993 (Bamforth et al. 1997) and data recovery was undertaken in 2001 (Lebow, McKim et al. 2005). The well-stratified site is adjacent to San Antonio Creek, just downstream from Barka Slough. Extensive radiocarbon dating indicates that the site was initially occupied at about 1290 B.C. and was abandoned after A.D. 670, with occupations spanning approximately 1,960 years. Seven analytic units representing different occupations were identified; three occupation surfaces and a refuse disposal feature were associated with the analytic units. All occupants used the site as a short-term residence for hunting, butchering, and consuming large mammals such as deer and elk. Differences between the occupations are also apparent. During the earliest occupations, the site was used in the spring and summer months and was occupied during the course of normal seasonal rounds. Paleoclimatic conditions were apparently very warm and dry, and Barka Slough was an oasis where water and browse attracted deer and elk from the surrounding xeric landscape. Subsequent occupations occurred during cooler and moister conditions, when Barka Slough was less of a magnet for large game because water and browse were available elsewhere. Two of the analytic units appear to represent occupations during the fall/winter by people who journeyed from their primary residence specifically to CA-SBA-1010 to hunt and collect, and then returned to the primary residence (Lebow, McKim et al. 2005).

CA-SBA-503 (Swordfish Cave)

Following an investigation of rock art sites on the Base (Hyder et al. 1996), excavations were conducted at Swordfish Cave (CA-SBA-503) due to concerns for preservation of the artwork (Lebow et al. 2016; Lebow, Harro et al. 2000; Lebow, Harro, McKim, Munns et al. 2005; Lebow and Onken 1997). The cave was found to have a multicomponent archaeological deposit, with the initial occupation beginning about 3550 cal B.P. and spanning about 370 years. The cultural assemblage associated with this period is dense and diverse. Three features are present, including two simple unprepared hearths and a rock cairn built over a human bone fragment. Fire-altered rock is abundant. Dietary remains indicate that occupants ate predominantly small mammals. After a hiatus of about 660 years, the site was occupied again at about 2740 cal B.P. near the end of the Early Period. Occupation was of shorter duration, and densities of cultural materials were substantially lower. Dietary remains were similar to those from the previous occupations; however, lithic technology was quite different. The initial occupants used a formal bifacial technology, while the terminal Early Period occupants used an expedient flake tool technology. The third and final occupation period occurred after a hiatus of approximately 2,500–2,600 years and dates between A.D. 1787 and 1804. Protohistoric use of the cave is indicated by cow bone that was cooked using aboriginal techniques as well as by a glass cane bead dating to the Mission Period. Dietary remains differ somewhat from those in the lower deposits. Primary among these differences is the presence of marine shell, which was absent from the earlier occupations. The protohistoric occupation also differed from previous occupations in that large mammal bone dominated the faunal assemblage, even when cow bone is excluded. Technologically, the protohistoric occupants were between the biface-oriented initial occupants and the expediently oriented terminal Early Period occupants. During all occupations, Swordfish Cave functioned as a short-term residence during the late spring and/or summer (Lebow et al. 2016; Lebow, Harro, McKim, Munns et al. 2005).

Excavations inside the cave appear to link the rock art with the occupations dating to the late and terminal Early Period. The correlation between rock art and cave occupations is clearest for the petroglyphs, because many of the carvings were buried and therefore inaccessible to the protohistoric occupants. Furthermore, artifacts used to incise cave walls were identified in late and terminal Early Period assemblages. The correlation between pictographs and site occupation is less clear, but a high incidence of ochre in the lower deposits suggests they were painted by the Early Period occupants. The presence of rock art and substantial amounts of ochre suggests that the site was used for ceremonial purposes in addition to habitation (Lebow et al. 2016; Lebow, Harro, McKim, Munns et al. 2005).

CA-SBA-530

CA-SBA-530 is a dense, multicomponent midden site on the coast at of the mouth of Honda Canyon. It is rapidly eroding into the ocean. Following test excavations at CA-SBA-530 by Science Applications International Corporation (Woodman et al. 1995), Applied EarthWorks completed two phases of data recovery excavations: the first phase was completed during October and November 2000, while fieldwork during the second phase was completed during September 2002 (with limited additional excavations in September 2003). Altogether, 22.3 cubic meters of eroding site deposits were excavated (Lebow et al. 2002; Lebow, McKim et al. 2007). Six temporally distinct archaeological deposits were sampled. One of the sampled deposits—and the most outstanding feature of the site—is a thick, dense midden that represents the site's initial occupation. That midden, which extends along the eroding sea cliff for about 100 meters, is horizontally stratified. The northern portion of the deposit, where the midden is thickest, dates to 10,570–8800 cal B.P.; the central portion of the deposit dates to 6200–5290 cal B.P.; the southern part, representing the thinnest and least dense portion of the basal midden, dates to 7560–6320 cal B.P.

Altogether, the basal midden represents occupations spanning 4,000–5,000 years. Subsequently, a thin dune formed on top of the basal midden. This dune was then occupied around 5290–4990 cal B.P. At about the same time, a small isolated dune developed on the lower slope of Honda Canyon. It was occupied over a relatively long period of time (5250–3900 cal B.P.). After that, several meters of dune sand covered the site. This dune was then occupied between 756 and 283 cal B.P.

Paleoenvironmental information is available for CA-SBA-530 (Lebow, McKim et al. 2007). Archaeobotanical analysis revealed increased proportions of Asteraceae through time, with the highest proportions during the Late Period. Conversely, *Rhamnus* spp. and conifer charcoal was found only in the early Holocene and the early Early Period occupations and probably reflected wetter and cooler conditions. The basal midden appeared to represent a long period (approximately 4,000–5000 years) of relative dune stability, a period that also corresponded to the apparent wetter and cooler conditions reflected in the archaeobotanical assemblage. However, wetter and cooler conditions after about 7,000 years ago contradicts evidence elsewhere that warmer and drier conditions prevailed during the Altithermal.

Dietary analysis revealed that proportions of protein from shellfish range between 70.4 and 93.1 percent, numbers that are consistent with other sites on Vandenberg SFB. Proportions of fish in the diet increased slightly through time, with the highest proportions in the Late Period and the lowest in the early Holocene and early Early Period. Marine habitat use was fairly static through time. Birds were unusually common in every occupation at CA-SBA-530, particularly compared to most sites on Vandenberg SFB. Use of large terrestrial mammals such as deer appeared to have increased through time—the earliest occupations contained the lowest percentage of protein from large terrestrial mammals. Large terrestrial mammals were of the greatest dietary importance in the Late Period occupation—this occupation was the only time in which large terrestrial mammals were of greater dietary importance than either small/medium mammals or sea mammals. The early Holocene occupation had the lowest percentage of protein contributed by marine mammals. Occupations between 7560 and 6320 cal B.P. showed an appreciable increase in the importance of sea mammals, after which there was a steady decline in the dietary contribution by sea mammals.

Lithic data from CA-SBA-530 provided new insight into settlement systems and land-use strategies in the Vandenberg SFB region. Previous studies suggested that prehistoric settlement systems shifted from a forager to a collector strategy about 8,500 years ago. However, biface stage profiles from the early Early Period occupations at CA-SBA-530 conformed best with expectations of a forager land-use strategy and were nearly identical to profiles from early Holocene sites elsewhere on the base. As a consequence, it appeared that the early Early Period occupants at CA-SBA-530 were employing a forager land-use strategy. Conversely, the biface stage profile evident for the youngest occupation at CA-SBA-530 was very similar to profiles at other Middle and Late Period sites on the base, and conformed best with expectations of a collector land-use strategy. Thus, data from CA-SBA-530 indicated that the shift from a forager to a collector land-use strategy occurred after about 5,000 years ago (Lebow et al. 2002; Lebow, McKim et al. 2007).

CA-SBA-212

CA-SBA-212 is a long, narrow archaeological site that stretches for 850 meters along the coastline at Point Pedernales. It contains three spatially distinct prehistoric shell middens, all adjacent to the sea cliff and eroding as the sea cliff retreats. Applied EarthWorks excavated 10.63 cubic meters during data recovery at the site. Seven spatiotemporally distinct occupations were identified through analysis of 32 radiocarbon samples. The site was initially occupied during the middle of the Middle Period (around A.D. 365–790), with the possibility that occupation started even earlier, around 790–380 B.C. Nearly continuous distributions of radiocarbon age determinations following the initial occupation suggest that the site was occupied throughout the last half of the Middle Period and the entire Late Period, with the terminal occupation at the end of the Late Period or during the early historic period (McKim et al. 2007).

Abundant faunal remains from CA-SBA-212 provided significant insights into subsistence strategies. One of these is that use of shellfish and fish intensified during the Late Period at Loci A and C, while at Locus B fish were relatively unimportant and shellfish use appears unchanged through time. Other evidence of intensified use of food resources in Loci A and C included greater than expected diversity, indicating that additional resources were used to supplement the species relied upon during earlier periods. However, while use of shellfish and fish intensified, use of sea mammals declined, particularly during the later part of the Late Period. Mussel shell sizes also decreased, suggesting that mussel beds were overexploited (McKim et al. 2007). These diachronic patterns support observations about subsistence made by others on Vandenberg SFB and the Santa Barbara channel region during the late Holocene.

As sites with substantial marine mammal bone assemblages are rare, abundant pinniped remains at CA-SBA-212 offered a unique opportunity to study marine mammal hunting on the Vandenberg SFB coast. For the last 15 years, a high-profile debate in the archaeological literature has been whether human predation during the late Holocene reduced pinniped populations and forced pinnipeds to move to offshore rookeries and haul outs. Based on faunal data from CA-SBA-212, it appears that mainland rookeries and haul outs were used throughout prehistory, including the Late Period (McKim et al. 2007).

CA-SBA-211

CA-SBA-211, a variable-density scatter of marine shell, animal bones, and lithic debris, lies on the coast at Rocky Point. A knoll in the southwest corner of the site contains the most substantial midden, while a dune in the central part of the site contains a buried lens of marine shell. Applied EarthWorks excavated 5.21 cubic meters in October 2007, mostly focused on deposits that were being lost to erosion (Lebow, McKim, Haslouer et al. 2008). Analysis of six radiocarbon samples revealed two spatiotemporally distinct occupations, with initial use of the site around A.D. 710–1070, which corresponds to the late Middle Period, and a terminal occupation around A.D. 1680–1690, corresponding to the late Late Period.

Data from CA-SBA-211 revealed that residents during both periods of occupation relied heavily on shellfish for subsistence. Proportions of protein from shellfish during all occupations were above 90 percent, well above base-wide averages for comparable time periods and even well above averages for other coastal sites. For the initial occupation, the strong emphasis on shellfish appeared to be related to the site function—residents were using the site for the purpose of harvesting shellfish. During the terminal occupation, which functioned as a short-term residence, subsistence emphasized shellfish, but harvesting shellfish was not the only purpose of the occupation (Lebow, McKim, Haslouer et al. 2008).

Applied EarthWorks' previous research on the Base indicated that land-use strategies shifted from foraging to collecting around 3,000 years ago (see the discussion below). Thus, occupants at CA-SBA-211 during both periods were probably collectors. However, neither occupation fits with expectations of lithic technology in a logistically mobile land-use system. The explanation is simple for the initial occupation—shellfish collection does not require lithic reduction or even use of lithic tools. For the terminal occupation, which occurred after Spanish explorers had been in the region for around 140 years, the explanation is not as clear but may lie in an altered lithic technology following the introduction of metal implements such as knives (Lebow, McKim, Haslouer et al. 2008).

CA-SBA-1119

CA-SBA-1119 is a multicomponent site on south Vandenberg SFB, in the bottom of Honda Canyon about 330 meters inland from its mouth at the Pacific Ocean. Honda Creek is eroding intact shell midden.

Excavations revealed three distinct periods of occupation but one of those, dating to 540–340 B.C., was too deeply buried to access and only a small column sample was recovered (Lebow et al. 2009). Substantial collections were recovered from a midden dated to A.D. 400–700 and from another dated to A.D. 1430–1782.

All occupations at the site took place after human population density had begun to rise following about 7,000 years of stability. The terminal Late Period occupation occurred at the highest peak population density around 400–600 years ago and/or during a precipitous drop after the peak. Shellfish provided most of the protein during all occupations, but the A.D. 400–700 occupation had a much greater reliance on large mammals (both terrestrial and marine). During the terminal occupation, fish and rabbits were much more important. Residents associated with both of those occupations were importing tool stone and reducing cores and bifaces. By the time of the most recent occupation, residents had apparently adopted metal implements and were no longer using lithic material for manufacturing tools. All occupants used CA-SBA-1119 as a short-term residence. Data from CA-SBA-1119 joins a growing body of evidence suggesting that land-use strategies changed around 3,000 years ago, from residentially mobile to logistically organized settlement systems.

CA-SBA-694 and CA-SBA-695

CA-SBA-694 and -695 are contiguous sites along the coast on north Vandenberg SFB, in the vicinity of Purisima Point. Both sites were severely damaged by wind erosion and also suffer from sea cliff retreat. Excavations at CA-SBA-694 identified three artifact concentrations, all containing marine shell, fish bone, other faunal remains, and lithic debitage. All three loci date to the same period, between A.D. 1480 and 1782. Vertebrate faunal assemblages from all loci are unusual in that they are mostly (95 percent) fish bones. CA-SBA-695, situated immediately north of CA-SBA-694, is considerably older at A.D. 130–420. Excavations here found only a low-density scatter of lithic debitage and faunal remains. Fish bones are still the most prevalent of the vertebrate faunal remains, although the proportion (57 percent) is much lower. Unlike most sites on Vandenberg SFB, the shellfish assemblages at both sites contain more black turban snails than California mussel (Moratto et al. 2009).

CA-SBA-646

CA-SBA-646 is located on Point Arguello, on south Vandenberg SFB. Wind and water erosion had eroded a substantial midden, reducing its size from about 30 by 10 meters in 1970 to 4 by 2 meters in 1997. Two spatially distinct prehistoric archaeological deposits were identified during fieldwork (Lebow, McKim, Harro, Hawley, and Munns 2010). One of these was the rapidly eroding shell midden first recorded in 1970; the second was a previously unknown shell midden buried under historical/modern fill. Radiocarbon analysis revealed that these two deposits are also temporally distinct. The midden remnant recorded in 1970 dated to A.D. 1530–1720, corresponding to the late Late Period. The buried midden is considerably older and appeared to reflect a series of occupations over a span of as much as 1,180 years between 400 B.C. and A.D. 780, corresponding to the early Middle Period.

The initial period of occupation at CA-SBA-646 occurred as regional human population densities were increasing, but well before they peaked around 400–600 years ago. Intriguingly, the site was abandoned when regional population densities peaked. The final occupation occurred immediately after the peak density, when introduced diseases decimated regional populations. During both periods of occupation, CA-SBA-646 functioned as a short-term residential site used during seasonal rounds. Site inhabitants appeared to have been drawn to Point Arguello by birds such as cormorants and auklets that nest in the spring. All seasonality indicators pointed to occupations during March, April, and/or May. Both occupations had surprisingly large numbers of bird bones (more than 30 percent by weight), whereas very few sites in the region have more than 3 percent by weight. But while birds may have been the attraction, shellfish (particularly California mussel) provided, by far, the bulk of the dietary protein during both periods of occupation. Analysis of mussel shell sizes indicates that site occupants were stripping mussel beds, rather than managing the beds by plucking only the larger individuals.

CA-SBA-649

CA-SBA-649 lies on the coast of south Vandenberg SFB, just north of Point Arguello. Wind and sea cliff retreat have eroded large parts of the site. Excavations identified three spatiotemporally distinct shell middens (Lebow, Enright, Harro, and McKim 2010). The site was initially occupied around A.D. 410–700 when it repeatedly served as a short-term residence during late spring, summer, and/or fall. While at the site, occupants collected and consumed shellfish and hunted locally available animals, with a focus on birds that were probably nesting at Point Arguello. On-site chert outcrops were used as a source of tool stone to make expedient flake tools and produce early-stage bifaces. Very shortly (or immediately) after that initial occupation, the site was occupied again between A.D. 700 and 890. This occupation was much like the previous one, but with greater emphasis on shellfish procurement and consumption, and less emphasis on birding. Fish and rabbits were more important during this occupation. During this period, the site again repeatedly functioned as a short-term residence during the late spring, summer, and/or fall. The on-site chert outcrops continued to serve as a source of stone for making expedient tools. The final occupation at CA-SBA-649 occurred between A.D. 1680 and 1782, after Spanish explorers had reached the area and regional human populations were decimated due to Old World diseases. Once again, the site functioned as a short-term residence, although occupation was less intensive. The subsistence focus was clearly on shellfish, although locally available animals were also hunted and consumed. Chert was obtained from the on-site outcrops, but the focus of lithic reduction was less on early stages than during the earlier occupations.

CA-SBA-223/H (Lompoc Landing)

CA-SBA-223/H is on the coast between Purisima Point and the mouth of the Santa Ynez River. It contains a prehistoric component as well as the remains of the historical Lompoc Landing (a wharf and associated community). Sea cliff retreat is eroding portions of the prehistoric component. Excavations in the prehistoric component found that although CA-SBA-223/H is recorded as a single very large site, it actually comprises 11 spatiotemporally distinct loci (Lebow, McKim, Harro, Warren et al. 2010). Occupations began in Loci A and I around A.D. 190–640. The site was then abandoned for a brief period and reoccupied around A.D. 770. After that, occupation was roughly continuous at various loci during a 720-year interval until A.D. 1490. Subsequent use of the site was more sporadic. Occupations at Locus E (A.D. 1490–1680) and Locus H (A.D. 1650–1782) probably occurred after introduced Old World diseases had decimated native populations. Locus A is an unusually dense shell midden and was the only location that appeared to host temporally distinct occupations, with an early component dated to A.D. 190–640 and the subsequent occupation around A.D. 860–1350.

In terms of settlement systems, CA-SBA-223/H reflects a series of short-term residences and special-use locations where people periodically visited to collect tool stone, gather shellfish, fish, and hunt. Use of the site was almost exclusively limited to the spring and/or summer. Only Locus B appears to have been occupied during the fall/winter in addition to the spring/summer. Analysis of lithic remains clearly indicates that obtaining tool stone was an important activity. Exceptionally high ratios of lithic debitage to flaked stone tools, a preponderance of early- to middle-stage unused biface production rejects, and attributes of the debitage all indicate that occupants were knapping the local tool stone and exporting bifaces. For on-site use, cores were used to produce expedient flake tools.

CA-SBA-223/H inhabitants relied primarily on subsistence resources available nearby. Locally available shellfish—primarily California mussel and turban snails—provided the lion’s share of protein during all occupations. Occupants appear to have been stripping mussel beds. The proportion of turban snails to California mussel in the CA-SBA-223/H assemblage is much higher than typical for regional sites, a relationship that could reflect the proximity to prime turban snail habitat but also might reflect occupations during the summer and concerns for paralytic shellfish poisoning. Fish were second in terms of protein contribution, and large terrestrial and marine mammals were third. During the early occupations, marine mammals formed a larger share of the diet than during the later occupations, while the opposite is true for large terrestrial mammals. Analysis of butchery patterns indicates that animals were generally brought to the site whole (or nearly whole), suggesting nearby kills. A comparative lack of high-utility meat elements suggests that the better cuts of meat were exported. Intriguingly, CA-SBA-223/H is one of the few sites in Santa Barbara County to yield elk bones. Furthermore, the site is unusual in that sea otters—a relatively difficult animal to kill because they rarely come to land—are the most common marine mammal in the faunal assemblage. Interesting in the context of sea mammal hunting was recovery of a fur seal humerus with the tip of a projectile point still embedded in the bone (Lebow, McKim, Harro, Warren et al. 2010).

CA-SBA-1547

CA-SBA-1547 (the Sudden Flats Site) is a rapidly eroding dense shell midden buried on the coastal plain of south Vandenberg SFB (Lebow, Harro et al. 2014; Lebow et al. 2015). Excavations to recover data that would otherwise be lost to erosion revealed that the shell midden is a single component dating between 11,104 and 10,494 cal B.P., corresponding to the transition from the Pleistocene to the Holocene, and making it the oldest known archaeological deposit on Vandenberg SFB and one of the oldest, if not the oldest, coastal shell middens on the mainland of western North America.

Excavations focused exclusively on the ancient buried shell midden and produced an analytic sample of 23 flake tools, 18 bifaces, 11 burins, 7 radially fractured tool fragments, 1 utilized burin spall, 1 anvil, 1 hammerstone, 1 core, 4,948 pieces of lithic debitage, 2,665 vertebrate faunal remains (including 357 fish bones), 11 bone tool fragments, 32,369.96 grams of marine shell, 16 pieces of pigment, and three pieces of asphaltum. Artifacts of interest that were collected from eroding exposures (and thus not included in the analytical sample) include a milling slab, a handstone, and a chipped stone eccentric crescentic. The shellfish assemblage is dominated by California mussel; the vertebrate faunal assemblage is diverse with bones from fish, sea mammals, small terrestrial mammals such as rabbits, and large terrestrial mammals such as deer.

Analyses of materials recovered from the Sudden Flats Site revealed interesting and informative surprises. Paleocoastal sites are typically thought to reflect a heavy reliance on marine resources for subsistence, and occupants at the Sudden Flats Site were certainly eating copious amounts of California mussel. But aside from shellfish, occupants were consuming more terrestrial animals (particularly rabbits) than fish or sea mammals. When the faunal data from the Sudden Flats Site are compared with data from other, younger coastal sites on Vandenberg SFB, the quantities of marine resources—including shellfish—are not unusual. Other coastal sites that date to later periods have higher proportions of shellfish, fish, and sea mammals. In other words, the data from the Sudden Flats Site do not support the common perception that paleocoastal occupants were unusually reliant on marine resources.

While the subsistence remains from the Sudden Flats Site are unexpectedly normal, the lithic assemblage is remarkably abnormal. Most surprising and interesting in the lithic assemblage is the strong presence of a burin technology. Burins have not previously been found on Vandenberg SFB and are rare throughout California. Microblades were also recovered, suggesting the presence of a microblade core industry, also not previously found on Vandenberg SFB and rare in California. Mid-stage bifaces of locally obtained Monterey chert were surprisingly large and well made when compared to all other more recent Monterey chert bifaces on Vandenberg SFB, suggesting a different reduction technology that did not survive. The proportion of obsidian in the lithic assemblage, obtained from distant sources, is much higher at the Sudden Flats Site than found at any other Vandenberg SFB site. Furthermore, the sources are geographically diverse, suggesting that trade was relatively unconstrained compared to later periods.

The Sudden Flats Site appears to have functioned as a short-term residential location that, given the dense shell midden, was probably repeatedly occupied. Between 11,104 and 10,494 calendar years ago, the site occupants were foragers that collected shellfish, hunted terrestrial and marine mammals, and fished. Tool stone was brought to the site (probably mostly from nearby chert sources but also from distant obsidian sources), and the site was used as a general workshop for manufacturing and maintaining tools (Lebow, Harro et al. 2014; Lebow et al. 2015).

CA-SBA-639

CA-SBA-639 is a dense and diverse shell midden on the coast just south of Point Arguello (Lebow et al. 2016). Excavations reveal it was occupied between 1260 and 640 cal B.P., and reflects repeated short-term occupations. Shellfish density is remarkably high, reaching as much as 254,600 grams per cubic meter in the 50–60 centimeter level. As is typical of coastal sites on Vandenberg SFB, the shellfish assemblage is dominated by California mussel, indicating that shellfish collection focused on the rocky foreshore that would have been prevalent in the site vicinity. Vertebrate faunal density was also relatively high, with an overall value of 1,184 specimens per cubic meter but reaching as high as 8,267 per cubic meter in the 50–60 centimeter level. Marine mammal bones dominate the assemblage by weight, which is highly unusual in Vandenberg SFB assemblages. Also unusual is that bird bones were second in frequency. Both of these unusual findings probably reflect proximity to marine mammal haul outs and bird nesting habitats. The lithic assemblage was likewise unusual in that site occupants were using stone from a nearby source for initial stages of reduction. Biface manufacture and maintenance, which is typical of residential sites on Vandenberg SFB, does not appear to have been occurring during the sampled occupations.

Patterns Evident from Applied EarthWorks' Investigations

Applied EarthWorks has been performing archaeological studies on Vandenberg since 1995 and has compiled a substantial body of archaeological data. Importantly, all recovered materials were collected and examined by the same staff using the same protocols, ensuring that the datasets are consistent. Consequently, variations in the data can be attributed to prehistoric behavior and not variations in data collection and analyses. Following is a brief summary of the patterns evident in the compiled data. Only well-dated assemblages of sufficient size were included in the compilations.

Subsistence data from 45 dated components reveal that shellfish were the primary dietary contributors during the terminal Pleistocene and early Holocene. Fish were nearly absent, but large mammals were nearly as important as they were during the Late Period. Shellfish continued to be the primary dietary contributor until approximately 3,800 years ago (late Early Period), at which time their dominance began to decline. Fish remained a minor contributor during the Early Period, while large terrestrial mammals increased in importance. Sea mammals showed a slight increase during this period compared to the early Holocene, while rabbits appeared to decrease slightly. The Middle Period is marked by several changes in subsistence. For the first time, more sites than not have minor shellfish contributions. In the place of shellfish, inhabitants appear to have turned to both large terrestrial and marine mammals. Site location is a determining factor for which type of animal was targeted. The Late Period was a time of much variability. Shellfish remained an integral part of the diet, although not to the same extent as before about 4,000 years ago. Fish are the only subsistence resource that exhibited a clear increase during this time period. The remaining subsistence taxa are highly variable in terms of frequency. Both large terrestrial and sea mammal hunting appear to have increased during the Late Period (Lebow, McKim et al. 2007).

Lithic data from 29 components reveals that the early Holocene lithic assemblage fits perfectly with the expected technology among foragers in a tool stone rich environment. Unretouched and retouched flake tools dominate, bifaces are generalized, and biface stage profiles show incremental replacement. Early Period residential assemblages are similar except for the greatly increased use of bifaces as cores. By the

Middle Period, stone tool technological organization had become much more centered at residential bases. Bifaces were used as cores and generalized tools while task groups occupied special-use sites. At residences, bifaces were prepared and maintained, but the overarching technology invoked for on-site tasks was expedient. This cycle of biface production/use/repair that began at the residence, passed through specialized sites, and returned again to the residence clearly describes a logistical land-use system. It appears, therefore, that the land-use strategy shifted from foraging to collecting around the end of the Early Period and the beginning of the Middle Period (Lebow, McKim et al. 2007).

Overall, the time around 3,000 years ago appeared to have been pivotal in the prehistory of the Vandenberg SFB region. Prior to that time, human population densities were low but with relatively limited variability; after that time, human population densities began to increase and substantial variability is evident. Prior to 3000 B.P., California mussels appear to have consistently been procured through a stripping strategy, whereas after that time the procurement strategy was much more variable and included a plucking strategy that would have more efficiently maintained mussel beds. Prior to 3000 B.P., bivalves from sandy beaches and estuaries are more frequent than after 3,000 years ago, when they are nearly absent. This pivotal point at about 3000 B.P. coincides fairly closely with King's (1990) transition between the Early and Middle periods. Lebow et al. (2006) proposed that the period around 3,000 years ago represented a shift in land-use strategy, from a residentially mobile system (i.e., foraging) to a logistically mobile strategy (i.e., collecting).

RESEARCH ISSUES AND QUESTIONS

As detailed by Lebow and Moratto (2005:2-17–2-19), nearly all archaeological research completed on thee Base since the 1960s has been either explicitly or implicitly oriented toward understanding cultural evolution and cultural processes. That orientation also will form the basis for Applied EarthWorks' continuing research. Important and interesting research issues within the overarching orientation of cultural evolution and cultural processes on the base include subsistence, settlement systems and land-use strategies, technology, trade and exchange, human population densities, and paleoenvironments. Each of these issues is discussed below, and specific questions are generated.

Subsistence

Studies of subsistence are basic to understanding land-use strategies and settlement systems. Using data collected during the STS project, Glassow (1996:128–132) infers that shellfish were the primary subsistence focus during the early Holocene (prior to 8500 B.P.). This inference is supported by data from Applied EarthWorks' investigations on the Base. The emphasis on shellfish in early Holocene sites is intriguing given that around 9,000–10,000 years ago the sea level was lower and the coastline on Vandenberg SFB was 2.0–3.5 kilometers farther out than it is today. In other words, early Holocene sites that are now on the coast were substantially inland at the time of occupation but still reflect a strong emphasis on shellfish (e.g., Lebow, Harro et al. 2014; Lebow, McKim et al. 2007). Coastal sites outside the base, such as CA-SLO-2 in Diablo Canyon, also indicate a strong marine subsistence orientation during the early Holocene (Greenwood 1972; Moratto 1984:108), as do sites along the Santa Barbara coast (Erlandson 1991). Excavations at Daisy Cave on San Miguel Island revealed a strong emphasis on fishing more than 8,500 years ago (Rick et al. 2001).

While agreeing that shellfish played an important role in the early Holocene diet, Erlandson (1994:166) suggested that plant foods also were important as "lean shellfish meats alone cannot sustain humans for long without carbohydrates or fats." Recent excavations at the Cross Creek Site (CA-SLO-1797) appear to support Erlandson's assertion, as abundant milling stones associated with occupations dating between circa 9,500 and 10,300 years ago were recovered, suggesting that plant gathering and processing "was of paramount importance to the subsistence regime" (Fitzgerald 2000:129).

Abundant manos and milling slabs at sites dating between 8500 and 6500 B.P. appear to reflect a dietary shift with increased reliance on seeds (Glassow 1996:129). Shellfish continued to dominate the diet, but large terrestrial mammals composed a larger proportion of the subsistence base (Lebow, McKim et al. 2007). Applied EarthWorks found that use of small mammals (e.g., rabbits) decreased slightly during the Early Period, although Glassow (1996) suggested otherwise. Sea mammals and fish composed a minor part of the subsistence strategy during this period (Glassow 1996:129; Lebow, McKim et al. 2007; Woodman et al. 1995:5-55). Ferraro et al.'s (1988:7-22–7-33) model of ecological change on the Lompoc Mesa suggested that shellfish habitats would have been affected by rising sea levels during this period, possibly accounting for the increased reliance on terrestrial resources. Around 5,000 years ago, acorns became more important and other seeds less important, as indicated by increasing proportions of mortars and pestles and decreasing frequencies of manos and milling slabs (Glassow 1990:13-25–13-26, 1992:120).

Shellfish remained the focus of subsistence during the Middle Period (Glassow 1996:131), although emphasis on this resource diminished (Lebow, McKim et al. 2007). To some extent, shellfish were replaced by increased use of both large terrestrial mammals and sea mammals. Several sites along San Antonio Creek that were occupied from the late Early Period through the middle of the Middle Period reflect extensive use of big game (e.g., elk and deer) (Bamforth et al. 1997; Colten et al. 1997; Lebow, McKim et al. 2005; Lebow, McKim et al. 2014) although this subsistence strategy appears to reflect an adaptation to environmental conditions (Lebow, McKim et al. 2014). In addition, two sites on Vandenberg SFB reflect a strong emphasis on sea mammal procurement—CA-SBA-212 on the South Base coast (McKim et al. 2007) and the Combar Road site complex (Lebow et al. 2006). Fish were not a large part of the diet during the Middle Period.

Shellfish remained an integral part of the Late Period diet, but with less emphasis than during earlier periods. Use of fish increased substantially (Glassow 1996; Lebow, McKim et al. 2007). Glassow (1996) suggested that use of birds also increased, but Lebow, McKim et al. (2007) found that proportions of birds were fairly static throughout the Holocene. Lebow, McKim, Harro, Hawley, and Munns (2010) and Lebow, Enright, Harro, and McKim (2010) found that fluctuating proportions of birds by site is more spatial than temporal and reflects proximity to suitable bird habitat. In their analysis of base-wide subsistence data, Lebow, McKim et al. (2007) found that use of large mammals was highly variable during the Late Period, but that overall use of large terrestrial mammals and sea mammals increased during the Late Period. This is contrary to Glassow's (1992:123) suggestion that use of sea mammals decreased. Similarly, Applied EarthWorks found that large terrestrial mammal hunting increased during the Late Period. Sites with low percentages of large terrestrial mammals have high percentages of sea mammals and vice versa.

Increased subsistence diversity during the Late Period is noted, although the evidence is not as clear as once thought. Lebow and Harro (1998) report dietary expansion to include yellow nut grass during the Middle-Late Transitional Period. Glassow (1990:13-32, 2002) indicates that proportions of California mussel decreased and percentages of secondary species correspondingly increased in shellfish assemblages during the Late Period. However, Lebow et al. (2006) used base-wide data to examine shellfish assemblage diversity, and based on MNI, found that use of California mussels did not decrease through time. Instead, the data suggested that mussel sizes decreased during the Late Period, and since previous studies made comparisons based on weight, the diminished mussel sizes gave the appearance of decreased importance. Furthermore, Lebow (2014) found that increased proportions of black turban snails—a secondary species when compared to California mussel—during the Late Period is primarily due to proximity of Late Period sites to suitable turban snail habitat.

Questions

- What resources were used for subsistence by occupants at Project sites? How did these resources vary through time? Did resource use change in response to variations in population or the environment?

- If present, does an early Holocene occupation reflect a strong orientation toward marine subsistence, as suggested by previous studies (e.g., Glassow 1996:128–132; Lebow, Harro et al. 2014; Lebow, McKim et al. 2007)? Or does the apparent early Holocene focus on marine resources simply reflect the biases of (1) a very small sample of early Holocene sites and/or (2) the proximity of early Holocene sites to the coast? Is there evidence to support Erlandson's and Fitzgerald's inference that plant resources were very important to early Holocene people?

- If present, does an occupation between about 8,500 and 6,500 years ago reflect increased reliance on seeds and lower use of marine resources (Glassow 1996)?

- Glassow (1990, 1996) associated the appearance of mortars and pestles around 5000 B.P. with a shift from hard seed processing to acorn processing. However, others (e.g., Schneider 1993) have cautioned against making such direct correlations between milling stones and function, noting that grinding implements often were used for a wide variety of tasks. Other than a shift in the relative proportions of milling stones, is there evidence at Project sites to suggest that subsistence shifted from hard seeds to acorns around 5000 B.P.? Is there evidence other than manos and milling slabs to suggest that seeds were an important part of the diet prior to 5000 B.P.? Conversely, is there evidence to suggest that grinding implements such as manos, milling slabs, mortars, and pestles were used for processing something other than vegetal resources?

- Glassow (1996) suggested that fish and sea mammals increased in importance by about 2,500 years ago and that sea mammals were increasingly important sources of food during the Middle Period. Is this pattern evident in the faunal assemblages at Project sites?

- Glassow (1990), Lebow and Harro (1998), and Perry (2004) inferred diet breadth expansion at the end of the Middle Period, including increased use of secondary shellfish species and yellow nut grass tubers. Lebow et al. (2006) disputed the increased use of secondary shellfish taxa but instead attributed the apparent decrease to smaller California mussels. Do Project sites provide evidence of increased diet breadth during the Late Period? Is increased use of secondary shellfish taxa evident?

- Using data from the northern Channel Islands, Arnold (1992a) proposed that social and economic complexity among the Chumash advanced substantially during the Middle-Late Transitional Period in response to elevated sea temperatures and decreased marine productivity (see also Arnold et al. 1997). Colten (1992, 1993, 1995) suggested a reduction in shellfish productivity, a decline in marine mammal productivity, and increased use of fish. Although the issue of marine degradation during this period has been questioned (e.g., Raab 1996; Raab et al. 1995; Raab and Larson 1997), the proposal of social reorganization around this time is generally accepted. In their examination of occupations on the Base spanning this transitional period, Lebow et al. (1998) could not produce unequivocal evidence of subsistence stress that could be attributed to either marine or terrestrial environmental degradation. Is there evidence of subsistence stress during this period in the archaeological data from Project sites?

- Colten et al. (1997) noticed that mussel shell sizes decreased through time at CA-SBA-2696 and inferred overexploitation of this resource. Similarly, Moore et al. (1988) inferred overexploitation of mussel beds due to the small mussel shells at CA-SBA-1816. Glassow and Gregory (2000) also noted small mussels in the collection from CA-SBA-699. Glassow (1991:79) found that mussel sizes varied between sites at Point Sal—with smaller shells found at sites that represented longer or more intense occupations—and inferred that the collection pressure resulted in collection of smaller shellfish.

- In an examination of base-wide data, Lebow et al. (2006) found that mussel sizes were relatively consistent prior to 3,000 years ago, but became highly variable after that time. Based on this pattern, they suggested that mussel beds were routinely stripped prior to 3,000 years ago but after that time mussel collection varied between stripping and plucking. Do the mussel sizes at Project sites vary through time? If so, do the variations appear to reflect intensified use of mussel beds?

- Based on data from CA-SBA-690 and CA-SBA-1040, Glassow (1990, 1996) inferred increased use of birds as a source of food during the Late Period. However, using data from 45 site components, Lebow, McKim et al. (2007) found that use of birds was relatively consistent throughout the Holocene. If present, do Late Period assemblages at Project sites suggest increased use of birds?

Settlement Systems and Land-Use Strategies

Settlement systems have long been of interest to scholars working on Vandenberg, starting with Ruth's (1936) comparison of site distributions between the northern part of Santa Barbara County and the mainland channel area. Initial studies such as Ruth's focused more on the patterns evident in the distributions of sites (e.g., Glassow et al. 1976; Spanne 1974), while subsequent studies have been more interested in settlement organization to help explain the distribution patterns.

Spanne (1974:7–8), after completing the initial base-wide survey, noticed that the most intensively occupied sites (e.g., villages) and the highest site densities were on south-facing landforms. Major drainages and tributaries also appeared to have high site densities and to contain large numbers of sites with evidence of intensive occupation. In addition, the high ridges east of the Casmalia Grade on Lompoc-Casmalia Road appeared to have high densities of sites as well as a number of sites evincing intensive occupations. West aspects of landforms also contained sites, but they appeared to be smaller and less intensively occupied. Spanne (1974:7) also noted a pattern in which sites "seem to be arranged in linear fashion as if connecting the major centers of population. Some of these linear patterns run parallel to the coastline between Rocky Foreshore zones while others seem to connect coastal and interior population centers or population centers and various resources zones."

After a survey of 6,165 acres and evaluation of 24 sites for the 1983 Fuels Management Program, Schilz et al. (1984:32) suggested that the pattern of site locations within the coastal strand south of Point Sal is consistent: sites are located near chert outcrops, along inland streams and springs, and along the coastal bluffs and dunes. This pattern reflects the locations of raw materials, food, and water as well as travel routes.

During the initial stages of the STS project, Glassow et al. (1976) noted that:

> there appears to have been a varying pattern of settlement along the Lompoc-Vandenberg coast during the Late Chumash Period. This pattern consists of the location of population centers several miles inland when the coastal environment is characterized by exposed sandy beaches and a resultant lack of resources. Interior populations in these areas seem to have made periodic trips to rocky coastal areas during periods of low tides in order to exploit shellfish which must have been an important food source for these people in spite of their orientation toward the interior.

> Where coastal areas are southerly facing with an abundance of available food resources, population centers were located on the coastal plain. These centers appear to have been more sedentary than interior population centers found in the Lompoc-Vandenberg area. Craft specialization may have been present in some of these coastal areas [Glassow et al. 1976:49–50].

By the conclusion of the STS project, the focus of the research had shifted from distribution patterns to subsistence and settlement systems. Based on data available from the STS sites, Glassow (1990:13-2) distinguished between residential bases, where groups spend relatively long periods of time completing a variety of activities, and camps, which were occupied for a relatively short period of time and used for limited activities. However, Glassow recognized that settlement systems are more complicated and that the range of types might include various residential bases used for various lengths of time and differing purposes as well as short-term camps used by different combinations of group members for differing purposes.

Using data from the STS and other projects, Glassow (1990) also provided a comprehensive analysis of evolving settlement systems on Vandenberg SFB.

> Perhaps the most fundamental change in the subsistence-settlement systems that existed prehistorically in the Vandenberg region appears to have occurred at the onset of the ecological adaptation that characterized the so-called Millingstone Horizon, which correlated with the first phase of King's (1981) Early Period (phase Ex). Occurring ca. 8500 B.P., this change entailed a shift from a highly mobile settlement system with apparently no emphasis on a principal residential base to one that placed a good deal of emphasis on a principal residential base. In the south Vandenberg area this residential base was located at CA-SBA-552. In terms of the forager-collector continuum proposed by Binford (1980), this change entailed a shift from a classic forager subsistence-settlement system to one more typical of collectors. Once this shift occurred, there was substantial continuity in the nature of subsistence-settlement systems through the rest of prehistory.
>
> Throughout the terminal Early and the Middle Periods, the subsistence-settlement system continued to emphasize use of CA-SBA-210/552 as a principal residential base, and shellfish collecting continued to provide most of the animal protein to the diet of the site's inhabitants. Through the course of these two periods increasing emphasis was placed on marine mammal hunting and fishing, with the former being particularly important to subsistence at certain subsidiary residential bases. A major shift at the beginning of the terminal Early Period was the abandonment of an emphasis on seed collecting/processing in favor of much less emphasis on acorns, at least while populations occupied sites near the coast.
>
> Regarding subsidiary residential bases of the terminal Early and Middle Periods, those for which data are available contain large volumes of midden, implying that they were regularly used focal points of the settlement system. Use of subsidiary residential bases is particularly obvious during the period between 2500 and 2000 B.P. As was undoubtedly the case during all periods of prehistory since 8500 B.P., however, many sites that were part of the settlement system were very small and used only sporadically, thus leaving little behind for the archaeologist to study. Moreover, significant amounts of time during an annual cycle probably were spent at sites located considerable distances from the coast.
>
> Late Period subsistence-settlement systems appear to differ in several significant ways from those of the preceding Middle Period. While emphasis was still placed on using CA-SBA-210/552 as a principal residential base, subsidiary residential bases appear more numerous and in a greater diversity of locations. It may be also that subsidiary residential bases were not used as systematically as was the case earlier. Subsistence also shifted toward a greater dependence on fish, although shellfish still dominate the animal protein dietary intake. Furthermore, some sites were used for highly focused subsistence pursuits, the emphasis on fowling at CA-SBA-690 and 1040 being examples among the sites considered in this analysis [Glassow 1990:13-25–13-26].

In the research design for the final report of MX studies, Glassow (1984a:2-18) noted that the principal theme running throughout the archaeological project is hunter-gatherer subsistence and settlement. However, he acknowledged that "only a hazy picture emerges of subsistence-settlement systems" on the San Antonio Terrace after analyses of the MX data (Glassow 1984b:10-24). These data suggest that the settlement system was logistically organized, with sites used for overnight stays and day-use activities organized around residential bases. Based on lithic data, Bamforth (1984:9-94–9-95) identified a change in settlement systems around A.D. 500. Prior to that time, site types on the edge and the interior of the terrace were very similar. After that time, base camps were established on the terrace edge, and sites on the interior were temporary and more task specific. Glassow suggested that residential sites on the terrace edge after A.D. 500 reduced the need to establish overnight camps on the terrace interior.

This settlement organization also applied to the coast, the San Antonio Terrace, and the Casmalia Hills. Residential bases were established in each of these resource zones, and the subsistence-related activities at each residential base reflected the resources available in that particular area. Sites on the coast were oriented toward gathering shellfish and fishing, while residential bases at the edge of the terrace reflected an emphasis on terrestrial hunting. Residential bases in the Casmalia Hills were strategically located relative to a variety of resources, and plant gathering and processing was emphasized (Glassow 1984b:10-24). In its analysis of sites on the San Antonio Terrace, Tetra Tech concluded that the settlement model developed from the MX data was overly simplistic. It was suggested that sites on the San Antonio Terrace were used on a seasonal basis for plant procurement and that use of the edge and the interior of the terrace was not linked, as inferred by Glassow. Instead, use of the terrace edge was more closely related to resources outside the terrace, particularly those found in the valley margin and riparian zone (Tetra Tech 1990:9-1).

Studies associated with development of space launch complexes on South Base suggested that people using Spring Canyon were logistically organized, and that the canyon itself was used seasonally.

> A model of human adaptation at Spring Canyon is based on the following archaeological observations. First, the sites around Spring Canyon appear to be more than brief, temporary encampments established while riparian resources are exploited. Alternatively, none of the Spring Canyon sites appear to have been permanent, year-round settlements. What appears to be represented archaeologically is another manifestation of the reliance on logistic mobility in Late Period settlement systems in Purismeño Chumash territory. It is a settlement pattern in which human populations seasonally move from residential bases to short-term occupations which serve as staging areas for subsistence activities [Moore et al. 1988:13-2–13-3].

Subsistence and settlement systems in the Vandenberg region were the focus of the Union Oil Pipeline Project. As discussed above (Section 3.2.1.4), research for that project emphasized resource use and settlement in the Santa Ynez River valley (Woodman et al. 1991). The results indicated that the valley was characterized by short-term occupations in a settlement system that did not change throughout the Holocene, despite changes in climate and human populations. Site distribution patterns suggested that use of the valley did increase through time and that the habitats used by valley occupants became increasingly diverse. However, the overall land-use strategy remained that of a generalized forager system, probably associated with a more complex land-use strategy outside the project area.

Following 20 years of archaeological excavations on the Base, Applied EarthWorks has generated a sizeable body of data from sites of various ages and functions (see Sections 3.2.1.5–3.2.1.10, above). Applied EarthWorks found that biface manufacture and use correlates with site function, and that the pattern of early Holocene biface manufacture and use differs from the pattern in the late Holocene (see the discussion in Section 3.2.2.3, below). The early Holocene pattern fits with models for a foraging land-use strategy, while the late Holocene pattern fits with models for a collector land-use strategy. The technological transition appears to have occurred around the end of the Early Period and the beginning of the Middle Period. Around that same time, human population densities began to increase. Prior to that time, California mussels were consistently procured by stripping beds, while after that time the procurement strategy was much more variable and included a plucking strategy that would have more efficiently maintained mussel beds. Furthermore, bivalves from sandy beaches and estuaries are more frequent before than after that time. Given timing of these behavioral changes, Lebow et al. (2006) and Lebow, McKim et al. (2007) concluded that the shift from a residentially mobile system (i.e., foraging) to a logistically mobile land-use strategy (i.e., collecting) occurred around 3,000 years ago—substantially later than proposed by Glassow (1990, 1996) and Woodman et al. (1991).

Applied EarthWorks also found that paleoenvironmental conditions influenced settlement systems. Xeric conditions between around 3240 and 2700 years ago attracted deer and elk to San Antonio Creek and Barka Slough, which in turn attracted human hunters. During that interval, short-term residential sites associated with killing and butchering large mammals were common along the banks of the creek (Colten et al. 1997; Lebow, McKim et al. 2005; Lebow, McKim et al. 2014). On South Base, Lebow, McKim et al. (2011) found that people moved residential bases inland to the banks of upper Honda Creek during periods of extended drought, to take advantage of the deer that were attracted to the well-watered canyon slopes, but also continued to collect littoral resources.

Questions

- What activities were completed at Project sites? How did these activities vary through time? How did each temporal component function within a settlement system?

- Do the functional data from Project sites fit within Glassow's (1990) model of evolving settlement systems?

- Glassow's (1990) model of settlement organization indicated that the system expanded during the Late Period—that the range and diversity of site types increased as did the diversity of habitats exploited. Others (e.g., Lebow and Harro 1998; Woodman et al. 1991) have provided support for this Late Period expansion. Do data from Project sites support a Late Period expansion of the settlement system?

- If Glassow (1990, 1996) and Woodman et al. (1991) are correct, the existence of a stable collector land-use system for 8,500 years on Vandenberg SFB during a time when settlement systems throughout California were evolving toward this type of land-use strategy begs an explanation. Alternatively, Lebow et al. (2006) and Lebow, McKim et al. (2007) suggested that a foraging land-use system was in place until around 3,000 years ago. What do data from Project sites suggest about land-use strategies? Does it appear that the occupants were using a foraging system until around 3,000 years ago, or was the shift to a collector system made about 8,500 years ago?

Technology

Lithic Technology

Abundant chert sources and high frequencies of bifacial tools on Vandenberg SFB have long piqued an interest in lithic technology among investigators in the area. Some studies have examined the possibility of biface manufacture for trade and exchange; this topic is examined below in Section 3.2.2.4. Other studies have focused more on tool stone procurement and lithic technologies specific to the base.

As part of the MX project, Grivetti (1984) attempted to identify chert sources and to assess tool stone quality on the base. Five types of sources were identified: middle Monterey Formation bedrock, other Monterey bedrock, terrace and stream gravels, beach gravels, and Franciscan Formation bedrock. The gravel deposits, the upper Monterey Formations, and the Franciscan Formations were found to have inferior quality chert, whereas the middle Monterey Formation and beach clasts were found to contain tool stone of excellent quality.

Schilz et al. (1984:96) found that raw tool stone was initially reduced at quarry sites but that subsequent reduction was completed at habitation sites. A core technology rather than a biface technology was found at quarry site CA-SBA-1542; cores were used to produce flakes that were transported back to habitation sites (Rudolph 1984). Ferraro et al. (1988:7-22) found that Early Period sites on the Lompoc Mesa contain higher frequencies of nearly finished bifaces, while production of early-stage bifaces is associated with Middle and Late Period sites. However, studies on the Lompoc Mesa by Environmental Solutions (1990b:14-6) suggested that technological organization and tool stone procurement did not change through time and that “the widespread availability of tool stone on Lompoc Mesa led to the embeddedness of lithic procurement tasks within the subsistence system.” In an analysis of the STS collections, Arnold (1990:8-79–8-86) found that both core and biface reduction trajectories are evident on the base and that different cherts were selected for bifaces and cores—tabular chert or outcrops at the beaches were primarily used for bifaces, and cobbles and canyon rim deposits were used for cores. Biface production was found to occur at a variety of site types and during all time periods.

Recent investigations on the Base examined lithic technology in the context of land-use strategies. Various relationships between lithic technologies and the evolution of hunter-gatherer land use have been proposed (e.g., Bamforth 1991b; Kelly 1988, 1992; Parry and Christenson 1987; Schalk and Atwell 1994; Shott 1986; Torrence 1989). In general, collectors are thought to have prepared tools in advance for use during resource procurement, and thus the tools tend to be relatively formal. Conversely, foragers make tools to fit the task at hand, and the tools tend to be relatively expedient (Carr 1994; J. Johnson 1989). However, the relationship between technology and land use is greatly affected by the availability and quality of tool stone (Andrefsky 1994; Lebow 1995; Lebow and Atwell 1995), to the extent that these factors may override constraints imposed by the land-use strategy. If tool stone is unavailable or of poor quality, tool conservation will be a primary technological factor regardless of land-use strategy. Tool conservation is often expressed by use of bifacial technologies because bifaces make versatile tools that also can be used as cores (J. Johnson 1989; Kelly 1988; Kuhn 1992). Conservation is not necessary if tool stone of suitable quality is readily available, and technology becomes relatively expedient regardless of land-use strategy.

Technological correlates of prehistoric land use have been examined on Vandenberg. Bamforth (1984) found that lithic technology emphasized curation rather than expediency at sites on the San Antonio Terrace during all time periods, despite the availability of high-quality tool stone in the region. However, technology became increasingly expedient through time, which he correlated with changing land-use strategies. Bamforth (1984:46) suggested that conservation was necessary during earlier occupations because no tool stone sources were immediately available on the San Antonio Terrace, and thus use of the terrace required portable tool kits and tool curation. Later use of the terrace was associated with staging sites at the edge of the terrace where tool stone could be stored and thus the need for conservation was relaxed. In sum, he argued that curatorial behavior may reflect local shortages, but that such shortages are not as likely at residential bases which should exhibit less evidence of a curated technology (Bamforth 1986). He found support for this argument in the lithic data from the Union Oil Pipeline. Those data revealed a reliance on an expedient lithic technology (i.e., flake tools) at project sites and a curated technology (i.e., bifaces) for off-site activities (Bamforth 1991a:244).

Since 1996, Applied EarthWorks has been collecting data on lithic technology from sites of all ages and types on the Base, resulting in the identification of a key pattern in the manufacture and use of bifacial tools. Lebow et al. (2002:11-55–11-62) summarized the pattern. Briefly, the data revealed that the manufacture of bifacial tools during the late Holocene was spatially distinct from use of bifacial tools. People during this time manufactured the bifaces at residential sites as part of gearing up for tasks completed at special-use sites. In other words, bifacial tools were manufactured at residential sites and carried for use during hunting and gathering forays away from the residential sites. Bifaces were carried because they are versatile and can be used as cutting implements or as cores to manufacture flake tools or later stage bifacial tools. Broken bifaces were returned from the special-use site to the residential site for maintenance, repair, or discard. However, while at the residential sites, occupants used simple flake tools to complete most tasks, rather than using bifaces. Consequently, residential sites dating to the late Holocene predominately contain unused early-stage bifaces and used late-stage bifaces. Special-use sites from the late Holocene contain used mid-stage bifaces. Lebow et al. (2002) inferred that this pattern reflects logistical mobility evident in a collector land-use system. The pattern evident in early Holocene lithic assemblages differs. Rather than a bimodal biface stage profile, with unused early-stage bifaces and used late-stage bifaces, early Holocene sites exhibit a relatively unimodal biface stage profile centered on the middle stages. Earlier stage bifaces were used much more frequently in early Holocene sites than in late Holocene sites. These patterns reflect a residentially mobile (i.e., foraging) land-use system where it was not necessary to "gear up" for special-use sites.

Recent excavations at the Sudden Flats Site unexpectedly revealed a burin technology associated with occupations around 10,910–10,600 cal B.P. Burins have not previously been found on Vandenberg and are rare throughout California. Microblades were also recovered from the site, suggesting the presence of a microblade core industry, also not previously found on the Base and rare in California. Mid-stage bifaces of locally obtained Monterey chert were surprisingly large and well made when compared to all other more recent Monterey chert bifaces on Vandenberg, suggesting a different reduction technology that did not survive (Lebow, Harro et al. 2014; Lebow et al. 2015).

Other Technologies

In his research design for Santa Barbara County, Glassow (1993) examined other aspects of technology within the context of cultural adaptation. Specifically, he discussed the evolution of fishing technology, development of new technology for processing acorns, temporal changes in projectile point types (particularly changes related to the introduction of the bow and arrow), modifications to bead drills, development of the bladelet industry, and introduction of the *tomol*. These issues have received far greater attention in the channel region than on Vandenberg SFB, largely because data from sites on the base needed to address these topics either are not available or are very limited.

Only projectile points have received much attention on Vandenberg SFB. Brian Glenn (1990, 1991) examined temporal variability in projectile points on the base using data from the STS and MX projects. Out of 777 projectile points, he was able to type 269 into 37 different categories, primarily on the basis of size and haft morphology. Unfortunately, sample sizes are very small for some types, and temporal assignments for many types are either tenuous or impossible. Overall, Glenn (1991:66–67) proposed a sequence of projectile points beginning about 3000 B.C. with large triangular concave-base points. Large side-notched types were either contemporaneous with, or immediately postdated, the concave-base types. Large contracting-stem points entered the record around 1400 B.C., but the terminal date for this type is unknown. Triangular leaf-shaped and bipointed types of the Cottonwood Series are associated with the Late Period, postdating A.D. 1150.

Questions

- How close were sources of tool stone to occupants at Project sites? Does the availability of tool stone appear to have affected lithic technology used by site occupants?

- Studies at some sites (e.g., Rudolph 1984) suggested that inhabitants of the region employed a core technology. Other studies indicated that a biface technology was used, while some studies suggested that both biface and core technologies were employed (e.g., Arnold 1990; Lebow et al.

1998; Lebow et al. 1999). Burin and microblade technologies are apparent at the Sudden Flats Site, occupied during the transition from the Pleistocene to the Holocene (Lebow, Harro et al. 2014; Lebow et al. 2015). What lithic technologies were used by the inhabitants at Project sites? Did that technology change through time?

- If technological organization does vary through time, how does the variation relate to settlement systems and changing land-use strategies?
- Does lithic data from Project sites support the technological organization identified by Lebow et al. (2002), where late Holocene occupants spatially segregated the manufacture and use of bifacial tools while early Holocene occupants did not?
- Glassow (1993) identifies various technological innovations in the channel region. Only Projectile points have received much attention on the base (Glenn 1990, 1991). Are there other evolving technologies evident in the assemblages from Project sites?

Trade and Exchange

Given the abundant naturally occurring chert on Vandenberg SFB, the large number of early-stage, unused bifaces in archaeological collections from the base, and the well-documented trade among the Chumash in the channel region, the topic of trade and exchange in the Vandenberg region has expectedly focused on the role of bifaces as an exchange commodity. Based on his survey results, Spanne (1974:7) speculated that “the Vandenberg area was the location of certain sites that specialized in the production of large chert preforms or blanks which may have been traded elsewhere.” He elaborated in a 1975 article, noting that chert is abundant in the Vandenberg area but rare in the channel region, and that residents of the channel area may have obtained chert through trade (Spanne 1975). Lathrap and Hoover (1975) and subsequently Arnold (1980:11) proposed that the ethnohistoric village of *Shilimaqshtush* served as a center for the manufacture of crude Monterey chert bifaces. Arnold (1990) continued this line of inquiry with analyses of bifaces from the STS collections, concluding that Monterey chert bifaces were traded to the Channel Islands and that “the regional importance of the preform industry at Vandenberg, although it was never a legitimate craft specialization, also is suggested by the appearance of Base-produced implements at remote Channel Island sites, where local cherts were available but not employed to make bifaces” (Arnold 1990:8-86).

Others question the existence of an industry to manufacture bifaces for exchange on Vandenberg SFB. Lebow et al. (1998) and Lebow et al. (1999), while not directly addressing the issue of bifaces in the context of trade and exchange, examined bifaces in the context of the technological organization of hunter-gatherers. They proposed that biface production on Vandenberg is diagnostic of a collector land-use strategy operating in an area of abundant tool stone sources. As discussed in Section 3.2.2.3, due to time stresses, collectors prepared their tool kits in advance for use during logistical forays into areas without readily available tool stone (cf. Bamforth 1991a). Thus, they maintained that biface manufacture on Vandenberg was primarily a technological adaptation rather than evidence of trade and exchange.

Subsequently, Lebow et al. (2002) and Lebow, McKim et al. (2007) directly tackled the question of biface manufacture on the Base for trade and found that the STS data provided little support for Arnold’s (1990) interpretations. Although acknowledging that some level of exchange between the Vandenberg region and the Channel Islands was likely, Lebow et al. (2002) and Lebow, McKim et al. (2007) found that Arnold’s interpretation of a biface manufacturing industry was biased by the analysis itself. Specifically, Arnold limited her lithic analysis to selected tool classes but excluded flake tools. Furthermore, use-wear analysis was limited to a very small proportion of the collection, which suggested that early-stage bifaces were unused and therefore were interpreted as produced for exchange. Applied EarthWorks’ analyses of much larger samples indicated that some early-stage bifaces are, in fact, used. Also through a more detailed lithic analysis, Lebow et al. (2002) and Lebow, McKim et al. (2007) found that sites Arnold interpreted as biface preform production centers contained flake tools that added to functional complexity. Overall, Applied EarthWorks' analyses suggested that "the biface tool kit was the foundation upon which most other tool types were derived" (Lebow et al. 2002:11-69). In other words, bifaces were produced for use, not for exchange.

Beads have received little attention among Vandenberg scholars in the issue of trade and exchange, probably because bead densities are substantially lower on the base than they are in the channel region. Glassow (1990) noted that three of the STS sites evince shell bead manufacturing dating as far back as 3000 B.P. Lebow, McKim, Harro et al. (2008) found evidence of bead manufacturing during all occupations at CA-SBA-207, dating as far back as the late Early Period. It is not clear, however, if bead manufacture decreased during the Late Period as production specialized among the Island Chumash (Arnold 1992b). Glassow did indicate that "the volume of . . . exchange appears to increase significantly during the Late Period, when many thousands of *Olivella* shell beads, including the callus money beads, entered the Vandenberg region" (Glassow 1996:141). He also noted, however, that populations on Vandenberg continued to make their own shell beads through the late Holocene, as evinced by *Olivella* shell detritus at CA-SBA-210 and CA-SBA-551 (Glassow 1990).

Obsidian has long been recognized as evidence of trade and exchange (e.g., Ericson 1981; Hughes 1986). However, obsidian is found only in very low densities on the base and thus has received little attention as a source of data on trade and exchange. Glassow (1990) noted that obsidian in the STS assemblages primarily derives from the Coso volcanic field on the northern edge of the Mojave Desert. Obsidian flakes are found in deposits of all ages, but they appear most frequently in Middle and Late Period deposits. Obsidian studies for the Coastal Branch Aqueduct (see Section 3.2.1.5) included geologic sourcing of 45 specimens from eight sites. Included in the study were 21 samples from CA-SBA-2696, located on the banks of San Antonio Creek on North Base (Colten et al. 1997). Twenty of the 21 specimens derived from Coso; a single piece was from the Casa Diablo source (Skinner and Davis 1996). Applied EarthWorks compiled obsidian hydration data when preparing Volume 5 of the Vandenberg AFB Integrated Cultural Resources Management Plan and found that of the 53 obsidian specimens for which geologic source had been identified, 31 (58.5 percent) were from Coso. However, that sample is strongly influenced by the sample from CA-SBA-2696—when it is excluded, Coso is still the most common source (11 of 32) but the proportion is much lower (34.4 percent). Obsidian from the Casa Diablo source is second in frequency on the Base (Lebow and Moratto 2005:Appendix A). Like Coso, the Casa Diablo source is east of the Sierra Nevada but is considerably farther north.

Stevens and Eerkens (2012) examined the spatiotemporal distribution of obsidian from selected sites on the Base and found that during the early Holocene, obsidian from northerly geologic sources (Casa Diablo and other eastern Sierra sources in the region, plus sites closer to the coast north of the San Francisco Bay area) was as nearly equally represented as obsidian from the Coso Volcanic Field. Conversely, during the late Holocene, obsidian was overwhelmingly (72 percent) from the Coso Volcanic Field, with only 28 percent from the more northerly sources.

Following Stevens and Eerkens (2012), Lebow, Harro et al. (2014) examined the spatiotemporal distribution pattern apparent in all sourced obsidian in Vandenberg collections. They found that the patterns of obsidian frequency and directions to obsidian sources indicate that trade and exchange was most active during the terminal Pleistocene/early Holocene and that trade networks were multidirectional. As the amount of obsidian entering the archaeological record decreased, the proportion of obsidian from the Coso Volcanic Field increased while the proportion from sources in the Napa Valley region decreased. In other words, as trade became more restricted it also became more discriminate and focused more on sources east of the Sierra Nevada. By the Late Period, trade for obsidian had nearly stopped and what little that did arrive was from the Coso Volcanic Field, the closest source to Vandenberg SFB.

North of the base in San Luis Obispo County, geologic sourcing of artifactual obsidian has received considerable attention as a means of elucidating trade patterns (e.g., Bouey and Basgall 1991; Jones et al. 1994; Jones and Waugh 1995). Obsidians from Coso, Casa Diablo, and Napa Valley sources are best represented in the Point Piedras Blancas assemblages. Casa Diablo obsidian is most common before about 1500 B.P., but Coso obsidian is most prevalent about 1000 B.P.

> As manifested along the central coast, the transition from Casa Diablo to Coso glass probably represents increased interaction with resident populations to the south. This area is the heartland of the Chumash interaction sphere, a socioeconomic system which expanded its influence toward the north at this time, as either a florescence of economic leverage and/or a population intrusion [Bouey and Basgall 1991:225].

Jones and Waugh (1995) disputed the temporal variations between Coso and Casa Diablo obsidian, suggesting that hydration rim studies used by Bouey and Basgall are unreliable. Instead, in their studies at Little Pico Creek, Jones and Waugh (1995:130) found that Casa Diablo obsidian was most common, suggesting a more northerly connection. A major increase of obsidian into the archaeological record was identified around 3500 B.C., with increasing amounts through the Middle Period. However, a major decrease in obsidian frequency after the Middle-Late Transitional Period suggests decreased interregional relationships.

Ophiolite is another type of rock found in Vandenberg archaeological assemblages (e.g., Harro et al. 2000:4-66). It apparently had economic value to prehistoric inhabitants of the region and may have been exchanged locally. As described by Harro et al. (2000:4-65), ophiolite is a layered body of the earth’s crust common to ocean floors that appears anomalously on continental margins through tectonic uplift (Thorpe and Brown 1985). An outcrop of ophiolite several thousands of feet thick is exposed along the coast between Lions Head and Point Sal (Dibblee 1989). Rock types in this deposit include basalt, dacite, gabbro, pyroxenite, and others (Hopson 1979; Hopson and Frano 1977). Unaltered ophiolitic rocks can be obtained from the exposure along the sea cliff or as water-rolled cobbles from the nearby beaches.

Although ophiolite rocks were occasionally used for grinding implements, they appear to have been particularly valued by prehistoric people for use as heating elements. As a result of its heating properties, ophiolite was apparently desired for cooking, and as a result was moved considerable distances. In a study of fire-altered rock at CA-SBA-935, located 4.4 miles (7.0 kilometers) from the ophiolite source, Harro et al. found that:

> Overall, ophiolite rocks form 34.1 percent of the fire-altered rock assemblage . . . . Considering the abundance of sandstone and shale around the site, coupled with the distance that ophiolite rocks would have been carried, ophiolitic rocks must have held a special value for fire-making [Harro et al. 2000:4-67].

Ophiolite is found in archaeological assemblages as far north as the Santa Maria River and as far south as the rim of Honda Canyon (Spanne, personal communication 2000), suggesting that the material was sufficiently valuable that it was traded or carried for substantial distances.

Questions

- Do early-stage bifaces at Project sites appear to reflect an industry related to exchange with groups from the channel region, as suggested by Arnold (1990) and inferred by Lathrap and Hoover (1975) for CA-SBA-205 just south of Vandenberg SFB? If so, what items were received in exchange? Or are bifaces present at the site more related to technological adaptations, as suggested by Lebow et al. (2002) and Lebow, McKim et al. (2007)?

- Do beads recovered from Project sites represent exchange with groups in the channel region, or is there evidence of bead manufacture in the Vandenberg region? Does evidence of bead manufacture on the base decrease or disappear after the Middle-Late Transitional Period when bead production was apparently restricted to the Channel Islands? Is there an influx of shell beads after this period that cannot be accounted for by local manufacture?

- Current studies suggest that the archaeological obsidian on Vandenberg SFB is derived mostly from the Coso source (Glassow 1990; Lebow, Harro et al. 2014; Skinner and Davis 1996; Stevens and Eerkens 2012). What obsidian sources are represented at Project sites? What do these sources say about trade and exchange? Do proportions of obsidian from various sources change through time?

Human Population Densities

More than any other scholar, Glassow has been responsible for studies of prehistoric human population densities on Vandenberg SFB. In his 1996 book, *Purisimeño Chumash Prehistory*, Glassow attempted to reconstruct human population densities by graphing the distribution of radiocarbon dates at 200-year intervals, using 187 radiocarbon dates from 134 site components (representing 54 sites) in the Vandenberg region. He suggested that the resulting distribution pattern may be significant.

> - A cluster of components dating between 7400 and 8000 B.P. There are too few dates earlier than 8000 B.P. to define a cluster.
>
> - A possible cluster dating between 6400 and 7200 B.P.
>
> - A possible depression in component frequencies between 3200 and 3600 B.P. The frequencies of dated components between 6400 and 3600 B.P. are too low to discern any clusters or peaks.
>
> - An apparent frequency peak between 2400 and 2800 B.P.
>
> - A prominent peak at the 2000–2200 B.P. interval, which is followed by a depression in component frequencies between 2000 and 1400 B.P.
>
> - An abrupt rise in component frequency after 1400 B.P., with the highest peak in the distribution during the 400–600 B.P. interval. However, there appears to be a depression between 600 and 1000 B.P.
>
> - A decline beginning at 400 B.P. Of course, the continuing decline in components dating after 200 B.P. is related to European contact and missionization [Glassow 1996:100].

Glassow (1996:100–102) compared the Vandenberg population curve with similar graphs developed for the Channel Islands and for the channel mainland, reasoning that similar patterns among the three areas inspire greater confidence in their accuracy because random patterns would not be duplicated by multiple datasets. All three distribution patterns do share gross similarities, although some disparities in the timing of the peaks and valleys are apparent. Both the Vandenberg and the channel mainland curves have peaks between 8000 and 7000 B.P.; the Channel Islands curve has a similar peak that is slightly earlier. All three patterns exhibit a depression between 3600 and 3200 B.P. A peak is evident just before 2000 B.P. on the Vandenberg and channel mainland curves, followed by a sharp decline. This peak and valley appears approximately 200 years earlier in the Channel Islands pattern. Component frequencies rise sharply after 1600–1400 B.P. and peak between 1200 and 1000 B.P. on the Vandenberg and mainland graphs; the Channel Islands curve is similar, but again is 200 years earlier. Both the Vandenberg and mainland patterns have a depression beginning 1000–800 B.P., and ending 200 years later. Once again, the Channel Islands have a similar depression, but 200 years earlier.

Based on the three distribution patterns, Glassow infers that human population densities remained relatively low on Vandenberg (compared to the channel region) until about 2800 B.P. A period between 3600 and 3200 B.P. had very low population densities, not only on Vandenberg but also throughout California. Populations grew substantially between 2800 and 2000 B.P. before decreasing and remaining low until about 1400 B.P. A period of growth is then evident, followed by a slight decline between 1000 and 600 B.P. Population densities then reached their highest peak between 600 and 400 B.P. This peak does not necessarily reflect population growth—it might reflect an expansion of the settlement system to include a greater number of sites (Glassow 1996:102–103).

Lebow (2000b:8-1–8-14) correlated an updated version of Glassow's population database with spatiotemporal distribution patterns apparent among radiocarbon-dated sites on Vandenberg SFB. He found that peak radiocarbon date frequencies between 800 and 400 B.P. correspond to increased numbers of short-term residential sites as well as with increased numbers of locations that were used for gathering or processing resources. However, frequencies of villages and long-term residential sites decreased during that same period. Furthermore, the average site size (including villages) decreased during that time. These patterns prompted Lebow to suggest that the peak frequencies of radiocarbon dates after 800 B.P. reflect a change in settlement systems rather than an increase in human population density. Specifically, he proposed that severe and extended drought associated with the Middle-Late Transitional Period prompted regional inhabitants to disperse into smaller, more mobile groups because drought-diminished resources were insufficient to support predrought populations.

Applied EarthWorks has periodically updated Glassow's radiocarbon database, with the most recent update following Applied EarthWorks' investigations at CA-SBA-639 (Lebow et al. 2016). It now includes 732 radiocarbon dates from 121 sites. Given the much larger sample size, many of the peaks and valleys observed by Glassow have been smoothed. The general shape of the curve as described by Lebow et al. (2016) is relatively flat, with low population densities, throughout the early Holocene and most of the middle Holocene. At around 4000 cal B.P., the curve begins a gentle upward trend reflecting slightly increased densities around the transition from the middle to the late Holocene. That gentle upward trend continues to around 1,400 cal B.P., when the curve climbs sharply to a peak at 600–400 cal B.P. It then drops dramatically, probably as a result of introduced diseases (Erlandson and Bartoy 1995, 1996; Erlandson et al. 2001; Preston 1996).

Questions

- How do occupations at Project sites correspond to the patterns apparent in the radiocarbon frequency distributions (Glassow 1990, 1996; Lebow, McKim, Haslouer et al. 2008)? In turn, how do the occupations relate to environmental conditions (see the discussion below)?

- As discussed above, Lebow (2000b) inferred that peak radiocarbon frequencies at 600–400 cal B.P. reflected a shift in land-use strategies rather than an actual increase in human population densities. Do the data from Project sites support this inference?

- Radiocarbon date frequencies in the most recent database (Lebow et al. 2016) indicate that human population densities began a general upward trend around 4,000 years ago. How do occupations at Project sites fit within this general pattern of increasing population densities?

Paleoenvironments

Paleoenvironmental data for Vandenberg SFB used by archaeologists derive from various sources in the region and on the Base. These various sources tend to be in general agreement at a macro scale but are not necessarily consistent at a smaller scale.

Regional Paleoenvironmental Studies

Heusser (1978) analyzed fossil pollen in a sediment core pulled from 625 meters beneath the water in the Santa Barbara Channel. Overall, plant associations throughout the Holocene were similar to those evident today, although major changes in the distributions of plant communities are inferred (Heusser 1978:676). Specifically, the palynological data indicated that upland coniferous plant communities were much more extensive before about 7800 B.P., and that fern, alder, sedge, and cattails (reflecting relatively wet environments) continued to decrease throughout the remainder of the Holocene. Cooler and moister conditions were apparent during the early Holocene, although the temperatures may have been only 1–2°C cooler with 150–250 millimeters more rainfall. Oak and Asteraceae (sunflower family) pollen became increasingly common after 7800 B.P., reaching a maximum around 5700–4300 B.P. These communities reflected warmer and drier climates and more open habitats. Since about 2300 B.P., chaparral and coastal sage communities increased as Asteraceae decreased, probably due to greater precipitation and/or lower temperatures.

In a widely cited study, Pisias (1978) used fossil radiolarian fauna from the same core used by Heusser to develop an 8,000-year temperature curve of the sea surface. Individual varves were counted in portions of the core to establish a temporal curve (Pisias 1978:369). Four radiolarian assemblages were defined by associations with current water temperatures; the distributions of these assemblages within the core were then examined. Prior to 5,400 years ago, sea-surface temperatures generally were warmer than those of today; these warmer water temperatures were correlated with more humid conditions and arboreal vegetation. Alpine glacier advances were marked by sharp decreases in sea-surface temperatures. After 5,400 years ago, the sea-surface temperature generally was cooler, which correlated with drier onshore conditions. Within this period, warmer water conditions were evident between 1000 and 800 B.P., 3600 and 3000 B.P., and at 5400 B.P. The data also suggested that the range of February temperatures over the span of the Holocene is comparable to the total seasonal range found during today’s climate.

Pisias (1978, 1979) suggested that cooler water temperatures increased the flow in the California Current, which in turn increased upwelling. Conversely, warmer sea temperatures decreased the upwelling. As a result, marine productivity would have declined, perhaps substantially, during warm-water episodes. This information has been used by some scholars to propose models of cultural adaptation based on marine degradation resulting from warmer sea temperatures (e.g., Arnold 1987, 1992a; Colten 1992, 1993, 1994), although others (e.g., Raab et al. 1995; Raab and Larson 1997) questioned the evidence of marine degradation.

Kennett (1998:121–124) summarized investigations of a 200-meter marine sediment sample pulled from the Santa Barbara Channel during the Ocean Drilling Project. Carbon and oxygen isotopic analysis of planktonic foraminiferal species were used to examine climatic changes; sedimentation rates and 13 accelerator mass spectrometry (AMS) dates provided relatively good chronological control when compared with previous core studies. This temporal control allowed examination of climatic change at 25-year intervals during the late Holocene. The results painted a different picture of water temperature change compared to the Pisias (1978, 1979) results, particularly for the late Holocene. Kennett’s work indicated that sea temperatures never varied more than 6°C, rather than the 11°C suggested by Pisias. Early Holocene temperatures tended to be more stable than late Holocene temperatures, particularly during the last 1,500 years. Generally, sea-surface temperatures were warmer during the early Holocene, although several warm-cold fluctuations were evident. Three major climatic shifts were suggested during the last 3,000 years. Between 3,000 and 1,500 years ago, the sea-surface temperature was warm and relatively stable, not varying more than 4 degrees between 11 and 15°C. Between 1500 and 600 B.P., the water became much colder and unstable, ranging between 9 and 13.5°C, before warming up again after circa 600 B.P. (Kennett 1998:297–300).

Based on these results, Kennett suggested that:

> the greatest intensity and inferred marine productivity occurred between 1000 and 400 B.P. Oxygen isotopic measurements on California mussel shells from radiocarbon dated contexts also provide supporting evidence for cold, highly productive seas between 1400 and 500 years ago, but also show cold water conditions centered around 250 years B.P. . . . it appears that the most favorable interval for marine resources occurred between 1500 and 600 B.P. Warmer marine conditions, less favorable for high productivity, occurred between 3000 and 1500 B.P. and again after 600 B.P., with the possible exception of a short interval centered around 250 B.P. (Little Ice Age) [Kennett 1998:301].

Larson and Michaelsen (1989) used tree-ring data from the Transverse Ranges in central Santa Barbara County to assess climatic conditions during the last 1,600 years. These data suggested several periods of drought. Between A.D. 500 and 650 the climate was moderately dry, followed by very dry conditions between A.D. 650 and 800. Extreme drought was evident between A.D. 750 and 770. A period of 150 years, between A.D. 1100 and 1250, had low rainfall; the period between A.D. 1120 and 1150 was particularly harsh. Stine (1994) also found evidence of severe drought conditions between A.D. 892–1112 and A.D. 1209–1350 based on tree-ring data in the Sierra Nevada.

Vandenberg SFB Paleoenvironmental Studies

Paleoenvironmental data also derive from studies on and near Vandenberg SFB. Most recent of these were completed by Scott Anderson of Northern Arizona University, who drilled two cores in the San Antonio Creek area (Anderson 2009; Anderson et al. 2012; Anderson et al. 2015) including one for the San Antonio Creek Stream Restoration Project (Lebow, McKim et al. 2014). Combined, the two cores provided a pollen record for most of the Holocene. Early Holocene vegetation was primarily coastal sage scrub and chaparral with woodland elements to about 9,000 years ago. Evidence of woodland communities diminished due to drying to about 5,600 years ago. After that time, coastal sage scrub and grasslands expanded during the late Holocene. Most dramatic were changes in vegetation during the Historic Period due to introduced species and grazing by sheep and cattle (Anderson et al. 2015).

Palynology was also completed for the Union Oil Pipeline Project (Woodman et al. 1991). Pollen columns were extracted from a spring in Santa Lucia Canyon and from near the mouth of Oak Canyon. The Santa Lucia column encompassed the past 11,000 years, while the Oak Canyon sample reflected only the past 4,500–5,000 years. Some radiocarbon dates from the Santa Lucia stratigraphic sequence were not in chronological order, leaving the results open to question. Pollen from the Santa Lucia column indicated that the environment prior to 4000 B.P. was warmer, drier, and more open than is currently evident. The spring from which the core was pulled did not exist prior to 4000 B.P., although conditions may have been marshy. After 4000–3000 B.P., conditions cooled and/or moisture increased. The water table rose as a result of the increased moisture, forming the spring. Like the Santa Lucia column, the Oak Canyon core contained pollen suggesting that conditions prior to 4000 B.P. were warm, dry, and open. An increase in the chaparral community probably reflects cooler, moister conditions beginning around 4000–3600 B.P. and continuing until about 2000 B.P. Warmer, drier conditions prevailed between about 1700 and 600 B.P., reflected by a shrinking chaparral community and an expanding coastal sage scrub community. This period was followed by a sharp increase in pollen from oak trees and plants of the chaparral community, suggesting cooler, more mesic conditions (Morgan, Cummings, and Rudolph 1991:77–87).

In summarizing the results of the pollen study, Morgan, Cummings, and Rudolph (1991:88) noted that "the Holocene climatic record for the coastal portion of northern Santa Barbara County revealed from analysis of the Oak Canyon and Santa Lucia Canyon cores is marked by major sedimentological and geomorphological changes, and, to a smaller degree, by changes in vegetation." Vegetation communities evident today have existed throughout the Holocene, but the distributions of the various communities have changed in response to climatic conditions.

Archaeological data in the form of lagomorph and artiodactyl indices from CA-SBA-1010 (Lebow, McKim et al. 2005) and CA-SBA-3932 (Lebow, McKim et al. 2014) along San Antonio Creek indicate that a period of severe drought occurred between about 3,400 and 2,700 years ago. Proportions of jackrabbits in the archaeological assemblages are higher than before and after, suggesting that the normal coastal sage scrub was at least partly desiccated. Surprisingly, though, proportions of deer and elk in archaeological assemblages dramatically increased. Under drought conditions, deer and elk populations should suffer and proportions of artiodactyl remains should decrease. It is apparent, then, that riparian habitat along San Antonio Creek and/or Barka Slough provided the browse, cover, and water that deer and elk needed to survive. Essentially, during the drought the riparian habitat served as a magnet that attracted deer and elk—and that, in turn, attracted human hunters. Indeed, CA-SBA-1010 adjacent to Barka Slough was a place where people killed and butchered deer and elk during this drought.

Glassow (1996:103–106) examined dune formation and soil development for evidence of paleoenvironmental change. As part of the STS (Glassow 1990:Appendix 2) and MX projects, Johnson (1984) developed a dune chronology for Vandenberg SFB. Two episodes of dune formation occurred during the Holocene: Old Dunes, dating between 13,000 and 5000 B.P., and Intermediate Dunes, which formed sometime after 5000 B.P. At CA-SBA-670, Intermediate Dunes formed between 3200 and 500 B.P. Distinct differences in color, topography, and soil development suggest that the Old and Intermediate dunes developed during distinctly different intervals. Intermediate Dunes apparently formed rapidly as they lack internal horizonization. Glassow (1996:105) concluded that “an environmental event of significant magnitude” would have been associated with dune formation. Based on Johnson’s dune chronology and archaeological sites investigated for the STS, Glassow proposed a period of environmental instability around 9,000 years ago that resulted in a surface without soil development at CA-SBA-931. Old Dunes formed between 8200 and 5000 B.P., representing a paleoenvironmental change that allowed sand to accumulate and soil to develop. Intermediate Dunes formed between 3200 and 500 B.P., which Glassow inferred was related to an arid period that reduced vegetation and allowed sand to accumulate. These dunes then stabilized, allowing soils to develop (Glassow 1996:106).

Glassow summarizes his interpretation of paleoenvironmental conditions on Vandenberg:

> Prior to 7000 B.P. climate likely was cooler than present. Because pines and ferns were still prevalent in the Santa Barbara Channel region, as they were during the Pleistocene epoch, annual precipitation levels may have been relatively high. However, vegetation communities in the Vandenberg region probably contained the same species as they do today; only the geographic distribution of the communities was different. It also is possible that climatic conditions and vegetation communities were relatively unstable during portions of the period between about 12,000 B.P. and 7000 B.P., which may be the reason why the Vandenberg pollen record appears to indicate a more arid climate and associated vegetation, and why soil development at CA-SBA-931 was minimal around 9000 B.P.
>
> Between 7000 B.P. and 4700 B.P. climate was significantly warmer than present. This is the period of the Altithermal in western North America, and a variety of evidence indicates that low precipitation levels accompanied the warmer weather. Vegetation communities were becoming more open.
>
> Between 4700 B.P. and about 2000 B.P. climate was generally cooler than before, but not always as cool as the present climate. Although the Santa Barbara Channel pollen record indicates that relatively warm and dry vegetation prevailed, the Vandenberg pollen record indicates that vegetation had shifted to types expectable during relatively cool and wet conditions but, again, not as cool and wet as today’s climate.
>
> The sharp increase in water temperatures between around 3600 B.P. and 3100 B.P. has no obvious signature in either the Santa Barbara Channel or the Vandenberg pollen record, perhaps because these records cannot resolve climatic events of so short a duration. It is possible that this was a

> warm climatic interval only 200 or 300 years long. I suspect that precipitation levels were relatively low during at least part of this period, largely because this was likely the interval when the Intermediate Dunes along the south Vandenberg coast (and likely elsewhere in the region) were most active.
>
> Between about 2000 B.P. and 800 B.P. climate again became relatively warm, although generally not to the extremes of earlier periods such as the one just mentioned. Vegetation in the Vandenberg region became relatively open, which may reflect generally lower precipitation levels.
>
> After 800 B.P. climate became generally cooler again, and distributions of vegetation communities approached today's, with chaparral becoming more prevalent. However, an 80-year period of very arid climatic conditions falls at the beginning of this period [Glassow 1996:111–112].

Questions

- How do occupations at Project sites correlate with the paleoenvironmental conditions posited by Glassow (1996:111–112)?
- Do archaeobotanical or faunal remains from Project sites provide evidence of paleoenvironmental conditions? If so, does that evidence support or contradict other paleoenvironmental data?
- Arnold (1992a) inferred significant marine degradation associated with warm sea water temperatures during the Middle-Late Transitional Period, an inference disputed by others (e.g., Raab et al. 1995). Is there evidence of marine degradation in the shellfish, fish, or marine mammal assemblages from Project sites around the end of the Middle Period? Raab and Larson (1997:326) suggested that "the stress indicators identified by Arnold and Colten are more convincingly correlated with moisture trends than marine subsistence problems." Is there evidence of severe and extended drought conditions in Project site assemblages? If so, are those conditions associated with changes in subsistence and settlement systems?
- Cultural change is often linked with population growth and/or environmental change (e.g., Arnold 1992a; Glassow 1990, 1996). Can specific adaptive measures be linked to environmental change apparent at Project sites? If so, how do these changes fit with the paleoenvironmental and population model proposed by Glassow (1996:112–113) for the Base?

DATA REQUIREMENTS

Addressing the research issues and questions discussed above requires various datasets, including but not limited to chronology, lithic debris, faunal remains, and archaeobotanical remains. Site or component function, critical to understanding settlement systems and land-use strategies, can usually be elucidated through analysis of tool use, lithic technology, faunal and archaeobotanical remains, and cultural features.

Chronological Data

Understanding chronology is a prerequisite to analyses of cultural evolution. Radiocarbon dating, using charcoal or shell from clearly cultural contexts such as features or occupation surfaces, is the preferred method for determining the absolute age of an archaeological site or component. Dating single charcoal or shell specimens provides much more reliable ages than composite samples. Cross-dating of temporally diagnostic artifacts, such as beads, projectile points, or historical items, also can provide chronological data, although the resolution is typically lower than for radiocarbon dating. If obsidian is present in the lithic assemblage, obsidian hydration measurements can provide relative dates. Absolute dates can be obtained using an established hydration rate that adequately accounts for geologic source and site-specific environmental factors, such as effective hydration temperature. Measuring hydration rims is an inexact science in which numerous variables affect individual rim widths, so reliable use of hydration measurements as a dating technique requires a substantial sample of obsidian from each component or site to allow patterns of rim measurements to be apparent.

Lithic Data

Lithic artifacts are often the most abundant type of cultural residue left by the site occupants. The types of artifacts and their relative frequencies provide information about specific activities conducted at the site. Similarly, microscopic edge-wear analysis of flaked stone tools indicates tool function and the types of activities that occurred at the site. Diversity in the lithic tool assemblage reflects the intensity and duration of site occupation. When considered together, the types of artifacts, their function, and diversity in the lithic assemblage contributes to an understanding of overall site function. Analysis of lithic artifacts provides valuable data on lithic technology and how that technology changed through time in response to changing land-use strategies. Tool stone procurement strategies can be elucidated by examining proportions of local and exotic raw materials. Lithic data can illuminate the role of bifaces in trade and exchange with neighboring regions.

Faunal Data

Faunal data may directly reflect subsistence practices and provide important clues to diet, seasonality, and the biotic environment. In turn, this information can be used to elucidate site or component function and the role of a site in the settlement system. Numbers of identified species in a particular assemblage provide a qualitative measure of resource selection which, when compared with other sites and components, can indicate spatiotemporal changes in resource selection. For example, on South Base, Glassow (1996:135) found that intensified mussel collecting during the Late Period prompted increased use of other smaller shellfish species as well. Similarly, analysis of *Mytilus zonarius* (California mussel) remains from CA-SBA-2696 on San Antonio Creek revealed smaller shells during the most recent occupation, suggesting that long-term human predation affected the size, abundance, and ecology of the mussel population (Colten et al. 1997:7-23–7-25). Faunal remains can reflect paleoenvironmental conditions. Additionally, noneconomic faunal species such as land snails, ostracods, insects, rodents, and reptiles can provide important information on site environment and depositional processes at work in site formation (e.g., Price 1996).

Archaeobotanical Data

Cultural botanical remains provide direct evidence of subsistence and seasonality, and can contribute to understanding site function(s). Similarly, paleobotanical remains can provide important environmental data. For example, archaeobotanical analysis at CA-SBA-2696 revealed primarily riparian vegetation during early occupations, with oak and other more xeric plants more prevalent during the final occupation, reflecting a change from a wetland environment to drier conditions (Price 1996). Similarly, archaeobotanical remains from a component dating to the Middle-Late Transitional Period at CA-SBA-677 on south Vandenberg SFB included charcoal from greasewood and creosote, both arid-environment plants (Lebow et al. 1998:7-5). Their presence in a coastal site might reflect the severe 80-year drought between A.D. 795 and 875 corresponding to the Middle-Late Transitional Period. Flotation of soil samples from cultural features and macrobotanical identification of floral specimens are necessary to acquire this information.

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1993 *Prestabilization Assessment of Archaeological Sites on Vandenberg Air Force Base, Santa Barbara County, California.* Center for Archaeological Research, University of Mississippi. Submitted to U.S. Department of the Interior, National Park Service, Western Regional Office, San Francisco.

Thorpe, Richard, and Geoff Brown
1985 *The Field Description of Igneous Rocks*. Open University Press, New York.

Torrence, Robin
1989 Tools as Optimal Solutions. In *Time, Energy and Stone Tools*, edited by Robin Torrence, pp. 1–6. Cambridge University Press, New York.

Weber, Carmen
1994 *Testing and Stabilization of the Olivera Adobe Ruin (CA-SBA-785/H)*. Chambers Group, Inc. Submitted to U.S. Department of the Interior, National Park Service, Western Region Interagency Archeological Services Branch, San Francisco, Contract No. 1443 CX 8000-92-010.

Woodman, Craig F., Chantal Cagle, Philip de Barros, and Teresa Rudolph
1995 *Final Report, Archaeological Survey and Evaluation of the Honda Beach Site, SBA-530*. Science Applications International Corporation and Chambers Group, Inc., Santa Barbara. Submitted to the National Park Service, Western Region, Interagency Archeological Services Branch, Contract 1443 CX 8000-92-010.

Woodman, Craig F., James L. Rudolph, and Teresa P. Rudolph (editors)
1991 *Western Chumash Prehistory: Resource Use and Settlement in the Santa Ynez River Valley*. Science Applications International Corporation, Santa Barbara, California. Prepared for the Unocal Corporation. Submitted to the U.S. Army Corps of Engineers, Los Angeles District.

APPENDIX B

Cultural Resource Records

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
PRIMARY RECORD

Primary # 42-000538
HRI #
Trinomial CA-SBA-538
NRHP Status Code

Other Listings
Review Code Reviewer Date

 Resource Name or #

P1. Other Identifier:

***P2. Location: a. County:** Santa Barbara ☒ **Not for Publication** ☐ **Unrestricted**
b. USGS 7.5′ Quad: Tranquillon Mtn. **Date:** 1959, PR 1978 T , R ; Unsectioned SB **B.M.**
c. Address: Vandenberg Space Force Base, CA
d. UTM: NAD 83, Zone 10N; 717847 **mE /** 3832081 **mN**
e. Other Locational Data: The site is on south Vandenberg Space Force Base (SFB) approximately 1,200 meters east of the Pacific Coast and 1,600 meters northeast of Point Pedernales. It is adjacent to former Space Launch Complex 5 (SLC-5).

***P3a. Description:** CA-SBA-538 was a sparse lithic scatter originally recorded as a sand blowout with artifacts on the surface, including a core scraper, cobble scraper, and a blade fragment (Lathrop 1950). Glassow et al. (1976) and other subsequent studies describe the site as having been destroyed by construction of SLC-5.

***P3b. Resource Attributes:** AP2. Lithic Scatter

***P4. Resources Present:** ☐ Building ☐ Structure ☐ Object ☒ Site ☐ District ☐ Element of District ☐ Other:

***P5a. Photograph or Drawing:**

P5b. Description of Photo: Overview of CA-SBA-538, facing southeast.

***P6. Date Constructed/Age and Sources:** ☒ Prehistoric ☐ Historic ☒ Both

***P7. Owner and Address:**
U.S. Space Force
1028 Iceland Ave., Bldg. 11146
Vandenberg SFB, CA 93437

***P8. Recorded By:** Alexandria Bulato
Applied EarthWorks, Inc.
515 E. Ocean Ave., Suite G
Lompoc, CA 93436

***P9. Date Recorded:** 2/3/2022

***P10. Survey Type:** ☒ Intensive ☐ Reconnaissance ☐ Other
Describe:

***P11. Report Citation:** VSFB Project ID: 813-21-052CR
Morrison, Alex E.
2022 *Archaeological Investigations Supporting Section 106 Compliance for the Space Launch Complex 5 Phantom Space Project, Vandenberg Space Force Base, Santa Barbara County, California*, with contributions by Chantal Cagle, Joyce L. Gerber, Clayton G. Lebow, and Eric S. Nocerino. Applied EarthWorks, Inc., Lompoc, California. Prepared for Phantom Space Corporation, Tucson, Arizona.

***Attachments:** ☐ NONE ☒ Location Map ☒ Sketch Map ☐ Continuation Sheet ☐ Building, Structure, and Object Record ☒ Archaeological Record ☐ District Record ☐ Linear Feature Record ☐ Milling Station Record ☐ Rock Art Record ☐ Artifact Record ☐ Photograph Record ☐ Other (list):

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
ARCHAEOLOGICAL SITE RECORD

Primary # 42-000538
HRI #/Trinomial CA-SBA-538

 Resource Name or #

***A1. Dimensions: a. Length** 68 meters (N–S) **x b. Width** 76 meters (E–W)

Method of Measurement: ☐ Paced ☐ Taped ☐ Visual estimate ☒ Other: GIS mapping

Method of Determination (check any that apply): ☒ Artifacts ☐ Features ☐ Soil ☐ Vegetation ☐ Topography ☐ Cut bank ☐ Animal burrow ☐ Excavation ☐ Property boundary ☐ Other (explain):

Reliability of Determination: ☐ High ☐ Medium ☒ Low Explain: Artifacts not relocated by subsequent surveys.

Limitations (check any that apply): ☐ Restricted access ☐ Paved/built over ☐ Site limits incompletely defined ☒ Disturbances ☐ Vegetation ☐ Other (explain):

A2. Depth: ☐ None ☒ Unknown Method of determination: Survey.

***A3. Human Remains:** ☐ Present ☒ Absent ☐ Possible ☐ Unknown (explain):

***A4. Features:** No features have been observed.

***A5. Cultural Constituents (not associated with features):** Three lithic artifacts were noted when the site was originally recorded: a core scraper, a cobble scraper, and a blade fragment (Lathrop 1950). These artifacts were not relocated during subsequent surveys.

***A6. Were Specimens Collected?** ☒ No ☐ Yes (If yes, attached Artifact Record or catalog.)

***A7. Site Condition:** ☐ Good ☐ Fair ☒ Poor ☒ Disturbances: Previous studies indicate that the site was destroyed during construction of SLC-5.

***A8. Nearest Water (type, distance, and direction):** Honda Creek, 200 meters south.

***A9. Elevation:** 320 feet

A10. Environmental Setting (vegetation, fauna, soils, geology, landform, slope, aspect, exposure, etc.): The site is on south Vandenberg SFB near the mouth of Honda Canyon, at the site of the former SLC-5, which was demolished between 2009 and 2012. Vegetation consists of coastal sage scrub. See Morrison et al. (2022:Chapter 2) for a complete list of the vegetative community on Vandenberg SFB.

A11. Historical Information (full citations in A15 below):

***A12. Age:** ☒ Prehistoric ☐ Protohistoric ☐ 1542–1769 ☐ 1769–1848 ☐ 1848–1880 ☐ 1880–1914 ☐ 1914–1945 ☐ Post 1945 ☐ Undetermined Describe position in regional prehistoric chronology or factual historic dates if known:

A13. Interpretations: Past studies indicate that the site was destroyed and therefore retains no data potential, and the site has been determined to be ineligible for the National Register of Historic Places. Survey for the current project did not identify any surface artifacts at the recorded site location, and no excavation was conducted.

A14. Remarks: None.

A15. References:

Glassow, Michael A., Laurence W. Spanne, and Jeffrey Quilter
1976 *Evaluation of Archaeological Sites on Vandenberg Air Force Base, Santa Barbara County, California*. Department of Anthropology, University of California, Santa Barbara. Submitted to U.S. Department of the Interior, National Park Service, Office of Archaeology, San Francisco, Contract No. CX800040020.

Lathrop
1950 CA-SBA-2230 Archaeological Site Record. On file, 30th Civil Engineer Squadron, Cultural Resources Section, Vandenberg Air Force Base, California.

A16. Photographs:
Original media/negatives kept at: Applied EarthWorks, Inc.

***A17. Form Prepared By:** Alexandria Bulato **Date:** 2/3/2022
Affiliation and Address: Applied EarthWorks, Inc., 515 E. Ocean Ave., Suite G, Lompoc, CA 93436

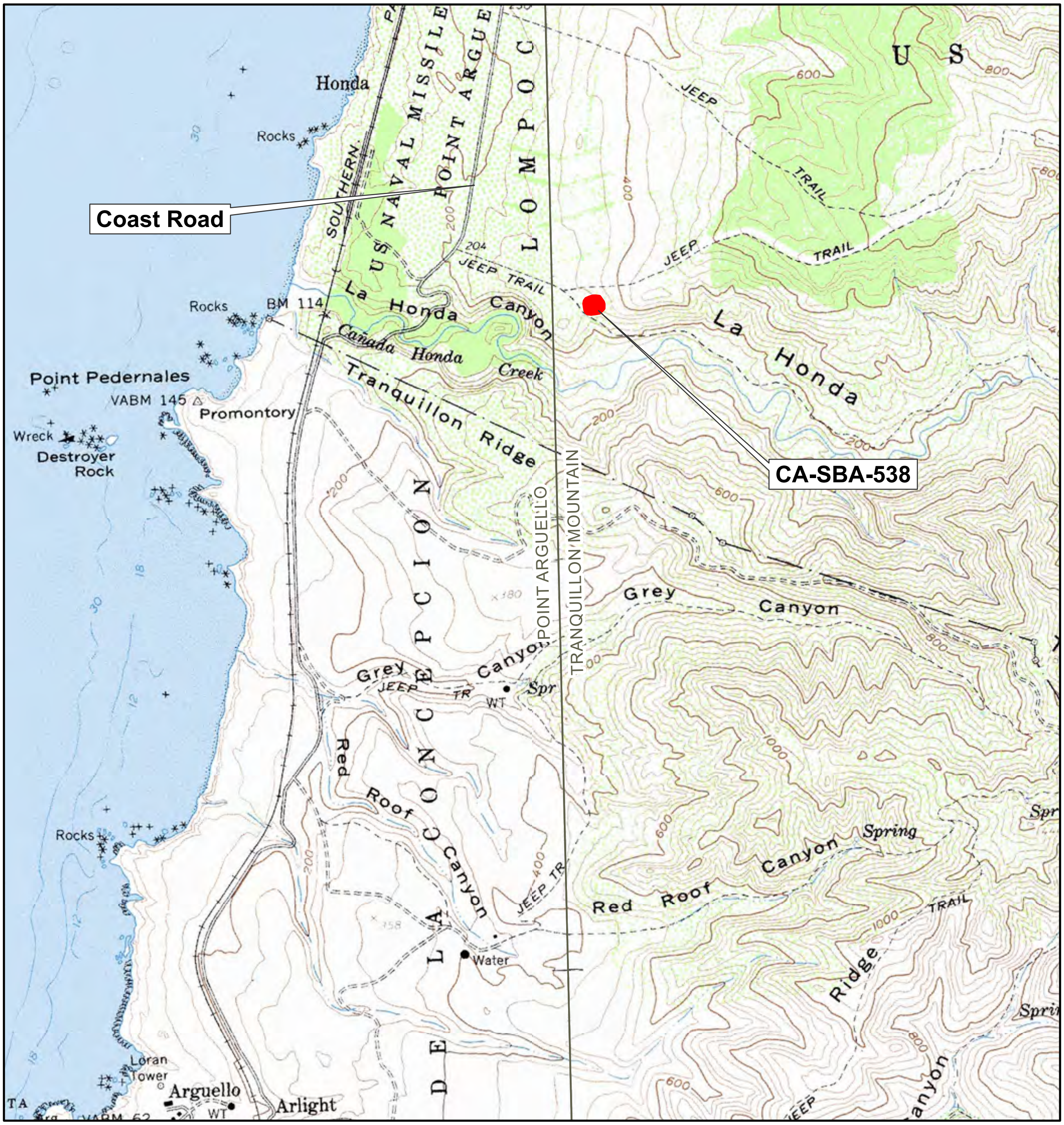
UPDATE

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
LOCATION MAP

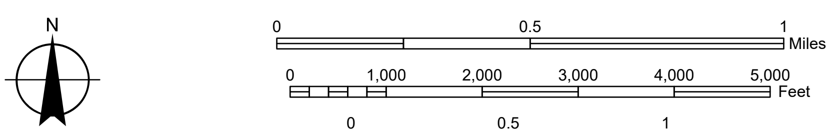
Primary # 42-000538
HRI#
Trinomial CA-SBA-538

Page 3 **of** 4 **Resource Name or #:** **Scale:** 1:24,000

Map Name: Point Arguello (1959), Tranquillon Mountain (1959-PR1978) CA, USGS 7.5' quadrangles **Date:** 02/2022



Scale: 1:24,000



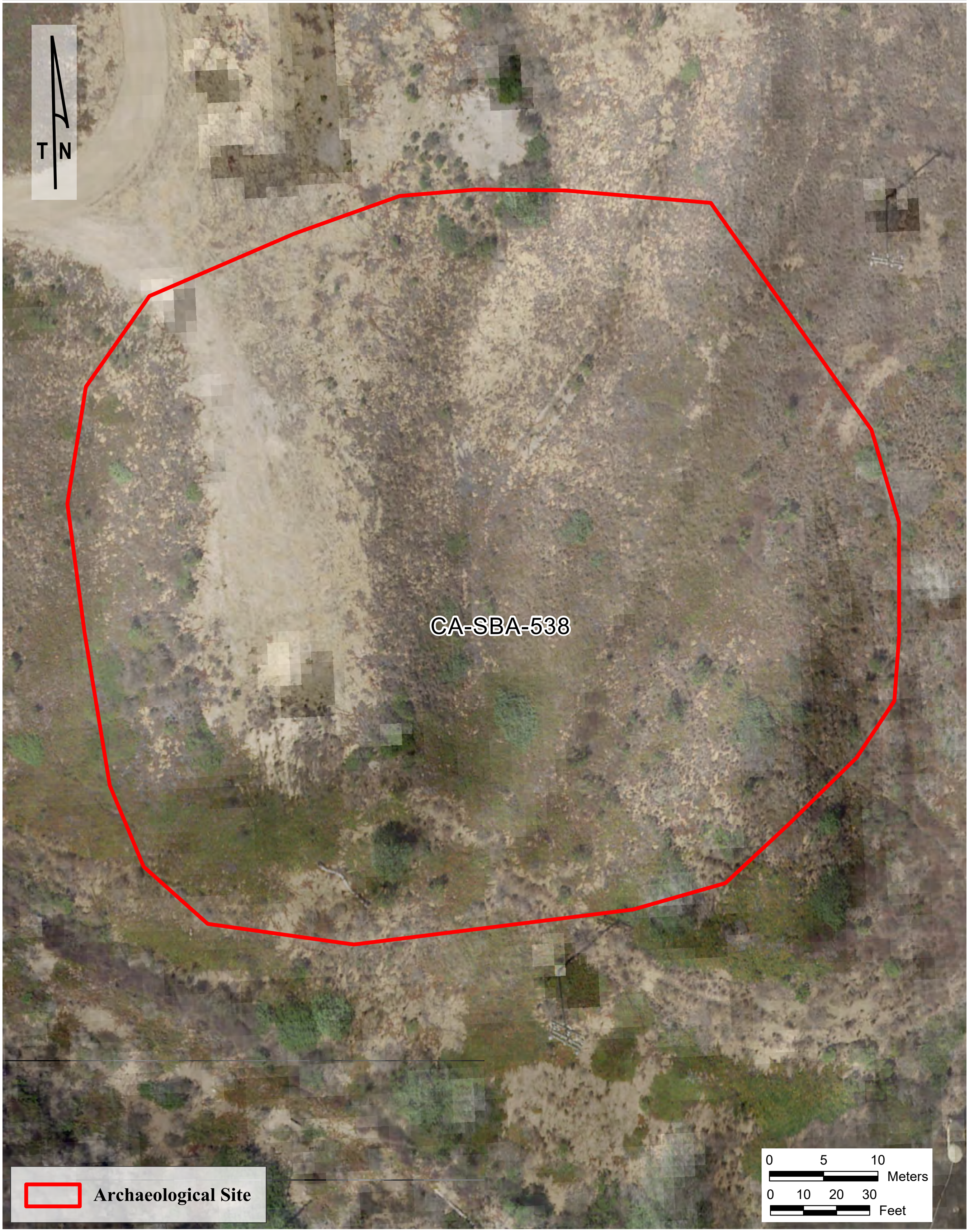
UPDATE

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
SKETCH MAP

Primary # 42-000538
HRI#
Trinomial CA-SBA-538

Page 4 **of** 4 **Resource Name or #:**

Drawn by: T. Crimmel **Scale:** 1 inch equals 42 feet **Date of map:** February 2022



DPR 523K (1/95)

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
PRIMARY RECORD

Primary # 42-002934
HRI #
Trinomial CA-SBA-2934
NRHP Status Code

Other Listings
Review Code | Reviewer | Date

 Resource Name or #

P1. Other Identifier:

***P2. Location: a. County:** Santa Barbara ☒ **Not for Publication** ☐ **Unrestricted**
b. USGS 7.5′ Quad: Tranquillon Mtn. **Date:** 1959 PR 1978 T , R ; Unsectioned SB **B.M.**
c. Address: Vandenberg Space Force Base, CA
d. UTM: NAD 83, Zone 10N; 717717 **mE /** 3832020 **mN**
e. Other Locational Data: The site is approximately 20 meters southwest of the terminus of Dart Road on a terrace on the north side of lower Honda Canyon. This site is near former Space Launch Complex 5 (SLC-5).

***P3a. Description:** A sparse lithic scatter consisting of five flakes and a tabular fragment (Calicher 1994).

***P3b. Resource Attributes:** AP2 Lithic Scatter

***P4. Resources Present:** ☐ Building ☐ Structure ☐ Object ☒ Site ☐ District ☐ Element of District ☐ Other:

***P5a. Photograph or Drawing:**

P5b. Description of Photo: Overview of CA-SBA-2934, facing north.

***P6. Date Constructed/Age and Sources:** ☒ Prehistoric ☐ Historic ☐ Both

***P7. Owner and Address:**
U.S. Space Force
30 CES/CEIEA
1028 Iceland Ave., Bldg. 11146
Vandenberg SFB, CA 93437

***P8. Recorded By:** Alexandria Bulato
Applied EarthWorks, Inc.
515 E. Ocean Ave., Suite G
Lompoc, CA 93436

***P9. Date Recorded:** 2/3/2022

***P10. Survey Type:** ☐ Intensive ☐ Reconnaissance ☒ Other
Describe: Subsurface testing

***P11. Report Citation:** VSFB Project ID: 813-21-052CR
Morrison, Alex E.
2022 *Archaeological Investigations Supporting Section 106 Compliance for the Space Launch Complex 5 Phantom Space Project, Vandenberg Space Force Base, Santa Barbara County, California*, with contributions by Chantal Cagle, Joyce L. Gerber, Clayton G. Lebow, and Eric S. Nocerino. Applied EarthWorks, Inc., Lompoc, California. Prepared for Phantom Space Corporation, Tucson, Arizona.

***Attachments:** ☐ NONE ☒ Location Map ☒ Sketch Map ☐ Continuation Sheet ☐ Building, Structure, and Object Record ☒ Archaeological Record ☐ District Record ☐ Linear Feature Record ☐ Milling Station Record ☐ Rock Art Record ☐ Artifact Record ☐ Photograph Record ☐ Other (list):

***A1. Dimensions: a. Length** 22 meters (E–W) **x b. Width** 10 meters (N–S)

Method of Measurement: ☐ Paced ☐ Taped ☐ Visual estimate ☒ Other: GIS mapping

Method of Determination (check any that apply): ☒ Artifacts ☐ Features ☐ Soil ☐ Vegetation ☐ Topography ☐ Cut bank ☐ Animal burrow ☒ Excavation ☐ Property boundary ☐ Other (explain):

Reliability of Determination: ☒ High ☐ Medium ☐ Low Explain: Subsurface excavations.

Limitations (check any that apply): ☐ Restricted access ☐ Paved/built over ☐ Site limits incompletely defined ☐ Disturbances ☐ Vegetation ☐ Other (explain):

A2. Depth: ☐ None ☒ Unknown Method of determination: Survey and subsurface testing.

***A3. Human Remains:** ☐ Present ☒ Absent ☐ Possible ☐ Unknown (explain):

***A4. Features:** No features have been observed.

***A5. Cultural Constituents (not associated with features):** Five lithic flakes and a tabular fragment were noted when the site was originally recorded (Calicher 1994). These artifacts were not relocated during the surface survey for the current project, and no additional artifacts were found during subsurface survey (Morrison 2022).

***A6. Were Specimens Collected?** ☒ No ☐ Yes (If yes, attached Artifact Record or catalog.)

***A7. Site Condition:** ☐ Good ☐ Fair ☒ Poor ☒ Disturbances: Imported gravels were observed in the upper levels of soil in some areas of the site. The site appears to have been destroyed during construction of the SLC-5 complex.

***A8. Nearest Water (type, distance, and direction):** Honda Creek, 185 meters south.

***A9. Elevation:** 324 feet

A10. Environmental Setting (vegetation, fauna, soils, geology, landform, slope, aspect, exposure, etc.): The site is on south Vandenberg Space Force Base near the mouth of Honda Canyon, at the site of the former SLC-5, which was demolished between 2009 and 2012. Vegetation in the vicinity consists of coastal sage scrub. See Morrison (2022:Chapter 2) for a complete list of the vegetative community on Vandenberg SFB.

A11. Historical Information (full citations in A15 below):

***A12. Age:** ☒ Prehistoric ☐ Protohistoric ☐ 1542–1769 ☐ 1769–1848 ☐ 1848–1880 ☐ 1880–1914 ☐ 1914–1945 ☐ Post 1945 ☒ Undetermined Describe position in regional prehistoric chronology or factual historic dates if known:

A13. Interpretations: Past studies have documented a low density and diversity of artifacts at the site and did not recover any chronological data. Investigations indicate that the site was destroyed during construction of SLC-5 and cultural deposits are no longer present; therefore, the site retains no data potential (Morrison 2022).

A14. Remarks: Applied EarthWorks Inc. excavated five shovel test pits within the recorded site boundaries, and no cultural material was found (Morrison 2022).

A15. References:

Calicher, H.
1994 CA-SBA-2934 Archaeological Site Record. On file, 30th Civil Engineer Squadron, Cultural Resources Section, Vandenberg Space Force Base, California.

A16. Photographs:
Original media/negatives kept at: Applied EarthWorks, Inc.

***A17. Form Prepared By:** Alexandria Bulato **Date:** 2/3/2022
Affiliation and Address: Applied EarthWorks, Inc., 515 E. Ocean Ave., Suite G, Lompoc, CA 93436

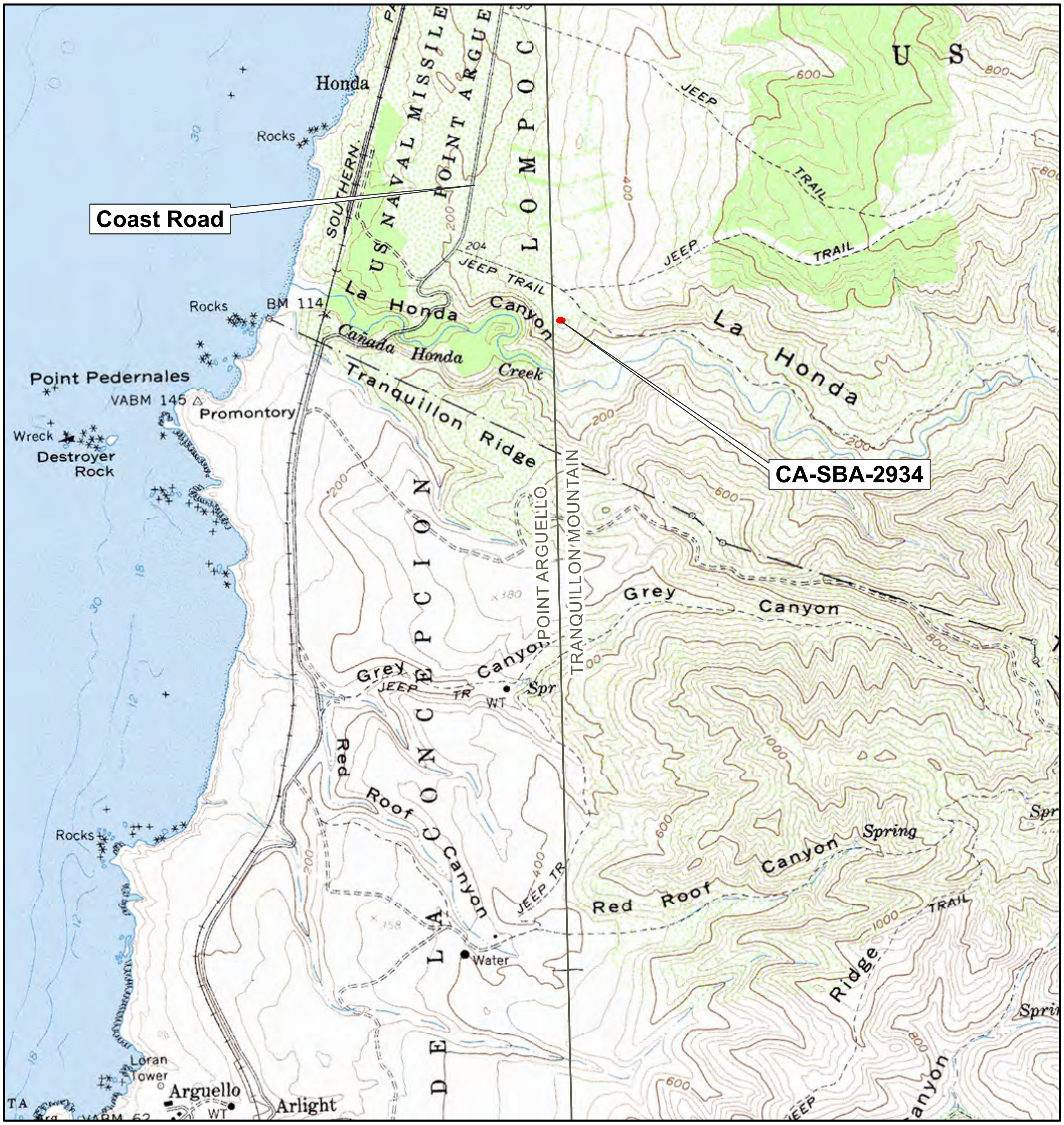
UPDATE

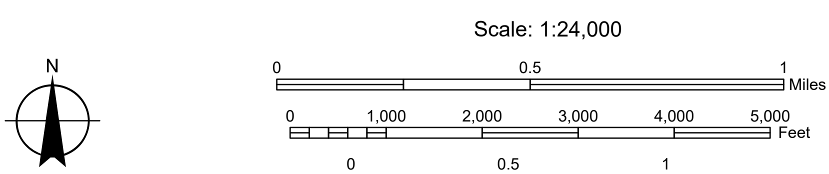
State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
LOCATION MAP

Primary # 42-002934
HRI#
Trinomial CA-SBA-2934

Page 3 **of** 4 **Resource Name or #:** **Scale:** 1:24,000

Map Name: Point Arguello (1959), Tranquillon Mountain (1959-PR1978) CA, USGS 7.5' quadrangles **Date:** 01/2022





State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
SKETCH MAP

Primary # 42-002934
HRI#
Trinomial CA-SBA-2934

Resource Name or #:

Drawn by: T. Crimmel **Scale:** 1 inch equals 33 feet **Date of map:** January 2022

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
PRIMARY RECORD

Primary #
HRI #
Trinomial
NRHP Status Code

Other Listings
Review Code | Reviewer | Date

Page 1 **of** 3 **Resource Name or #** VAFB-ISO-1049

P1. Other Identifier: AE-4232-ISO-001

*__P2. Location: a. County:__ Santa Barbara ☒ **Not for Publication** ☐ **Unrestricted**
b. USGS 7.5′ Quad: Point Arguello **Date:** 1959, PR1982 T , R ; Unsectioned SB **B.M.**
c. Address: Vandenberg Space Force Base
d. UTM: NAD 1983 Zone 10N; 717112 **mE /** 3832961 **mN**
e. Other Locational Data: The site is on south Vandenberg Space Force Base, approximately 1,070 meters north of La Honda Canyon and 615 meters northeast of Space Launch Complex 5 (SLC-5). It is approximately 45 meters south of the intersection of Ocean and Delphy roads.

***P3a. Description:** This isolate is an approximately 3.0 by 1.5 centimeter biface thinning flake made of light-colored chert with orange and white inclusions.

***P3b. Resource Attributes:** AP16. Other Isolate

***P4. Resources Present:** ☐ Building ☐ Structure ☐ Object ☐ Site ☐ District ☐ Element of District ☒ Other: Isolate

***P5a. Photograph or Drawing:**

P5b. Description of Photo: None available

***P6. Date Constructed/Age and Sources:**
☒ Prehistoric ☐ Historic ☐ Both

***P7. Owner and Address:**
U.S. Space Force
30 CES/CEIEA
1028 Iceland Ave., Bldg. 11146
Vandenberg SFB, CA 93437

***P8. Recorded By:** Karin Olmedo
Applied EarthWorks, Inc.
515 E. Ocean Ave. Suite G
Lompoc, CA 93436

***P9. Date Recorded:** 2/15/2022
Field Data Collected: 5/12/2021

***P10. Survey Type:** ☐ Intensive
☒ Reconnaissance ☐ Other
Describe: Isolate found near area where Extended Phase 1 excavations took place.

***P11. Report Citation:** VSFB Project ID: 813-21-052CR
Morrison, Alex E.
2022 *Archaeological Investigations Supporting Section 106 Compliance for the Space Launch Complex 5 Phantom Space Project, Vandenberg Space Force Base, Santa Barbara County, California*, with contributions by Chantal Cagle, Joyce L. Gerber, Clayton G. Lebow, and Eric S. Nocerino. Applied EarthWorks, Inc., Lompoc, California. Prepared for Phantom Space Corporation, Tucson, Arizona.

***Attachments:**
☐ NONE ☒ Location Map ☒ Sketch Map ☐ Continuation Sheet
☐ Building, Structure, and Object Record ☐ Archaeological Record ☐ District Record ☐ Linear Feature Record
☐ Milling Station Record ☐ Rock Art Record ☐ Artifact Record
☐ Photograph Record ☐ Other (list):

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
LOCATION MAP

Primary #
HRI#
Trinomial

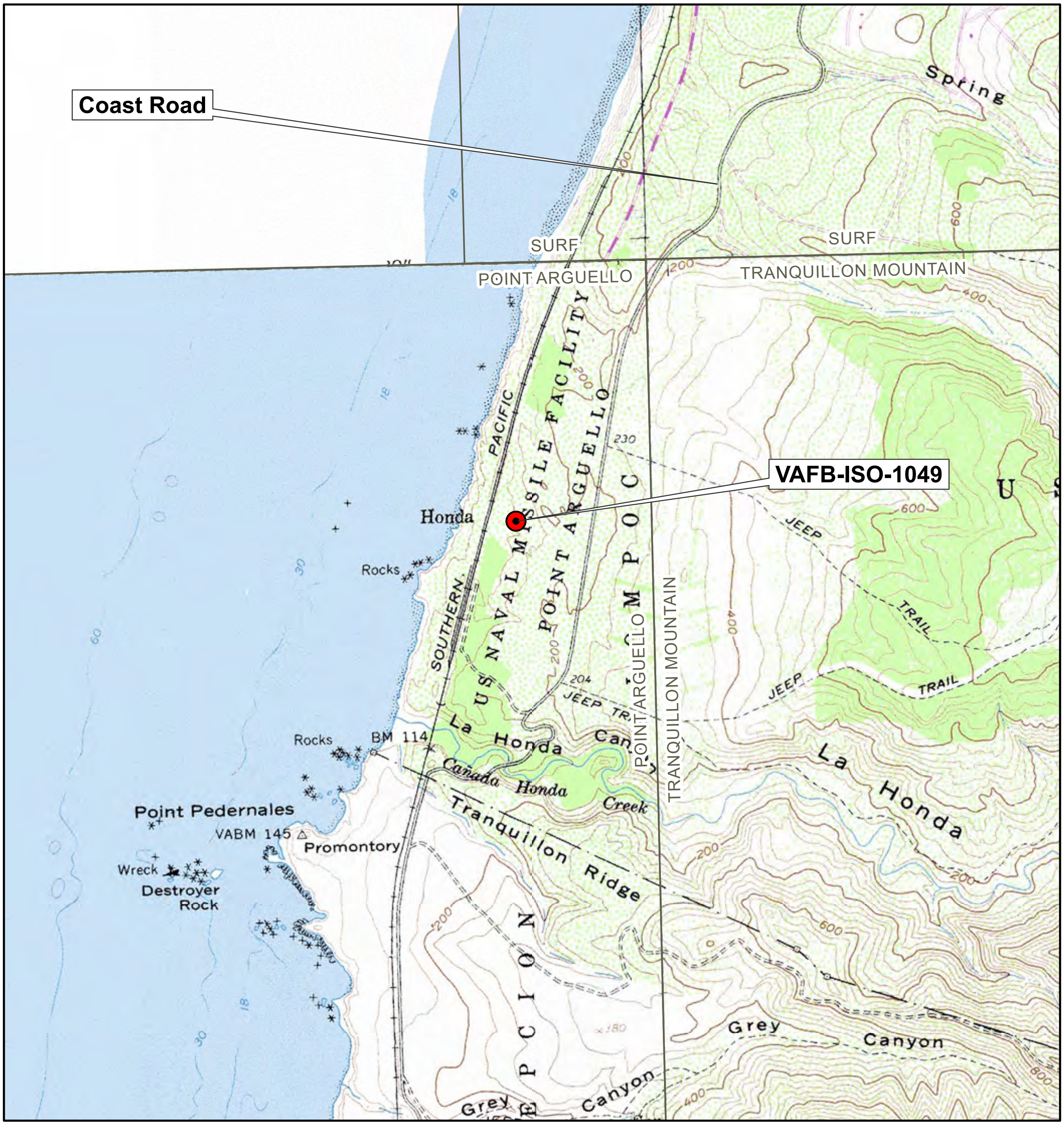
Page 2 **of** 3

Resource Name or #: VAFB-ISO-1049

Scale: 1:24,000

Map Name: Point Arguello (1959), Tranquillon Mountain (1959-PR1978) CA, USGS 7.5' quadrangles

Date: 03/2022



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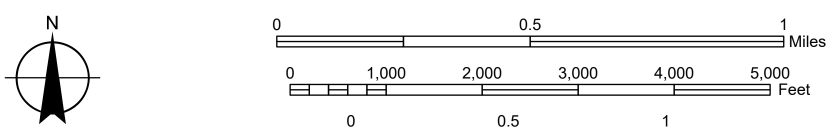
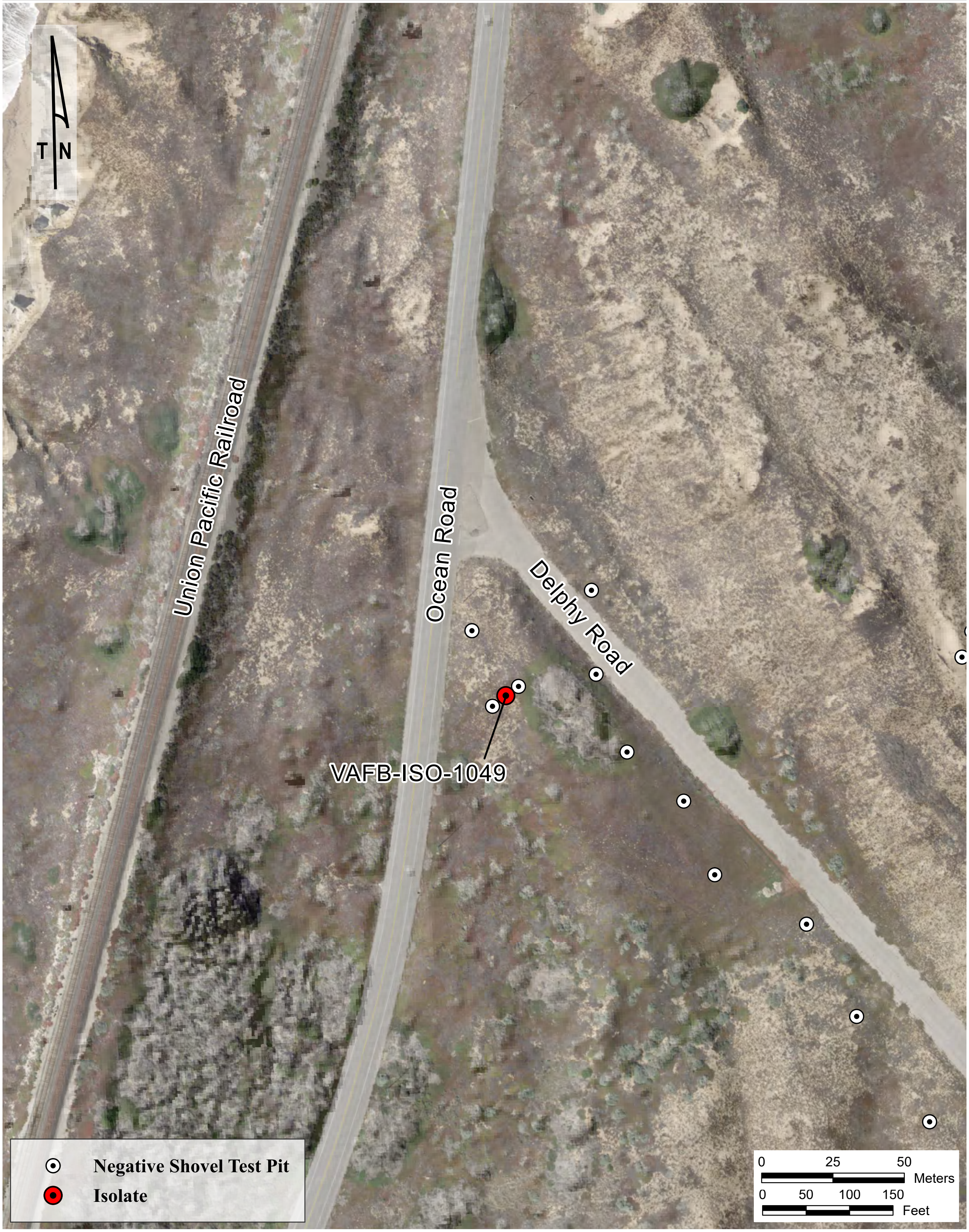


State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
SKETCH MAP

Primary #
HRI#
Trinomial

Page 3 **of** 3 **Resource Name or #:** VAFB-ISO-1049

Drawn by: T. Crimmel **Scale:** 1 inch equals 158 feet **Date of map:** March 2022



APPENDIX C

State Historic Preservation Office Concurrence Letters

E.O.11593

DETERMINATION OF ELIGIBILITY NOTIFICATION

NATIONAL REGISTER OF HISTORIC PLACES

OFFICE OF ARCHEOLOGY AND HISTORIC PRESERVATION

HERITAGE CONSERVATION AND RECREATION SERVICE

Request submitted by: DOD/AF/W.C.Martin

Date request received: 8/11/78

Name of property: CA-SBa-670 State: CA

Location: Vandenberg Air Force Base

Opinion of the State Historic Preservation Officer:

(x) Eligible ( ) Not eligible ( ) No response

Comments:

The Secretary of the Interior has determined that this property is:

(x) Eligible Applicable criteria: D

Comments: 36 CFR Part 63.3 Determination

( ) Not eligible

Comments:

( ) Documentation insufficient (see accompanying sheet explaining additional materials required)

[illegible] (Sgd.)

Keeper of the National Register

Date: [illegible]

WASO-185
9/75

STATE OF CALIFORNIA – THE RESOURCES AGENCY Edmund G. Brown, Jr., *Governor*

OFFICE OF HISTORIC PRESERVATION
DEPARTMENT OF PARKS AND RECREATION
P.O. BOX 942896
SACRAMENTO, CA 94296-0001
(916) 653-6624 Fax: (916) 653-9824
calshpo@ohp.parks.ca.gov
www.ohp.parks.ca.gov

June 20, 2011 Reply in Reference To: **USAF110418A**

Richard N. Cote - Deputy Base Civil Engineer
Department of the Air Force
30th Space Wing (AFSPC)
30th Civil Engineer Squadron
1172 Iceland Ave
Vandenberg AFB CA 93437-6012

Re: Section 106 consultation on the N1-N3, N6 *Feeder Lines Replacement Project*

Dear Mr. Cote:

Thank you for consulting regarding the Department of the Air Force, Vandenberg Air Force Base (VAFB) efforts to comply with Section 106 of the National Historic Preservation Act (NHPA) of 1966 (16 U.S.C. 470f), as amended, and its implementing regulation found at 36 CFR Part 800. As I understand, you are seeking concurrence on the appropriateness of the Area of Potential Effects (APE), historic property identification efforts, the ineligibility of 11 archaeological sites (Ca-Sba-0538, -1106, -1107, -1114, -1122H, -1124H, -1940, -1678, -2219, -2230 and -2231), the eligibility of one archaeological site (Ca-Sba-1119), and a finding of "*No Adverse Effect*", pursuant to 36 CFR Part 800.5(b).

Designed to upgrade electrical service between Substation N and VAFB launch facilities SLC-4 East, SLC-4 West and SLC-6 at VAFB; the undertaking involves demolishing approximately 15.04-km of two existing paralleling overhead power-lines and replacing them with approximately 9.91-km of two new paralleling overhead power-lines. Both the existing and replacement lines are identified as the N1-N3 and N6 Feeder Lines and both also parallel portions of existing VAFB launch facility access roads. The undertaking will reposition the alignment of the feeder lines closer to the shoulder of the aforementioned roads to better facilitate construction and maintenance needs. As described, the Area of Potential Effect (APE) includes the alignments of both the existing and replacement lines and the area extant of 34 previously recorded cultural resource sites they intersect. Demolition includes removing poles and cable from the existing line (involving 13 eligible and potentially eligible sites) and construction includes installing new poles and cable for the replacement line (involving seven eligible and potentially eligible sites). Identification efforts included background research of pertinent VAFB cultural resource files and records, consultation with the Santa Ynez Band of Chumash, field-survey and archaeological excavation.

Based on additional communications with VAFB cultural resource staff and a review of the report titled *Identification of Historic Properties and Assessment of Adverse Effects, N1, N3, N6 Feeder Lines Replacement Project, Vandenberg Air Force Base, Santa Barbara County, California, XUMU101387E1* (including the seven supporting technical reports) prepared by Petersen and Ryan (2011); I have the following comments:

1. Pursuant to 36 CFR Parts 800.4(a)(1) and 800.16(d), I find the Area of Potential Effect (APE) for the proposed undertaking has been properly determined and documented.

2. Pursuant to 36 CFR Part 800.4(b)(1), I find the "*Level of Effort*" appropriate for identifying

historic properties in the current APE as it consisted of background research, Native American (NA) consultation, field-survey and archaeological testing.

3. I **concur** on the ineligibility of Ca-Sba-0538, -1106, -1107, -1114, -1122H, -1124H, -1940, -1678, -2219, -2230 and -2231 for the following reasons:

   A. After reviewing the VAFB submittal and excavations reports, Ca-Sba-0538, -1106, -1107 and -1114 appear to no longer exist due to prior construction work and the processes of erosion; Ca-Sba-1678, -1940, -2219, -2230 and -2231 appear to contain small, disturbed and homogenous samples of archaeological remains with limited data potentials; and, Ca-Sba-1122H and -1124H have been previously determined ineligible with SHPO concurrence.

4. VAFB determined Ca-Sba-1119 was eligible under Criterion D. After reviewing the 450-page excavation report prepared by Applied Earthworks (AE) in 2009, I have no objections to VAFB's determination of eligibility for the site under Criterion D.

5. I find the resource treatments described in the VAFB submittal appropriate for avoiding impacts to (eligible and potentially eligible) Historic Properties Ca-Sba-0537, -0639, -0643, -0647, -0662, -0670, -1145, -1149, -1542, -1544, -1560 and -2920 during the demolition phase of project work as they consist of the following:

   A. Hand cutting poles above the surface of the ground.
   B. In-place abandonment of pole trunks.
   C. In-place abandonment of poles where feasible.
   D. Helicopter, crane or hand removal of cut poles where in-place abandonment is not feasible.
   E. Staging of cranes off-site or on existing access roads.
   F. Placement of temporary decking (such as plywood) to prevent ground disturbance should cranes need to traverse sites.
   G. Archaeological monitoring of the above activities.

5. I find the proposed locations for installing new poles within (eligible and potentially eligible) Historic Properties Ca-Sba-0537, -0551, -0643, -0670, -1149, -1542, and -3547 appropriate for avoiding impacts during the construction phase of project work because:

   A. Ca-Sba-0537, -0643, -0670 and -1542 - new poles will be installed at locations where field-survey and excavation confirmed the absence of archaeological remains.
   B. Ca-Sba-1547, -1559, -1560, and -1561 - new poles will be installed on artificial fill that measures 4.0 to 15.0-m deep and exceeds the <2.0-m depths of pole construction.
   C. Ca-Sba-0551 and -1149 - new poles will be installed adjacent to portions of existing access roads that have been cut down below the level of archaeological deposit.
   D. Ca-Sba-3547 - the new pole will not change the existing condition of the view-shed for the historic coast-guard station.

7. Please be advised that VAFB may have additional responsibilities for compliance with 36 CFR Part 800 should the current project description change in methodological and/or geographical scope

6. Based on the above comments, and because there are no project activities proposed for implementation at the remaining sites in the APE (Ca-Sba-0654, -0636, -0676, -1686 and -1119); I **concur** with the finding of "*No Adverse Effect*", pursuant to 36 CFR Part 800.5(b) for the current undertaking.

Thank you for considering historic properties as part of your project planning. Please contact Jeff Brooke of my staff at (916) 445-7003 or by email at jbrooke@parks.ca.gov if you have any questions or concerns.

Sincerely,

Susan K Stratton for

Milford Wayne Donaldson, FAIA
State Historic Preservation Officer

State of California • Natural Resources Agency

Gavin Newsom, *Governor*

DEPARTMENT OF PARKS AND RECREATION
OFFICE OF HISTORIC PRESERVATION

Lisa Ann L. Mangat, *Director*

Julianne Polanco, State Historic Preservation Officer
1725 23rd Street, Suite 100, Sacramento, CA 95816-7100
Telephone: (916) 445-7000 FAX: (916) 445-7053
calshpo.ohp@parks.ca.gov www.ohp.parks.ca.gov

June 12, 2019

Reply in Reference To: USAF_2019_0510_001

Lieutenant Colonel Jason M. Aftanas
Commander, 30th Civil Engineer Squadron
1172 Iceland Avenue
Vandenberg AFB, CA 93437-6011

Re: Section 106 Consultation for ML/KL and South Loop 2 (SL-2) Power Lines Replacement Project, Vandenberg AFB (USAF letter of May 02, 2019 and e-mail of June 11, 2019))

Dear Colonel Aftanas:

The United States Air Force (USAF) is initiating consultation with the State Historic Preservation Officer (SHPO) on the above-cited undertaking in accordance with Section 106 of the National Historic Preservation Act of 1966 (54 U.S.C. § 306108), as amended, and its implementing regulation found at 36 CFR Part 800.

The USAF proposes to repair and replace the entire ML/KL power line and segments of the South Loop 2 (SL-2) power line that were damaged during the Honda Canyon Fire in 2016. The project engineer and base archaeologist worked together to design the proposed undertaking so that it would limit the potential impacts to cultural resources that are located in the area of potential effects (APE).

As documentation for its determination of effect, the USAF submitted a cultural resources survey report prepared by Roscoe Loetzerich (USAF) and dated May 2019. A records review of the VAFB's cultural resources records revealed that ten cultural resources are located within the APE. Based on information contained in the above-cited report, the USAF has made the following Determinations of Eligibility (DOE):

Trinomial number(s)	USAF's DOE
CA-SBA-537 CA-SBA-670 CA-SBA-1125H CA-SBA-2229	Between 1978 and 2001, the USAF and the SHPO had determined that these sites were eligible for listing on the National Register of Historic Places (NRHP).
CA-SBA-2230 CA-SBA-2231H	In 2011 (USAF110418A), the USAF and the SHPO had determined that these sites were not eligible for listing on the NRHP.

CA-SBA-1127	The USAF has determined that this site is not eligible for listing on the NRHP and has requested the SHPO to review and comment on that determination
CA-SBA-1815	The USAF has determined that this site is eligible for listing on the NRHP and has requested the SHPO to review and comment on that determination
CA-SBA-945H CA-SBA-2306	The USAF has not evaluated these sites for their eligibility for listing on the NRHP, but for the purposes of this proposed undertaking, the USAF will assume that they are eligible.

On May 02, 2019, the USAF initiated consultation with Mr. Freddie Romero of the Santa Ynez Band of Chumash Indians (SYBCI) in regards to this proposed undertaking. On June 11, 2019, Mr. Romero stated that the SYBCI Elders Council had reviewed the proposed undertaking and said that it could move forward as proposed. Mr. Romero also stated that the SYBCI had the following recommendations: (1) That Native American monitors be retained for those areas where cultural resources are located, including a 50 meters buffer; (2) Should any changes or revisions be made to this proposed undertaking, that the SYBCI Elders Council should be consulted; and (3) If human remains are encountered, that the USAF should follow the NAGPRA MOU between the SYBCI and the VAFB. The USAF has accepted those recommendations and stated that the proposed undertaking would be implemented pursuant to them.

The USAF has determined that the proposed undertaking could affect the ten cultural resources identified above, but that effect would not be adverse. Based on the records review, the cultural resources survey report, and the tribal consultation, the USAF has determined that a finding of No Adverse Effect to Historic Properties is appropriate for this proposed undertaking. The USAF has requested the SHPO to review and comment on that determination, the determinations of eligibility and ineligibility, and the identification of the APE. After reviewing the information submitted by the USAF, the SHPO has the following comments:

1) The SHPO has no objections to your identification and delineation of area of potential effect pursuant to 36 CFR Parts 800.4 (a)(1) and 800.16(d);
2) The SHPO concurs that CA-SBA-1127 is not eligible for listing on the NRHP:
3) The SHPO concurs that CA-SBA-1815 is eligible for listing on the NRHP; and
4) The SHPO does not object to your Finding of No Adverse Effect to Historic Properties, as described above, pursuant to 36 CFR Part 800.5(c)(1).

Be advised that under certain circumstances, such as an unanticipated discovery or a change in project description, the USAF may have additional future responsibilities for this undertaking under 36 CFR Part 800. Should cultural artifacts be encountered during ground disturbing activities, please halt all work until a qualified archaeologist can be consulted on the nature and significance of such artifacts.

If you have any questions or concerns, please contact Ed Carroll of my staff at (916) 445-7006 or Ed.Carroll@parks.ca.gov.

Sincerely,

Julianne Polanco
State Historic Preservation Officer

APPENDIX D

Provenience Information Log

Provenience Information Log

Sites: CA-SBA-2934, VAFB-ISO-700, VAFB-ISO-258, VAFB-ISO-259

Site	LOT	Unit	Level	Unit Size (cm)	Field Mesh (in)	Exc Vol (m3)	Exc Date	Comments	Order
	1	STP 1	000-020	50	1/8	0.039	5/3/2021		1
	2	STP 1	020-040	50	1/8	0.039	5/3/2021		2
	3	STP 2	000-020	50	1/8	0.039	5/3/2021		3
	4	STP 2	020-040	50	1/8	0.039	5/3/2021		4
	5	STP 2	040-060	50	1/8	0.039	5/3/2021		5
	6	STP 2	060-080	50	1/8	0.039	5/3/2021		6
	7	STP 3	000-020	50	1/8	0.039	5/3/2021		7
	8	STP 3	020-040	50	1/8	0.039	5/3/2021		8
	9	STP 3	040-060	50	1/8	0.039	5/3/2021		9
	10	STP 3	060-080	50	1/8	0.039	5/3/2021		10
	11	STP 3	080-100	50	1/8	0.039	5/3/2021		11
	12	STP 4	000-020	50	1/8	0.039	5/3/2021		12
	13	STP 4	020-040	50	1/8	0.039	5/3/2021		13
	14	STP 4	040-060	50	1/8	0.039	5/3/2021		14
	15	STP 4	060-080	50	1/8	0.039	5/3/2021		15
	16	STP 4	080-100	50	1/8	0.039	5/3/2021		16
	17	STP 6	000-020	50	1/8	0.039	5/3/2021		17
	18	STP 6	020-040	50	1/8	0.039	5/3/2021		18
	19	STP 6	040-060	50	1/8	0.039	5/3/2021		19
	20	STP 6	060-080	50	1/8	0.039	5/3/2021		20
	21	STP 7	000-020	50	1/8	0.039	5/3/2021		21
	22	STP 7	020-040	50	1/8	0.039	5/3/2021		22
	23	STP 7	040-060	50	1/8	0.039	5/3/2021		23
	24	STP 7	060-080	50	1/8	0.039	5/3/2021		24
	25	STP 7	080-100	50	1/8	0.039	5/3/2021		25
	26	STP 8	000-020	50	1/8	0.039	5/3/2021		26
	27	STP 8	020-040	50	1/8	0.039	5/3/2021		27
	28	STP 9	000-020	50	1/8	0.039	5/3/2021		28
	29	STP 9	020-040	50	1/8	0.039	5/4/2021		29
	30	STP 10	000-020	50	1/8	0.039	5/4/2021		30
	31	STP 10	020-040	50	1/8	0.039	5/4/2021		31
	32	STP 11	000-020	50	1/8	0.039	5/3/2021		32
	33	STP 11	020-040	50	1/8	0.039	5/3/2021		33

Provenience Information Log

Sites: CA-SBA-2934, VAFB-ISO-700, VAFB-ISO-258, VAFB-ISO-259

Site	LOT	Unit	Level	Unit Size (cm)	Field Mesh (in)	Exc Vol (m3)	Exc Date	Comments	Order
	34	STP 12	000-020	50	1/8	0.039	5/3/2021		34
	35	STP 12	020-040	50	1/8	0.039	5/3/2021		35
	36	STP 13	000-020	50	1/8	0.039	5/4/2021		36
	37	STP 13	020-040	50	1/8	0.039	5/4/2021		37
	38	STP 14	000-020	50	1/8	0.039	5/4/2021		38
	39	STP 14	020-040	50	1/8	0.039	5/4/2021		39
	40	STP 15	000-020	50	1/8	0.039	5/4/2021		40
	41	STP 15	020-040	50	1/8	0.039	5/4/2021		41
	42	STP 16	000-020	50	1/8	0.039	5/4/2021		42
	43	STP 16	020-040	50	1/8	0.039	5/4/2021		43
	44	STP 17	000-020	50	1/8	0.039	5/4/2021		44
	45	STP 17	020-030	50	1/8	0.0195	5/4/2021		45
	46	STP 18	000-020	50	1/8	0.039	5/4/2021		46
	47	STP 18	020-040	50	1/8	0.039	5/4/2021		47
	48	STP 19	000-020	50	1/8	0.039	5/4/2021		48
	49	STP 19	020-040	50	1/8	0.039	5/5/2021		49
CA-SBA-2934	50	STP 20	000-020	50	1/8	0.039	5/4/2021		50
CA-SBA-2934	51	STP 20	020-040	50	1/8	0.039	5/4/2021		51
CA-SBA-2934	52	STP 20	040-060	50	1/8	0.039	5/4/2021		52
CA-SBA-2934	53	STP 20	060-080	50	1/8	0.039	5/4/2021		53
CA-SBA-2934	54	STP 20	080-100	50	1/8	0.039	5/5/2021		54
	55	STP 21	000-020	50	1/8	0.039	5/4/2021		55
	56	STP 21	020-040	50	1/8	0.039	5/4/2021		56
	57	STP 21	040-060	50	1/8	0.039	5/5/2021		57
	58	STP 21	060-080	50	1/8	0.039	5/5/2021		58
	59	STP 21	080-100	50	1/8	0.039	5/5/2021		59
	60	STP 22	000-020	50	1/8	0.039	5/5/2021		60
	61	STP 22	020-040	50	1/8	0.039	5/5/2021		61
	62	STP 22	040-060	50	1/8	0.039	5/5/2021		62
	63	STP 22	060-080	50	1/8	0.039	5/5/2021		63
	64	STP 22	080-100	50	1/8	0.039	5/5/2021		64
	65	STP 23	000-020	50	1/8	0.039	5/5/2021		65
	66	STP 23	020-040	50	1/8	0.039	5/5/2021		66

Provenience Information Log

Sites: CA-SBA-2934, VAFB-ISO-700, VAFB-ISO-258, VAFB-ISO-259

Site	LOT	Unit	Level	Unit Size (cm)	Field Mesh (in)	Exc Vol (m3)	Exc Date	Comments	Order
	67	STP 23	040-060	50	1/8	0.039	5/5/2021		67
	68	STP 23	060-080	50	1/8	0.039	5/5/2021		68
	69	STP 23	080-100	50	1/8	0.039	5/5/2021		69
	70	STP 24	000-020	50	1/8	0.039	5/6/2021		70
	71	STP 25	000-020	50	1/8	0.039	5/6/2021		71
	72	STP 25	020-040	50	1/8	0.039	5/6/2021		72
	73	STP 25	040-060	50	1/8	0.039	5/6/2021		73
	74	STP 25	060-080	50	1/8	0.039	5/6/2021		74
	75	STP 25	080-095	50	1/8	0.0294	5/6/2021		75
	76	STP 26	000-020	50	1/8	0.039	5/6/2021		76
	77	STP 26	020-040	50	1/8	0.039	5/6/2021		77
	78	STP 26	040-060	50	1/8	0.039	5/6/2021		78
	79	STP 26	060-080	50	1/8	0.039	5/6/2021		79
	80	STP 26	080-100	50	1/8	0.039	5/7/2021		80
	81	STP 27	000-020	50	1/8	0.039	5/5/2021		81
	82	STP 27	020-040	50	1/8	0.039	5/5/2021		82
	83	STP 27	040-060	50	1/8	0.039	5/5/2021		83
	84	STP 27	060-080	50	1/8	0.039	5/5/2021		84
	85	STP 27	080-100	50	1/8	0.039	5/5/2021		85
	86	STP 28	000-020	50	1/8	0.039	5/6/2021		86
	87	STP 28	020-040	50	1/8	0.039	5/6/2021		87
	88	STP 28	040-060	50	1/8	0.039	5/6/2021		88
	89	STP 28	060-080	50	1/8	0.039	5/6/2021		89
	90	STP 28	080-095	50	1/8	0.0294	5/6/2021		90
	91	STP 29	000-020	50	1/8	0.039	5/6/2021		91
	92	STP 29	020-040	50	1/8	0.039	5/6/2021		92
	93	STP 29	040-060	50	1/8	0.039	5/6/2021		93
	94	STP 29	060-080	50	1/8	0.039	5/6/2021		94
	95	STP 30	000-020	50	1/8	0.039	5/6/2021		95
	96	STP 30	020-040	50	1/8	0.039	5/6/2021		96
	97	STP 30	040-060	50	1/8	0.039	5/6/2021		97
	98	STP 30	060-080	50	1/8	0.039	5/6/2021		98
	99	STP 30	080-085	50	1/8	0.0098	5/6/2021		99

Provenience Information Log

Sites: CA-SBA-2934, VAFB-ISO-700, VAFB-ISO-258, VAFB-ISO-259

Site	LOT	Unit	Level	Unit Size (cm)	Field Mesh (in)	Exc Vol (m3)	Exc Date	Comments	Order
CA-SBA-2934	100	STP 31	000-020	50	1/8	0.039	5/5/2021		100
CA-SBA-2934	101	STP 31	020-040	50	1/8	0.039	5/5/2021		101
CA-SBA-2934	102	STP 31	040-060	50	1/8	0.039	5/5/2021		102
CA-SBA-2934	103	STP 31	060-080	50	1/8	0.039	5/5/2021		103
	104	STP 32	000-020	50	1/8	0.039	5/6/2021		104
CA-SBA-2934	105	STP 33	000-020	50	1/8	0.039	5/5/2021		105
CA-SBA-2934	106	STP 33	020-040	50	1/8	0.039	5/5/2021		106
CA-SBA-2934	107	STP 33	040-060	50	1/8	0.039	5/6/2021		107
CA-SBA-2934	108	STP 33	060-080	50	1/8	0.039	5/6/2021		108
CA-SBA-2934	109	STP 33	080-100	50	1/8	0.039	5/6/2021		109
CA-SBA-2934	110	STP 34	000-020	50	1/8	0.039	5/6/2021		110
CA-SBA-2934	111	STP 34	020-040	50	1/8	0.039	5/6/2021		111
CA-SBA-2934	112	STP 34	040-060	50	1/8	0.039	5/6/2021		112
CA-SBA-2934	113	STP 35	000-020	50	1/8	0.039	5/5/2021		113
CA-SBA-2934	114	STP 35	020-040	50	1/8	0.039	5/5/2021		114
CA-SBA-2934	115	STP 35	040-060	50	1/8	0.039	5/5/2021		115
CA-SBA-2934	116	STP 35	060-080	50	1/8	0.039	5/5/2021		116
CA-SBA-2934	117	STP 35	080-100	50	1/8	0.039	5/5/2021		117
	118	STP 36	000-020	50	1/8	0.039	5/7/2021		118
	119	STP 36	020-040	50	1/8	0.039	5/7/2021		119
	120	STP 37	000-020	50	1/8	0.039	5/7/2021		120
	121	STP 37	020-040	50	1/8	0.039	5/7/2021		121
	122	STP 38	000-020	50	1/8	0.039	5/7/2021		122
	123	STP 38	020-040	50	1/8	0.039	5/7/2021		123
	124	STP 39	000-020	50	1/8	0.039	5/7/2021		124
	125	STP 39	020-040	50	1/8	0.039	5/7/2021		125
	126	STP 40	000-020	50	1/8	0.039	5/7/2021		126
	127	STP 40	020-040	50	1/8	0.039	5/7/2021		127
	128	STP 40	040-060	50	1/8	0.039	5/7/2021		128
	129	STP 40	060-080	50	1/8	0.039	5/7/2021		129
	130	STP 41	000-020	50	1/8	0.039	5/6/2021		130
	131	STP 41	020-040	50	1/8	0.039	5/7/2021		131
	132	STP 41	040-060	50	1/8	0.039	5/7/2021		132

Site	LOT	Unit	Level	Unit Size (cm)	Field Mesh (in)	Exc Vol (m3)	Exc Date	Comments	Order
	133	STP 41	060-075	50	1/8	0.0294	5/7/2021		133
	134	STP 42	000-020	50	1/8	0.039	5/7/2021		134
	135	STP 42	020-040	50	1/8	0.039	5/7/2021		135
	136	STP 43	000-020	50	1/8	0.039	5/7/2021		136
	137	STP 43	020-040	50	1/8	0.039	5/7/2021		137
	138	STP 44	000-020	50	1/8	0.039	5/7/2021		138
	139	STP 44	020-040	50	1/8	0.039	5/7/2021		139
	140	STP 45	000-020	50	1/8	0.039	5/10/2021		140
	141	STP 45	020-040	50	1/8	0.039	5/10/2021		141
	142	STP 46	000-020	50	1/8	0.039	5/10/2021		142
	143	STP 46	020-040	50	1/8	0.039	5/10/2021		143
	144	STP 47	000-020	50	1/8	0.039	5/10/2021		144
	145	STP 47	020-040	50	1/8	0.039	5/10/2021		145
	146	STP 48	000-020	50	1/8	0.039	5/7/2021		146
	147	STP 48	020-040	50	1/8	0.039	5/7/2021		147
	148	STP 48	040-060	50	1/8	0.039	5/7/2021		148
	149	STP 48	060-080	50	1/8	0.039	5/7/2021		149
	150	STP 48	080-100	50	1/8	0.039	5/7/2021		150
	151	STP 49	000-020	50	1/8	0.039	5/6/2021		151
	152	STP 49	020-040	50	1/8	0.039	5/7/2021		152
	153	STP 49	040-060	50	1/8	0.039	5/7/2021		153
	154	STP 49	060-080	50	1/8	0.039	5/7/2021		154
	155	STP 49	080-100	50	1/8	0.039	5/7/2021		155
	156	STP 50	000-020	50	1/8	0.039	5/7/2021		156
	157	STP 50	020-040	50	1/8	0.039	5/7/2021		157
	158	STP 50	040-060	50	1/8	0.039	5/7/2021		158
	159	STP 50	060-070	50	1/8	0.0195	5/7/2021		159
	160	STP 51	000-020	50	1/8	0.039	5/7/2021		160
	161	STP 51	020-040	50	1/8	0.039	5/7/2021		161
	162	STP 51	040-060	50	1/8	0.039	5/7/2021		162
	163	STP 51	060-080	50	1/8	0.039	5/7/2021		163
	164	STP 52	000-020	50	1/8	0.039	5/7/2021		164
	165	STP 52	020-040	50	1/8	0.039	5/7/2021		165

Site	LOT	Unit	Level	Unit Size (cm)	Field Mesh (in)	Exc Vol (m3)	Exc Date	Comments	Order
	166	STP 52	040-060	50	1/8	0.039	5/7/2021		166
	167	STP 52	060-080	50	1/8	0.039	5/7/2021		167
	168	STP 53	000-020	50	1/8	0.039	5/7/2021		168
	169	STP 53	020-040	50	1/8	0.039	5/7/2021		169
	170	STP 53	040-060	50	1/8	0.039	5/7/2021		170
	171	STP 53	060-080	50	1/8	0.039	5/7/2021		171
VAFB-ISO-700	172	STP 56	000-020	50	1/8	0.039	5/7/2021		172
VAFB-ISO-700	173	STP 56	020-040	50	1/8	0.039	5/7/2021		173
VAFB-ISO-700	174	STP 57	000-020	50	1/8	0.039	5/7/2021		174
VAFB-ISO-700	175	STP 57	020-040	50	1/8	0.039	5/7/2021		175
VAFB-ISO-700	176	STP 58	000-020	50	1/8	0.039	5/7/2021		176
VAFB-ISO-700	177	STP 58	020-040	50	1/8	0.039	5/7/2021		177
	178	STP 59	000-020	50	1/8	0.039	5/10/2021		178
	179	STP 59	020-040	50	1/8	0.039	5/10/2021		179
	180	STP 59	040-060	50	1/8	0.039	5/10/2021		180
	181	STP 59	060-070	50	1/8	0.0195	5/10/2021		181
	182	STP 60	000-020	50	1/8	0.039	5/10/2021		182
	183	STP 60	020-040	50	1/8	0.039	5/10/2021		183
	184	STP 60	040-060	50	1/8	0.039	5/10/2021		184
	185	STP 60	060-080	50	1/8	0.039	5/10/2021		185
	186	STP 61	000-020	50	1/8	0.039	5/10/2021		186
	187	STP 61	020-040	50	1/8	0.039	5/10/2021		187
	188	STP 61	040-060	50	1/8	0.039	5/10/2021		188
	189	STP 61	060-080	50	1/8	0.039	5/10/2021		189
	190	STP 61	080-100	50	1/8	0.039	5/10/2021		190
	191	STP 62	000-020	50	1/8	0.039	5/10/2021		191
	192	STP 62	020-040	50	1/8	0.039	5/10/2021		192
	193	STP 62	040-060	50	1/8	0.039	5/10/2021		193
	194	STP 62	060-080	50	1/8	0.039	5/10/2021		194
	195	STP 63	000-020	50	1/8	0.039	5/10/2021		195
	196	STP 63	020-040	50	1/8	0.039	5/10/2021		196
	197	STP 63	040-060	50	1/8	0.039	5/10/2021		197
	198	STP 63	060-080	50	1/8	0.039	5/10/2021		198

Site	LOT	Unit	Level	Unit Size (cm)	Field Mesh (in)	Exc Vol (m3)	Exc Date	Comments	Order
	199	STP 64	000-020	50	1/8	0.039	5/10/2021		199
	200	STP 64	020-040	50	1/8	0.039	5/10/2021		200
	201	STP 64	040-060	50	1/8	0.039	5/10/2021		201
	202	STP 64	060-080	50	1/8	0.039	5/10/2021		202
	203	STP 64	080-090	50	1/8	0.039	5/11/2021		203
	204	STP 65	000-020	50	1/8	0.039	5/10/2021		204
	205	STP 65	020-040	50	1/8	0.039	5/11/2021		205
	206	STP 65	040-060	50	1/8	0.039	5/11/2021		206
	207	STP 65	060-080	50	1/8	0.039	5/11/2021		207
	208	STP 65	080-100	50	1/8	0.039	5/11/2021		208
	209	STP 66	000-020	50	1/8	0.039	5/11/2021		209
	210	STP 66	020-040	50	1/8	0.039	5/11/2021		210
	211	STP 66	040-060	50	1/8	0.039	5/11/2021		211
	212	STP 66	060-080	50	1/8	0.039	5/11/2021		212
	213	STP 66	080-100	50	1/8	0.039	5/11/2021		213
	214	STP 67	000-020	50	1/8	0.039	5/11/2021		214
	215	STP 67	020-040	50	1/8	0.039	5/11/2021		215
	216	STP 67	040-060	50	1/8	0.039	5/11/2021		216
	217	STP 67	060-080	50	1/8	0.039	5/11/2021		217
	218	STP 67	080-100	50	1/8	0.039	5/11/2021		218
	219	STP 68	000-020	50	1/8	0.039	5/11/2021		219
	220	STP 68	020-040	50	1/8	0.039	5/11/2021		220
	221	STP 68	040-060	50	1/8	0.039	5/11/2021		221
	222	STP 68	060-080	50	1/8	0.039	5/11/2021		222
	223	STP 68	080-100	50	1/8	0.039	5/11/2021		223
	224	STP 69	000-020	50	1/8	0.039	5/11/2021		224
	225	STP 69	020-040	50	1/8	0.039	5/11/2021		225
	226	STP 69	040-060	50	1/8	0.039	5/11/2021		226
	227	STP 69	060-080	50	1/8	0.039	5/11/2021		227
	228	STP 69	080-100	50	1/8	0.039	5/11/2021		228
	229	STP 70	000-020	50	1/8	0.039	5/11/2021		229
	230	STP 70	020-040	50	1/8	0.039	5/11/2021		230
	231	STP 70	040-060	50	1/8	0.039	5/11/2021		231

Site	LOT	Unit	Level	Unit Size (cm)	Field Mesh (in)	Exc Vol (m3)	Exc Date	Comments	Order
	232	STP 70	060-080	50	1/8	0.039	5/11/2021		232
	233	STP 70	080-100	50	1/8	0.039	5/11/2021		233
	234	STP 71	000-020	50	1/8	0.039	5/11/2021		234
	235	STP 71	020-040	50	1/8	0.039	5/11/2021		235
	236	STP 71	040-060	50	1/8	0.039	5/11/2021		236
	237	STP 71	060-080	50	1/8	0.039	5/11/2021		237
	238	STP 71	080-100	50	1/8	0.039	5/11/2021		238
	239	STP 72	000-020	50	1/8	0.039	5/11/2021		239
	240	STP 72	020-040	50	1/8	0.039	5/11/2021		240
	241	STP 72	040-060	50	1/8	0.039	5/11/2021		241
	242	STP 72	060-080	50	1/8	0.039	5/11/2021		242
	243	STP 72	080-100	50	1/8	0.039	5/11/2021		243
	244	STP 73	000-020	50	1/8	0.039	5/11/2021		244
	245	STP 73	020-040	50	1/8	0.039	5/11/2021		245
	246	STP 73	040-060	50	1/8	0.039	5/11/2021		246
	247	STP 73	060-080	50	1/8	0.039	5/11/2021		247
	248	STP 73	080-100	50	1/8	0.039	5/11/2021		248
	249	STP 74	000-020	50	1/8	0.039	5/11/2021		249
	250	STP 74	020-040	50	1/8	0.039	5/11/2021		250
	251	STP 74	040-060	50	1/8	0.039	5/11/2021		251
	252	STP 74	060-080	50	1/8	0.039	5/11/2021		252
	253	STP 74	080-100	50	1/8	0.039	5/11/2021		253
	254	STP 75	000-020	50	1/8	0.039	5/11/2021		254
	255	STP 75	020-040	50	1/8	0.039	5/11/2021		255
	256	STP 75	040-060	50	1/8	0.039	5/11/2021		256
	257	STP 75	060-080	50	1/8	0.039	5/11/2021		257
	258	STP 75	080-100	50	1/8	0.039	5/11/2021		258
	259	STP 76	000-020	50	1/8	0.039	5/11/2021		259
	260	STP 76	020-040	50	1/8	0.039	5/11/2021		260
	261	STP 76	040-060	50	1/8	0.039	5/11/2021		261
	262	STP 76	060-080	50	1/8	0.039	5/11/2021		262
	263	STP 76	080-100	50	1/8	0.039	5/11/2021		263
	264	STP 77	000-020	50	1/8	0.039	5/11/2021		264

Provenience Information Log

Sites: CA-SBA-2934, VAFB-ISO-700, VAFB-ISO-258, VAFB-ISO-259

Site	LOT	Unit	Level	Unit Size (cm)	Field Mesh (in)	Exc Vol (m3)	Exc Date	Comments	Order
	265	STP 77	020-040	50	1/8	0.039	5/11/2021		265
	266	STP 77	040-060	50	1/8	0.039	5/11/2021		266
	267	STP 77	060-080	50	1/8	0.039	5/11/2021		267
	268	STP 77	080-100	50	1/8	0.039	5/11/2021		268
	269	STP 78	000-020	50	1/8	0.039	5/11/2021		269
	270	STP 78	020-040	50	1/8	0.039	5/11/2021		270
	271	STP 78	040-060	50	1/8	0.039	5/11/2021		271
	272	STP 78	060-080	50	1/8	0.039	5/11/2021		272
	273	STP 78	080-100	50	1/8	0.039	5/11/2021		273
	274	STP 79	000-020	50	1/8	0.039	5/11/2021		274
	275	STP 79	020-040	50	1/8	0.039	5/11/2021		275
	276	STP 79	040-060	50	1/8	0.039	5/11/2021		276
	277	STP 79	060-080	50	1/8	0.039	5/11/2021		277
	278	STP 80	000-020	50	1/8	0.039	5/12/2021		278
	279	STP 80	020-040	50	1/8	0.039	5/12/2021		279
	280	STP 80	040-060	50	1/8	0.039	5/12/2021		280
	281	STP 80	060-080	50	1/8	0.039	5/12/2021		281
	282	STP 80	080-100	50	1/8	0.039	5/12/2021		282
	283	STP 81	000-020	50	1/8	0.039	5/12/2021		283
	284	STP 81	020-040	50	1/8	0.039	5/12/2021		284
	285	STP 81	040-060	50	1/8	0.039	5/12/2021		285
	286	STP 81	060-080	50	1/8	0.039	5/12/2021		286
	287	STP 81	080-100	50	1/8	0.039	5/12/2021		287
	288	STP 82	000-020	50	1/8	0.039	5/12/2021		288
	289	STP 82	020-040	50	1/8	0.039	5/12/2021		289
	290	STP 82	040-060	50	1/8	0.039	5/12/2021		290
	291	STP 82	060-080	50	1/8	0.039	5/12/2021		291
	292	STP 82	080-100	50	1/8	0.039	5/12/2021		292
	293	STP 83	000-020	50	1/8	0.039	5/12/2021		293
	294	STP 83	020-040	50	1/8	0.039	5/12/2021		294
	295	STP 83	040-060	50	1/8	0.039	5/12/2021		295
	296	STP 83	060-080	50	1/8	0.039	5/12/2021		296
	297	STP 83	080-100	50	1/8	0.039	5/12/2021		297

Site	LOT	Unit	Level	Unit Size (cm)	Field Mesh (in)	Exc Vol (m3)	Exc Date	Comments	Order
	298	STP 84	000-020	50	1/8	0.039	5/12/2021		298
	299	STP 84	020-040	50	1/8	0.039	5/12/2021		299
	300	STP 84	040-060	50	1/8	0.039	5/12/2021		300
	301	STP 84	060-080	50	1/8	0.039	5/12/2021		301
	302	STP 84	080-100	50	1/8	0.039	5/12/2021		302
	303	STP 85	000-020	50	1/8	0.039	5/12/2021		303
	304	STP 85	020-040	50	1/8	0.039	5/12/2021		304
	305	STP 85	040-060	50	1/8	0.039	5/12/2021		305
	306	STP 85	060-080	50	1/8	0.039	5/12/2021		306
	307	STP 85	080-100	50	1/8	0.039	5/12/2021		307
	308	STP 86	000-020	50	1/8	0.039	5/12/2021		308
	309	STP 86	020-040	50	1/8	0.039	5/12/2021		309
	310	STP 86	040-060	50	1/8	0.039	5/12/2021		310
	311	STP 86	060-080	50	1/8	0.039	5/12/2021		311
	312	STP 86	080-100	50	1/8	0.039	5/12/2021		312
VAFB-ISO-259	313	STP 87	000-020	50	1/8	0.039	5/12/2021		313
VAFB-ISO-259	314	STP 87	020-040	50	1/8	0.039	5/12/2021		314
VAFB-ISO-259	315	STP 88	000-020	50	1/8	0.039	5/12/2021		315
VAFB-ISO-259	316	STP 88	020-040	50	1/8	0.039	5/12/2021		316
VAFB-ISO-259	317	STP 89	000-020	50	1/8	0.039	5/12/2021		317
VAFB-ISO-259	318	STP 89	020-040	50	1/8	0.039	5/12/2021		318
VAFB-ISO-258	319	STP 90	000-020	50	1/8	0.039	5/12/2021		319
VAFB-ISO-258	320	STP 90	020-040	50	1/8	0.039	5/12/2021		320
VAFB-ISO-258	321	STP 91	000-020	50	1/8	0.039	5/12/2021		321
VAFB-ISO-258	322	STP 91	020-040	50	1/8	0.039	5/12/2021		322
VAFB-ISO-258	323	STP 92	000-020	50	1/8	0.039	5/12/2021		323
VAFB-ISO-258	324	STP 92	020-040	50	1/8	0.039	5/12/2021		324
AE-4232-ISO-1	325	STP 93	000-020	50	1/8	0.039	5/12/2021		325
AE-4232-ISO-1	326	STP 93	020-040	50	1/8	0.039	5/12/2021		326
AE-4232-ISO-1	327	STP 93	040-060	50	1/8	0.039	5/12/2021		327
AE-4232-ISO-1	328	STP 94	000-020	50	1/8	0.039	5/12/2021		328
AE-4232-ISO-1	329	STP 94	020-040	50	1/8	0.039	5/12/2021		329
AE-4232-ISO-1	330	STP 95	000-020	50	1/8	0.039	5/12/2021		330

Site	LOT	Unit	Level	Unit Size (cm)	Field Mesh (in)	Exc Vol (m3)	Exc Date	Comments	Order
AE-4232-ISO-1	331	STP 95	020-040	50	1/8	0.039	5/12/2021		331
	332	DOC	n/a	n/a	n/a		5/3/2021	daily work record (8 pgs)	332
	333	DOC	n/a	n/a	n/a		5/3/2021	photograph log (5 pgs)	333
AE-4232-ISO-1	2804	SCP 1	Surface	n/a	n/a	0	5/12/2021		2804

DEPARTMENT OF THE AIR FORCE
UNITED STATES SPACE FORCE
SPACE LAUNCH DELTA 30

Lieutenant Colonel Charles G. Hansen
Commander, 30th Civil Engineer Squadron
1172 Iceland Ave
Vandenberg SFB CA 93437-6011

Ms. Julianne Polanco
State Historic Preservation Officer
Department of Parks and Recreation
Office of Historic Preservation
P.O. Box 942896
Sacramento CA 94296-0001

Dear Ms. Polanco

Phantom Space Corporation proposes to construct and operate a completely new orbital launch site (OLS) at Vandenberg Space Force Base (VSFB) in order to launch its Daytona-E and Laguna-E small-lift class vehicles. The OLS is proposed to be built on 21 acres of undeveloped land in the South Base portion of VSFB in Santa Barbara County, California. The proposed launch site was historically occupied by Space Launch Complex (SLC)-5, which was previously demolished to bare earth around 2012, except for access roads which still connect the site to Coast Road, a main thoroughfare.

The proposed *Phantom Space SLC-5 OLS Project* would include the construction of a new space launch complex designated as SLC-5. The new SLC-5 will include two, 1,500 square feet concrete launch pads (designated SLC-5 East and SLC-5 West), an assembly facility, refurbishment facility, payload processing facility, launch and mission control center, customer support facility, and storage for ground support equipment. The new launch complex will require dedicated utilities such as electric circuits, communication, and water lines, and a fence line and fire breaks will be constructed around the perimeter. Altogether, the project components (launch site, utility corridor, roads, firebreaks and vegetation management areas) total 21 acres.

VSFB has carried out a reasonable and good-faith cultural resources investigation that fulfills federal agency responsibilities pursuant to 36 CFR 800.4(a)-(d) and 36 CFR 800.5(a)-(d). Per §800.3(c-f), VSFB is consulting with the California State Historic Preservation Officer (SHPO) on its findings. Additionally, the Federal Aviation Administration (FAA) expects to receive an application from Phantom Space Corporation to conduct commercial launches at the launch site, and the FAA's proposed issuance of a launch license is also considered an undertaking as defined in 36 CFR 800.16(y).

Phantom Space Corporation contracted Applied Earthworks to conduct a cultural resources study of the Project Area of Direct Impacts (ADI), and to prepare an analysis specifically addressing potential impacts on cultural resources from rocket engine noise and sonic boom vibrations associated with static tests and launches from the proposed Phantom Space OLS. A threshold of 120 decibels (dB) has been established, above which historic properties could be susceptible to damage. An analysis was performed to delineate an area where noise levels are expected to exceed 120 dB, and that area was delineated as a 3,200-feet radius around the proposed launch pads. Sonic booms associated with launches were also considered and are measured as pressure in pounds per square foot (psf). The threshold for damage resulting from sonic booms (overpressure) is established at two psf or greater. Both Phantom rockets will produce a sonic boom of less than 2 psf, which will occur over open ocean more than 20 miles south and west of the Santa Barbara Channel Islands.

No prehistoric rock art, rock cairns, rock shelters, or structures constructed of rock, wood, glass block, or adobe, which could be affected by launch noise vibrations were identified within the polygon of the noise vibration study. Only one historic-age built-environment resource, the Union Pacific Railroad's Honda trestle, is situated within the 120 dB noise vibration contour. This steel structure, constructed to withstand strong vibrations and concussive forces, has no potential to be affected by noise vibrations, and therefore, it is excluded from the Area of Potential Effect (APE).

The Juan Bautista de Anza National Historic Trail is mapped as intersecting the launch noise contour, along the coast approximately 2,000 feet to the west of the proposed launch pads. There is no physical manifestation of the former Anza Trail route anywhere near this location, and therefore, this portion of the Anza Trail is only eligible for the NRHP in concept. This project has no potential to impede the public's perception of the route that Anza followed along the coast in the vicinity of the Project. Furthermore, the construction and use of SLC-5 would not introduce any visual or auditory elements which would have the potential to cause effects to this historic property under 36 CFR 800.3(a)(1); therefore, the Anza Trail was considered in this study, but it has been excluded from the APE because it has no potential to be affected.

Background research revealed that four archaeological sites (CA-SBA-538, -670, -2230, and -2934) were previously recorded within the ADI. CA-SBA-670 was previously determined eligible for the NRHP through Executive Order 11593. CA-SBA-538 and CA-SBA-2230 were previously determined ineligible for the NRHP (USAF110418A). The NRHP eligibility of CA-SBA-2934 was unevaluated prior to the current study.

Neither CA-SBA-538 nor CA-SBA-2230, which were previously evaluated as ineligible for the NRHP, were tested during the current investigation. Archaeological investigations revealed that CA-SBA-2934 is no longer present, likely due to ground disturbance associated with the demolition of SLC-5. In fact, archaeological testing did not yield any archaeological materials anywhere within the Project ADI. No testing was performed in the portion of NRHP-eligible CA-SBA-670 within the ADI because Project activities within the site boundaries would be limited to clearing vegetation from the existing pavement. Protective fencing will be installed to ensure Project activities do not extend beyond the existing roadway of Honda Canyon Road and encroach into CA-SBA-670. Furthermore, noise vibrations would not disturb the significant aspects of CA-SBA-670, as it contains only surface and/or buried archaeological material that would not be affected by rocket engine noise because soils would protect materials in place.

Details of the investigation are provided in the attachment. VSFB presents the following federal agency determinations for concurrence from the SHPO:

a. The APE for the Phantom Space SLC-5 OLS Project is adequately delineated; and

b. The undertaking will have *no adverse effect* on historic properties.

VSFB has reached a Section 106 finding of *no adverse effect* for this undertaking. Barring objection to this finding by the SHPO, VSFB has fulfilled its Section 106 responsibilities for this undertaking and no further consultation is required. If, subsequent to this consultation, any changes to the design of the project are made with the potential to affect a historic property, or, project implementation results in a significant discovery during construction, VSFB will re-open Section 106 consultation for this project.

If you have any questions or require additional information, please contact Josh Smallwood, Cultural Resources Manager, 30 CES/CEIEA, 1028 Iceland Avenue, Building 11146, Vandenberg SFB; phone: 760-419-0092; e-mail: stacy.smallwood.1@spaceforce.mil. Thank you for your assistance with this undertaking.

Sincerely

HANSEN.CHARLES.G.1162353914 Digitally signed by HANSEN.CHARLES.G.1162353914 Date: 2022.05.05 07:54:29 -07'00'

CHARLES G. HANSEN, Lt Col, USAF
Commander

Attachment:
Identification of Historic Properties and Assessment of Effects, Phantom Space SLC-5 Orbital Launch Site Project (813-21-052)

State of California • Natural Resources Agency
Gavin Newsom, *Governor*

DEPARTMENT OF PARKS AND RECREATION
OFFICE OF HISTORIC PRESERVATION
Armando Quintero, *Director*

Julianne Polanco, State Historic Preservation Officer

1725 23rd Street, Suite 100, Sacramento, CA 95816-7100
Telephone: (916) 445-7000 FAX: (916) 445-7053
calshpo.ohp@parks.ca.gov www.ohp.parks.ca.gov

May 17, 2022

Reply in Reference to: USAF_2022_0505_001

Lt. Col. Charles G. Hansen
Commander, 30th Civil Engineer Squadron
1172 Iceland Avenue
Vandenberg AFB, CA 93437-6011

VIA ELECTRONIC MAIL

Re: Section 106 Consultation for Orbital Launch Site Construction, Space Launch Complex 5, Vandenberg Space Force Base, Santa Barbara County

Dear Lt. Col. Hansen:

The United States Air Force (USAF) is initiating consultation with the State Historic Preservation Officer (SHPO) regarding its effort to comply with Section 106 of the National Historic Preservation Act of 1966 (54 U.S.C. 306108), as amended, and its implementing regulation found at 36 CFR Part 800.

The USAF are proposing to construct a 21-acre space launch complex identified as SLC-5 at Vandenberg Space Force Base. Supporting elements and features proposed for construction include concrete pads, an assembly facility, a mission control center and utilities.

As vegetation clearance is proposed within the boundaries of CA-SBA-670, a prehistoric site previously determined eligible for National Register of Historic Places (NRHP) inclusion, the USAF will install protective fencing during project activities. Additionally, the USAF evaluated CA-SBA-2934 determined it not eligible for NRHP inclusion.

The USAF are requesting concurrence with its APE definition, its determination that CA-SBA-2934 is not eligible for NRHP inclusion and a finding of no adverse effect. Upon review of the information provided, the SHPO has the following comments:

1. The SHPO does not object to the USAF's APE definition.

2. The SHPO concurs that CA-SBA-2934 is not eligible for NRHP inclusion.

3. The SHPO concurs with the USAF's finding of no adverse effect. Be advised that under certain circumstances, such as an unanticipated discovery or a change in

project description, the USAF may have future responsibilities for this undertaking under 36 CFR Part 800.

This letter is being sent in electronic format only. Please confirm receipt of this letter. Please notify Ed Carroll, Historian II, at Ed.Carroll@parks.ca.gov if there are any questions or to request a hard copy of this letter.

Sincerely,

Julianne Polanco
State Historic Preservation Officer

DEPARTMENT OF THE AIR FORCE
UNITED STATES SPACE FORCE
SPACE LAUNCH DELTA 30

Josh Smallwood
30 CES/CEIEA
1028 Iceland Avenue
Vandenberg SFB, CA 93437-6010

Ms. Nakia Zavalla
Santa Ynez Band of Chumash Indians
P.O. Box 517
Santa Ynez, CA 93460

Dear Ms. Zavalla

Phantom Space Corporation proposes to construct and operate a completely new orbital launch site (OLS) at Vandenberg Space Force Base (VSFB) in order to launch its Daytona-E and Laguna-E small-lift class vehicles. The OLS is proposed to be built on 21 acres of undeveloped land in the South Base portion of VSFB in Santa Barbara County, California. The proposed launch site was historically occupied by Space Launch Complex (SLC)-5, which was previously demolished to bare earth around 2012, except for access roads which still connect the site to Coast Road, a main thoroughfare.

The proposed *Phantom Space SLC-5 OLS Project* would include the construction of a new space launch complex designated as SLC-5. The new SLC-5 will include two, 1,500 square feet concrete launch pads (designated SLC-5 East and SLC-5 West), an assembly facility, refurbishment facility, payload processing facility, launch and mission control center, customer support facility, and storage for ground support equipment. The new launch complex will require dedicated utilities such as electric circuits, communication, and water lines, and a fence line and fire breaks will be constructed around the perimeter. Altogether, the project components (launch site, utility corridor, roads, firebreaks, and vegetation management areas) total 21 acres.

VSFB determined the Project is an undertaking subject to compliance with Section 106 of the National Historic Preservation Act of 1966, as amended, and will comply with Section 106 using the implementing regulations [36 CFR Part 800]. VSFB has carried out a reasonable and good-faith cultural resources investigation that fulfills federal agency responsibilities pursuant to 36 CFR 800.4(a)-(d) and 36 CFR 800.5(a)-(d). With this letter and the accompanying report, VSFB is initiating consultation with the Tribe.

Phantom Space Corporation contracted Applied Earthworks to conduct a cultural resources study of the Project Area of Direct Impacts (ADI), and to prepare an analysis specifically addressing potential impacts on cultural resources from rocket engine noise and sonic boom vibrations associated with static tests and launches from the proposed Phantom Space OLS. A threshold of 120 decibels (dB) has been established, above which historic properties could be susceptible to damage. An analysis was performed to delineate an area where noise levels are expected to exceed 120 dB, and that area was delineated as a 3,200-feet radius around the proposed launch pads. Sonic booms associated with launches were also considered and are measured as pressure in pounds per square foot (psf). The threshold for damage resulting from sonic booms (overpressure) is established at two psf or greater. Both Phantom rockets will produce a sonic boom of less than 2 psf, which will occur over open ocean more than 20 miles south and west of the Santa Barbara Channel Islands.

No prehistoric rock art, rock cairns, rock shelters, or structures constructed of rock, wood, glass block, or adobe, which could be affected by launch noise vibrations were identified within the polygon of the noise vibration study. Only one historic-age built-environment resource, the Union Pacific Railroad's Honda trestle, is situated within the 120 dB noise vibration contour. This steel structure, constructed to withstand strong vibrations and concussive forces, has no potential to be affected by noise vibrations, and therefore, it is excluded from the Area of Potential Effect (APE).

The Juan Bautista de Anza National Historic Trail is mapped as intersecting the launch noise contour, along the coast approximately 2,000 feet to the west of the proposed launch pads. There is no physical manifestation of the former Anza Trail route anywhere near this location, and therefore, this portion of the Anza Trail is only eligible for the NRHP in concept. This project has no potential to impede the public's perception of the route that Anza followed along the coast in the vicinity of the Project. Furthermore, the construction and use of SLC-5 would not introduce any visual or auditory elements which would have the potential to cause effects to this historic property under 36 CFR 800.3(a)(1); therefore, the Anza Trail was considered in this study, but it has been excluded from the APE because it has no potential to be affected.

Background research revealed that four archaeological sites (CA-SBA-538, -670, -2230, and -2934) were previously recorded within the ADI. CA-SBA-670 was previously determined eligible for the NRHP through Executive Order 11593. CA-SBA-538 and CA-SBA-2230 were previously determined ineligible for the NRHP (USAF110418A). The NRHP eligibility of CA-SBA-2934 was unevaluated prior to the current study.

Neither CA-SBA-538 nor CA-SBA-2230, which were previously evaluated as ineligible for the NRHP, were tested during the current investigation. Archaeological investigations revealed that CA-SBA-2934 is no longer present, likely due to ground disturbance associated with the demolition of SLC-5. In fact, archaeological testing did not yield any archaeological materials anywhere within the Project ADI. No testing was performed in the portion of NRHP-eligible CA-SBA-670 within the ADI because Project activities within the site boundaries would be limited to clearing vegetation from the existing pavement. Protective fencing will be installed to ensure Project activities do not extend beyond the existing roadway of Honda Canyon Road and encroach into CA-SBA-670. Furthermore, noise vibrations would not disturb the significant aspects of CA-SBA-670, as it contains only surface and/or buried archaeological material that would not be affected by rocket engine noise because soils would protect materials in place.

Details of the investigation are provided in the attachment; however, briefly stated, VSFB has determined the following:

a. The APE for the Phantom Space SLC-5 OLS Project is adequately delineated; and

b. The undertaking will have *no adverse effect* on historic properties.

VSFB has reached a Section 106 finding of *No Adverse Effect* for this undertaking. The Base recognizes that the Santa Ynez Band of Chumash Indians may have concerns beyond the purview of the National Historic Preservation Act. Therefore, I am seeking any additional comments or concerns you may have about cultural resources. I would appreciate receiving any feedback as part of this consultation within the next 30 calendar days. Please feel free to let me know if you require additional time. I can be reached at (760) 419-0092 or via email at stacy.smallwood.1@spaceforce.mil. Thank you for your assistance with this undertaking.

Sincerely

S. Josh Smallwood

JOSH SMALLWOOD, M.A., RPA
Base Archaeologist
Asset Management Flight

Attachment:
Identification of Historic Properties and Assessment of Effects, Phantom Space SLC-5 Orbital Launch Site Project (813-21-052)

From: Wendy Teeter
To: SMALLWOOD, STACY J GS-12 USSF SSC 30 CES/CEIEA
Cc: Nakia Zavalla; Crystal Mendoza
Subject: [Non-DoD Source] RE: Phantom Space at SLC-5 (813-21-052)
Date: Thursday, May 26, 2022 11:51:35 PM

Dear Josh,

Thank you for the information related to this project and the findings from the investigation into impacts from this undertaking. We have no concerns with the project using your avoidance methods. If any tribal cultural resources will be impacted during this project we would request a tribal monitor be present. Would you please include Crystal Mendoza, the Tribe's Cultural Resources Administrative Assistant moving forward. She is extremely helpful in making sure we get back to you in a more timely manner.

Best wishes,

Wendy

Wendy Giddens Teeter, PhD, RPA

Cultural Resources Archaeologist | Elders' Council and Culture Department

Santa Ynez Band of Chumash Indians

wteeter@santaynezchumash.org <mailto:wteeter@santaynezchumash.org>

cell: 805-325-8630

From: SMALLWOOD, STACY J GS-12 USSF SSC 30 CES/CEIEA <stacy.smallwood.1@spaceforce.mil>
Sent: Monday, April 25, 2022 10:12 AM
To: Nakia Zavalla <NZavalla@santaynezchumash.org>
Cc: Wendy Teeter <WTeeter@santaynezchumash.org>
Subject: Phantom Space at SLC-5 (813-21-052)

Dear Ms. Zavalla,

Phantom Space Corporation proposes to construct and operate a completely new orbital launch site (OLS) at Vandenberg Space Force Base (VSFB) in order to launch its Daytona-E and Laguna-E small-lift class vehicles. The OLS is proposed to be built on 21 acres of undeveloped land in the South Base portion of VSFB in Santa Barbara County (see attachments).

VSFB has reached a Section 106 finding of No Adverse Effect for this undertaking. The Base recognizes that the Santa Ynez Band of Chumash Indians may have concerns beyond the purview of the National Historic Preservation Act. Therefore, I am seeking any additional comments or concerns you may have about cultural resources. I would appreciate receiving any feedback as part of this consultation within the next 30 calendar days. Please feel free to let me know if you require additional time. I can be reached at (760) 419-0092 or via email at stacy.smallwood.1@spaceforce.mil <mailto:stacy.smallwood.1@spaceforce.mil> . Thank you for your assistance.

-Josh

Josh Smallwood, M.A., RPA

Historic Preservation Manager

SLD 30 CES/CEIEA

1028 Iceland Avenue, Building 11146

Vandenberg Space Force Base, CA 93437-6010

Mobile: 760-419-0092

APPENDIX D
California Coastal Commission Consultation

DEPARTMENT OF THE AIR FORCE
UNITED STATES SPACE FORCE
SPACE LAUNCH DELTA 30

23 November 2022

Beatrice L. Kephart
30 CES/CEI
1028 Iceland Avenue
Vandenberg SFB CA 93437-6010

Cassidy Teufel
Federal Consistency Coordinator
Energy, Ocean Resources and Federal Consistency
California Coastal Commission
455 Market Street, Suite 228
San Francisco, CA 94105-2219

Dear Mr. Teufel,

Under the Federal Coastal Zone Management Act (CZMA) of 1972, as amended, Section 307c(l), and 15 Code of Federal Regulations Part 930, the Department of the Air Force (DAF) has determined that the Propsed Action, development and operation of Phantom Space Corporations Daytona-E and Laguna-E Launch Operations at Space Launch Complex 5, on Vandenberg Space Force Base, California is consistent to the maximum extent practicable with the California Coastal Management Plan, pursuant to the requirements of the CZMA. We respectfully request that the Coastal Commission concur with our Consistency Determination.

The Attachment to this letter serves as the analytical basis for the Consistency Determination. The DAF is preparing the Environmental Assesment in accordance with the National Environmental Policy Act and its implementing regulations.

If you need additional information or have questions, please call me at (805) 605-7924 or email at beatrice.kephart@spaceforce.mil. You can also call Tiffany Whitsitt-Odell at (805) 606-2044 or email at tiffany.whitsitt-odell@spaceforce.mil.

Sincerely

BEATRICE L. KEPHART
Chief, Installation Management Flight

Attachment:
CZMA CD for Phantom Space Corporation Daytona-E and Laguna-E Launch Operations
Biological Assessment for the Phantom Launch Program

STATE OF CALIFORNIA - NATURAL RESOURCES AGENCY GAVIN NEWSOM, *GOVERNOR*

CALIFORNIA COASTAL COMMISSION
ENERGY, OCEAN RESOURCES AND FEDERAL CONSISTENCY
455 MARKET STREET, SUITE 300
SAN FRANCISCO, CA 94105-2421
VOICE (415) 904-5200
FAX (415) 904-5400

December 7, 2022

Beatrice L. Kephart
30 CES/CEI
1028 Iceland Avenue
Vandenberg SFB, CA 93437-6010

Re: **Consistency Determination No. CD-0010-22: Phantom Space Corporation's Daytona-E and Laguna-E Launch Sites and Operations**

Dear Chief Kephart,

On November 23, 2022, California Coastal Commission (Commission) staff received a consistency determination (CD) from the United States Space Force (Space Force) for the development and operation of Phantom Space Corporation's (Phantom) Daytona-E and Laguna-E Launch sites. The launch sites at Space Launch Complex 5 (SLC-5) include infrastructure to conduct launches of Daytona-E and Laguna-E launch vehicles. This location on SLC-5 was formerly used by the National Aeronautics and Space Administration to launch Scout space launch vehicles. Phantom anticipates a maximum of 48 launches annually and an additional 48 static fire tests annually.

Commission staff has reviewed your consistency determination and supporting materials and determined that the consistency determination remains incomplete and cannot be filed pursuant to Section 930.41(a) of the Coastal Zone Management Act until the following additional information is provided.

Project Description and Alternatives

1. *Near Simultaneous Operations and Cumulative Impacts:* Please provide more detail on the "near simultaneous" operations required by Phantom, as described in the alternatives analysis. Please describe what this entails, how much time would elapse between the launches or tests, and how the cumulative impacts of near simultaneous operations were addressed in the analysis.
2. *Alternative locations:* Please provide a brief description of why the alternative locations at the Pacific Spaceport Complex in Kodiak, Alaska were eliminated from consideration.

Biological Resources

1. *Proposed location relative to former NASA launch site:* Please provide a map showing the extent to which the proposed launch sites overlap with the location of former NASA launch site.
2. *Vegetation Mapping:* Please provide a vegetation map of the proposed project disturbance area that identifies the size and location of the vegetation alliances

within it. Please use those alliances identified in the Manual of California Vegetation Second Edition (Manual) (Sawyer,Keeler-Wolf and Evens 2009; available online at https://vegetation.cnps.org). The Manual should be used when describing existing conditions in environmental documents, assessing impacts, and mapping vegetation. The vegetation maps provided in the consistency determination materials make use of broad general categories of vegetation communities (such as "iceplant," "chaparral," "coastal scrub," etc.) rather than the standard vegetation alliance classifications from the Manual, and the relationship between these broad categories and the standard classifications is unclear.

3. *Wetlands:* Please provide maps of the proposed project site and adjacent areas showing the extent and location of single-parameter wetlands. Please also provide the wetland delineation data sheets used to develop these maps.

4. *Wildlife:* Please provide maps of the known locations of wildlife use areas (seabird roosting or nesting areas, marine mammal haul-outs, etc.) within the larger project area that may be adversely affected by the proposed construction and operation of SLC-5. Please provide the locations of wildlife use areas on the noise and sonic boom maps.

5. *Habitat Disturbance:* Please provide figures and quantification of all temporary and permanent habitat disturbance areas for each of the individual project components including the proposed areas of firebreaks and fuel reduction zones and what type of disturbance is proposed to take place within these areas. The quantification should also include the estimated volume of material to be graded, filled or excavated, and information on where excavated or fill materials would be imported from or exported to. Please include a topographic map with areas planed for cut and fill marked.

6. *Sensitive Species Surveys:* Please provide information regarding the potential presence of any California endangered or threatened plants and animals and any California species of special concern and/or fully protected species that may occupy the habitats within the proposed Phantom project footprint. Upon identification of the potential presence of such species please provide the appropriate protocol level surveys for the respective species.

7. *California Red-Legged Frog:* Please provide a rationale for the threshold identified (a decrease of 15%) to require mitigation for disturbance to California Red-legged frog. Please also describe how the monitoring plan proposed will enable Space Force to make the determination that a 15% decrease in California red-legged frog was due to launch noise, rather than other factors.

8. *Thresholds for Adverse Impacts:* Please provide the thresholds proposed for determining adverse impacts to other special-status species.

Water Quality

1. *Spill Prevention and Response:* Please provide any protective measures planned for spill prevention, containment, and response during launch operations.

2. *Deluge Water:* Please provide information on the potential water quality contaminants that may be present in deluge water after a launch. Please describe the water quality testing that will be performed prior to discharging the deluge water, where the clean water will be discharged and whether it will flow to Honda creek.

Please also provide more information on the expected water treatment procedures if contaminants are found.

3. *Stormwater Management:* Please provide information on where the stormwater in the stormwater management system will go, including whether it is expected to percolate to groundwater or flow to Honda Creek.
4. *First Stage Separation:* Please provide detail on the ultimate fate of the first stage once it lands in the ocean. Please describe any anticipated efforts to recover the first stage. If the first stage remains in the ocean, please describe the materials expected to be deposited to the ocean and their expected impacts.
5. *Water Supply:* Please provide information on the status and capacity of the current water supply that is expected to be used for the project.

Additional Information

1. *Consultations with other Resource Agencies and Tribal Entities*: Please describe the status of any consultations with other state, federal or local resource agencies and Native American Tribes regarding the project.
2. *Cultural Resources*: Please provide a brief description of the nature of the cultural resources at the proposed project site (e.g. historic building, Chumash site, etc.).
3. *Public Access Closures:* The CD application states that Phantom expects to conduct up to a combined total of 96 static fire tests and launches. Elsewhere the application states that closures to Jalama Beach Campground will not change from current conditions. Please clarify whether launches or tests at SLC-5 will require campground closures.
4. *Visual Simulation:* Please provide a visual simulation of the proposed constructed facility from publicly accessible locations at Jalama State Beach.

Although not required for filing under Section 930.41(a) of the Coastal Zone Management Act, please provide the draft National Environmental Policy Act (NEPA) document for Phantom's proposed project, if available, and provide a timeline for the remainder of the NEPA process. Please also provide a description of the expected greenhouse gas emissions that will result from construction and operation of the project. Finally, please provide a description of the partnership between the Space Force and Phantom, including any leases or contracts for the project.

Pursuant to 15 CFR §930.41(a), the 60-day time period for review of this submittal has not begun and will not begin until the Commission staff receives the information discussed in this letter. If you need further assistance or have any additional questions, please contact me at Holly.Wyer@coastal.ca.gov.

Sincerely,

Holly Wyer

Holly Wyer
Senior Environmental Scientist
Energy, Ocean Resources, and Federal Consistency Division

DEPARTMENT OF THE AIR FORCE
UNITED STATES SPACE FORCE
SPACE LAUNCH DELTA 30

9 November 2023

Beatrice L. Kephart
30 CES/CEI
1028 Iceland Avenue
Vandenberg SFB CA 93437-6010

Cassidy Teufel
Federal Consistency Coordinator
Energy, Ocean Resources and Federal Consistency
California Coastal Commission
455 Market Street, Suite 228
San Francisco, CA 94105-2219

Dear Mr. Teufel,

Under the Federal Coastal Zone Management Act (CZMA) of 1972, as amended, Section 307c(l), and 15 Code of Federal Regulations Part 930, the Department of the Air Force (DAF) has determined that the Propsed Action, development and operation of Phantom Space Corporations Daytona-E and Laguna-E Launch Operations at Space Launch Complex 5, on Vandenberg Space Force Base, California is consistent to the maximum extent practicable with the California Coastal Management Plan, pursuant to the requirements of the CZMA. We respectfully request that the Coastal Commission concur with our Consistency Determination.

The Attachment to this letter serves as the analytical basis for the Consistency Determination. The DAF has prepared a draft Environmental Assesment (attached) in accordance with the National Environmental Policy Act and its implementing regulations.

If you need additional information or have questions, please call me at (805) 605-7924 or email at beatrice.kephart@spaceforce.mil. You can also call Tiffany Whitsitt-Odell at (805) 606-2044 or email at tiffany.whitsitt-odell@spaceforce.mil.

Sincerely

BEATRICE L. KEPHART
Chief, Installation Management Flight

Attachment:
CZMA CD for Phantom Space Corporation Daytona-E and Laguna-E Launch Operations
Draft Environmental Assessment for Phantom Space Corporation

COASTAL ZONE MANAGEMENT ACT CONSISTENCY DETERMINATION FOR Phantom Space Corporation Daytona-E and Laguna-E Launch Operations at Space Launch Complex 5, Vandenberg Space Force Base, California

November 2023

Prepared for

Space Launch Delta 30, Installation Management Flight
1028 Iceland Avenue, Bldg. 11146
Vandenberg Space Force Base, California 93437

Prepared by

ManTech SRS Technologies, Inc.
300 North G Street
Lompoc, CA 93436

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ACRONYMS AND ABBREVIATIONS

BCI	Bat Conservation International
BMPs	Best Management Practices
BO	Biological Opinion
CARB	California Air Resources Board
C.F.R.	Code of Federal Regulations
CCA	California Coastal Act
CCMP	California Coastal Management Plan
CD	Consistency Determination
CDFW	California Department of Fish and Wildlife
CNDDB	California Natural Diversity Database
CNEL	A-weighted Community Noise Equivalent Level
CNPS	California Native Plant Society
CRLF	California red-legged Frog
CY	cubic yard(s)
CZMA	Coastal Zone Management Act
DAPTF	Declining Amphibian Populations Task Force
dB	decibel(s)
dBA	A-weighted decibel(s)
DOD	Department of Defense
E	East
EA	Environmental Assessment
EPMs	Environmental Protection Measures
ESA	Endangered Species Act
ESHA	Environmentally Sensitive Habitat Areas
FAA	Federal Aviation Administration
ft	foot or feet
ft^2	square feet
GN2	gaseous nitrogen
GSE	ground support equipment
HIF	Horizontal Integration Facility
HP	horsepower

ISO	Organization for Standardization
IWTP	Industrial Wastewater Treatment Ponds
kg	kilogram(s)
km	kilometer(s)
LAA	May affect, likely to adversely affect
Lmax	maximum sound level
lbf	pound force
lbs	pounds
LEO	low-earth orbit
LOA	Letter of Authorization
LOX	liquid oxygen
LP	Launch Pad
m	meter(s)
mi	mile(s)
MMPA	Marine Mammal Protection Act
MSRS	ManTech SRS Technologies, Inc.
NA	Not Applicable
NCI	Northern Channel Islands
NE	No Effect
NL	Not Listed under the ESA
NLAA	May affect, not likely to adversely affect
NMFS	National Marine Fisheries Service
NOTAM	Notices to Airmen
NOTMARs	Local Notices to Mariners
NRHP	National Register of Historic Places
OWTS	Onsite Wastewater Treatment Systems Manual
Phantom	Phantom Space Corporation
PSCA	Pacific Spaceport Complex
psf	pounds per square foot
RP-1	Rocket Propellant 1
RWQCB	California Regional Water Quality Control Board
SBCAPCD	Santa Barbara County Air Pollution Control District
scf	standard-cubic-foot
SECDEF	Secretary of Defense
SEL	sound exposure level
SLC	Space Launch Complex
SLD 30	Space Launch Delta 30
SMR	State Marine Reserve
SPCC	Spill Prevention, Contingency, and Countermeasures
TEA-TEB	triethylaluminum-triethylboron
TEV	Transporter Erector Vehicle
U.S.	United States
U.S.C.	United States Code
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
VHA	Vehicle Hazard Area

VSFB	Vandenberg Space Force Base
VTF	Vertical Test Facility
W	West

1 INTRODUCTION

Space Launch Delta 30 (SLD 30) of the Department of the Air Force (DAF), United States (U.S.) Space Force (hereinafter, Space Force) submits this Consistency Determination (CD) for the California Coastal Commission's review. The Proposed Action would implement Phantom Space Corporations (Phantom) Daytona-E and Laguna-E launch program and associated construction of a new launch facility at Space Launch Complex (SLC)-5 on Vandenberg Space Force Base (VSFB; Figure 1-1).

The purpose of the Proposed Action is to address lack of accessible U.S. enterprise access to space and to fulfill requirements of commercial and governmental entities in the small satellite orbital and suborbital market. Phantom's mission is to provide low-cost access to satellite technology by mass manufacturing launch vehicles, satellites, and space propulsion systems. Over the past several years, the Department of Defense (DOD) and intelligence community have shifted from the use of U.S. government-developed rockets to nearly exclusive reliance upon the commercial space transportation industry for reliable, affordable, and agile access to space for national security missions. This new model has proven valuable and the shift to commercial launch service providers for national security missions is now DOD's standard practice.

The Space Force's mission to "secure our Nation's interests in, from, and to space" is enabled by Space Systems Command's largest organization, the Assured Access to Space Directorate. The Assured Access to Space Directorate procures launch services from the commercial space transportation industry at VSFB. Space launch for the Space Force, other DOD organizations, and the intelligence community simply cannot be accomplished without commercial space launch service providers, like Phantom. As a U.S.-based and 100% U.S.-controlled space launch company, Phantom is one of a few small-class launch service providers available to the U.S. government for U.S. national security space missions. Phantom and the Space Force have entered into a Commercial Space Operations Support Agreement to conduct launches safely and efficiently from VSFB. Specific launch mission contracts are competed and awarded, as needed.

The Proposed Action is also consistent with Congress's grant of authority to the Secretary of Defense (SECDEF), pursuant to 10 United States Code (U.S.C.) Section 2276(a), Commercial Space Launch Cooperation, that SECDEF is permitted to take action to:

> (1) maximize the use of the capacity of the space transportation infrastructure of the DOD by the private sector in the U.S.;
>
> (2) maximize the effectiveness and efficiency of the space transportation infrastructure of the DOD;
>
> (3) reduce the cost of services provided by the DOD related to space transportation infrastructure at launch support facilities and space recovery support facilities;
>
> (4) encourage commercial space activities by enabling investment by covered entities in the space transportation infrastructure of the DOD; and
>
> (5) foster cooperation between the DOD and covered entities.

The Proposed Action is needed to fulfill the 2020 National Space Policy (U.S. Government 2020) to reduce space transportation costs and ensure continued exploration, development, and space use are more accessible. Additionally, this Proposed Action would invest in modernizing launch infrastructure through resuming operations at the SLC-5 location, which has been unused since the National Aeronautics and

Space Administration Scout program ended in 1994. The Proposed Action supports SLD 30's vision to become the "world's most innovative space launch and landing team."

By increasing launch capacity at VSFB, the Proposed Action allows continued fulfillment of the 2020 National Space Policy guidelines, including promoting a "robust commercial space industry and strengthen United States leadership as the country of choice for conducting commercial space activities" (U.S. Government 2020). The Proposed Action ensures that U.S. space launch capability is not reduced or limited, and that the U.S. remains the leader in space launch technology.

One important benefit to the federal government for using commercial launch service providers versus the historical approach of U.S.-government development rockets is the reduced costs to the American taxpayer. Lower launch costs are a direct value to the American taxpayer and allows the DOD to field space systems more efficiently to counter increased adversary space threats and enhance U.S. space-based services to U.S. and allied warfighters. Cost benefits are realized through competitive commercial launch pricing which is created in-part by efficient commercial launch operations. For example, Phantom realizes launch efficiency by operating from SLC-5 in an airport-like manner, including maximizing the use of the launch complex with a frequent cadence of multiple launch vehicles. Also, by maximizing the use of a given launch complex, Phantom can optimize spacecraft payload processing, logistics, launch system preparation, scheduling, and staffing. This is similar to an airline maximizing the use of a gate at a hub airport. Furthermore, VSFB's existing national security infrastructure, policies, and procedures ensure national security missions are properly protected. Fracturing launch operations at multiple sites increases costs to launch customers, including national security missions, and increases risks and costs to protecting national security.

1.1 AUTHORITY

This CD is being submitted by the Space Force in compliance with Section 930 et seq. of the National Oceanic and Atmospheric Administration Federal Consistency Regulations (15 Code of Federal Regulations [C.F.R.] Part 930). The Space Force prepared this CD per Section 307(c)(1)(A) of the CZMA, as amended, 15 C.F.R. Part 930, and the enforceable policies of the California Coastal Act (CCA) (California Public Resources Code, Division 20).

1.2 DETERMINATION

The project launch site (SLC-5) is located within the boundary of VSFB and owned by the Department of Defense. Although the CZMA federal lands definition excludes federal lands from the coastal zone, actions within them must be reviewed for consistency with the CCMP to the maximum extent practicable.

Phantom activities for construction and operation of SLC-5 have been developed to minimize and/or mitigate potential effects to coastal uses and/or resources to comply with the enforceable policies of the CCA, to the maximum extent practicable. Based on the review of the Proposed Action's compliance with the CZMA, the Space Force has determined that the Proposed Action is consistent to the maximum extent practicable with the CCMP, pursuant to the requirements of the CZMA.

1.3 CONSULTATIONS WITH OTHER RESOURCE AGENCIES AND TRIBAL ENTITIES

SLD 30 completed Section 7 consultations with the National Marine Fisheries Service (NMFS) and United States Fish and Wildlife Service (USFWS). NMFS provided a Section 7 concurrence letter on 4 May 2022 (WCRO-2022-00970). The existing SLD 30 Letter of Authorization issued by NMFS for Level B harassment of marine mammals incidental to launch activities covers the Proposed Action. Formal Section 7 consultation with the USFWS was completed and a Biological Opinion (BO) issued for the Proposed Action on 24 April 2023 (08EVEN00-2022-0045260-S7). SLD 30 is required to comply with the National Historic Preservation Act and completed Section 106 consultation when the SHPO concurred with SLD 30's determination of no adverse effect to historic properties in their Section 106 concurrence letter received on 17 May 2022 (USAF_2022_0505_001). SLD 30 completed tribal consultation on a government-to-government basis with the Santa Ynez Band of Chumash Indians, a federally recognized tribe. The Santa Ynez Band of the Chumash Indians responded on 26 May 2022 and requested a tribal monitor be present during ground disturbance in and near known prehistoric sites.

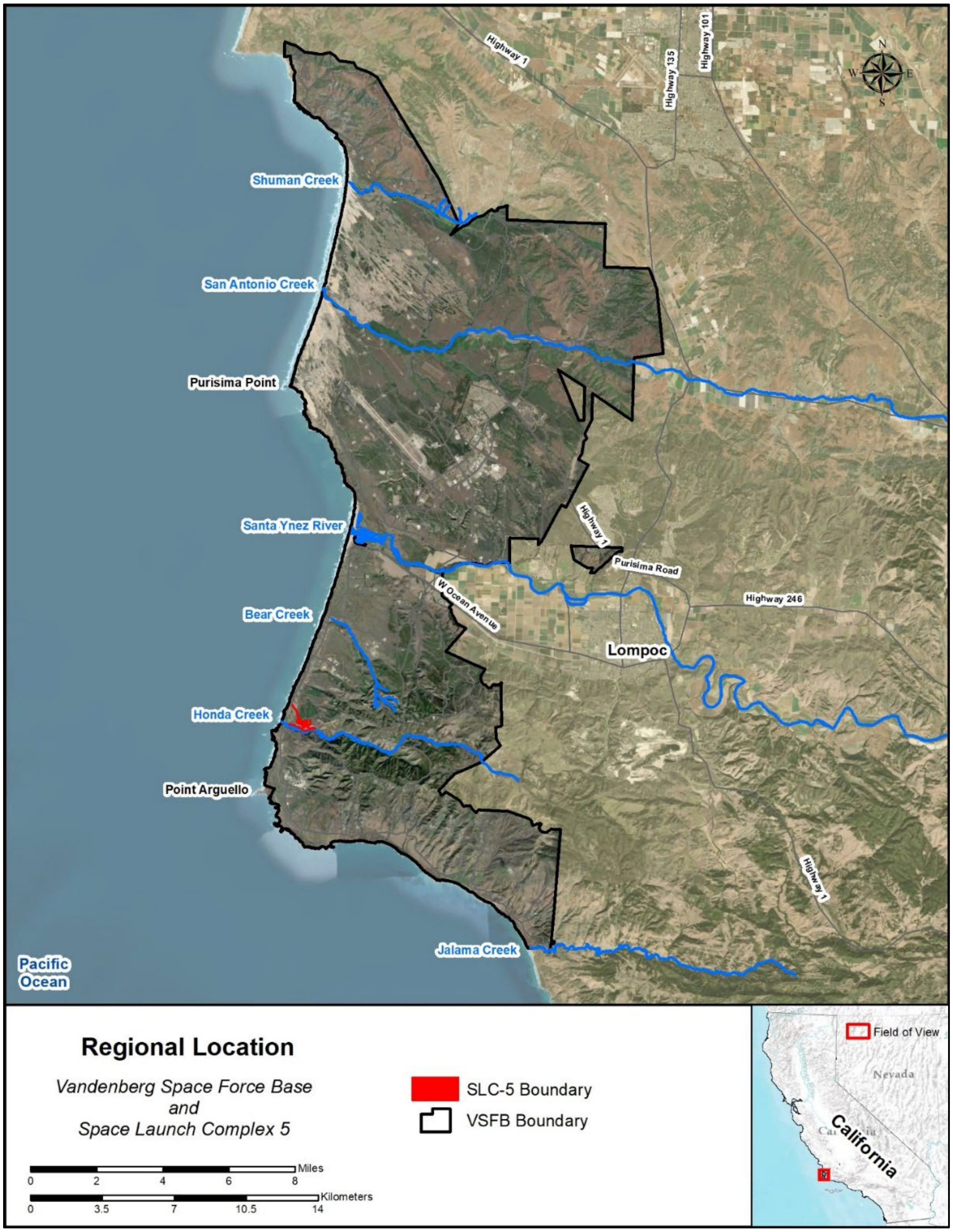

Figure 1-1: Regional location of Proposed Action Area

2 DESCRIPTION OF PROPOSED ACTION

2.1 PROPOSED ACTION

The Proposed Action is to re-construct a launch facility at the same SLC-5 location used by NASA between 1962 and 1994 to launch Scout space launch vehicles (Figures 2-1 through 2-3). At the completion of the Scout program in 1994, all facilities at SLC-5 were deactivated and then demolished between 2009 and 2012. Access roads and nearby utility lines were left in place, providing some existing infrastructure that facilitates redevelopment of this launch site. The new SLC-5 launch facilities will operate Phantom Space Corporation's (Phantom) Daytona-E and Laguna-E launch program (Figure 1-1). Phantom would construct two launch pads and a Horizontal Integration Facility (HIF) at the site and install utilities and firebreaks. To meet fire safety standards, fire access roads around SLC-5 would require improvements and repairs. Phantom proposes to perform up to a combined total of 48 launches of the Daytona-E and the Laguna-E from SLC-5 annually. In addition, Phantom would conduct up to 48 vertical tests (static fire) annually. The following subsections detail the various components of the Proposed Action.

Figure 2-1: Photos of prior Scout Launch Site

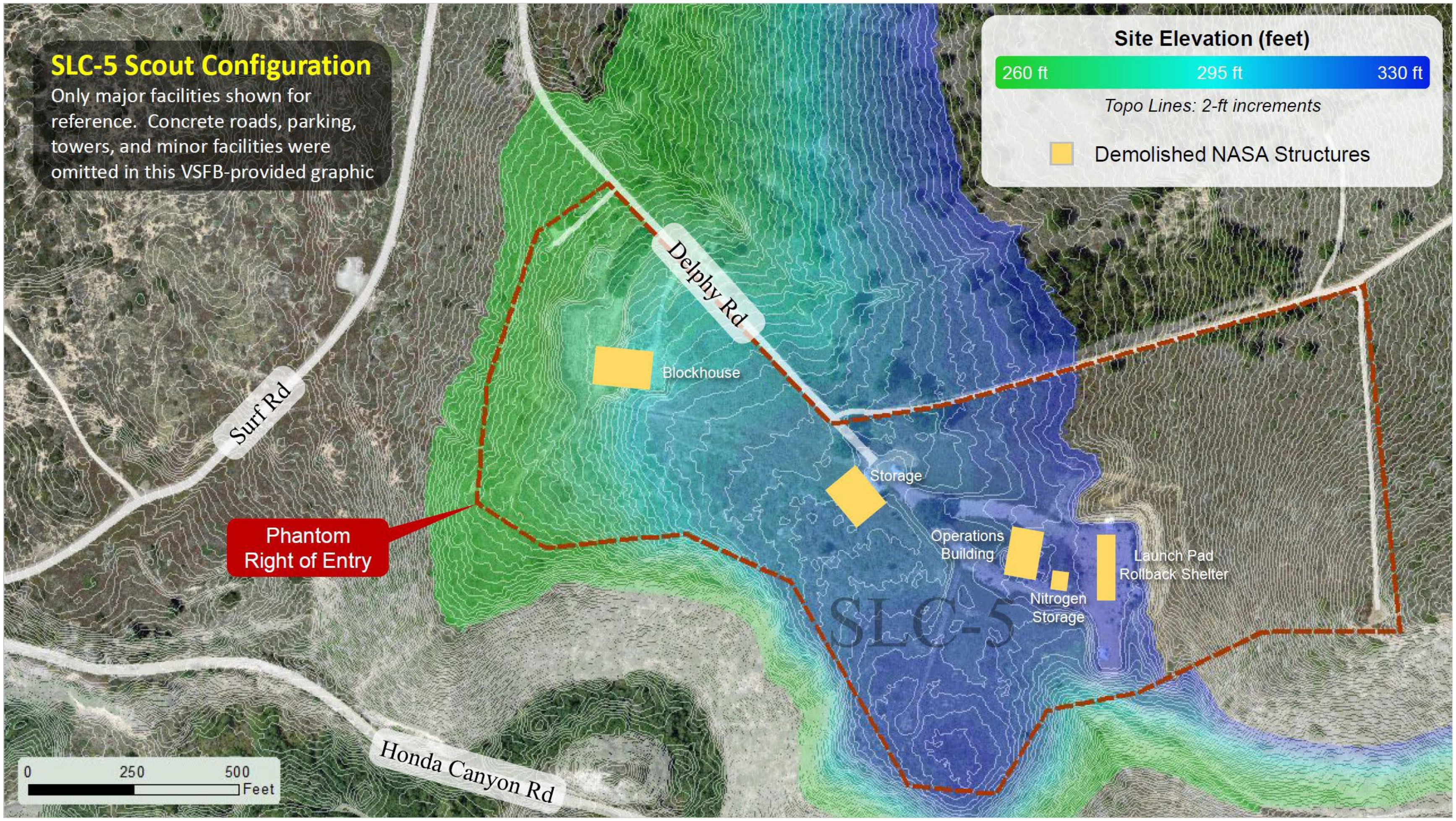

Figure 2-2: Primary Scout facilities and SLC-5 right of entry

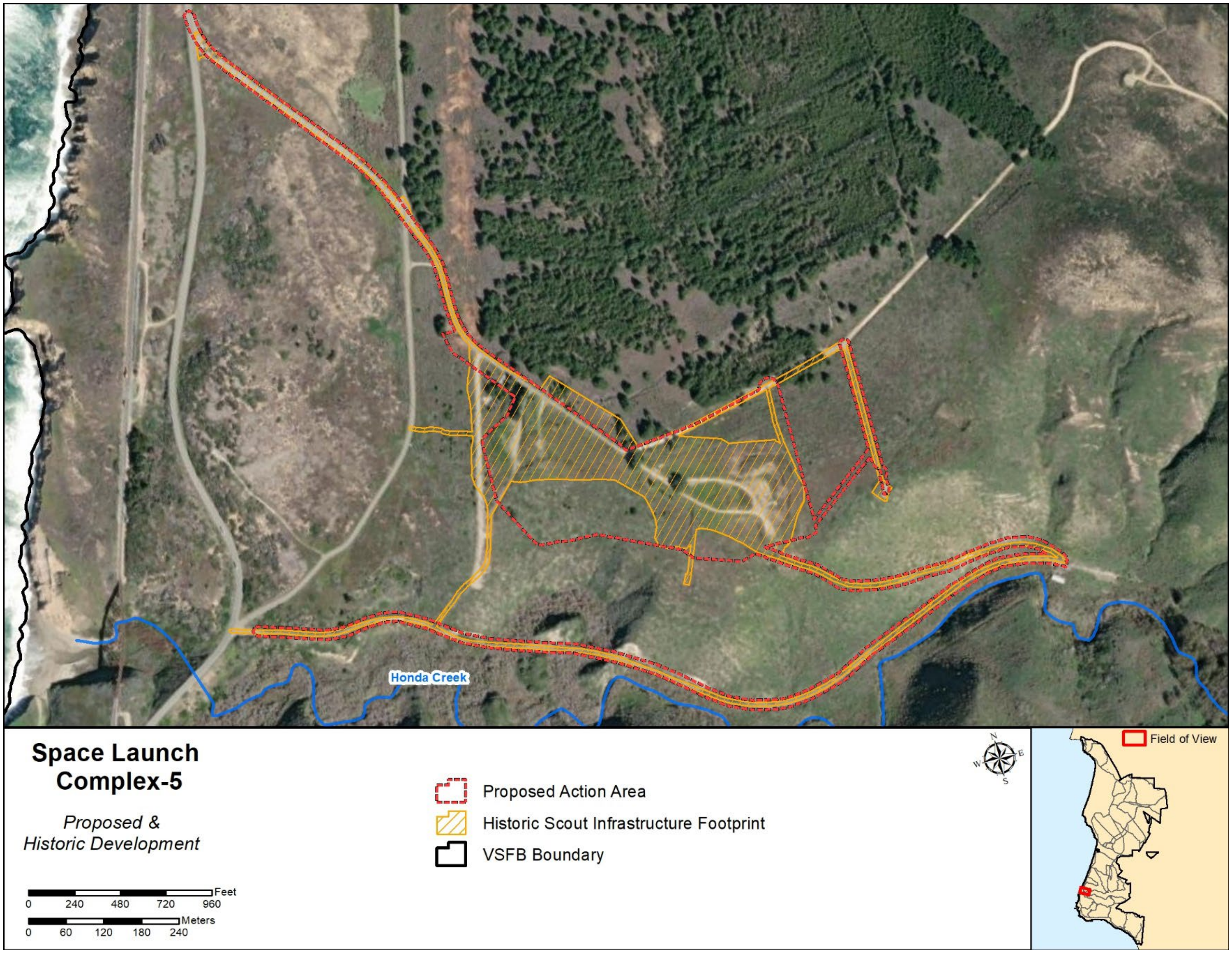

Figure 2-3: Overlay of historic infrastructure footprint and Proposed Action Area

2.1.1 Concept of Operations

Phantom would perform primary vehicle and payload assembly offsite at the existing Phantom Factory in Tucson, Arizona, where first and second stages would be produced on assembly lines leveraging engines from Ursa Major in Denver, Colorado, other commercial supply chain vendors, and in-house fabrication of major components. Once assembled, the rockets would be shipped via commercial truck transport to VSFB. Payloads would be shipped from several locations, including Phantom's factories in Arizona, Florida, Colorado, and California. Final integration would be performed at SLC-5 with marriage of first and second stages and customer payload integration utilizing a HIF. Because the HIF would be constructed in Phase I-b (see Section 2.1.3, below), Phantom would initially install a temporary building for staging and payload integration. The flight-ready vehicle would then be mounted on a Transporter Erector Vehicle (TEV) and transported to one of two launch pads (SLC-5 East [E] and SLC-5 West [W]; Figure 2-5), erected, and mounted to a launch stool (Figure 2-4). Both Daytona-E and Laguna-E utilize liquid oxygen (LOX) and rocket propellant-1 (RP-1) or Jet-A, which would be loaded prior to launch. Both vehicles are described in greater detail in the following section. Phantom will coordinate each launch using a local operations center, to be housed at an existing VSFB facility, and an offsite Mission Operations Control center in Tucson, Arizona. Tracking equipment and instrumentation would be located at SLC-5 to support launches.

Figure 2-4: Launch Stool (conceptual design)

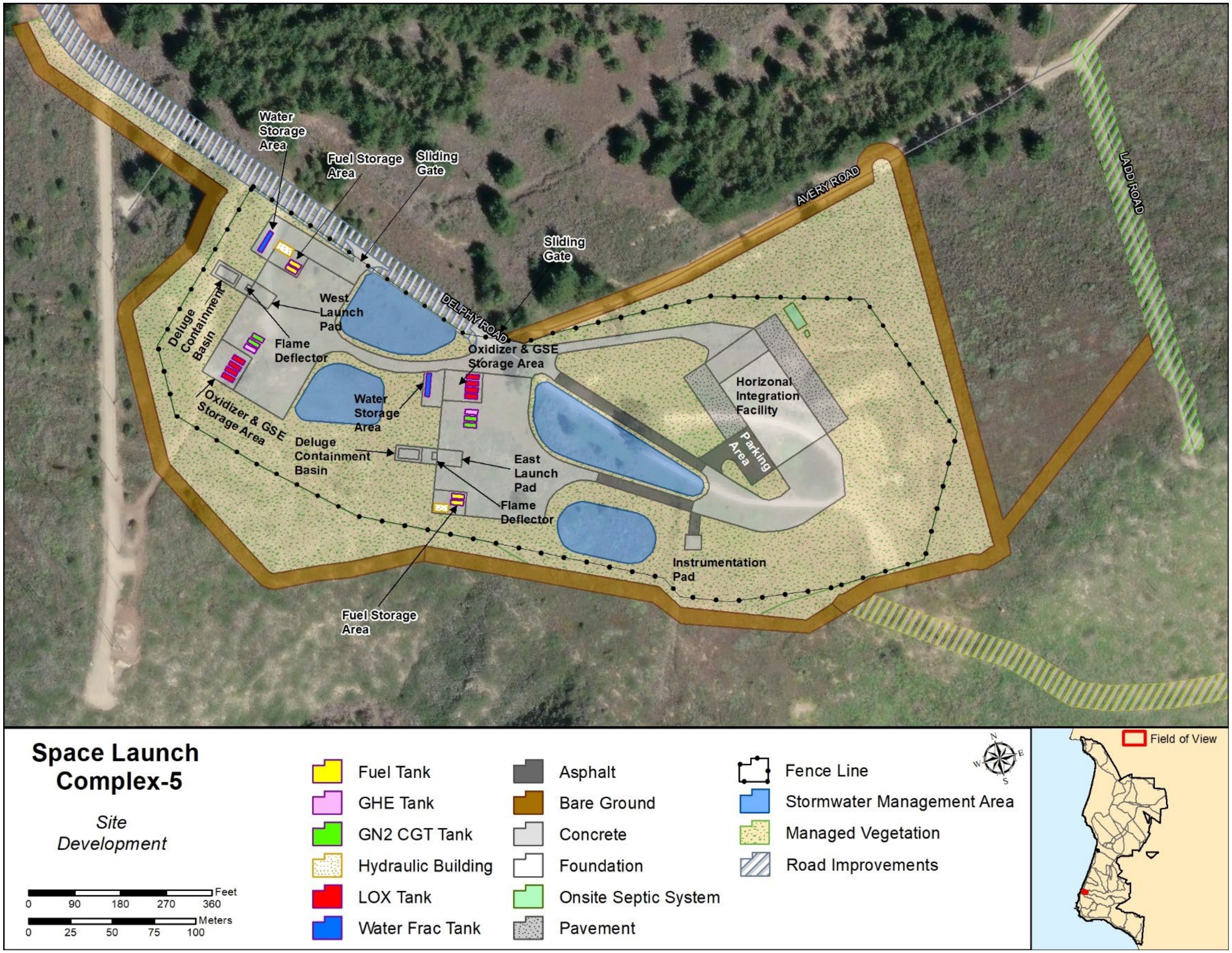

Figure 2-5: Conceptual Site Plan

A stationary 533 horsepower (HP) generator would be kept on site during launch operations for emergency backup power. This generator would be used as an emergency back-up power source only. Generators require maintenance and testing per manufacturers recommendations to ensure they are ready in an emergency situation. Maintenance and testing also ensures generators perform efficiently when needed. In addition, Phantom may rely on a second 533 HP generator as primary power for SLC-5 for the first three years of operations if the installation of electrical utilities connecting to existing VSFB circuits is delayed (see Section 2.1.5). As applicable, maintenance and testing activities for stationary and portable generator engines will be complied with according to federal, state, and local air quality regulations and permits.

Initially, mobile 24,000 standard-cubic-foot (scf) tube bank trailers would supply gaseous helium (one tube trailer per pad) and gaseous nitrogen (GN2) (two tube trailers per pad) to on-site ground support equipment (GSE) during launch operations. However, once approaching full launch cadence at SLC-5, Phantom would install a connection line to VSFB's high-pressure GN2 line through the utility corridor following Delphy Road, but still maintain at least one mobile tube bank trailer for GN2 onsite. A kerosene (RP-1 or Jet-A) fuel storage area would be designated for placement of International Organization for Standardization (ISO) portable tanks. At each SLC-5W and SLC-5E, up to two 20-ft 5,500-gallon ISO tanks would be connected to a fuel transfer manifold. The fuel transfer manifold would include a 275-gallon-per-minute pump, isolation valves, and 4-inch line from the storage area to the pad. There would be up to approximately 20,100 gallons of kerosene (RP-1 or Jet-A) stored in portable ISO tanks at SLC-5. Fuel transfer manifolds would provide basic filtration and a means to de-tank the launch vehicle. LOX storage would be provided by up to six 20-ft portable ISO tanks at each pad, or a total of approximately 26,000 gallons of LOX per pad.

In ignitor fill module would support the ignition systems for the Daytona-E and Laguna-E launch vehicles and Phantom first and second stage engines. This module would either supply gaseous oxygen and hydrogen or triethylaluminum-triethylboron (TEA-TEB) for ignition. After launch, onsite staff would return to the pad to inspect and safeguard the site and reconfigure GSE for storage. Initial activities would include purging lines and storing cart-based GSE systems. Any hazardous waste (e.g., waste kerosene) collected would be disposed of properly per federal, local, and base regulations.

Full SLC-5 cadence will require approximately 25-30 permanent onsite staff to support operations and 10 temporary staff during launches.

2.1.2 Launch Vehicle Descriptions

Daytona-E is an expendable 54.4-foot (ft) two-stage, ground-launched vehicle (Figure 2-6). Both stages use LOX and kerosene-based RP-1 or Jet-A. The first stage utilizes seven Hadley engines (Figure 2-7; later to be converted to a single Ripley engine), the second stage uses a single vacuum optimized Hadly engine. The Hadley engines developed by Ursa Major are pump-fed ultra-high efficiency 3D printed rocket engines. Laguna-E is also a two-stage, expendable rocket, at 78.7 ft (Figure 2-6). The first stage is powered by 3 Ripley engines (Figure 2-7) that utilize LOX and RP-1 or Jet-A propellants. The Ripley engines are also developed by Ursa Major and pump-fed ultra-high efficiency 3D printed rocket engines. The second stage of the Laguna-E uses a single vacuum optimized Hadley engine. Both vehicle's primary structure is high-strength, reliable aluminum alloys.

The Daytona-E uses approximately 1,800 gallons of LOX and 1,000 gallons of RP-1 or Jet-A. Laguna-E utilizes approximately 4,000 gallons of kerosene-based propellant (RP-1 or Jet-A) and approximately 6,500 gallons of LOX. The mobile operations center would command loading and unloading of propellants. In order to reduce risk, the amount of time the vehicle is loaded with propellants and gases would be minimized by rapidly loading them onto the vehicle immediately prior to launch through high-capacity hard lines and flex hoses. Tank pressurization on both vehicles would be achieved with helium. Daytona-E and Laguna-E both utilize hydrogen or TEA-TEB ignition systems.

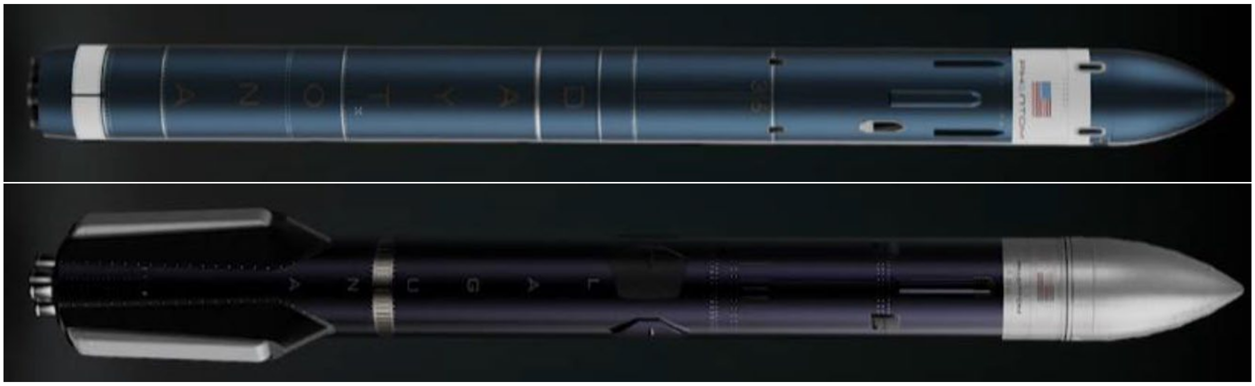

Figure 2-6: Daytona-E (top) and Laguna-E (bottom) Launch Vehicles (note: images not shown to scale)

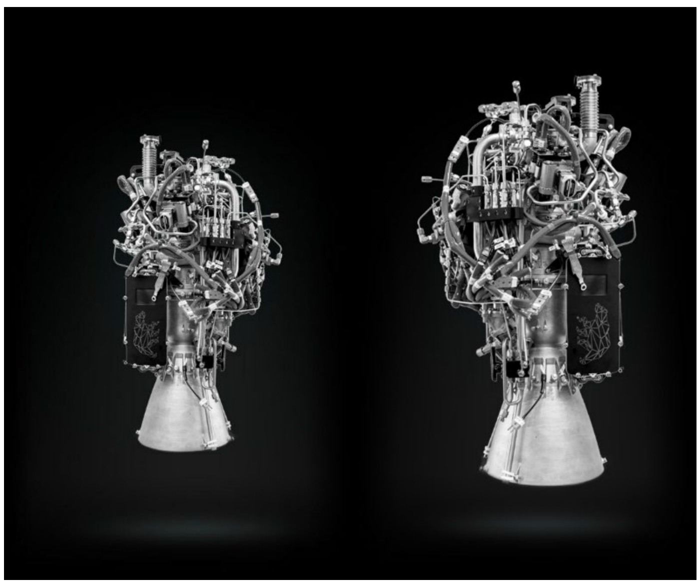

Figure 2-7: Ursa Major 3-D Printed Hadley Engine (left) and Ripley Engine (right)

Table 2-1: Launch Vehicle Specifications

Specification	Daytona-E	Laguna-E
Height	54.4 ft	78.7 ft
Target Mass to LEO	450 kg	1,200 kg
1st Stage Engines	7 Hadley	3 Ripley
2nd Stage Engines	1 Hadley	1 Hadley
Propellant	LOX/RP-1 or Jet-A	LOX/RP-1 or Jet-A
Total Propellant	27,000 pounds	110,000 pounds
Engine Ignition	Hydrogen/TEA-TEB	Hydrogen/TEA-TEB

Tank Pressurization	Helium	Helium
2^{nd} Stage Attitude Control	Hydrogen Peroxide	Hydrogen Peroxide

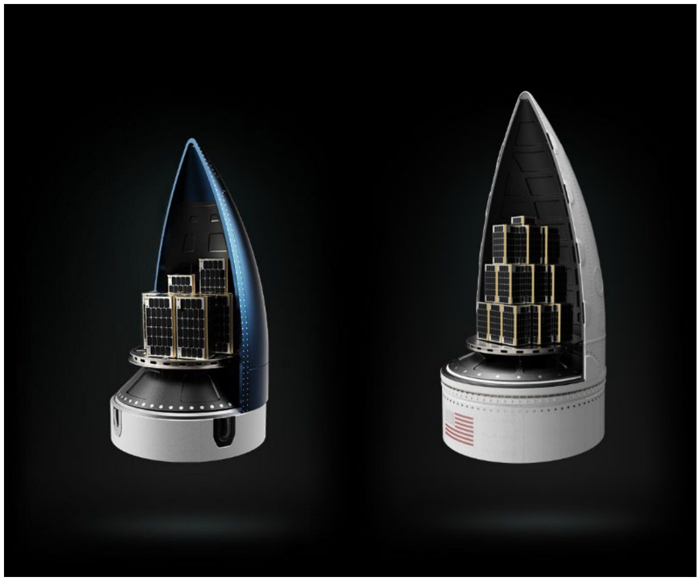

Figure 2-8: Daytona-E Fairing (left) and Laguna-E Fairing (right)

The fairings of both vehicles are designed to protect satellites and spacecraft on their way to orbit, minimizing shock and vibration, and support a wide variety of payloads. The Daytona-E fairing, at approximately 9.2 ft by 4.1 ft, can deliver 450 kilograms (kg) to low-earth orbit (LEO; Figure 2-8; Table 2-1); whereas the 11.5 ft by 6.5 ft Laguna-E fairing can deliver payloads of up to 1,200 kg into LEO (Figure 2-8; Table 2-1).

Stage separation in both vehicles is performed by pneumatic pushers. Phantom plans to use an autonomous flight termination system for the Daytona-E and Laguna-E but may initially utilize manual flight termination systems. Both systems would utilize thrust termination. Onboard power is provided by a series of lithium-ion battery cells.

2.1.3 SLC-5 Construction and Infrastructure Improvements

The SLC-5 launch site was used by National Aeronautics and Space Administration between 1962 and 1994 to launch Scout space launch vehicles. At the completion of the Scout program in 1994, all facilities at SLC-5 were deactivated and then demolished between 2009 and 2012. The proposed new SLC-5 construction is located entirely within the previosuly disturbed area. Required infrastructure improvements are discussed below.

2.1.4 Launch Pad and HIF Construction

Prior infrastructure supporting the Scout launch program at SLC-5 was demolished and removed; however, some additional demolition may be required if any remaining structures or materials are encountered during construction. The Proposed Action would include the construction of two new concrete launch pads – SLC-5E and SLC-5W (Figure 2-5) in three separate phases. Phase I-a would include construction of SLC-5W, site security, roadways, and primary site utility connections (Figure 2-9). During Phase I-b, Phantom would construct the HIF and instrumentation pad. Phase II would incorporate the construction of SLC-5E, supporting roadways, and utility connections. As discussed above, installation of electrical utilities connecting SLC-5 to existing VSFB may be shifted from Phase I-a to Phase I-b or Phase II, in which case, Phantom would rely on a 533 HP diesel powered generator as primary power up to the first 3 years (8 launches) of operations. Each pad would serve dual use as launch pads and Vertical Test Facilities (VTF) and each be approximately 1,500 square feet (ft^2) in area. An approximately 12-ft by 12-ft launch stool would be installed at each pad.

Construction during Phases I and II would require an estimated total of 40,000 cubic yards (CY) of excavation and cut/fill to bring the site to the desired grade and install the structures and supporting infrastructure. An approximately 12.5-ft-deep flame deflector would be constructed under each launch stool that curves from vertical to horizontal to redirect at least 150,000 pound-force (lbf) thrust and ability to contain up to 8,000 -gallons of water deluge. The deflector would have a reinforced concrete mat foundation sized for the engine thrust. The deflector itself would be reinforced concrete and have a short reinforced concrete tunnel that will project the exhaust away from Honda Canyon and the launch vehicle and exit into the water deluge catch basin. The deflector and tunnel will use a refractory concrete top layer to protect the reinforced concrete below. In total, an estimated 10,000 CY of concrete would be required for Phase I and II construction of SLC-5E and SLC-5W. The 7,500-ft^2 HIF would provide a site for payload and stage integration and house up to four 55-gallon drums of RP-1 or Jet-A for engine flow tests. The site would also contain an instrumentation pad located to the southwest of the HIF (Figure 2-5).

Site lighting would be required for the right of entry, roadways, parking areas, building exterior, and launch pads. The lighting would be pole-mounted, bug-friendly, T24 compliant light-emitting diode flood lights. Approximately 36 light poles would be installed around the perimeter and interior of SLC-5. The light poles would have a maximum height of 40 ft and be placed in holes dug down to approximately 20 ft below the surface. The lights would be designed with the minimum lumens needed to meet operational and security requirements and would be shielded to minimize stray light from entering Honda Canyon. A preliminary lighting plan and photometric model are shown in Figure 2-10. These fixtures would be supplied from a lighting panel in the HIF and provided with full astronomical clock and photocell control.

To comply with requirements of Federal Aviation Administration (FAA) Launch Site Operator License approval, the entire SLC-5 complex would be bound by perimeter fencing generally comprised of 7-ft-tall chain link fence with 1-ft outriggers and 3-strand barbed wire.

2.1.5 UTILITIES

New electrical power, fiber communication lines, and water would be extended from existing sources to SLC-5. These utilities would be installed within the footprint of Delphy Road and within a 100-ft-wide utility corridor immediately south of the road (Figure 2-11). Electrical and fiber communication lines would either be buried or installed on poles within this utility corridor or the road to establish new service connections at the launch complex.

The HIF would also require permanent sanitary sewer service which would be comprised of an on-site septic system with a septic tank and leach field (Figure 2-5). The septic system would be designed in accordance with the regulations set forth in the California Regional Water Quality Control Board (RWQCB) Onsite Wastewater Treatment Systems Manual (OWTS).

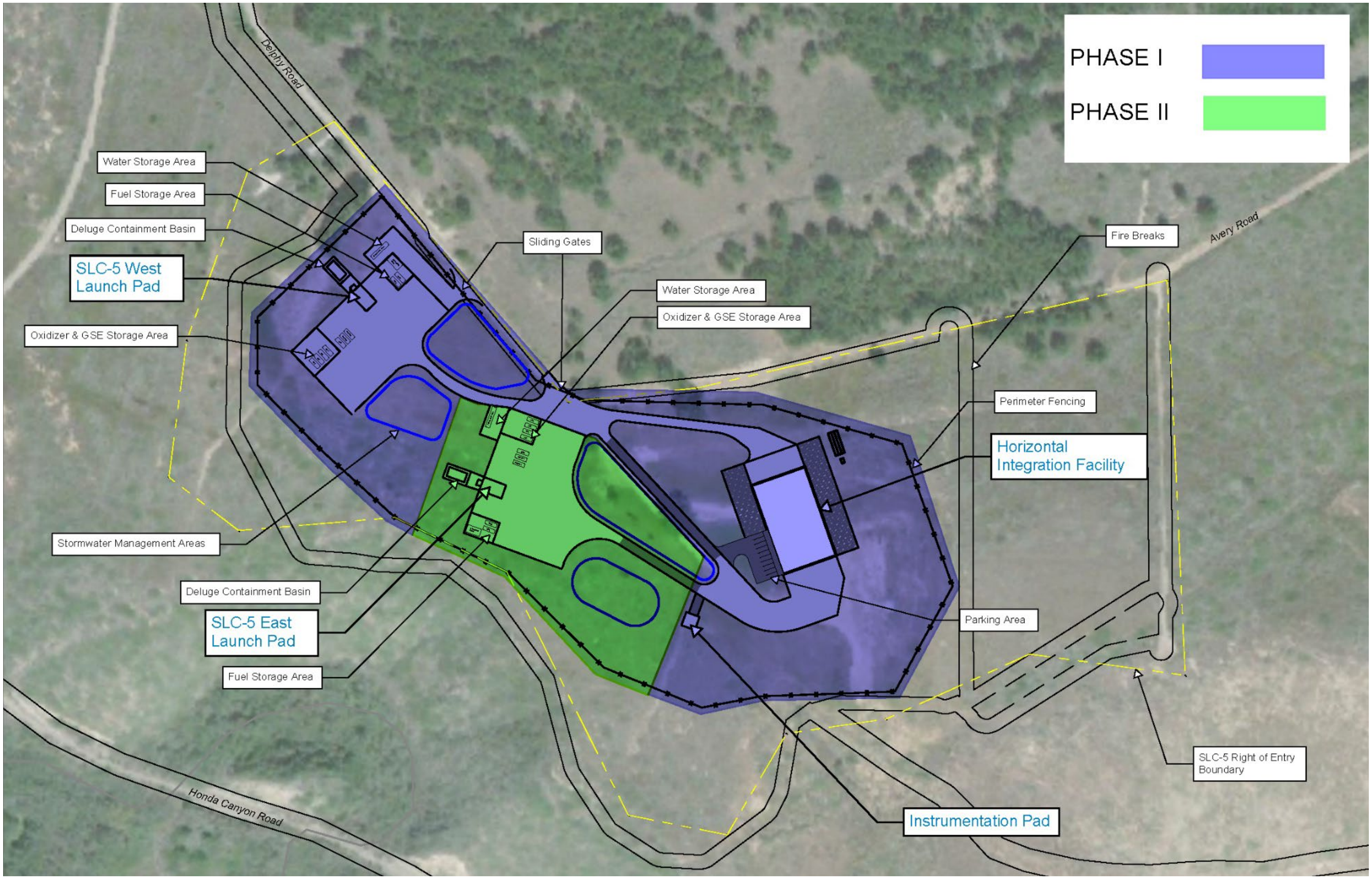

Figure 2-9: Construction Phases (Notes: Firebreaks and perimeter fencing in this figure are inaccurate; please refer to Figure 2-5 for realigned features. "Right of Entry" does not define the Proposed Action Area)

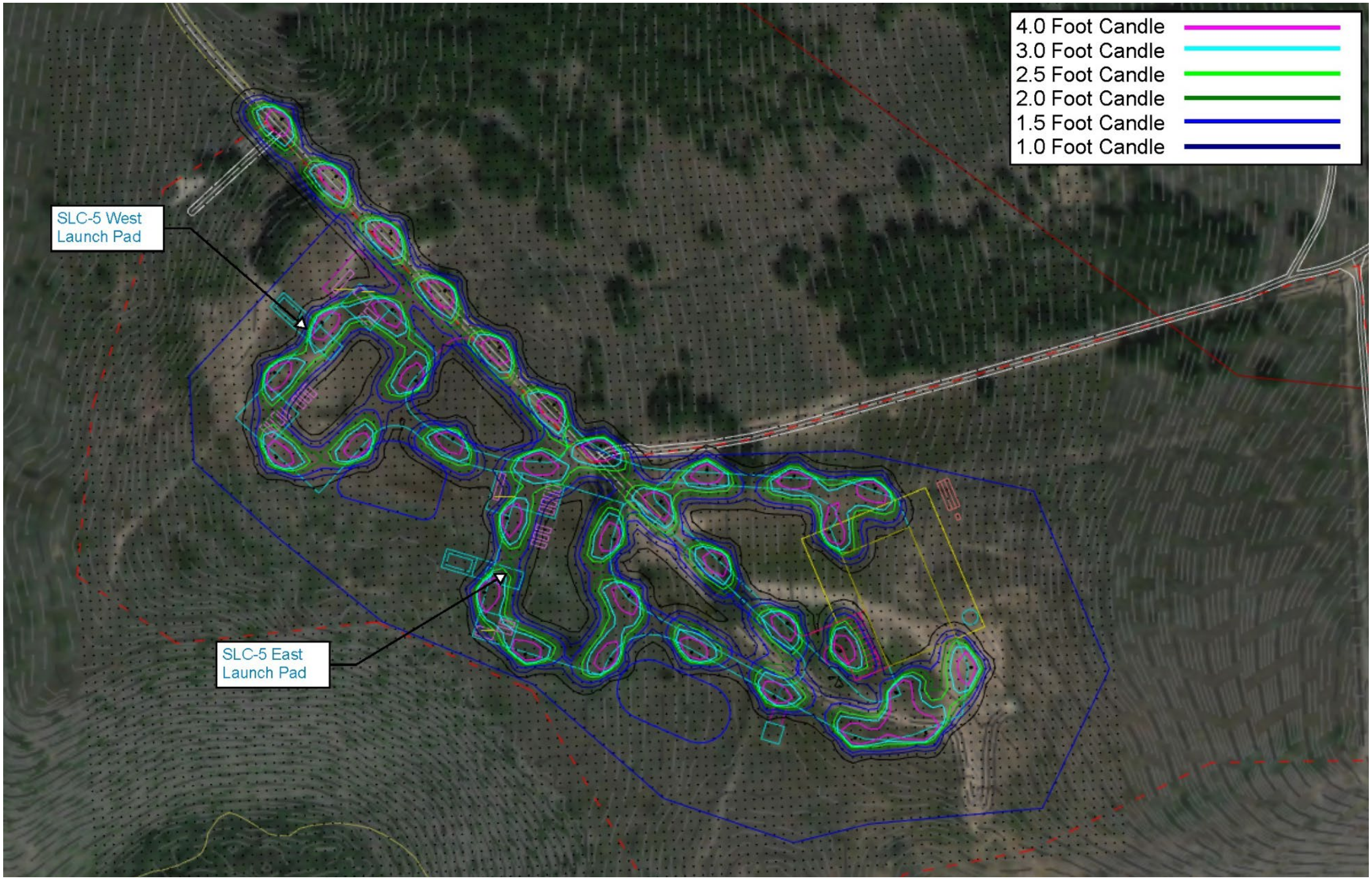

Figure 2-10: Preliminary Lighting Plan

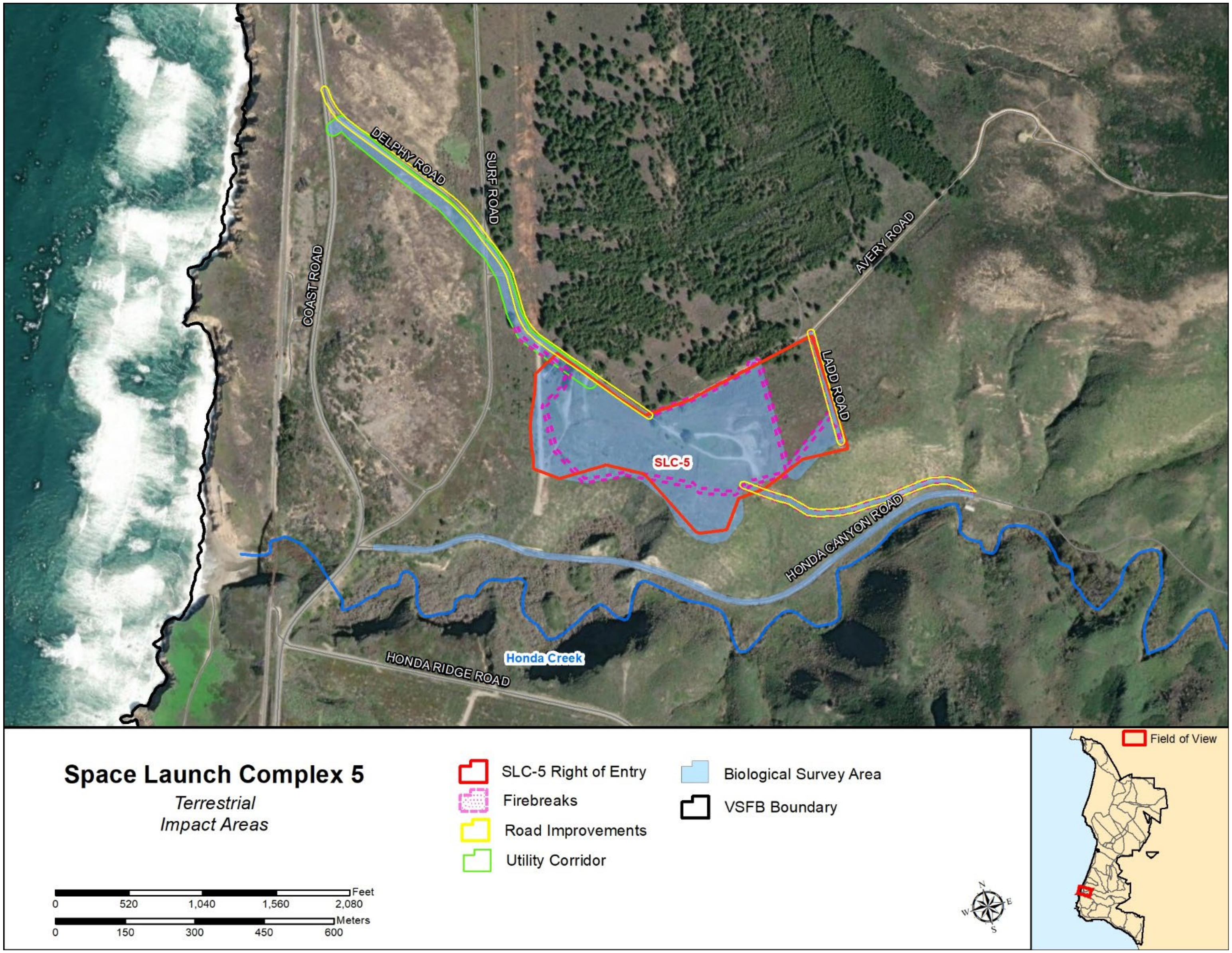

Figure 2-11: SLC-5 Construction and Ground Disturbance Areas (Note: "Right of Entry" does not define the Proposed Action Area)

2.1.6 Launch Program Operations

Phantom proposes to perform up to a combined total of 48 launches of the Daytona-E and the Laguna-E from SLC-5 annually. In addition, Phantom would conduct up to 48 static fire engine tests annually.

Prior to launch Phantom would deposit an estimated 6,500 to 8,000 gallons of deluge water into a flame bucket under the launch stool to reduce vibration. Phantom would design the pads at SLC-5E and SLC-5W so that there would be no water discharge into surrounding drainages. Immediately downstream of the flame deflector outlet, a concrete deluge containment basin would be provided that will collect deluge runoff. The deluge wastewater would be disposed of or discharged to grade per federal and state regulations and the RWQCB General Waiver for Specific Types of Discharges (or stand-alone state discharge permit). After each launch or storm event, Phantom would inspect the contents of the basin for any contamination per the waiver/permit. If the water is clean enough to go to grade, Phantom would discharge the water from the retention basin to an infiltration area or spray field.

Phantom estimates that up to 6 weather balloons made of latex would be released per launch event to measure wind speed. Measurements are used to create a profile of expected wind conditions during the launch event. A radiosonde, which is approximately the size of a shoe box and is powered by a 9-volt battery, would be attached to each weather balloon. The balloons will rise to approximately 12 to 19 mi (19 to 30 km) and burst into many pieces and land in the ocean with the radiosonde.

Launch trajectories will be unique to the vehicle configuration, mission, and environmental conditions but within a range of potential launch azimuths from 168° and 220°. ManTech SRS Technologies, Inc. (MSRS) performed sonic boom modeling using PCBoom 4.99 for an array of potential trajectories and meteorological conditions (MSRS 2022). For both vehicles, a sonic boom (overpressure of high energy impulsive sound) up to 1.5 pounds per square foot (psf) would be generated during ascent while the first-stage booster is supersonic. The overpressure would be primarily directed at the Pacific Ocean south of Point Conception and south of the Northern Channel Islands (NCI).

MSRS used the Launch Vehicle Acoustic Simulation Model (RUMBLE), a fully featured time-simulation model, to predict the location and magnitude of engine noise during launch and static fire engine tests (MSRS 2022). The FAA's Office of Environment and Energy approved using RUMBLE for this project on 1 April 2022. Engine noise produced during the launch would impact the area between the Santa Ynez River and Sudden Ranch, (Figures 2-14 and 2-15). Static fire engine tests would be conducted within several days prior to each launch. During static fire, when the vehicle is in a vertical position on the pad, engine noise would be focused along the coastline between SLC-4 and SLC-6 (Figures 2-16 and 2-17). Approved models do not depict sonic booms intersecting any portion of the mainland or the NCI.

The A-weighted Community Noise Equivalent Level (CNEL) contours from 65 to 75 A-weighted decibels (dBA) are presented in Figures 2-18 and 2-19 (MSRS 2022). CNEL is a cumulative metric that accounts for all noise events in a 24-hour period. To account for increased sensitivity to noise at night, CNEL applies an additional 10 decibel (dB) adjustment to events during the acoustical nighttime period, defined as 10:00 PM to 7:00 AM, and a 4.8 dB adjustment to events during the acoustical evening period (7:00 PM to 10:00 PM) to account for decreased community noise during this period. For the Daytona and Laguna launch vehicles, the CNEL 65 dBA for launch and static fire events extend less than 1.2 miles (mi) (1.9 kilometers [km]) and 1.8 mi (2.9 km), respectively from SLC-5 and are contained entirely within VSFB (Figures 2-18 and 2-19).

Post-launch activities would include depressurizing and emptying ground support systems of any commodities, departure of mobile fuel trailers, and any other portable equipment. If an additional launch is planned the propellants would be purged and Phantom would perform a series of inspections and checkouts to begin preparations for the next launch.

After a successful launch of the Daytona-E or Laguna-E, the first and second stages would separate during the phase in flight called Main Engine Cut Off. After separation, the first stage would fall to Earth into the Pacific Ocean approximately 230 to 660 nautical miles downrange and approximately 175 nautical miles west, at the closest, from the Baja Peninsula coastline. Figure 2-20 shows the range of potential splashdown sites in the broad ocean area. First stages will not be recovered. The first stage primary structure is aluminum and will typically break up during re-entry or impact with the ocean surface and sink after impact. Fairings will be either aluminum or composite materials. The fairings will sink if metallic. Composite fairings may float for a period unless they sustain major damage at impact. Wave action will deform the fairing until the composite materials delaminates and water can get into the honeycomb. At that point, they will sink. First stages and fairings are composed of inert materials that would not affect water quality or marine resources. The remaining stage would deliver the payload into orbit.

A de minimis amount of propellent will remain in the first stage upon impact (less than 1%). RP-1 and Jet-A are classified as Type 1 “Very Light Oil”, which is characterized as having low viscosity, low specific gravity, and highly volatile (USFWS 1998). Due to its high volatility, Type 1 oil evaporates quickly when exposed to the air and would completely dissipate within one to two days in the water. Clean-up following a spill of very light oil is usually not necessary or not possible, particularly with such a small quantity of oil that would enter the ocean (USFWS 1998). Since Type 1 oil is lighter than water and almost completely immiscible (i.e., very little will dissolve into the water column), it would stay on top of the water surface. Due to its low viscosity, it would rapidly spread into a very thin layer (several hundred nanometers) on the surface of water and would continue to spread as a function of sea surface, wind, current, and wave conditions. This spreading rapidly would reduce its concentration on the water surface and exposes more surface area of the fuel to the atmosphere, thus increasing evaporation rate. Although it would require one to two days for the propellant to completely dissipate, over 90% of its mass would evaporate within the first seven minutes and 99% of its mass would evaporate within the first hour (Fingas 2013; U.S. Air Force 2016). In the event of adverse ocean conditions (e.g., large swells, large waves) and weather conditions (e.g., fog, rain, high winds), the propellant would be volatilized more rapidly due to increased agitation and thus dissipate even more quickly and further reduce the likelihood of exposure If it impacts intact. Given the relatively small volume of propellant that would be expended (between 270 and 1,100 pounds) and rapid evaporation, impacts to surface water in the broad ocean area under the Proposed Action would not be significant.

All launch operations would comply with the necessary notification requirements, including issuance of Notices to Airmen (NOTAMs) and Local Notices to Mariners (NOTMARs), consistent with current procedures. A NOTAM provides notice of unanticipated or temporary changes to components of, or hazards in, the National Airspace System (FAA Order JO 7930.2S, Notices to Airmen). A NOTMAR provides notice of temporary changes in conditions or hazards in navigable waterways. Western Range operations, which would include the proposed launches from SLC-5, currently follow the procedures stated in a Letter of Agreement (dated 15 June 2021) between VSFB and FAA. The Letter of Agreement establishes responsibilities and describes procedures for the SLD 30, Western Range Operations, within airspace common to the Oakland Air Route Traffic Control Center, Los Angeles Air Route Traffic Control Center, Santa Barbara Terminal Radar Approach Control Facility, Fleet Area Control and Surveillance Facility, Air

Traffic Control System Command Center, Pacific Military Altitude Reservation Function, and Central Altitude Reservation Function areas of jurisdiction. The Letter of Agreement also defines responsibilities and procedures applicable to operations, which require the use of Restricted Areas, Warning Areas, Air Traffic Controlled Assigned Airspace, and/or altitude reservations within Western Range airspace.

The Proposed Action does not include altering the dimensions (shape and altitude) of the airspace. However, temporary closures of existing airspace issued by the FAA's Air Traffic Organization are Federal actions connected to the Proposed Action and thus analyzed in the Environmental Assessment (EA). Advance notice of these closures via NOTAMs would assist pilots in scheduling around any temporary disruption of flight activities in the area of operation. Launches would be of short duration and scheduled in advance to minimize interruption to airspace.

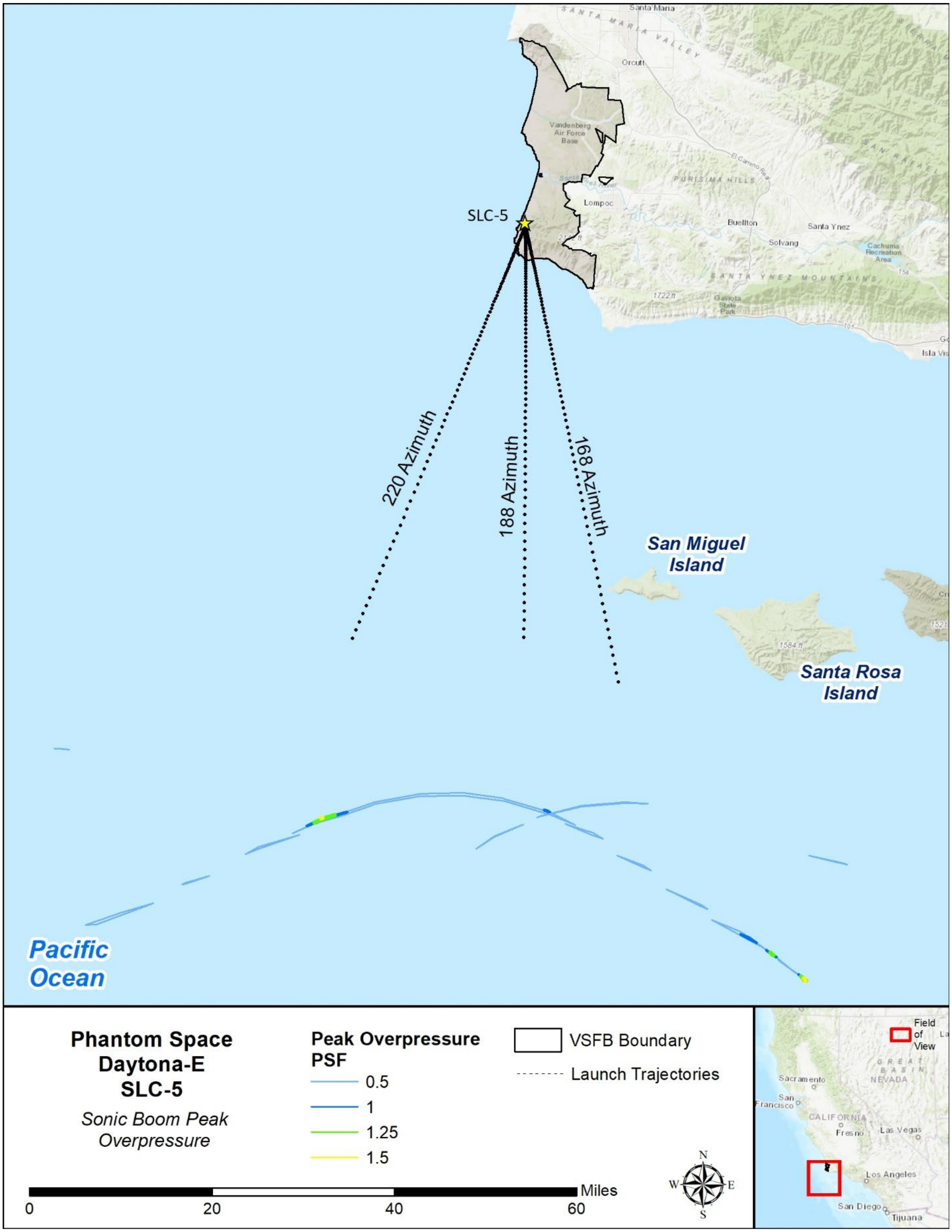

Figure 2-12: Predicted Sonic Boom Footprint for Daytona-E

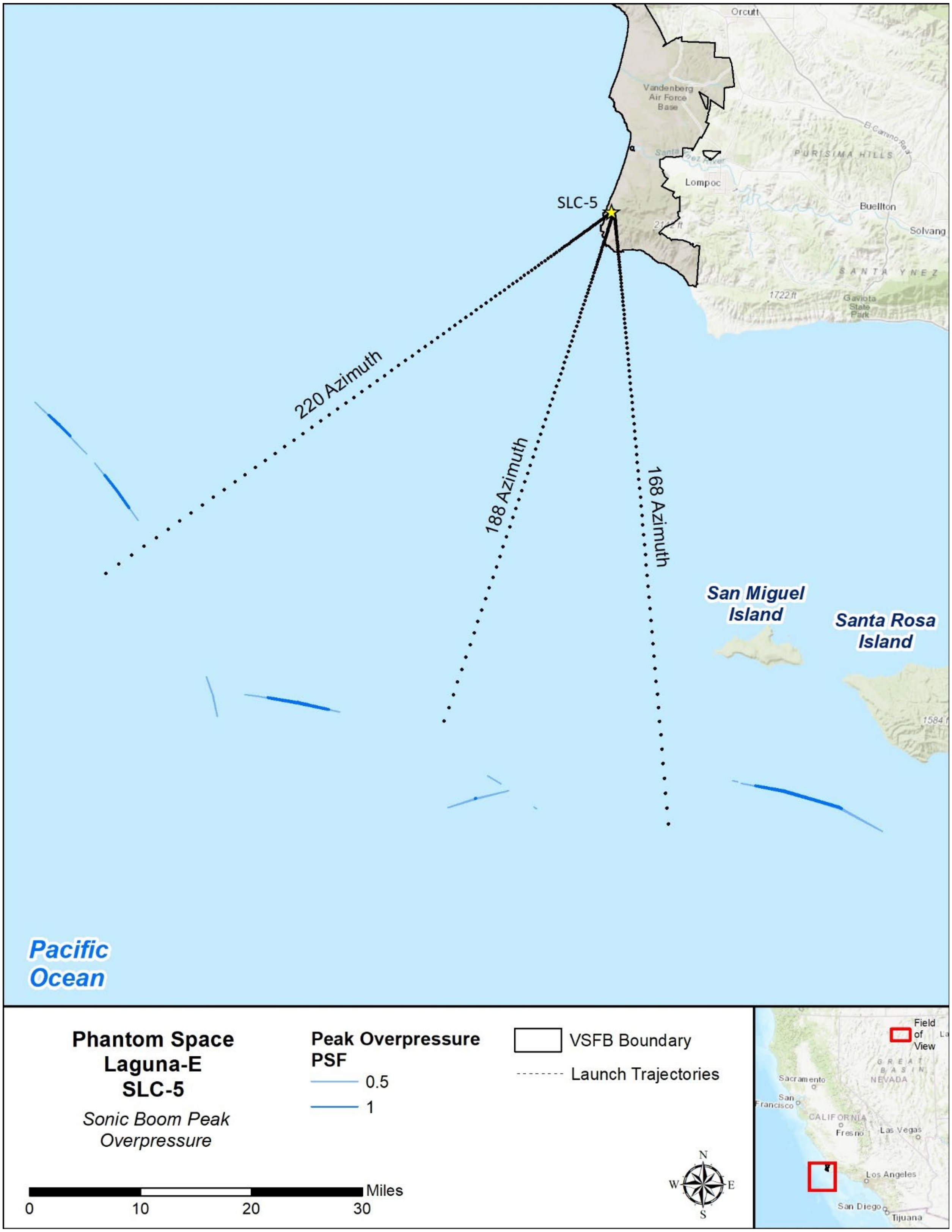

Figure 2-13: Predicted Sonic Boom Footprint for Laguna-E

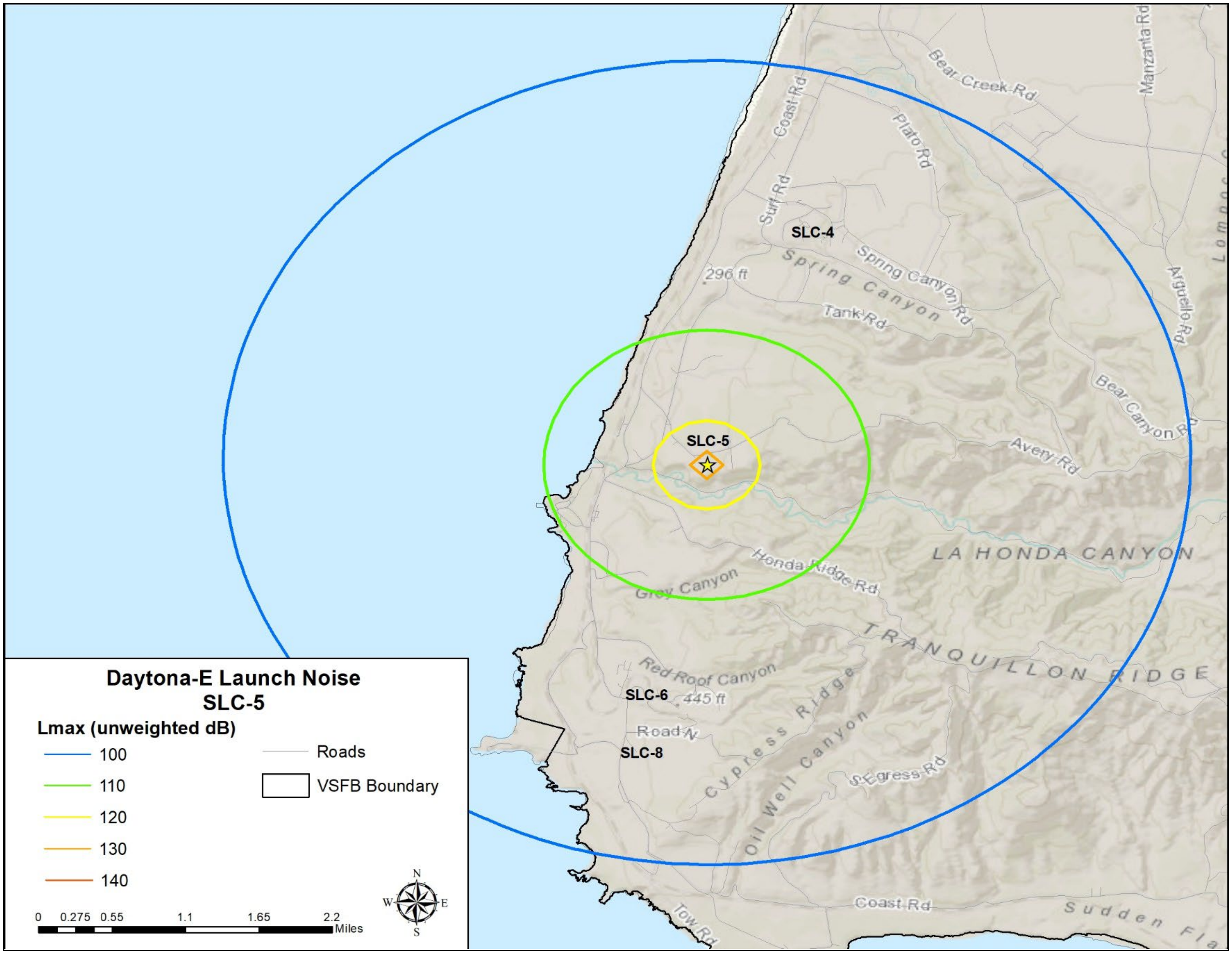

Figure 2-14: Maximum Engine Noise Distribution During Daytona-E Launch

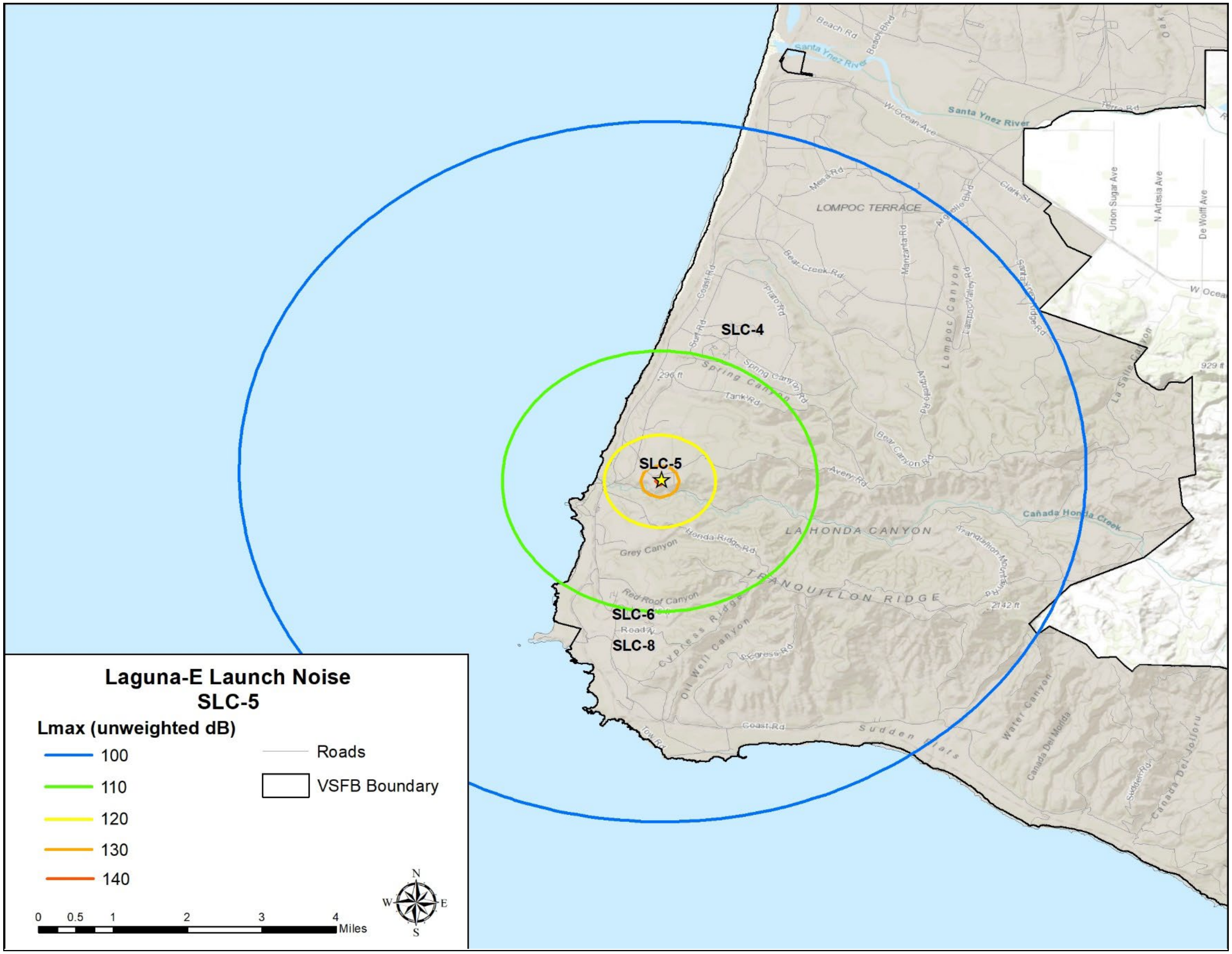

Figure 2-15: Maximum Engine Noise Distribution During Laguna-E Launch

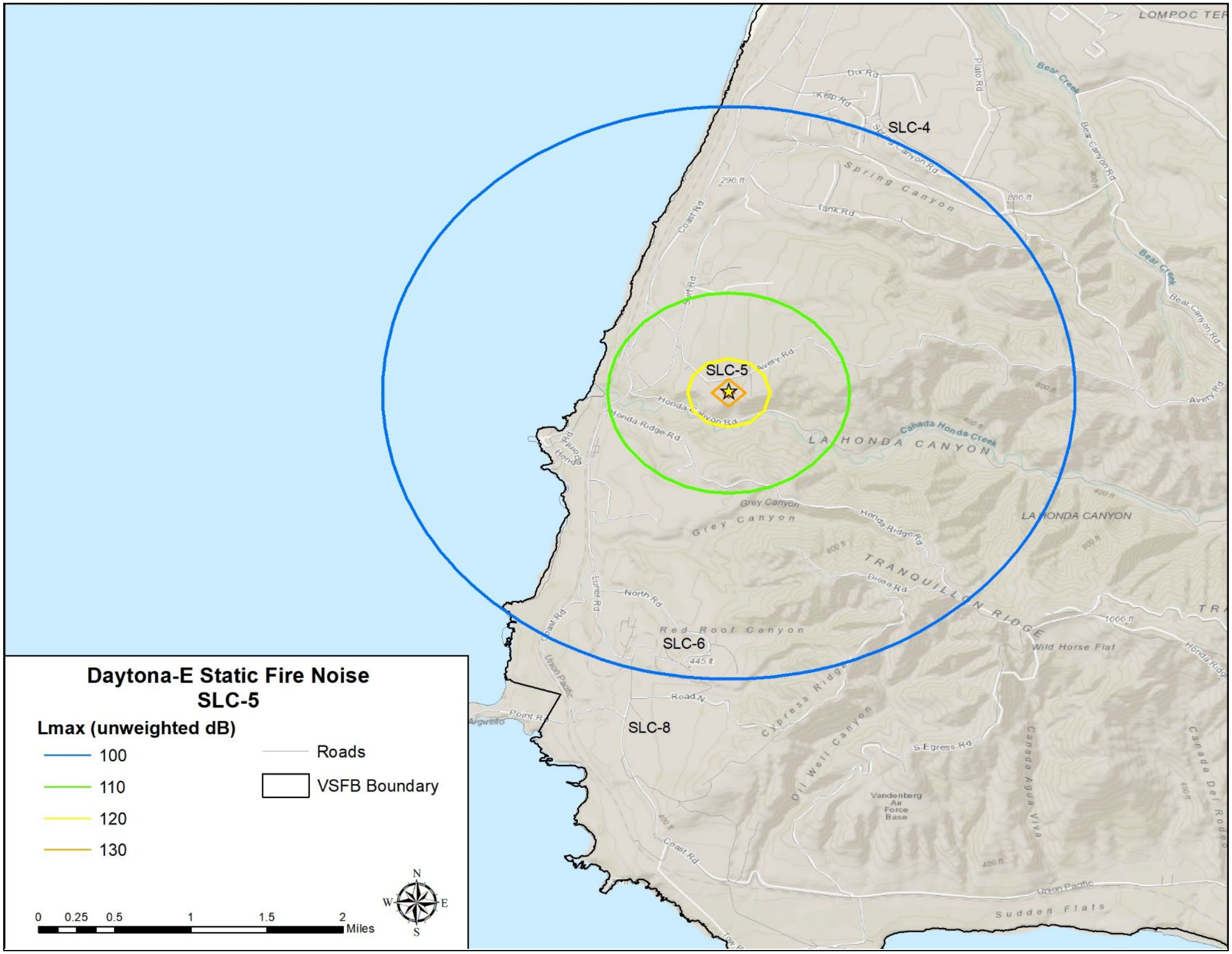

Figure 2-16: Maximum Engine Noise Distribution During Daytona-E Static Fire

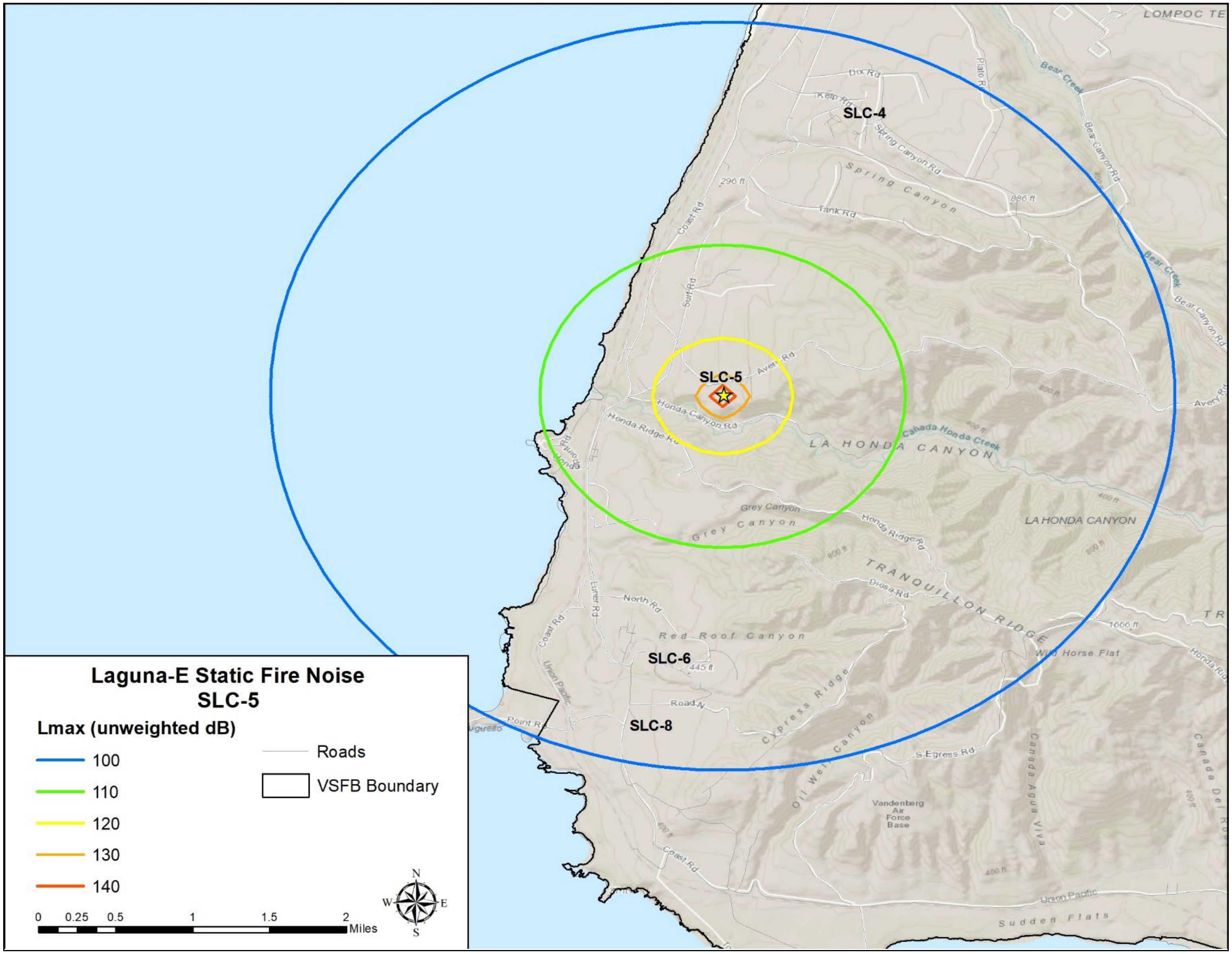

Figure 2-17: Maximum Engine Noise Distribution During Laguna-E Static Fire

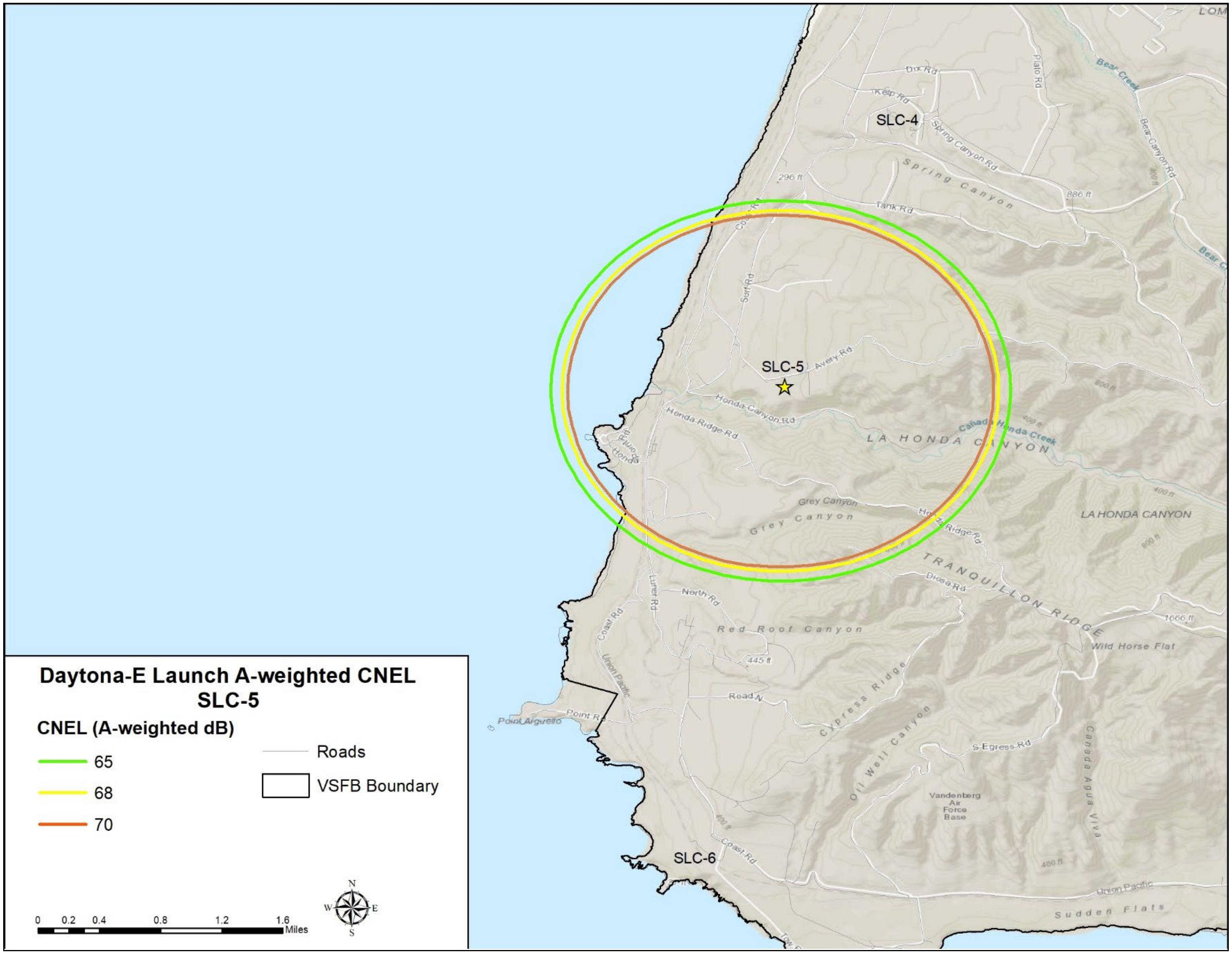

Figure 2-18: A-weighted Community Noise Equivalent Level during Daytona-E Launch

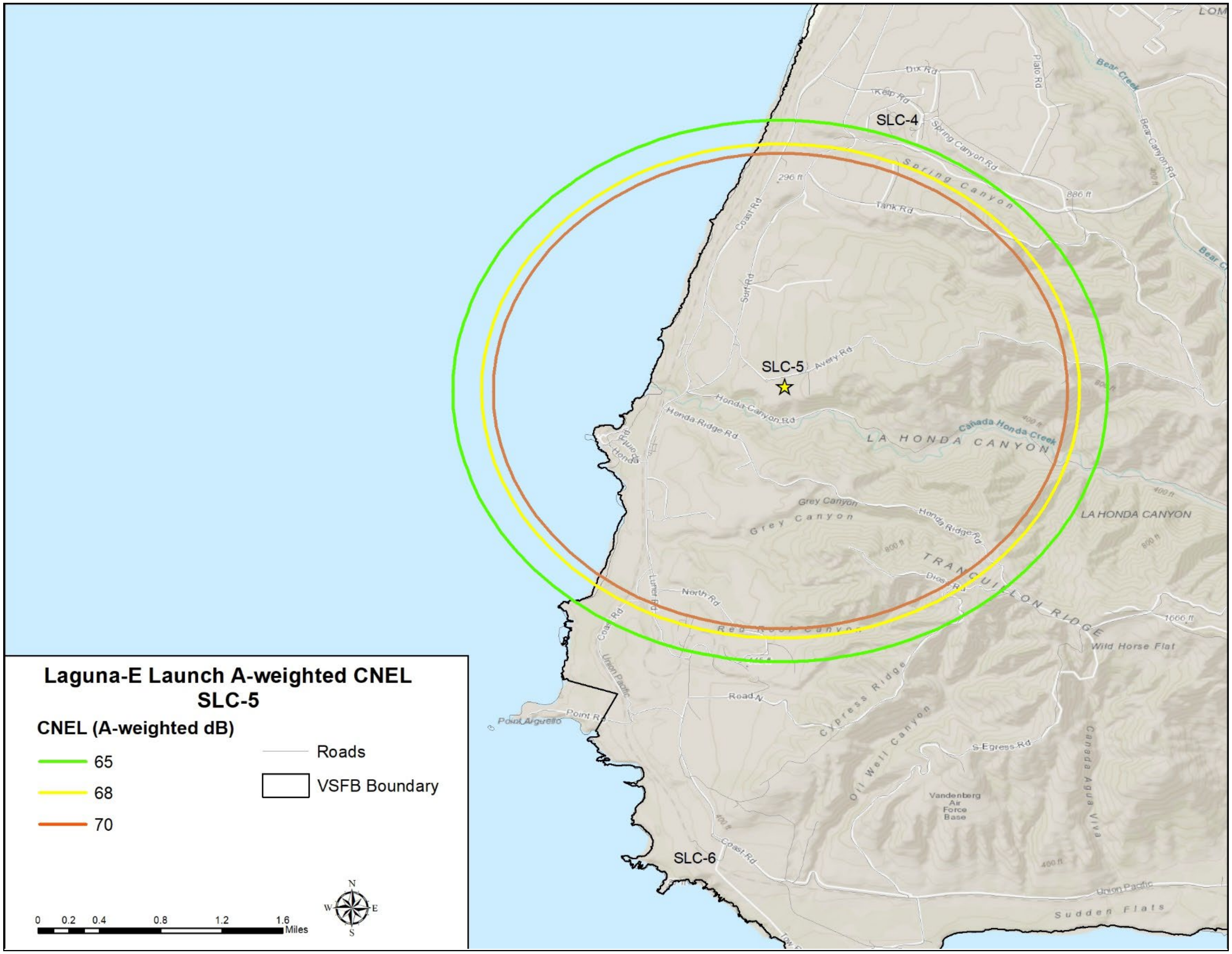

Figure 2-19: A-weighted Community Noise Equivalent Level during Laguna-E Launch

Figure 2-20: Daytona-E and Laguna-E First Stage Splashdown Zone in Broad Ocean Area

2.2 Alternatives Analysis

As discussed in Section 2.1 (Selection Criteria) of the EA, SLD 30 identified a range of reasonable alternatives on VSFB and other sites by evaluating the ability of each alternative to meet the purpose and need of the Proposed Action and their ability to meet selection criteria. The criteria for site selection alternatives were:

1) Direct orbital access to high-inclination, polar, and sun-synchronous orbits.
2) Existing and approved commercial or federal spaceport and proven launch pad to meet an initial launch target date for Daytona-E in calendar year 2024.
3) Ability to support a regular cadence of launch preparation and operations, including:
    a. Ability to accommodate multiple launch pads to conduct concurrent launch campaigns by preparing launch vehicles simultaneously so that the period between launches could be shortened to four or five days. Additionally, multiple launch pads allow operations to continue when a pad is unavailable for maintenance or upgrades.
    b. Ability to configure site to optimize for Phantom's projected launch systems.
    c. Ability to support up to 48 launches per year.
4) Provides minimal disruption to Phantom operations, including:
    a. Phantom staff having unimpeded access and use of the site.
    b. Ability to pre-position ground support equipment between launch operations.

In accordance with CEQ Regulations, reasonable alternatives were considered for Phantom's launch program, but dismissed from detailed analysis as they did not meet the requirements of the program. Phantom assessed several sites at VSFB and the Pacific Spaceport Complex (PSCA) at Kodiak Island in Alaska. Both locations are existing spaceports providing access to high-inclination, polar, and sun-synchronous orbits. At VSFB, Phantom evaluated SLC-8, SLC-5, Boat Dock, Sudden Flats, and Boathouse Flats. In addition, Phantom considered Launch Pad (LP)-1, LP-2, LP-3C, and LP-3E at PSCA. The Boat Dock, Sudden Flats, and Boathouse Flats at VSFB and LP-3E at PSCA have not previously or currently had active launch operations, causing uncertainty in their potential to support efficient launch operations. The time necessary to resolve the uncertainty through research and studies fails to meet the timeline requirements under Criterion 2, above, and were therefore eliminated from further consideration.

VSFB's SLC-8 and PSCA's LP-1, LP-2, and LP-3C are currently approved for launch operation. However, they are shared multi-user launch sites for commercial and government launch operators. As such, Phantom would only be able to use these pads on a temporary basis. Doing so would present considerable disruption and logistical challenges to Phantom operations and would not support a regular launch cadence under Criteria 3 and 4 above.

PSCA's commercial launch site license only permits a total of nine launches annually. This launch allocation must be shared amongst all commercial launch service providers. This availability is far short of Phantom's need for 48 launches per year. Similarly, SLC-8 is a multi-user launch complex for shared use of commercial and government small launch vehicles. SLC-8 is only authorized 15 launches per year which must be shared amongst all launch vehicles operating at SLC-8 with government-owned launch vehicles having priority. This availability is far short of Phantom's need for 48 launches per year.

Therefore, these alternatives were also eliminated from further consideration, and only the Proposed Action and No Action Alternative have been carried forward for further evaluation. VSFB SLC-5 location meets all four criteria. This location allows for direct access to the correct orbits, VSFB is an existing federal spaceport, and SLC-5 is located on a properly cited launch location that previously supported a successful

NASA program and is a 'proven launch pad' based on this. SLC-5 is able to support the cadence proposed and this location will allow Phantom personnel to have unimpeded access and use of the site and provides adequate support for ground equipment requirements. Therefore, SLC-5 meets all selection criteria listed above.

2.3 Consistency Analysis/Analysis of Effects

The effects test is a procedure where the project proponent determines whether the proposed activities comply with the federal consistency requirements of Section 307 of the CZMA (16 U.S.C. Section 1456) and its implementing regulations (15 C.F.R. Part 930). As defined in Section 304 of the CZMA, the term "coastal zone" does not include "lands the use of which is by law subject solely to the discretion of or which is held in trust by the Federal Government." However, per DAF implementing regulations (AFMAN 32-7003, Section 3.26.2), the DAF is required to undertake federal actions in a manner consistent to the maximum extent practicable with the enforceable policies[1] of California's approved coastal zone management programs through the federal consistency process under the CZMA.

The Space Force analyzed the effects of the Proposed Action by looking at reasonably foreseeable direct and indirect effects on any coastal use or resource, and by reviewing relevant management program enforceable policies (15 C.F.R. Part 930.33[a][1]) and the Coastal Resources Planning and Management Policies. Sections of the CCA relevant to this Proposed Action, as determined by the Space Force, include the following: Article 2 – Public Access (Section 30210 and 30211); Article 3 – Recreation (Section 30220); Article 4 – Marine Environment (Section 30230, 30231, 30232, 30234, and 30234.5); and Article 5 – Land Resources (Section 30244). Sections and Articles of the CCA not addressed below are not relevant to the Proposed Action.

Prior to evaluating whether the Proposed Action complies with the State of California's enforceable policies, the federal agency must first examine whether the Proposed Action would have a reasonably foreseeable effect on coastal zone uses or resources. Thus, the elements of the Proposed Action must first be examined to determine whether they have reasonably foreseeable effects before determining whether those effects are consistent with the State of California's enforceable policies. Coastal zone resources include both resources permanently located in the coastal zone (e.g., benthic organisms) and mobile resources (e.g., marine mammals and sea turtles) that typically move into and out of the coastal zone as part of a natural cycle.

The effects test evaluates the relative location of the Proposed Action to the coastal zone and the potential effects of stressors on coastal zone resources. The Space Force conducted the effects test and determined there are reasonably foreseeable effects to coastal uses and resources. The effects test for the Proposed Action is based on the locations of the proposed activities relative to the coastal zone and the potential effects of stressors on coastal zone resources.

The Proposed Action at VSFB could have the potential to affect coastal resources from acoustics (launch engine noise).

[1] SLD 30 is using the term "enforceable policies" within the meaning contemplated in 15 CFR 930.36. DAF does not concede that all aspects of California's coastal program are enforceable against the federal government.

3 ENFORCEABLE POLICIES OF THE CALIFORNIA COASTAL MANAGEMENT PROGRAM

The Space Force reviewed the CCMP to identify enforceable policies relevant to the Proposed Action according to Division 20 of the California Public Resources Code, approved as part of the coastal program. Section 3.1 (Enforceable Policies of the California Coastal Management Program That Are Not Applicable to the Proposed Action) identifies the CCMP policies that are not applicable to the Proposed Action. Section 3.2 (Enforceable Policies of the California Coastal Management Program That Are Applicable to the Proposed Action) provides an analysis of the CCMP policies that are applicable to the Proposed Action.

3.1 Enforceable Policies of the California Coastal Management Program That Are Not Applicable to the Proposed Action

The CCMP policies not applicable to the Proposed Action are provided in Table 3-1 below.

Table 3-1: Enforceable Policies of the CCMP That Are Not Applicable to the Proposed Action

Article	Section	State Enforceable Policy	Explanation of Non-Applicability
Article 2: Public Access	30212	New development projects	The Proposed Action does not include any new development that would block or impede public access.
	30212.5	Public facilities; distribution	The Proposed Action does not include any public facilities.
	30213	Lower cost visitor and recreational facilities; encouragement and provision; overnight room rentals	The Proposed Action does not include any visitor or recreational facilities.
	30214	Implementation of public access policies; legislative intent	This section explains the legislative intent applicable to the foregoing public access policies, and does not constitute a separate public access policy.
Article 3: Recreation	30221	Oceanfront land; protection for recreational use and development	The Proposed Action does not include any development of oceanfront land that would reduce available areas for public use.
	30222	Private lands; priority of development purposes	The Proposed Action does not include any development of private lands within the Action Area.
	30222.5	Oceanfront lands; aquaculture facilities; priority	The Proposed Action does not affect coastal zone lands suitable for aquaculture.
	30223	Upland areas	The Proposed Action does not affect the availability of upland areas necessary to support coastal recreational uses.

Table 3-1: Enforceable Policies of the CCMP That Are Not Applicable to the Proposed Action (continued)

Article	Section	State Enforceable Policy	Explanation of Non-Applicability
Article 3: Recreation	30224	Recreational boating use; encouragement; facilities	The Proposed Action does not include the development of any recreational boating facilities.
Article 4: Marine Environment	30233	Diking, filling, or dredging; continued movement of sediment and nutrients	The Proposed Action does not include any diking, filling, or dredging activities.
	30235	Construction altering natural shoreline	The Proposed Action does not include construction that would alter the natural shoreline processes.
	30236	Water supply and flood control	The Proposed Action does not alter any rivers or streams.
	30237	Repealed	
Article 5: Land Resources	30241	Prime agricultural land; maintenance in agricultural production	The Proposed Action does not include any prime agricultural lands.
	30241.5	Agricultural lands; determination of viability of uses; economic feasibility evaluation	The Proposed Action does not include any agricultural lands.
	30242	Lands suitable for agricultural use; conversion	The Proposed Action does not include any agricultural lands.
	30243	Productivity of soils and timberlands; conversion	The Proposed Action does not include any timberlands.
Article 6: Development	30250(a)	Development location; existing developed areas	This policy only applies to actions that require permitting, which cannot be enforced against the DAF.
	30252	Maintenance and enhancement of public areas	The Proposed Action does not include any new development that would require maintenance or enhanced public access to the coast.
	30254	Public works facilities	The Proposed Action does not include any new or expanded public works facilities.
	30254.5	Terms or conditions on sewage treatment plant development; prohibition	The Proposed Action does not include the development of a sewage treatment plant.
	30255	Priority of coastal-dependent developments	The Proposed Action does not include any development within the coastal zone.

Table 3-1: Enforceable Policies of the CCMP That Are Not Applicable to the Proposed Action (continued)

Article	Section	State Enforceable Policy	Explanation of Non-Applicability
Article 7: Industrial Development	30260	Location or expansion	The Proposed Action does not include the development of coastal-dependent industrial facilities.
	30261	Tanker facilities; use and design	The Proposed Action does not include the use of existing or new tanker facilities.
	30262	Oil and gas development	The Proposed Action does not include any oil and gas development.
	30263	Refineries or petrochemical facilities	The Proposed Action does not include new or expanded refineries or petrochemical facilities.
	30264	Thermal electric generating plants	The Proposed Action does not include new or expanded thermal electric generating plants.
	30265	Legislative findings and declarations; offshore oil transport	This section explains the legislative findings applicable to offshore oil transportation, and does not constitute a separate public access policy.
	30265.5	Governor or designee; co-ordination of activities concerning offshore oil transport and refining; duties	The Proposed Action does not include activities concerning offshore oil transport and refining.

3.2 Enforceable Policies of the California Coastal Management Program That Are Applicable to the Proposed Action

The CCMP enforceable policies that apply to the Proposed Action are policies where one or more of the Proposed Action components could affect a coastal zone resource or use identified by the policy. The CCMP enforceable policies that apply to the Proposed Action are provided in Table 3-2.

Table 3-2: Enforceable Policies of the CCMP That Are Applicable to the Proposed Action

Article	Section	State Enforceable Policy
Article 2: Public Access	30210	Access; recreational opportunities; posting
	30211	Development not to interfere with access
Article 3: Recreation	30220	Protection of certain water-oriented activities
Article 4: Marine Environment	30230	Marine resources; maintenance
	30231	Biological productivity; water quality
	30232	Oil and hazardous substance spills
	30234	Commercial fishing and recreation boating facilities
	30234.5	Economic, commercial, and recreational importance of fishing
Article 5: Land Resources	30240(b)	Environmentally sensitive habitat areas; adjacent developments
	30244	Archaeological or paleontological resources
Article 6: Development	30251	Scenic and visual qualities
	30253	Minimization of adverse impacts

3.2.1 Article 2: Public Access

Policies

CCA Section 30210 – "Access; recreational opportunities; posting" states:

> *In carrying out the requirement of Section 4 of Article X of the California Constitution, maximum access, which shall be conspicuously posted, and recreational opportunities shall be provided for all the people consistent with public safety needs and the need to protect public rights, rights of private property owners, and natural resource areas from overuse.*

CCA Section 30211 – "Development not to interfere with access" states:

> *Development shall not interfere with the public's right of access to the sea where acquired through use or legislative authorization, including, but not limited to, the use of dry sand and rocky coastal beaches to the first line of terrestrial vegetation.*

Consistency Review

The Space Force controls access to VSFB and on-Base recreation areas. Public access to VSFB and nearby SLC-5 is not permitted. Personnel and approved contractors may participate in outdoor activities on VSFB, such as camping, picnicking, sunbathing, hiking, bird watching, nature photography, fishing, and hunting. The closest public access beaches are Jalama Beach County Park, Surf Beach, and County of Santa Barbara Ocean Beach Park. Proposed launches at SLC-5 would not restrict access at Surf Beach or County of Santa Barbara Ocean Beach Park. SLD 30 Range Safety has confirmed that Phantom launch events will likely never result in the need to evacuate the public at Jalama Beach County Park based on the risk profiles of the Daytona-E and Laguna-E vehicles and with 168° being the eastern limit of Phantom's proposed azimuths. However, there may be rare missions that necessitate evacuation to be considered by SLD 30

Range Safety and potential email notifications be sent to people with reservations. Therefore, taking a very conservative approach to analyzing the effect of the Proposed Action, the Space Force estimates that there may be impacts to public use of Jalama Beach County Park during no more than 2 launch campaigns per year.

Evacuations to Jalama Beach County Park do not occur during every launch from VSFB and the decision to evacuate is based on risk analysis. For each launch from VSFB, Range Safety considers the number of people within the Impact Limit Line. Thirty days prior to launch, SLD 30 Range Safety conducts prelaunch debris risk assessments that determine high risk areas that contribute to the allowable risk criteria. If the risk of a Conditional Expected Casualty (CEc; a factor that estimates the risk of a multiple casualty event and assumes 100% vehicle failure) is greater than 0.01, Individual Risk is greater than 1/1,000,000, or the Expected Casualty risk is greater than 1/10,000, SLD 30 issues an evacuation requirements letter 25 days prior to launch. If evacuation is under consideration, SLD 30 notifies the County of Santa Barbara, and the County sends an email to reservation holders warning them that there may be a need to evacuate the park for the launch and providing them the opportunity to cancel the reservation. As a result of prior similar actions for SpaceX launches, 3 to 4 reservations (typically 1 to 3, but up to 8 people maximum per reservation) have been cancelled for each launch after the email announcement over the last few months (L. Semenza, County of Santa Barbara, pers. comm.). Up to 110 sites are available for reservation at the park. The launch risk factors are estimated based on the probability of vehicle failure, population size in the high-risk area, day of launch weather, and other factors. Generally, for launches from south VSFB, the population size in the Impact Limit Line determines the need for evacuation of Jalama Beach County Park and a CEc greater than 0.01 is typically triggered when the population exceeds 500 (G. Garcia, SLD 30 Range Safety, pers. comm.). Therefore, the number of users, including day users, campers, and staff, at Jalama Beach County Park may or may not exceed a level that triggers evacuation. When an evacuation of Jalama Beach County Park is under consideration, Santa Barbara County reports the projected number of campers for day of launch two to three days prior to the launch date. SLD 30 Range Safety compares the report to the maximum allowable number of people that would exceed the risk criteria and, if above, confirms the evacuation; or, if below, rescinds the evacuation. If an evacuation is confirmed, park staff request that all campers and day users leave the park. In addition, the Santa Barbara County Sheriff places roadblocks at the intersection of Highway 1 and Jalama Road to prevent the public from entering the affected area.

As discussed above, the Proposed Action is unlikely to result in any impacts to Jalama Beach County Park because the eastern bounding azimuth (168^{o}) will not necessitate closures to the park. Under a conservative, worst-case scenario the Space Force assumes there may be up to two launch events per year that necessitate consideration of evacuations that may result in impacts to the public via email notification, as described above, that could discourage some individuals to keep their reservation or move their reservation to a different date. Phantom would not exceed or increase the current allowable number of impacts to the park. Because impacts would be rare and Phantom would not exceed basewide impact limits, the Proposed Action would not substantially diminish the protected activities, features, or attributes Jalama Beach County Park.

Recreational and commercial boating and fishing occurs offshore of VSFB; however, impacts on offshore activities are unlikely other than temporary avoidance areas established during launch activities. Temporary avoidance areas for security and safety would not limit public access to adjacent areas. Areas would only be closed for the duration of the launch activity. The U.S. Coast Guard (USCG) would issue a NOTMAR that defines a public ship avoidance area for launch events. The avoidance area would be lifted as soon as the USCG determines it is safe to do so. Any impacts to recreation resources would be infrequent and temporary and would not result in a significant impact on recreation resources. Therefore, the Proposed Action would be consistent to the maximum extent practical with Section 30210 and 30211 of the CCA.

3.2.2 Article 3: Recreation

Policies

CCA Section 30220 – "Protection of certain water-oriented activities" states:

> *Coastal areas suited for water-oriented recreational activities that cannot readily be provided at inland water areas shall be protected for such uses.*

Consistency Review

As described under Section 3.2.1.2 (Consistency Review), the Proposed Action would result in temporary closures of offshore areas of VSFB. Temporary closures of these areas for security and safety do not limit public access to or use of adjacent areas. Areas would be closed for the duration of the activity (no more than two hours) and reopened at the completion of the activity.

Due to the temporary and short-term duration of the activities (48 launches from SLC-5 annually), broadcasting of NOTMARs, and the expansive offshore area that would still be available to the public, accessibility impacts associated with water-oriented recreational activities would remain negligible. Therefore, the Proposed Action would be consistent to the maximum extent practical with Section 30220 of the CCA.

3.2.3 Article 4: Marine Environment (Marine Resources)

Policies

CCA Section 30230 – "Marine resources; maintenance" states:

> *Marine resources shall be maintained, enhanced, and where feasible, restored. Special protection shall be given to areas and species of special biological or economic significance. Uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes.*

Consistency Review

As shown in Table 3-3, there are five species that occur in the marine environment off the VSFB coastline. One is federally listed as threatened under the Endangered Species Act (ESA) and four species are protected as defined under the Marine Mammal Protection Act (MMPA). The Space Force determined these species may be potentially affected by the Proposed Action from physical impacts during construction and noise impacts during construction and operation.

Table 3-3: Determination of Potential Impacts to Marine Mammals

Species	Status	ESA Effects Determination	MMPA Determination
Southern sea otter (*Enhydra lutris nereis*)	FT	NLAA	NE
Steller sea l–on - Eastern U.S. Stock (*Eumetopias jubatus*)	MMPA	NA	Level B
Northern elephant seal – California Breeding Stock (*Mirounga angustirostris*)	MMPA	NA	Level B
Pacific harbor seal – California Stock (*Phoca vitulina richardii*)	MMPA	NA	Level B
California sea lion – U.S. Stock (*Zalophus californianus*)	MMPA	NA	Level B

Notes: FE = Federally Endangered Species; FT = Federally Threatened Species; MMPA = Marine Mammal Protection Act, NA = not applicable; NE = no effect; NLAA = May affect, not likely to adversely affect; ESA = Endangered Species Act, MMPA = Marine Mammal Protection Act

In addition, there are up to 5 sea turtle species, 7 mysticetes (baleen whales), and 22 odontocetes (toothed cetaceans) that may be found within the region of influence. Sea turtles and cetaceans spend their entire lives in the water and spend most of their time (>90% for most species) entirely submerged below the surface. Additionally, when at the surface, sea turtle and cetacean bodies are almost entirely below the water's surface, with only the blowhole or head exposed for breathing. This minimizes exposure to in-air noise, both natural and anthropogenic, essentially 100% of the time because their ears are nearly always below the water's surface. As a result, in-air noise caused by sonic boom and engine noise would not affect sea turtle or cetacean species. Therefore, they were not considered further in the EA and are not considered further in this CD.

Southern Sea Otter (*Enhydra lutris nereis*)

Direct Impacts. No ground disturbing activities or vegetation management activities would occur within southern sea otter habitat; therefore, these actions will have no effect on the southern sea otter. The potential effects of noise and visual disturbance are discussed below.

Noise and Visual Impacts. To evaluate the worst-case scenario, noise from the louder of the two proposed vehicles, the Laguna-E, was analyzed for potential impacts to southern sea otters. If otters are present directly offshore of SLC-5 during a Laguna-E launch, they would experience noise levels of less than 120 dB Lmax (refer to Figure 3.4-1 of the EA). During static fire noise directly off the coast of SLC-5 would be less than 115 dB Lmax. However, otters are only occasionally observed along the coast between Purisima Point and Point Arguello, likely transiting through the area. Beginning at the Boat Dock and continuing to the south along Sudden Flats, the inshore habitat supports expansive kelp beds and a relatively high density of otters (refer to Figure 3.4-1 of the EA). Noise levels during a Laguna-E launch would reach between 100 and 110 dB Lmax in these areas (refer to Figure 3.4-1 of the EA).

Exceptionally little sound is transmitted between the air-water interface; thus, in-air sound would not have a significant effect on submerged animals (Godin 2008). In addition, according to Ghoul & Reichmuth (2014), "Under water, hearing sensitivity [of sea otters] was significantly reduced when compared to sea lions and other pinniped species, demonstrating that sea otter hearing is primarily adapted to receive airborne sounds." This study suggested that sea otters are less efficient than other marine carnivores at extracting noise from ambient noise (Ghoul & Reichmuth 2014). Therefore, the potential impact of underwater noise caused by in-air sound would be insignificant and discountable.

Extensive launch monitoring has been conducted for sea otters on both north and south VSFB, with pre- and post-launch counts and observations conducted at rafting sites immediately south of Purisima Point for numerous Delta II launches from SLC-2 and one Taurus launch from Launch Facility-576E and at the rafting sites near Sudden Flats for two Delta IV launches from SLC-6. No abnormal behavior, mortality, or injury of effects on the population has ever been documented for sea otter because of launch-related disturbance (SRS Technologies, Inc. 2006a, 2006b, 2006c, 2006d, 2006e, 2006f, 2006g; MSRS 2007a, 2007b, 2007c, 2008a, 2008b). More recently, for the SpaceX Falcon 9 SAOCOM launch and landing on 7 October 2018, sea otters were monitored during pre- and post-launch surveys on south VSFB (MSRS 2018b). The sonic boom received at the otter monitoring location was estimated at 0.71 psf and the maximum landing engine noise at this location was estimated at 99.5 dB Lmax. Count totals of both pups and adults were similar before and after the launch and there was no discernable impact on otters on south VSFB.

A prior study suggests that sea otters may be able to acclimate to sound exposures more than those anticipated due to the Proposed Action. Davis et al. (1988) conducted a study of northern sea otter's (*Enhydra lutris kenyoni*) reactions to various underwater and in-air acoustic stimuli. The purpose of the study was to identify a means to move sea otters away from a location in the event of an oil spill. Anthropogenic sound sources used in this behavioral response study included truck air horns and an acoustic harassment device (10 to 20 kHz at 190 dB) designed to keep dolphins and pinnipeds from being caught in fishing nets. The authors found that the sea otters often remained undisturbed and quickly became tolerant of the various sounds. When a fleeing response occurred because of the harassing sound, sea otters generally moved only a short distance (328 to 656 ft [100 to 200 m]) before resuming normal activity (Davis et al. 1988).

Curland (1997), studying the southern sea otter, also found that they may acclimate to disturbance. The author compared otter behavior in areas with and without human-related disturbance (e.g., kayaks, boats, divers, planes, sonic booms, and military testing at Fort Ord) near Monterey, California. Otters spent more time traveling in areas with disturbance compared to those without disturbance; however, there was no significant differences in the amount of time spent resting, foraging, grooming, and interacting, suggesting that the otters were becoming acclimated to regular disturbances from a variety of sources (Curland 1997). Extensive launch monitoring of sea otters on VSFB has shown that launch noise is not a primary driver of sea otter behavior or use of the habitat along Sudden Flats and has not had any apparent long-term consequences for populations, potentially indicating that this population has acclimated to launch activities. Therefore, any impacts because of noise or visual disturbance are expected to be limited to minor behavioral disruption and, therefore, insignificant. As such, VSFB has determined that the Proposed Action would have an insignificant impact on otters and therefore, may affect, but is not likely to adversely affect, the southern sea otter off the coast of VSFB.

Conclusion. Observations at VSFB have shown no abnormal behavior, mortality, or injury of otters during launch activities and noise studies have shown southern sea otters adapt to sound exposure. As a result, the Proposed Action would have an insignificant effect on southern sea otter. Therefore, VSFB has determined that the Proposed Action may affect, but is not likely to adversely affect, the southern sea otter and, therefore, would not be significant.

Marine Mammals Protected under the MMPA

Direct Impacts. No ground disturbing activities or vegetation management activities would occur within the habitat of the marine mammals listed in Table 3-3; therefore, these actions will have no effect on marine mammals.

Noise Impacts. To evaluate the worst-case scenario, noise from the louder of the two proposed vehicles, the Laguna-E, was analyzed for potential impacts to marine mammals. During a Laguna-E launch, engine noise levels would be less than 110 dB Lmax at the nearest pinniped haulout at North Rocky Point (refer to Figure 3.4-2 of the EA). Daytona-E launches would reach approximately 102 dB Lmax at the same location and static fire tests of either vehicle would be less than 100 dB Lmax. These levels are less than those generated by the Delta II launch vehicle, which was measured at approximately 125 dBA at South Spur in 1996 (ENSR Consulting and Engineering 1996).

Sonic boom modeling of the planned trajectories predicts that both Daytona-E and Laguna-E would not produce a sonic boom that would impact the mainland or the NCI. Modeling also predicted that neither vehicle would produce a sonic boom over 1.5 psf (Figures 2-12 and 2-13). Noise and visual disturbance can cause variable levels of disturbance to pinnipeds that may be hauled out within the areas of exposure, depending on the species exposed and the rocket engine sound levels. VSFB has monitored pinnipeds on VSFB during launches to characterize the effects of noise and visual disturbance on pinnipeds during numerous launches over the past two decades and determined there are generally no substantial behavioral disruptions or anything more than temporary affects to the number of pinnipeds hauled out on VSFB. Generally, only a portion of the animals present tend to react to sonic booms. Reactions between species are also different. For example, harbor seals and California sea lions tend to be more sensitive to disturbance than northern elephant seals. Normal behavior and numbers of hauled out pinnipeds typically return to normal within 24 hours or less after a launch event. No observations of injury or mortality to pinnipeds during monitoring were attributable to past launches. As a result, we expect the Proposed Action's potential impacts on MMPA protected pinnipeds to be limited to brief behavioral reactions.

Under the MMPA, the NMFS issued a Final Rule for taking marine mammals incidental to VSFB launches (NMFS 2019a), and a Letter of Authorization (LOA; NMFS 2019b). The LOA allows launch programs to unintentionally take small numbers of marine mammals during launches. The SLD 30 is required to comply with the LOA listed conditions and address NMFS concerns regarding marine mammals at VSFB. Under the LOA, monitoring of marine mammals at VSFB is required during launches, including the proposed Daytona-E and Laguna-E launch program at SLC-5, under the following:

- Between 1 January and 30 June, pinniped monitoring at south Base haulout locations would commence at least 72 hours prior to a launch event and continue until at least 48 hours after each event.

Given the authorizations and Environmental Protection Measures (EPMs) in place (as described in Appendix A, Section A.3, Marine Biological Resources), including the required monitoring, the Proposed Action would not result in significant impacts on MMPA protected pinnipeds.

Consistency Review Conclusion

The Space Force and USFWS completed formal consultation for impacts resulting from the Proposed Action that may affect but are not likely to adversely affect the southern sea otter. The Space Force will comply with the existing LOA issued by NMFS for Level B Harassment (behavioral disruption) of marine mammals and will implement necessary monitoring and mitigation activities to protect marine mammal species.

The Space Force has determined that the Proposed Action would not result in population-level impacts on any marine resources and biological productivity of coastal waters would be maintained for long-term commercial, recreational, scientific, and educational purposes. Therefore, the Proposed Action would be consistent to the maximum extent practicable with Section 30230 of the CCA.

3.2.4 Article 4: Marine Environment (Water Quality)

Policies

CCA Section 30231 – "Biological productivity; water quality" states:

> *The biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored through, among other means, minimizing adverse effects of waste water discharges and entrainment, controlling runoff, preventing depletion of ground water supplies and substantial interference with surface water flow, encouraging waste water reclamation, maintaining natural vegetation buffer areas that protect riparian habitats, and minimizing alteration of natural streams.*

CCA Section 30232 – "Oil and hazardous substance spills" states:

> *Protection against the spillage of crude oil, gas, petroleum products, or hazardous substances shall be provided in relation to any development or transportation of such materials. Effective containment and cleanup facilities and procedures shall be provided for accidental spills that do occur.*

Consistency Review

Effects of the Proposed Action on marine biological resources are addressed in Section 3.2.3 (Article 4: Marine Environment [Biological Productivity]) with regard to CCA Sections 30230 and 30231 and terrestrial biological resources are addressed in Section 3.2.6 (Article 5: Land Resources) with regard to CCA Section 30240(b). The analysis determined that the Proposed Action would not affect biological productivity in the coastal zone, and the Proposed Action is consistent with Sections 30230, 30231, and 30240(b) to the maximum extent practicable.

The Proposed Action would result in potential impacts on surface water, groundwater quality, and water supply associated with construction and launch activities. This section will evaluate potential effects on water quality for consistency with the CCA Section 30230.

Wetlands

A recent survey of the SLC-5 Proposed Action Area found no potential features for Waters of the U.S., Waters of the State, or one parameter wetlands that would require jurisdictional delineation (MSRS 2021d). There were plants present on the landscape with a wetland indicator status of FAC, FACW or OBL, but the density and coverage was low so an official delineation for a single parameter wetland was not required and would not pass the dominance test. Honda Creek is a perennial blueline waterway located immediately south of the Proposed Action Area and contains jurisdictional waters and wetlands protected under federal and state laws (MSRS 2021e).

Surface Water

Constructing the SLC-5 launch site, installing utilities, establishing firebreaks, and making improvements to access roads would disturb soils, remove vegetation, increase impermeable surfaces, and increase the potential for hazardous materials to be spilled or released. The EPMs, as described in Appendix A, Sections A.4 (Water Resources) and A.8 (Hazardous Materials and Waste Management) and compliance with all existing federal and state regulations, would avoid and minimize impacts on surface waters from construction and operation at SLC-5. In addition, road improvements would follow standard recommended practices to avoid and minimize erosion potential (e.g., Bloser et al. 2012), dirt access roads would be inspected after rainstorms for indications of erosion, and repairs made promptly. Therefore, construction of SLC-5 and associated infrastructure would not have a significant effect on surface water.

The proposed launch activities at SLC-5 would create exhaust clouds; however, there are no solid fuels proposed, the design of the deflector would direct exhaust away from Honda Canyon, and emissions are not expected to have any effect on surface waters. Phantom would enroll in RWQCB's General Waiver for Specific Types of Discharges (or other state discharge permit) prior to discharging any water out of the deluge water retention basin. Any deluge water that remains after launches or stormwater that accumulates within the basin would be tested for contamination. If contamination is encountered, the contents would be pumped out and disposed of per the waiver/permit and state and Federal regulations. If the water is clean enough to go to grade, it would be discharged from the retention basin to an infiltration area or spray field. The Proposed Action is also exempt from the need for coverage under the NPDES Construction General Permit, due to there being no potential for discharge to Waters of the U.S. Therefore, impacts to surface water from launch operations at SLC-5 under the Proposed Action would not be significant.

Commercial space companies are independently responsible for compliance to provisions of the Clean Water Act and its requirements for development of site-specific Spill Prevention, Contingency, and Countermeasures (SPCC) plan under 40 C.F.R. 112. Inspection and enforcement of each SPCC and any permitted tanks are delegated to the Santa Barbara County Certified Unified Programs Agency. The SPCC requirements for commercial space companies do not fall under the jurisdiction of SLD 30. Under 40 C.F.R. 112, the SPCC would include elements that the Commission considers critical for these plans, including: an oil spill risk and worst-case scenario spill assessment that includes oil spill trajectories and identification of the coastal resources at risk from oil spill impacts, response capability analysis of the equipment, personnel, and strategies (both on-site and under contract) capable of responding to a worst-case spill, including alternative response technologies, oil spill preparedness training and drills, and evidence of financial responsibility demonstrating capability to pay for costs and damages from a worst-case spill. Phantom's secondary containment would be sized to capture all materials contained within any tanks present and the SPCC would include the necessary specifications on the spill response supplies needed at the site during operations.

Marine Debris

As discussed above, first stages will not be recovered. The first stage primary structure is aluminum and will typically break up during re-entry or impact with the ocean surface and sink after impact. Fairings will be either aluminum or composite materials. The fairings will sink if metallic. Composite fairings may float for a period of time unless they sustain major damage at impact. Wave action will deform the fairing until the composite materials delaminates and water can get into the honeycomb. At that point, they will sink. First stages and fairings are composed of inert materials that would not affect water quality or marine resources. Weather balloons (latex) and radiosondes (plastic) are inert, would split into pieces above the water or at impact, and quickly sink.

Under nominal conditions, the first stage and fairing halves will impact the ocean approximately 390 and 440 mi (628 and 708 km) downrange, respectively, outside of State or Federal waters. Phantom would provide contributions to the California Lost Fishing Gear Recovery Project to offset the impacts from unrecoverable debris (first stage, fairing, weather balloon, and radiosonde) if they are deposited in State or Federal waters. For every 1 pound of unrecoverable debris, Phantom would make a compensatory donation of $10.00, which is sufficient to recover 1 pound of lost fishing gear. Phantom will provide annual reports to the DAF. These data will be included in the 5-year status update.

Ground Water

Construction of the SLC-5 launch site and associated utilities would not require substantial excavation activities or require the use of footings that would interact with groundwater. At maximum cadence of 48 launches and static fires per year, the annual usage for deluge would range between 100,800 to 480,000 gallons (0.31 to 1.47 ac-ft). In addition, a maximum of 72,000 gallons (0.22 ac-ft) per year would be required to support the personnel and operational activities at SLC-5. Therefore, at maximum cadence, the Proposed Action will use up to 552,000 gallons (1.69 ac-ft) of water per year, or roughly equivalent to the amount used by three American households in a year. To meet this need, the Space Force would install an extension to the VSFB water supply line. The current water source for VSFB is the San Antonio Creek Groundwater Basin via four (4) water wells. Water is treated and transported to south Base users through a supply line which requires routine maintenance, partly due to relatively few users on this part of VSFB. As a critical part of that maintenance, VSFB flushes the supply line periodically to maintain water quality by removing sediment, mineralization, and discolored water. This practice also improves the carrying capacity of the lines and helps identify any failing pipes or connections. SLD 30 currently flushes the water supply line on south VSFB annually. The volume of water that needs to be flushed is dependent on the amount of active water use, since supply lines that are used frequently do not build up sediments or mineralization as quickly. American Water, the contractor managing and maintaining VSFB's water lines, determined that the proposed water usage at SLC-5 would be entirely offset by the compensatory reduction in the volume of water discharged to grade and therefore have no effect on water extraction from the San Antonio Creek Groundwater Basin (C. Mathews, American Water Operations Manager, pers. comm.). Therefore, the Proposed Action's water usage would have no effect on the San Antonio Creek Groundwater Basin.

Deluge water remaining after launches and stormwater that is collected in the deluge basin would be managed per the RWQCB's General Waiver for Specific Types of Discharges enrollment conditions (or other state discharge permit). Any deluge water that remains after launches or stormwater that accumulates within the basin would be tested for contamination. If authorized by SLD 30, Phantom may use the Industrial Wastewater Treatment Ponds (IWTP) on VSFB to dispose of the deluge wastewater, if laboratory analysis indicates the water meets IWTP standards. Phantom would use a certified laboratory that follows protocols set by Environmental Protection Agency and American Society for Testing and Materials to test the water samples for hydrocarbons. The laboratory would determine the appropriate analytical method. Qualified personnel would collect the samples following protocols prescribed by the laboratory.

The Proposed Action is exempt from needing coverage under the NPDES Construction General Permit, due to there being no potential for discharge to Waters of the U.S. No stormwater from SLC-5 would reach or be discharged to Honda Creek, Waters of the U.S., Waters of the State, or jurisdictional wetlands or storm drains leading to any of these features. Any stormwater that accumulates within retention basins would be tested for contamination. If contamination is encountered, the contents would be pumped out and disposed of per the waiver/permit and state and Federal regulations. If the water is clean enough to go to grade, it would be discharged from the retention basin to an infiltration area or spray field (Figure 3-1). If authorized by SLD 30 and if laboratory analysis indicates the water meets IWTP standards, Phantom may use of the SLD 30 IWTP to dispose of the deluge wastewater. The Proposed Action is exempt from the need for coverage under the NPDES Construction General Permit, due to there being no potential for discharge to Waters of the U.S.

During construction, Phantom would follow standard Best Management Practices and ensure the environmental protection measures (Appendix A) are implemented to prevent erosion and contain any contamination from spills. Any temporarily disturbed areas would receive hydroseed and/or erosion control measures as appropriate and necessary to ensure there are no stormwater impacts to Honda Creek or any other offsite areas.

If the water is clean enough to go to grade, it would be discharged from the retention basin to an infiltration area or spray field (Figure 3-1). During operation of SLC-5, accidental discharge of pollutants could occur; however, proper handling of hazardous materials and wastes management would reduce or eliminate potential contaminated runoff that could infiltrate groundwater. Phantom would enroll in the Regional Water Quality Control Board's General Waiver for Specific Types of Discharges (or other state discharge permit) prior to discharging any water out of the deluge water retention basin. In addition, implementing EPMs to protect water resources (Appendix A, Section A.4, Water Resources) would further help protect groundwater resources. Therefore, the Proposed Action would not have significant impacts on groundwater.

Water Supply

VSFB has two sources of drinking water; during normal operating conditions, the primary source comes from the State Water Project and the secondary source comes from four groundwater wells located on VSFB property. The VSFB wells are typically only used to augment State Water supplies and become the primary source during emergency repair or annual maintenance shutdowns on the State Water Project system. Over the past twenty years there have been several persistent drought periods affecting State Water Project supplies and VSFB has had to rely on its groundwater wells for extended periods to meet supply demands. At maximum cadence of 48 launches and static fire events per year, the annual usage for deluge would range between 100,800 to 480,000 gallons (0.31 to 1.47 ac-ft). In addition, a maximum of 72,000 gallons (0.22 ac-ft) per year would be required to support the personnel and operational activities at SLC-5. Therefore, at maximum cadence, the Proposed Action will use up to 552,000 gallons (1.69 ac-ft) of water per year. To meet this need, Phantom would install an extension to the VSFB water supply line. Annual VSFB water use over the past three years (2019 through 2021) has averaged 910,500,000 gallons (2,794 ac-ft) per year. Phantom's proposed use of up to 1.69 ac-ft per year would represent approximately 0.06% of the total annual water usage and is within the normal fluctuation and water demand of VSFB. The Proposed Action's water usage would result in no effect to sensitive coastal resources in San Antonio Creek.

Conclusion

The Proposed Action avoids substantially interfering with surface water flow and would not substantially alter the quality of coastal waters, streams, wetlands, or estuaries. Therefore, the Proposed Action is consistent to the maximum extent practicable with Sections 30231 and 30232 of the CCA.

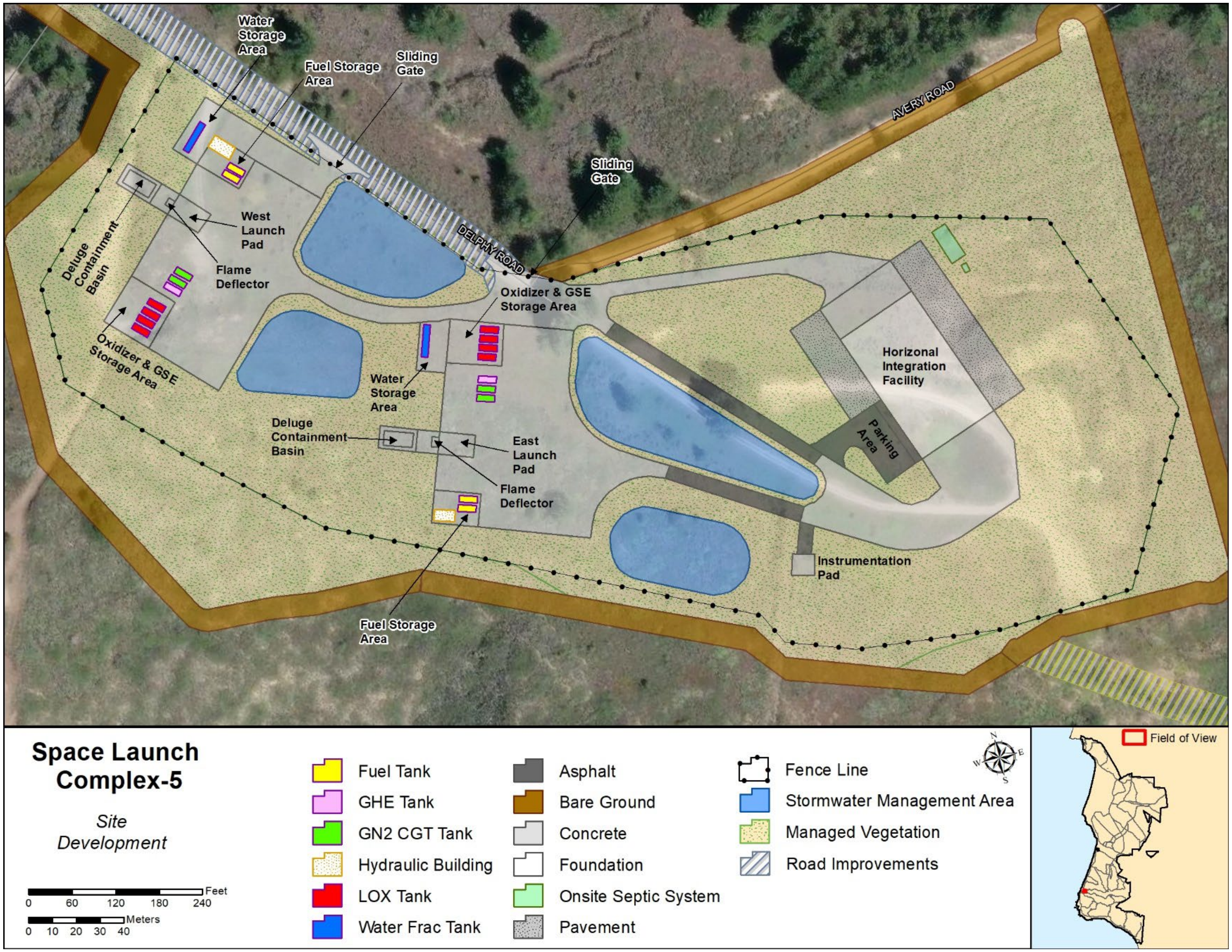

Figure 3-1: SLC-5 site plan

3.2.5 Article 4: Marine Environment (Commercial and Recreational Fishing)

Policies

CCA Section 30234 – "Commercial fishing and recreational boating facilities" states:

> *Facilities serving the commercial fishing and recreational boating industries shall be protected and, where feasible, upgraded. Existing commercial fishing and recreational boating harbor space shall not be reduced unless the demand for those facilities no longer exists or adequate substitute space has been provided. Proposed recreational boating facilities shall, where feasible, be designed and located in such a fashion as not to interfere with the needs of the commercial fishing industry.*

CCA Section 30234.5 – "Economic, commercial and recreational importance of fishing" states:

> *The economic, commercial, and recreational importance of fishing activities shall be recognized and protected.*

Consistency Review

Southern California's west coast is a leading recreational and commercial fishing area. Phantom conducted an in-depth analysis of the fisheries that may be affected by SLC-5 launches using the California Department of Fish and Wildlife (CDFW) Marine Fisheries Data Explorer database (CDFW 2023), as well as discussions with local fishermen associations. Phantom's launch azimuths will fall between 168^{o} – 220^{o} (see purple area in Figure 3-2. To reach sun synchronous orbits (SSO), which are in greater demand, flight trajectories are nearly centered within this azimuth fan at 187^{o} – 192^{o} (see orange area in Figure 3-2). This range overlays forty California Commercial Fisheries blocks as defined by CDFW, specifically blocks 643-644, 658-660, 671-675, 690-695, 713-717, 776, 732-736, 752-755, 777, 772-775, 818-820, 895, 839-841, 896, and includes two State Marine Reserves (SMR) in the region which prohibit or significantly minimize fishing, including the Vandenberg SMR directly west of SLC-5 and Richardson Rock SMR, west of San Miguel Island (red areas in Figure 3-2). Fishing in these blocks varies and is largely conducted by vessels from the Santa Barbara Harbor, which represents 94% of the fishing in these blocks. However, fishermen from the Port San Luis and Morro Bay Harbor also fish these waters, primarily within 3 nautical miles of the shoreline and north of Point Conception (C. Pavone, pers. comm.).

Fishing in the identified blocks is limited compared to other areas but is valuable for select species. The launch azimuth fan primarily overlays low producing fishing blocks and does not affect the high producing blocks that are further east around the Channel Islands (Figure 3-3). In 2022, the blocks overlaid by the range of Phantom's potential azimuths landed a total of 3,353,237 pounds (lbs) worth $4,468,697, which is 1.8% of the overall amount, or 2.3% of the value, of the state's total landings in 2022 (184,937,172 lbs worth $198,183,259; CDFW 2023).

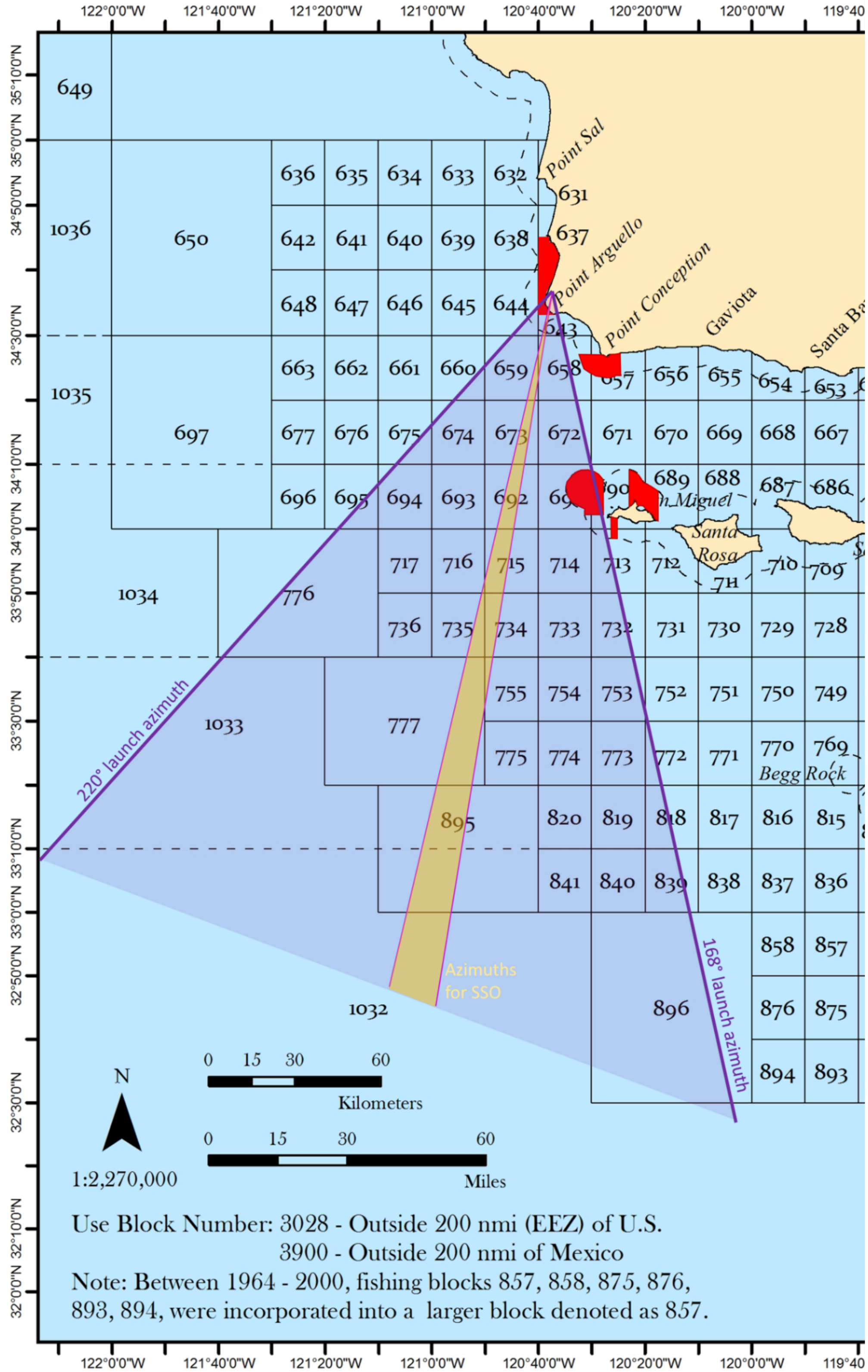

Figure 3-2: Phantom's Potential Launch Azimuth Range (purple), Most Frequent SSO Azimuths (orange), State Marine Reserves (red), and CDFW Fishing Blocks

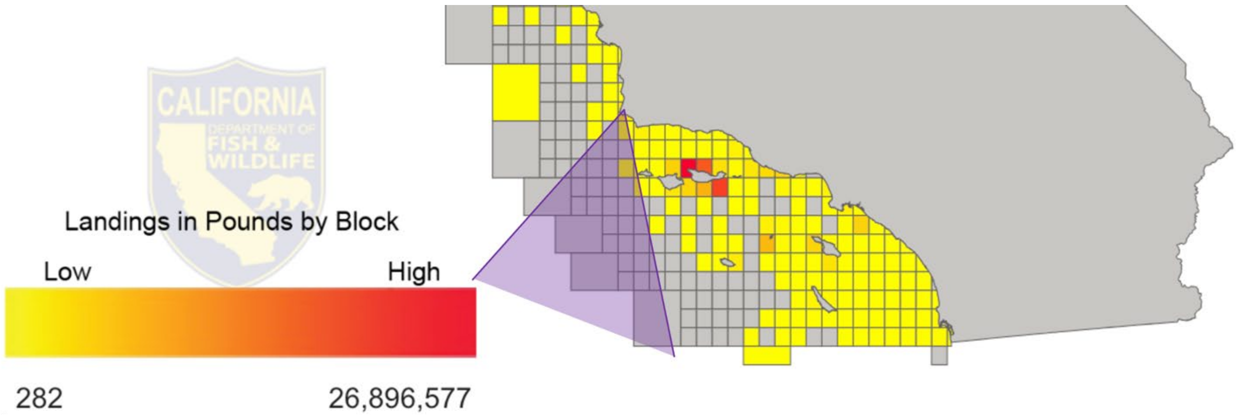

Figure 3-3: Landings in 2022 for Southern California Fisheries blocks

Further analysis of the blocks overlaid by the range of Phantom's potential azimuths revealed insights into the most active fisheries. Six Species Management groups were fished in the selected blocks (Table 3-4). Of these, Coastal Pelagic Species, Marine State Managed Invertebrates, and Groundfish dominated the landings by pounds and value. However, measured at the State level, only Groundfish and Marine State Managed Invertebrates stand out as a slightly higher than average contributor to State totals (Table 3-4).

Since 94% of vessels fishing in the area are from Santa Barbara Harbor, it's also valuable to look at these blocks from those vessels' perspectives. As shown in Table 3-4, the majority of Highly Migratory Species (namely bluefin tuna) brought in by Santa Barbara area-based vessels in 2022 came from the blocks overlaid by the range of Phantom's potential azimuths. However, the total value of this catch was only $156,284, or about 3.5% of the total value of the catch in 2022 (Table 3-4). Conversely, slightly more than one-third of groundfish brought in by the Santa Barbara area-based vessels comes from the blocks overlaid by the range of Phantom's potential azimuths, for a total value of $714,081 and 16% of these block's production.

The top 10 species from the selected blocks represent 95% of the landings by pounds (91% by value) as detailed in Table 3-5. This reveals market squid, red sea urchin, and California spiny lobster dominate the fishing and represent over two-thirds the selected blocks' landed value. Vermilion rockfish, shortspine thornyhead, brown rock crab, and red rock crab contribute substantially to state totals in these species but are much lower total value.

Table 3-4: Selected Blocks vs State and Santa Barbara Area Ports Totals in 2022

Species Management Group	Pounds	Value	% of Selected Blocks		% of State Total		% of Santa Barbara Area Total	
			lbs	$	lbs	$	lbs	$
Coastal Pelagic Species (CPS)	2,605,628	$ 1,561,017	77.7%	34.9%	1.7%	1.8%	2.5%	2.5%
Groundfish	173,390	$ 714,081	5.2%	16.0%	1.1%	4.1%	36.6%	37.7%
Highly Migratory Species (HMS)	32,119	$ 156,284	1.0%	3.5%	0.9%	1.8%	86.3%	74.6%
Marine State Managed Fish	103,387	$ 150,129	3.1%	3.4%	3.3%	1.8%	26.3%	8.9%
Marine State Managed Invertebrates	436,849	$ 1,877,662	13.0%	42.0%	4.6%	3.2%	12.0%	8.4%
Nearshore Fishery Management Plan Species	1,864	$ 9,524	0.1%	0.2%	1.1%	1.0%	4.1%	3.9%
TOTAL	3,353,237	$ 4,468,697	100%	100%	1.8%	2.3%	3.1%	5.1%

The public's safety during launch operations is of upmost importance to Phantom, FAA, USCG, and SLD 30, which includes the protection of maritime users near the launch vehicle's flight trajectory. Comprehensive safety measures, governed by federal regulations, are put into place for every launch to identify, communicate, and monitor areas that are at risk. Launch operations are conducted in a manner that is biased towards safety and vessels that ignore hazard warnings near the launch trajectory may delay or cancel a launch if they present unacceptable public risk. While considerable formal planning and regulatory communications are accomplished during this process, successful implementation is dependent upon the good faith and collaboration of all maritime users. Phantom is committed to go above and beyond the minimum regulatory requirements to coordinate with commercial and recreational fishing endeavors.

FAA regulations require Phantom to coordinate with USCG District 11 to receive an FAA license for launch activities. These FAA regulations do not bind the USCG to provide assets during commercial launch activities. The USCG has the discretion to determine how to employ its resources and manage risks related to space launch activities. The USCG supports SLD 30 with early warning communication to the maritime industry, which typically culminates in the USCG operational commander issuing a Local Notice to Mariners (LNM), aka NOTMAR, and/or Marine Safety Informational Bulletin (MSIB) notifying the public of the proposed location of space launch. These are notifications of potential hazardous operations and do not explicitly prohibit vessels from entering the identified areas. In determining the hazard areas, USCG District 11 evaluates Phantom and SLD 30 navigation risk assessments with launch and reentry activities associated with commercial and recreational vessels on the high seas off the California Coast.

Table 3-5: Top 10 Species in Selected Blocks vs State Totals in 2022

Species Management Group	Species Name	Pounds	Value	Pounds %	Value %	State% lbs	State % $
Coastal Pelagic Species (CPS)	Squid, market	2,587,714	$ 1,545,433	77.2%	34.6%	1.8%	1.8%
Groundfish	Rockfish, vermilion	41,416	$ 162,884	1.2%	3.6%	23.2%	25.6%
	Sablefish	81,673	$ 250,870	2.4%	5.6%	3.6%	5.9%
	Thornyhead, shortspine	19,887	$ 201,943	0.6%	4.5%	14.8%	22.2%
Highly Migratory Species (HMS)	Tuna, bluefin	27,761	$ 130,744	0.8%	2.9%	3.5%	6.0%
Marine State Managed Invertebrates	Crab, brown rock	11,669	$ 41,320	0.3%	0.9%	31.8%	41.4%
	Crab, red rock	40,013	$ 136,700	1.2%	3.1%	11.5%	17.3%
	Crab, yellow rock	27,241	$ 74,188	0.8%	1.7%	4.2%	4.7%
	Lobster, California spiny	16,017	$ 319,183	0.5%	7.1%	1.7%	1.7%
Marine State Managed Invertebrates	Sea urchin, red	324,841	$ 1,187,240	9.7%	26.6%	11.1%	11.6%
	TOTAL	3,178,232	$ 4,050,505	94.8%	90.6%	1.8%	2.3%

To ensure public safety, such warnings are issued for each launch time duration plus 30 minutes to account for any possible falling debris. The timing, duration, and direction of the launch is highly dependent upon the mission's requirements for accessing space. Akin to the ocean tides often dictating the best times for fishing, the earth's rotation and orbital mechanics dictate when and what direction to launch. For example, when needing to rendezvous with another spacecraft, the length of available times to launch can be as short as instantaneous and inflexible to move. Similarly, launch opportunities may only be available every few days or may only be available for a few weeks every so many years, which often is the case in launching to other planets or space objects. Alternatively, populating satellite constellations and launching prototype satellites are typically more flexible and may result in longer and adjustable times. Even with the most flexible orbital requirements, the length of the time window for launch, as well as the number of consecutive launch attempts, must be constrained to properly fit into other maritime operations as well as with the FAA-managed national airspace system and the efficient operations and movement across VSFB. As such, launch windows, and the subsequent hazard areas, are generally constrained to no more than 4 hours (often less) with one primary launch day and one back-up day. Some timing flexibility and back-up day allows the launch service provider flexibility around adverse weather as well as recover from unexpected launch or support system failures.

In addition to mission requirements, launch days/times are adjusted by SLD 30 personnel to fit within the range's schedule as well as FAA for national airspace coordination and USCG for maritime coordination. Launch service providers provide SLD 30 with several months of awareness of their launch manifests to help the range forecast launch demand for scheduling. FAA regulations require Phantom to request a specific launch day/time no later than 45 days prior to provide adequate time for final coordination and adjustments of the flight path and hazard areas. Typically, NOTMARs are issued several weeks prior to launch to warn mariners.

It's important to note that only a small subset of the blocks overlaid by the range of Phantom's potential azimuths (Figure 3-2) would be affected by each launch and only for a relatively short period of time. Notionally, this area will only be a block or two wide along each given trajectory. The size and shape of the vehicle hazard area (VHA) described in the NOTMAR is specific to the mission and timing. The VHA is typically characterized by a corridor of 5 to 15 nautical miles on either side of the flight path to a point where the risk is below safety thresholds. The size of the VHA varies based on several factors including the launch flight trajectory and simulations of variations of the trajectory, expected seasonal winds, launch vehicle reliability, launch vehicle break-up modeling in case of an anomaly, anticipated vessel traffic, and other factors. As such, a specific VHA cannot be developed for future Phantom missions until mission-specific launch profiles have been identified, scheduled, and modeled. Newer, unproven, or less-proven launch vehicles will have a larger VHA to be more cautionary. As vehicle reliability is proven, the VHA will narrow closer to the flight path but vary based on the other variables described above. Although VHAs have not been modeled for Phantom missions, Figure 3-4 shows two examples identified in recent NOTMARs for VSFB launches. The map on the left depicts a VHA of a relatively new launch vehicle approximately 10-15% larger than Phantom's Laguna launch vehicle. Because Phantom's vehicles are smaller, these are likely much larger than the VHAs that would be determined for Phantom's initial launches. The map on the right depicts the VHA of a highly reliable rocket approximately the same size as Phantom's Daytona. A similar sized VHA would be expected for Phantom's Daytona once reliability is established. The Laguna would be expected to have a slightly larger VHA. Note that in both examples, the vehicle launch azimuths are west from VSFB; Phantom's flight paths would be southerly, thus the VHA would also be aligned in a southern direction.

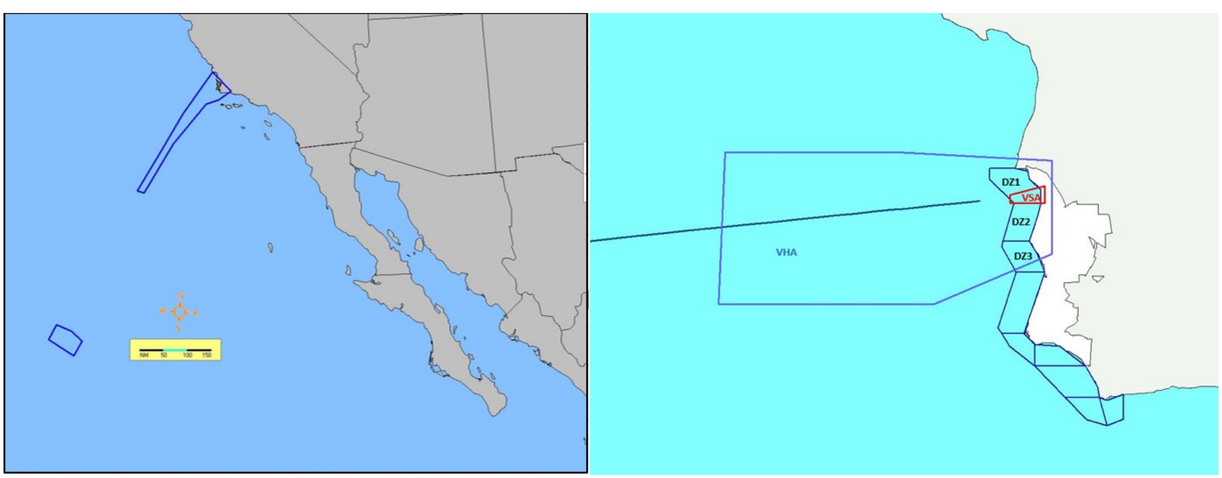

Figure 3-4: Example vehicle hazard areas for representative VSFB launches

It's also important to note that while newer launch vehicles have larger VHAs, they launch less frequently. Time between launches allows launch service providers to study the rocket's performance and address any concerns from the FAA and range personnel. The average time between launches of new vehicles has been 8.7 months and is no shorter than 2-3 months. Therefore, although larger VHAs are implemented, they occur infrequently. As launch vehicle reliability is proven, smaller VHAs can be applied, and launch cadence may increase. In addition, as the vehicle's reliability increases (and barring weather impacts) the launch will occur "on time" more regularly at the beginning of the launch window, thus shortening the period of time the VHA is applied. Phantom's projected launch cadence increases slowly over time and approximately doubles each year. As such, initial impacts to commercial and recreational fisheries will be infrequent and Phantom will have several years to develop strong relationships with maritime stakeholders.

As noted above, since the NOTMARs are typically unpatrolled warning areas and not hard closures, vessels that enter the hazard area pose a safety risk for the launch. SLD 30 range safety personnel update risk safety calculations on-the-spot when a vessel is observed in the VHA to ensure the safety requirements are not exceeded. For small vessels with only a few people, such as most recreational and commercial fishing vessels, the risk calculations often are not violated, and the launch may proceed. However, an increase in vessel traffic in the VHA and/or a vessel (even a small one) close to the trajectory may violate the safety criteria and cause the launch to be delayed or cancelled. A launch delay or cancellation adds significant operations costs to a launch, including rescheduling of range assets and staffing, perishable launch commodities (e.g., liquid oxygen, nitrogen gas, helium gas), mission delay costs, and potential customer penalties. Phantom is, therefore, highly motivated to work with other maritime users to avoid conflicts that could cause inadvertent delays.

Communication beyond the NOTMAR is key to successfully minimize and avoid impacts to recreational and commercial fishing stakeholders. Phantom will establish a communication protocol with these stakeholders in the region. During the months leading up to a launch, Phantom will actively seek input and coordinate with potentially affected stakeholders and explore ways to adjust the launch schedule that would avoid or mitigate any potential impacts. Phantom will establish regular dialogue with a variety of commercial and recreational fishing stakeholders, including the Port San Luis Commercial Fishermen's Association and similar fisherman associations, fish buyers and processors, harbor masters, and sport fishing companies. Informal and useful communications that have worked well at other spaceports include meet-and-greet events to increase awareness on both sides, email distribution lists of launch dates/times, and a hotline for launch updates to access while at sea. Through good faith cooperation and proactive coordination, Phantom aims to operate as a trusted neighbor alongside the fishing communities to provide a safe and productive maritime environment for all.

Initial discussions with the chair of the Port San Luis Commercial Fishermen's Association have already identified measures that will be implemented to avoid and minimize disruptions to fishing offshore of VSFB. Phantom will provide the chairmen of local fisherman's associations with an email that includes a printable flyer showing the date and time of the launch window(s), the VHA, and how long the VHA will be in effect. Although this duplicates the information presented in the NOTMAR, discussion with the chair of the Port San Luis Commercial Fishermen's Association indicated that directly communicating the area and physically posting it on an announcement board used by the fishermen would be the most effective way of enabling the fishermen to plan around launch activities, if necessary. Phantom discovered that many fishermen currently avoid all areas offshore of VSFB during launches because they did not realize that only a relatively small portion of the area is included in the VHAs, leaving lots of fishing grounds in the surrounding area completely unaffected during launches. Phantom also discovered that fishermen using the area offshore of VSFB primarily fish in the morning in near-shore (< 3 nautical miles) shallow reef habitat. Therefore, Phantom will avoid morning launches when there is orbital insertion flexibility and ensure that launch times are clearly communicated so that fisherman know where and when the VHA is in effect.

Furthermore, Phantom recognizes that different species are fished at different times of the year. As such, Phantom will adjust coordination with stakeholders according to the varying seasons. While regular communications with the broadest set of commercial and recreational fishing communities is important, understanding the top species is helpful to prioritize Phantom's coordination and collaboration with the specific fishermen most likely affected by a given launch. It's also important to understand that not all fisheries are productive year-round as shown in Table 3-6. For example, the Marine Fisheries Data Explorer database shows market squid is harvested largely October-February with November and December being the more active months.

Table 3-6: Most Active Months for Top 10 Species in Selected Blocks

Species Name	Most Active Months
Squid, market	Oct-Feb (Nov-Dec strongest)
Rockfish, vermilion	Year-round
Sablefish	Year-round (Sept-Oct strongest)
Thornyhead, shortspine	Jan-May
Tuna, bluefin	end of Aug-Sept
Crab, brown rock	Year-round (Oct-Nov strongest)
Crab, red rock	Year-round
Crab, yellow rock	Year-round (Apr-Sept)
Lobster, California spiny	Oct-Feb (Oct strongest)
Sea urchin, red	Year-round (less in Mar-May)

Phantom's leadership recognizes that the space launch industry bears the burden of initiating and sustaining this collaboration with support from VSFB and Phantom plans to be an industry leader in these efforts. Phantom's leadership has experience in balancing space launch and fishing needs. Specifically, Phantom's Chief Operations Officer and the company's top launch executive was the Chief Executive Officer of Alaska Aerospace Corporation, the State agency responsible for spaceport operations on Kodiak Island, Alaska. During his tenure he personally tackled the integration of increased commercial launches at the PSCA with one of the largest commercial fishing industries in the U.S. Working in good faith through better communication, relationships and trust developed, challenges were identified, both groups gained a better appreciation of each other's needs, and operations were adjusted to continue to ensure strong communications and shared use of the sea. Phantom is confident that these lessons and approaches can be applied to SLC-5 operations and the Southern California fishing industry to achieve collaboration and meet everyone's economic and operational needs.

As discussed above, Phantom is committed to an outreach program with the fishing communities beyond the formal NOTMAR process to successfully integrate Phantom's launch operations into the way-of-life of Southern California. The above detailed analysis and experience provides Phantom with unmatched insights to create an actionable and valuable plan. Within 90-days of completing the NEPA-process for SLC-5, Phantom, with support and collaboration from SLD-30, will develop a Phantom Space Fisheries Communications and Coordination Plan that will outline the planning and execution steps to avoid and minimize impacts of Phantom launches to the commercial and recreational fishing communities. This will be made available to the fishing communities and California Coastal Commission for transparency, feedback, and insight. Phantom will prepare an annual report outlining the communications completed, launches conducted, successes/challenges encountered, and takeaways (e.g., best practices and recommended actions) learned.

Genuine outreach, collaboration, and good-faith coordination between Phantom and the fishing communities will yield many options to best balance the needs of all maritime users. For example, launch days/times may be adjusted to the extent possible to avoid time sensitive fishing events such as short openers or other high use times. Similarly, collaborative pre-planning and deeper understanding of the NOTMAR warning areas allows mariners to understand how small adjustments in their plans, such as adjusting port departure times or fishing areas, will meet their landing goals while also respecting Phantom's shared use of the maritime environment for safety. Orbital mechanics and other competing demands, such as FAA commercial air traffic adjustments, may not fully satisfy fishermen requests. In these cases, additional coordination prior to and on launch day will help balance needs, including updated launch safety calculations and real-time radio communications. Therefore, impacts on recreational and commercial fishing would be less than significant. The Proposed Action is consistent to the maximum extent practicable with Sections 30234 and 30234.5 of the CCA.

3.2.6 ARTICLE 5: LAND RESOURCES

Policies

CCA Section 30240 (b) – "Environmentally sensitive habitat areas, adjacent developments" states:

> *Development in areas adjacent to environmentally sensitive habitat areas and parks and recreation areas shall be sited and designed to prevent impacts which would significantly degrade those areas, and shall be compatible with the continuance of those habitat and recreation areas..*

CCA Section 30244 – "Archaeological or paleontological resources" states:

> *Where development would adversely impact archaeological or paleontological resources as identified by the State Historic Preservation Officer, reasonable mitigation measures shall be required.*

Consistency Review

Biological resources within and near the Proposed Action Area were characterized based on a review of VSFB GIS data that includes multiple survey efforts and observations since the 1990's, review of prior survey reports for the area, and available documents for the Proposed Action. In addition, MSRS conducted biological surveys within the Proposed Action Area where construction/physical impacts would occur (construction area) in November 2019, March 2020, and August 2021. Qualified biologists conducted these surveys to identify species and habitats likely to be affected by the Proposed Action and characterized and mapped vegetation communities within the terrestrial Action Area subject to physical impacts. The primary surveyor, Alice Abela, is an expert in plant, bird, mammal, reptile, amphibian and insect identification and associated survey techniques. Ms. Abela has over 22 years of experience on VSFB performing species surveys, wetland delineations, and preparation of biological assessments (Attachment C). Additionally, Dr. John LaBonte, Ph.D. reviewed all survey results, research data, and determinations of species potential occurrence within the project area. Dr. John LaBonte specializes in reptiles and amphibians of Central California and has 27 years of biological research and professional experience working in Southern and Central California (Appendix C). Qualified biologists conducted surveys by walking meandering transects throughout the construction area. Prior special status species monitoring data, survey reports, and California Natural Diversity Database (CNDDB) records, were reviewed to assess the potential occurrence, distribution, and habitat use of special status species within the Action Area. During surveys, biologists mapped any special status species detected and evaluated habitat for the potential occurrence of special status species. The survey covered all areas and was adequate to detect any special status plants occurring in the area due to multiple visits at different times of year. No special status plant species were found within the Proposed Action Area. Biologists surveyed for potential wetlands, wetland vegetation, standing water, or defined channels. Biologists delineated all vegetation communities within the Proposed Action Area. The potential occurrence of special status animal species that were not observed during surveys was determined based on the presence of suitable habitat and records of occurrence of the species within and near the Action Area. These species were assumed present if suitable habitat or prior records indicated localities in the area. Additional sources reviewed to determine potential for occurrence included the CNDDB and existing local and regional references (e.g., University of California, Santa Barbara, museum catalog records, SLD 30 survey records).

Appendix B includes a list of special status species assumed to occur in the proposed Phantom construction footprint (Table B-1). All species that were reasonably likely to occur were assumed potentially present; therefore, the Space Force believes there is no requirement to conduct protocol surveys. These species likelihood of occurrence and where they may be found within the Action Area are discussed below.

The California least tern nests at Purisima Point and adults and fledglings roost and forage at Santa Ynez River lagoon. The nesting colony is approximately 9.4 mi north of SLC-5. The lagoon is approximately 6.0 miles north of SLC-5. At these distances, terns would be outside areas where loud noises would occur and be far enough from the launch and static fire activities that no effect on nesting, foraging, or roosting terns is expected. Potential habitat for least Bell’s vireo (federally listed endangered species/state listed endangered species) and southwestern willow flycatcher (federally listed endangered species/state listed endangered species) exists on VSFB. However, these species have not been documented within the area potentially impacted by a significant launch or static fire related noise. Historically occupied breeding habitat for the southwestern willow flycatcher along the Santa Ynez River on VSFB has been degraded and is unlikely to support breeding in the future (Seavy et al. 2012). As a result, these species were not carried forward for analysis of impacts.

As shown in Table 3-7, there are five species that occur within the vicinity of SLC-5 that are federally listed as threatened or endangered under the Endangered Species Act (ESA). The Space Force determined these species may be potentially affected by the Proposed Action from physical impacts during construction and noise impacts during construction and operation of the launch facility. The Space Force completed formal consultation with the USFWS for these species and the Biological Assessment has been included in this request for your awareness.

Table 3-7: Determination of Potential Impacts to Federally Listed Threatened & Endangered Species

Species	Status	ESA Effects Determination
FISHES		
Tidewater goby (*Eucyclogobius newberryi*)	FE	NLAA
AMPHIBIANS		
California red-legged frog (*Rana draytonii*)	FT	LAA
BIRDS		
California condor (*Gymnogyps californianus*)	FE	NLAA
Marbled murrelet (*Brachyramphus marmoratus*)	FT	NLAA
Western snowy plover (*Charadrius nivosus nivosus*)	FT	LAA

Notes: FE = Federally Endangered Species; FT = Federally Threatened Species; MMPA = Marine Mammal Protection Act, NA = not applicable; NE = no effect; NLAA = May affect, not likely to adversely affect; ESA = Endangered Species Act, MMPA = Marine Mammal Protection Act

Tidewater goby (TWG; *Eucyclogobius newberryi*)

Direct Impacts. The SLC-5 launch pads would be designed to direct any ejected steam or water and flame produced during launch away from Honda Canyon. As a result, there would be no potential impacts to Honda Creek, where suitable, but currently unoccupied TWG habitat is located. Therefore, the Proposed Action would not have any direct physical impacts on TWG.

Noise Impacts. To evaluate the worst-case scenario, noise from the louder of the two proposed vehicles, the Laguna-E, was analyzed for potential impacts to TWG. During each of the 48 launch events that would occur on an annual basis, engine noise produced by the Laguna-E would reach 130 dB maximum sound level (Lmax) at potential TWG habitat in Honda Creek. Static fire events would similarly reach up to 130 dB Lmax at this location.

Exceptionally little sound is transmitted between the air-water interface (Godin 2008). Therefore, in-air sound during launches and static fire events is not expected to cause more than a temporary behavioral disruption to fish, if present, in Honda Creek. Since TWG have not been detected during regular survey efforts dating back to 2008 (MSRS 2009, 2016, 2018a), they are unlikely to be present during the proposed launch and static fire activities; however, TWG could potentially recolonize Honda Creek in the future.

Conclusion. Because of the low likelihood of TWG presence in Honda Creek and the minimal transfer of in-air noise into underwater noise, the anticipated level of disturbance from the Proposed Action would be discountable. Therefore, VSFB has determined that the Proposed Action may affect but is not likely to adversely affect the TWG and, therefore, would not be significant.

California red-legged frog (CRLF; *Rana draytonii*)

Direct Impacts. Direct impacts on post-metamorphic CRLF, including injury and mortality, may inadvertently occur during removal of vegetation, site grading and contouring, construction, firebreak and fire access road establishment, and site maintenance from the operation of heavy equipment, machinery, and vehicles. CRLF that may disperse through the Action Area could become entrapped in any holes or trenches left open overnight. However, open holes and trenches would be covered overnight and the risk of impacts on CRLF will be reduced because biologists will monitor construction activities and search for animals trapped in open holes and trenches. Any CRLF detected within the construction area would be captured and relocated to nearby suitable habitat. In addition, when any demolition, contouring, or construction is occurring at SLC-5, the active construction areas would be surrounded by exclusion fence. A USFWS approved biologist would be present to monitor vegetation-clearing activities and move any CRLF encountered to the nearest suitable habitat out of harm's way. Regardless, post-metamorphic frogs may be injured or killed during construction and vegetation clearing activities. The risk of introducing or spreading chytrid fungus would be reduced by requiring implementation of the Declining Amphibian Populations Task Force (DAPTF) Fieldwork Code of Practice (DAPTF 2019).

During launches, ejected steam, deluge water, and flame may injure or kill CRLF that are in the vicinity of the launch pad or exhaust ducts at time of launch. However, the launch pads would be designed to direct any ejected steam or water and flame away from Honda Canyon, therefore avoiding any potential impacts to Honda Canyon, where CRLF are known to breed and the most likely area for them to occur year-round. Additionally, the exhaust ducts would be maintained free of water between launches and deluge water would only be added for 20-seconds. Any ejected water would be captured in a retention basin. Retained water would be tested for hydrocarbon contamination in the days following each launch. If the resulting values are compliant with the Vandenberg Hazardous Waste Management Plan (Department of the Air Force 2019), the water will be discharged to grade. Otherwise, water will be pumped and properly disposed of as wastewater. Any water retention basins would be designed to exclude access by CRLF. If such exclusion is not possible, and water is present in retention basin overnight, the basin would be checked daily for CRLF prior to pumping. Finally, due to vegetation management around the proposed launch pads, the likelihood of CRLF being present near the pads during launch events would be very low.

Noise Impacts. To evaluate the worst-case scenario, noise from the louder of the two proposed vehicles, the Laguna-E, was analyzed for potential impacts to CRLF. During each of the 48 launch events that would occur on an annual basis, engine noise from Laguna-E vehicles would reach 130 dB Lmax in areas known to be occupied by CRLF in Honda Creek. Static fire events would similarly reach up to 130 dB Lmax in Honda Canyon. Engine noise would reach as high as 144 dB Lmax in upland CRLF dispersal habitat on SLC-5 during these events (refer to Figure 3.3-3 of the EA). However, vegetation management in the immediate vicinity of launch vehicle launch sites would make CRLF presence above ground in these areas unlikely during typical dry conditions.

All life stages of CRLF can detect noise and vibrations (Lewis & Narins 1985) and are assumed to be able to perceive the engine noise produced by launch vehicles. There are no studies on the effects of noise on CRLF, and few studies on the effects of noise disturbance on anurans in general. Those studies that have been conducted have often focused on the effects of sustained vehicle noise associated with roads near breeding ponds, which have been shown to have negative effects on individual frog's behavior and physiology and may have consequences for populations (see Parris et al. 2009 and Tennessen et al. 2014). However, impacts from engine noise would be of short duration and, therefore expected to have different effects on frogs than sustained noise.

Engine noise would likely trigger a startle response in CRLF, causing them to flee to water or attempt to hide in place. It is likely that any reaction would be dependent on the sensitivity of the individual, the behavior in which it is engaged when it experiences the noise, and the sound level (e.g., higher stimuli would be more likely to trigger a response). Regardless, the reaction is expected to be the same – the frog's behavior would be disrupted, and it may flee to cover in a similar reaction to that of a frog reacting to a predator. As a result, there could be a temporary disruption of CRLF behaviors including foraging, calling, and mating (during the breeding season). However, frogs tend to return to normal behavior quickly after being disturbed. Rodrıguez-Prieto and Fernandez-Juricic (2005) examined the responses in the Iberian frog (*Rana iberica*) to repeated human disturbance and found that the resumption of normal behavior after three repeated human approaches occurred after less than four minutes. Sun and Narins (2005) examined the effects of airplane and motorcycle noise on anuran calling in a mixed-species assemblage, including the sapgreen stream frog (*Rana nigrovittata*). Sun and Narins found that frogs reduced calling rate during the stimulus but the sapgreen stream frog increased calling rate immediately after cessation of the stimuli, likely in response to the subsequent lull in ambient sound levels. Similarly, qualified biologists working on VSFB and elsewhere in CRLF occupied habitat have routinely observed a similar response in this species after disrupting individuals while conducting frog surveys (A. Abela, M. Ball, and J. LaBonte, pers. obs.). CRLF would, therefore, be expected to resume normal activities quickly once the disturbance has ended and any behavioral response would be short term.

Although no studies have been conducted on hearing damage in CRLF, Simmons et al. (2014) found that consistent morphological damage of hair cells in the hearing structures of American bullfrogs (Lithobates catesbeianus), which are within the same Family as the CRLF (Ranidae), were observed with sound exposure levels (SEL) greater than 150 dB Lmax SEL. Even after such hearing damage, bullfrogs showed full functional recovery within 3 to 4 days, thus the hearing damage was temporary (Simmons et al. 2014). CRLF in terrestrial environments may be exposed to engine noise levels of 144 dB Lmax and, therefore, even temporary hearing damage would be unlikely for CRLF that may be present. Additionally, due to vegetation management around the proposed launch vehicle sites, the likelihood of CRLF being present in terrestrial environments exposed to these noise levels would be very low and few individuals would be impacted.

In alignment with the BO, the Space Force commits to implement a monitoring program to track CRLF habitat occupancy, breeding behaviors (calling), and breeding success (egg mass and tadpole densities) in lower Honda Creek as the frequency of launch and static fire tests under the proposed project gradually increases. Because Phantom intends to slowly ramp up to a full tempo of 48 launches and 48 static fire tests annually over the course of five years, the Space Force will be able to assess incremental changes in the acoustic environment and CRLF populations in Honda Creek. The Space Force will place passive bioacoustic recorders and conduct CRLF surveys in Honda Creek. The specific threshold criteria for declining CRLF trends would be if surveys detected fewer adult frogs from baseline average two years consecutively, 15% (this was agreed upon through discussion between USFWS species-specific experts and the Space Force based on normal fluctuations observed in survey results in Honda Creek over the past 10+ years) or more decline in egg mass or tadpole densities, or average call-rate changes decrease with increasing disturbance level. The decline will be attributed to the Phantom Project if it cannot confidently be attributed to other natural or human caused factors not related to the Phantom project. The Space Force would mitigate for these impacts by creating new CRLF breeding habitat at the San Antonio Creek Oxbow Restoration Area, an established wetland mitigation site that is located outside of areas currently impacted by launch noise and site lighting on VSFB.

Artificial Lighting Impacts. The effects of artificial lighting on anurans are inconsistent and appear to vary by species and life stage (reviewed in Dutta 2018 and Froglife 2019). Frogs illuminated with acute artificial light originating from flashlights have been shown to reduce calling frequency (Baker & Richardson 2006; Hall 2016). Reduced calling has the potential to negatively impact breeding and, therefore, affect population dynamics (Baker & Richardson 2006).

The reaction to acute artificial light exposure may be different than that to diffused artificial ambient light, such as facility lighting. In studies on wood frogs (*Lithobates sylvaticus*), experimental exposure to artificial light at night was found to make them more vulnerable to other stressors such as parasites and pollution (May et al. 2019). In a study designed to mimic artificial light generated by street and outdoor lighting on common toads (*Bufo bufo*) during their breeding period, the total time spent in activity by male toads decreased by more than half due to decreases in activity during the night period. There were also changes in energy metabolism. Coupled, these changes have the potential to impact reproduction and overall fitness in species exposed to artificial light at night (Touzot et al. 2019).

If facility lighting associated with the Proposed Action results in an increased presence of artificial light in the Honda Creek riparian corridor CRLF are likely to be adversely impacted. However, except when necessary for safety or performance of launch operations, artificial lighting at the SLC-5 facility would be minimized during the hours of darkness. In addition, modeling of the preliminary lighting plan shows that lighting levels of 1-foot candle would not extend beyond the SLC-5 facility (refer to Figure 4.3-1 of the EA).

Habitat Impacts. The Proposed Action would not have any impacts to CRLF aquatic habitat. The Proposed Action may, however, result in a degradation in the quality of CRLF aquatic habitat in Honda Creek through exposure to artificial light at night. As noted above, artificial lighting at SLC-5 would be minimized during the hours of darkness, except when necessary for safety or performance of launch operations, and, to the maximum extent practicable, lights would be placed and designed to minimize illumination of Honda Canyon. Construction of SLC-5 and the associated firebreaks, fire access road maintenance, and utility corridor would result in impacts to approximately 37.8 ac (15.3 ha) of suitable CRLF upland dispersal habitat (Note: total excludes existing paved roads).

Conclusion. VSFB has determined that noise, artificial lighting, and potential physical impacts may affect, and are likely to adversely affect CRLF. To comply with the USSF's sections 7(a)(1) and 7(a)(2) obligations under the ESA, as well as the prospective USFWS Mitigation Policy, post-project restoration activities will be implemented. Restoration activities would align with the objectives of the CRLF Conservation Strategy (USFWS in prep) with the goal of achieving no net loss to the species. Therefore, effects on CRLF will not be significant.

Marbled Murrelet (MAMU; *Brachyramphus marmoratus*)

Direct Impacts. No ground disturbing activities or vegetation management activities would occur within or near MAMU habitat.

Noise and Visual Impacts. To evaluate the worst-case scenario, noise from the louder of the two proposed vehicles, the Laguna-E, was analyzed for potential impacts to MAMU. This species has occasionally been observed between the late summer through winter foraging off the coast of south VSFB (eBird 2021). Although unlikely, if MAMU were present immediately off the coast during a Laguna-E launch event, they would experience engine noise of less than 120 dB Lmax (refer to Figure 3.3-4 of the EA). During static fire events, noise directly off the coast of SLC-5 would be less than 115 dB Lmax. Noise levels during Daytona-E launches and static fire events would be less than those produced by the Laguna-E. Additionally, the majority of MAMU are found in a band approximately 984 to 6,561 ft (300 to 2,000 meters [m]) from shore (Strachan et al. 1995) where noise levels would decrease to as low as 110 dB Lmax. MAMU do not nest on VSFB so exposure to noise impacts would be limited to foraging adults.

Very little data are available regarding MAMU's response to noise and visual disturbances; however, Bellefleur et al. (2009) examined the response of MAMU to boat traffic. MAMU response was found to depend on the age of the birds, the distance and speed of the boats encountered, and the season. MAMU either showed no reaction, flew, or dove in response. Late in the season (July through August), some MAMU were found to fly completely out of feeding areas when approached by boats traveling in excess of 17.9 mi per hour (28.8 km per hour). The dominant response of MAMU to approach by boats was, however, for birds to dive and resurface a short distance away. Therefore, we expect MAMU to dive and resurface as a startle response, but then return to normal behavior soon after each launch or static fire event has been completed.

Conclusion. Based on our analysis, MAMU are unlikely to be present during a launch or static fire event and if present may have a temporary behavioral reaction in response to noise. Thus, the Proposed Action would have a discountable effect on MAMU. Therefore, VSFB has determined that the Proposed Action may affect, but is not likely to adversely affect MAMU and, therefore, would not be significant.

Western Snowy Plover (SNPL; *Charadrius nivosus*)

Direct Impacts. No ground disturbing activities or vegetation management activities would occur within or near SNPL habitat; therefore, these actions would have no effect on SNPL. The potential effects of noise are discussed below.

Noise and Visual Disturbance. To evaluate the worst-case scenario, noise from the louder of the two proposed vehicles, the Laguna-E, was analyzed for potential impacts to SNPL. The nearest nesting areas would be exposed to levels between 100 and 110 dB Lmax during Laguna-E launches (refer to Figure 3.3-5 of the EA) and less than 100 dB Lmax during static fire events. SNPL monitoring for impacts from launch-related engine noise and visual disturbance has been conducted during numerous launches on VSFB. Direct observations of wintering birds were made during a Titan IV and Falcon 9 launch from SLC-4E (SRS Technologies, Inc. 2006b; Robinette and Ball 2013). The Titan IV launches resulted in sound levels of 130 dBA Lmax. SNPL did not exhibit any adverse reactions to these launches (SRS Technologies, Inc. 2006b; Robinette and Ball 2013) except for one observation. During the launch of a Titan II from SLC-4W in 1998, monitoring of SNPL found the nest located closest to the launch facility had one of three eggs broken after the launch (Applegate and Schultz 1998). The cause of the damaged egg was not determined.

More recently on 12 June 2019, SNPL response was documented during a SpaceX Falcon 9 launch and first stage recovery at SLC-4. The return flight of the first stage to VSFB produced a 3.36 psf sonic boom and landing engine noise of 138 dB Lmax and 130 dB SEL, as measured on South Surf Beach. SNPL response to the noise impacts was documented via pre- and post-launch monitoring and video recording during the launch event. Incubating SNPL captured on video were observed to startle and either jump or hunker down in response to the sonic boom. One SNPL egg showed signs of potential damage. This egg was part of a three-egg clutch in which the other two eggs successfully hatched. It is not uncommon for one or more eggs from a successful nest to not hatch. Failure of the egg to hatch could not be conclusively tied to the launch event (Robinette and Rice 2019).

In alignment with the BO, the Space Force commits to augmenting the existing SNPL monitoring program on VSFB, which records habitat use, nesting efforts, nest fates, fledgling survival, and population size through each breeding season, with geospatial analysis of SNPL nesting and the noise environment. Sound meters will be deployed immediately inland of South Surf Beach and a control site to characterize the noise environment during the breeding season within the noise footprint of Phantom launches. Geospatial analysis will be performed annually as Phantom's launch tempo increases to assess whether patterns of nesting activity, nest fates, or fledgling success are negatively impacted by noise from Phantom operations. If the geospatial analysis shows that a statistically significant decline in breeding effort or nest success over two consecutive years, and that this decline cannot confidently be attributed to other natural or human caused catastrophic factors, the Space Force will offset this impact by increasing predator removal efforts on VSFB to include the non-breeding season, particularly focusing on raven removal adjacent to VSFB beaches, with a goal of achieving no net loss of the species.

Conclusion. VSFB has determined that the Proposed Action may affect, and is likely to adversely affect, the SNPL on VSFB. VSFB would perform geospatial analysis to monitor the impacts of noise from the Proposed Action and other launch programs on Base to assess any potential adverse impacts on the species at VSFB as the launch frequency under the Proposed Action gradually increases and reaches full tempo. If adverse effects are found, VSFB would mitigate those effects by increasing predator management efforts on VSFB to comply with the USSF's sections 7(a)(1) and 7(a)(2) obligations under the ESA. Mitigation activities would align with the SNPL Recovery Plan (USFWS 2007), and 5-year review (USFWS 2019) with the goal of achieving no net loss to the species. Therefore, effects on SNPL will not be significant.

California Condor (*Gymnogyps californianus*)

Direct Impacts. The Proposed Action is outside the normal range of the species and the species is not known to breed within the Action Area; therefore, physical impacts to habitat associated with the Proposed Action would have no effect on California condor.

Noise and Visual Disturbance. It is difficult to analyze the effect human disturbance could have on California condors. Generally, California condors are less tolerant of human disturbances near nesting sites than at roosting sites. The species is described as "keenly aware of intruders" and may be alarmed by loud noises from distances greater than 1.6 mi (2.6 km). In addition, the greater the disturbance in either noise level or frequency, the less likely the condor would be to nest nearby. As such, USFWS typically requires isolating roosting and nesting sites from human intrusion (USFWS 1996). Noise from a launch coupled with visual disturbance could cause a startle response and disrupt behavior if a condor is within the Proposed Action. Although launch noise and visual disturbance may cause a startle response and disrupt behavior, the likelihood of a condor being present during these activities is extremely low and, therefore, the effect of the Proposed Action would be discountable.

Conclusion. The overall likelihood of a California condor occurring within the Proposed Action Area during a launch or static fire event is extremely unlikely, hence, discountable. Therefore, VSFB has determined that Proposed Action may affect, but is not likely to adversely affect, the California condor and therefore, not be significant. The Space Force will coordinate with the USFWS and Ventana Wildlife Society to monitor for condor presence prior to launches.

Potential Impacts to Special Status Species

During construction of SLC-5 and the associated infrastructure, Phantom would remove vegetation by discing, mowing, masticating, grading, and/or hand removal. These activities would have potential adverse effects on special status wildlife species if they are inadvertently injured or killed by equipment or workers. If practicable, vegetation clearing will occur outside of bird nesting season (15 February through 15 August). If vegetation clearing occurs during nesting season, a qualified biologist would survey the area for nesting birds prior to vegetation clearing activities to prevent active nests from being damaged or chicks injured or killed. Environmental protection measures, described in Appendix A, would be implemented to avoid and minimize impacts on wildlife resources. Additional measures are included in the BO that would serve to avoid and minimize potential impacts to special status species during construction.

Construction of the SLC-5 facility, associated utilities, road improvements, and vegetation clearing would also generate noise and disturbance that could result in temporary impacts on wildlife species. Temporary disturbances due to noise and human presence related to these activities could disrupt foraging and roosting activities or cause wildlife species to avoid the work areas. The Space Force expects wildlife species to experience some level of noise disturbance during the day; however, construction activities would be temporary and only create noise above ambient levels over a relatively small area. Individuals would experience temporary behavioral disruption and likely move to adjacent suitable habitat until the noise disturbance ceases. A qualified biological monitor would oversee activities to ensure implementing environmental protection measures described in the table below that are designed to minimize and avoid impacts on native wildlife species. If vegetation clearing occurs during nesting season, a qualified biologist would survey the area for nesting birds and delineate buffers around nests to prevent disturbance from noise. As a result, potential impacts on wildlife species resulting from noise associated with construction and vegetation management would be less than significant.

Temporary disturbances to terrestrial wildlife species within the Action Area would also occur during the launch and static fire events from noise caused by the firing and flight of the vehicles. Wildlife responses to noise can be behavioral or physiological – ranging from mild, such as an increase in heart rate, to more damaging effects on metabolism and hormone balance. Because responses to noise are species specific, exact predictions of the effects on each species are unreliable without data pertaining to those species or similar species.

During launches and static firings, noise levels up to 140 dB Lmax would be produced at SLC-5. Although exact predictions cannot be made, these noises are expected to elicit a startle response in terrestrial wildlife species with developed hearing abilities. Potentially, wildlife hearing thresholds could shift either permanently or temporarily in wildlife if they are active on the surface close to SLC-5 during launch and static fire events. Exceptionally little sound is transmitted between the air-water interface; thus, in-air sound would not have a significant effect on submerged animals. Likewise, wildlife present below the ground surface would be insulated from noise impacts. Because the affected area is relatively small and the launch and static fire events are temporary, we expect behavioral disruptions and potential hearing threshold shifts would not have population-level impacts and therefore would not have a significant effect on wildlife resources.

Management actions focused on bats are incorporated in VSFB's Integrated Natural Resources Management Plan. The Space Force has been actively monitoring bats on VSFB. In the late 2000's, the Space Force worked with regional bat experts Patricia Brown, Dixie Pearson, Drew Stokes and others to assess bat diversity and distribution on VSFB. In 2011, the Central Coast Bat Research Group established acoustic monitoring protocols for studies on VSFB and initial acoustic surveys were completed across VSFB in a variety of habitats. In 2013, in cooperation with Bat Conservation International (BCI) and University of California, Santa Cruz, the DAF designed and installed an artificial habitat for Townsend's big eared bat (*Corynorhinus townsendii*), combining suitable roost for a maternity colony as well as overwintering. Recently, the Department of Defense has partnered with BCI to fully cooperate in the North American Bat Monitoring Program at VSFB. This includes deploying many acoustic recording devices each summer, starting in 2023. A pilot program was completed in 2022. In 2022 and 2023, VSFB hosted researchers from Humboldt Polytechnic in 2022 and BCI and the University of California, Los Angeles in 2023 investigating bats and communicable diseases, including COVID 19. As part of the Proposed Action, the DAF will augment the current bat monitoring program at VSFB by conducting additional acoustic monitoring within the noise footprint to determine which bat species are present in Honda Canyon and to record and assess their call rates before and after rocket launches. Monitoring will begin during the first calendar year of launch operations and continue annually as Phantom's program gradually increases over six years to full cadence. The Space Force will discontinue monitoring after concurrence from the Commission if adverse effects attributable to the proposed project are not detected after three years of monitoring once Phantom and all other proposed launch programs impacting Honda Creek reach full or near full tempo.

Vegetation Communities

The proposed project will re-establish the SLC-5 launch site that was operated from by the National Aeronautics and Space Administration between 1962 and 1994 to launch Scout space launch vehicles. The site was fully demolished by 2012. The proposed redevelopment of SLC-5 would largely overlap the previous footprint that was developed for the Scout program (Figure 2-3). Vegetation alliances within the project area were assessed and mapped following the Manual of California Vegetation Second Edition (Sawyer et al. 2009) and are presented in Figure 3-2 and Table 3-5).

Construction Impacts. Figure 3-2 shows the vegetation alliances (a mix of upland types) within the Proposed Action area where construction would occur. During construction of SLC-5 and the associated infrastructure, Phantom would remove vegetation by discing, mowing, masticating, grading, and/or hand removal prior to construction activities in areas permanently or temporarily impacted by the Proposed Action. Table 3-6 provides estimates of permanent impacts to the vegetation alliances occurring within the Proposed Action Area. A total of 32.5 acres of predominantly vegetated habitat (native and non-native) would be permanently impacted by the Proposed Action.

The Space Force would preserve existing native vegetation to the extent feasible while meeting construction and fire safety requirements. Additionally, native vegetation would be allowed to re-establish in areas where temporary impacts occur because Phantom would apply an appropriate native hydroseed mix in coordination with the SLD 30/CEI botanist. There is also an abundance of native vegetation on VSFB outside of the Proposed Action Area. The Space Force considers the small fraction of native vegetation loss from implementing the Proposed Action to be insignificant.

Phantom realigned the perimeter fence and firebreak on the south side of SLC-5 to avoid a stand of lemonade berry. The proposed project would be implemented in a manner that is consistent to the maximum extent practicable with Section 30240.

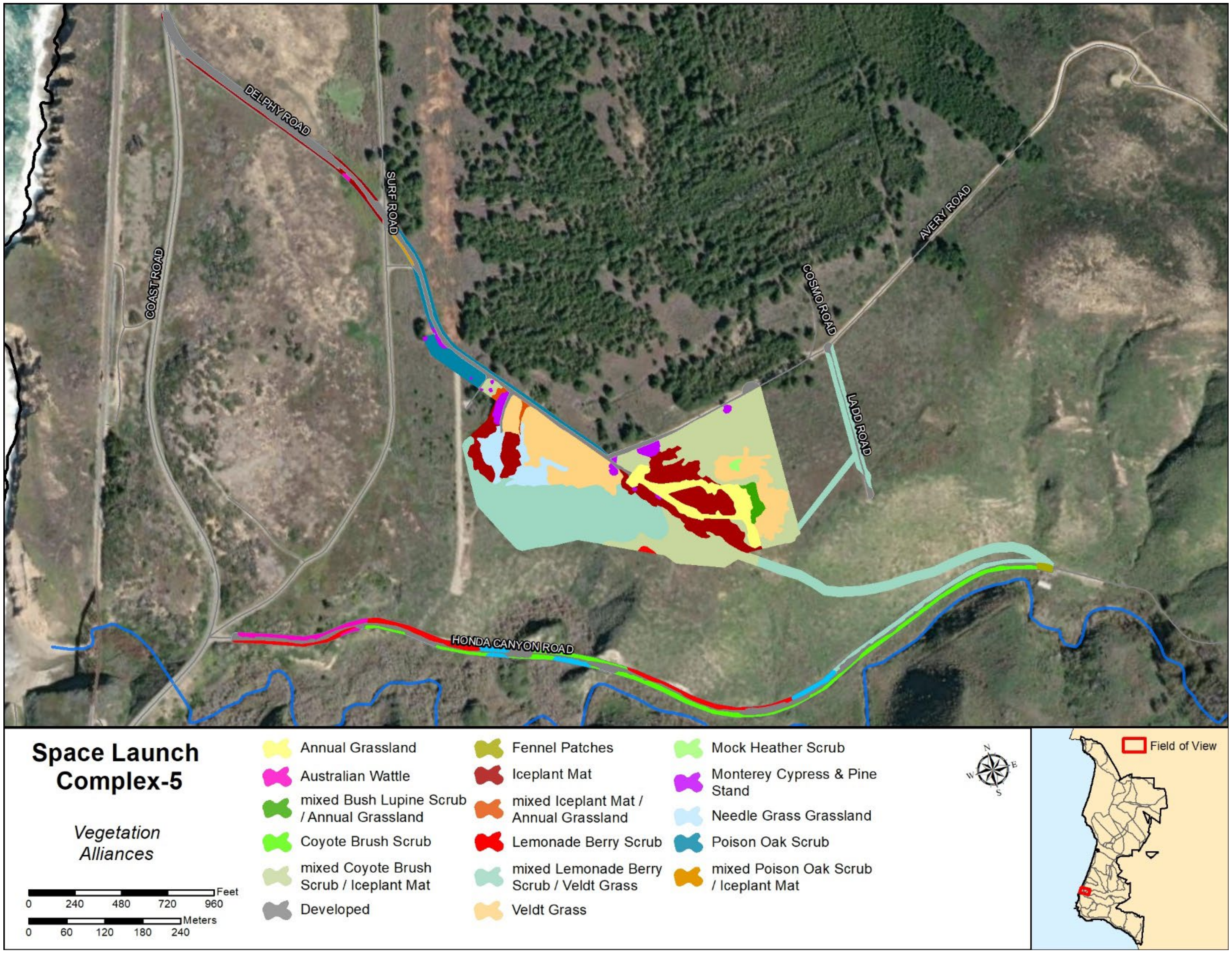

Figure 3-5: Vegetation alliances within the vicinity of the Proposed Action

Table 3-8: Absolute cover of main component species per vegetation alliance

Common Name	Alliance Name	Absolute Cover of Main Component Species*
Annual Grassland	*Avena* spp. - *Bromus* spp. Herbaceous Semi-Natural Alliance	20% *Medicago polymorpha* ; 10% *Plantago coronopus* ; 10% *Carpobrotus* sp.
Arroyo Willow Thicket	*Salix lasiolepis* Shrubland Alliance	95% *Salix lasiolepis* ; 10% *Rhubus ursinus* ; 5% *Foeniculum vulgare*
Australian Wattle Patch	*Acacia* spp. - *Grevillea* spp. - *Leptospermum laevigatum* Shrubland Semi-natural Alliance	90-100% *Acacia longifolia*
Mixed Bush Lupine Scrub / Annual Grassland	mixed *Lupinus arboreus* Shrubland Alliance and *Avena* spp. - *Bromus* spp. Herbaceous Semi-Natural Alliance	70% *Lupinus arboreus* ; 20% *Carpobrotus* sp.; 10% *Ericameria ericoides* ; 10% *Ehrharta calycina*
Coyote Brush Scrub	*Baccharis pilularis* Alliance	50% *Baccharis pilularis* ; 30% *Artemisia californica* ; 20% *Toxicodendron diversilobum*
Mixed Coyote Brush Scrub / Iceplant Mat	mixed *Baccharis pilularis* Alliance and *Mesembryanthemum* spp. - *Carpobrotus* spp. Herbaceous Semi-Natural Alliance	40% *Carpobrotus* sp.; 20% *Ehrharta calycina* ; 20% *Ericameria ericoides* ; 5% *Baccharis pilularis* ; 5% *Frangula californica*
Developed	Developed - Unvegetated	None
Fennel Patches	*Conium maculatum* - *Foeniculum vulgare* Herbaceous Semi-Natural Alliance	40% *Foeniculum vulgare*
Iceplant Mat	*Mesembryanthemum* spp. - *Carpobrotus* spp. Herbaceous Semi-Natural Alliance	70-95% *Carpobrotus* sp.; 0-15% *Ehrharta calycina* ; 0-15% *Bromus* sp.; 0-1% *Acmispon glaber* ; 0-1% *Ericameria ericoides* ; 0-1% *Leptosyne gigantea*
Mixed Iceplant Mat / Annual Grassland	Mixed *Mesembryanthemum* spp. - *Carpobrotus* spp. Herbaceous Semi-Natural Alliance and *Avena* spp. - *Bromus* spp. Herbaceous Semi-Natural Alliance	50% *Bromus* sp.; 50% *Carpobrotus* sp.
Lemonade Berry Scrub	*Rhus integrifolia* Shrubland Alliance	30% *Rhus integrifolia* ; 0-45% *Salvia melifera* ; 0-30% *Toxicodendron diversilobum* ; 0-15% *Carpobrotus* sp.; 10% *Artemisia californica* ; 0-10% *Baccharis pilularis* ; 10-15% *Encelia californica*
Mixed Lemonade Berry Scrub / Veldt Grass	mixed *Rhus integrifolia* Shrubland Alliance and *Ehrharta calycina*	25% *Rhus integrifolia* ; 20% *Ehrharta calycina* ; 15% *Ericameria ericoides* ; 10% *Carpobrotus* sp.; 10% Salvia melifera
Monterey Cypress & Pine Stand	*Hesperocyparis macrocarpa* - *Pinus radiata* Forest & Woodland Semi-Natural Alliance	85% *Hesperocyparis macrocarpa* ; 0-75% *Carpobrotus* sp.
Mock Heather Scrub	*Lupinus chamissonis* - *Ericameria ericoides* alliance	30% *Ericameria ericoides* ; 30% *Carpobrotus* sp.; 20% *Ehrharta calycina*
Needle Grass Grassland	*Nassella* spp. - *Melica* spp. Herbaceous Alliance	30% *Stipa pulchra* ; 25% *Bromus* sp.; 15% *Medicago polymorpha* ; 10% *Plantago coronopus* ; 5% *Carpobrotus* sp.
Poison Oak Scrub	*Toxicodendron diversilobum* Shrubland Alliance	40% *Artemisia californica* ; 20% *Toxicodendron diversilobum* ; 15% *Ericameria ericoides* ; 10% *Carpobrotus* sp.; 3% *Baccharis pilularis*
Mixed Poison Oak Scrub / Iceplant Mat	mixed *Toxicodendron diversilobum* Shrubland Alliance and *Mesembryanthemum* spp. - *Carpobrotus* spp. Herbaceous Semi-Natural Alliance	50% *Carpobrotus* sp.; 30% *Ericameria ericoides* ; 20% *Toxicodendron diversilobum* ; 10% *Artemisia californica* ; 5% *Baccharis pilularis* ; 2% *Frangula californica*
Veldt Grass	*Ehrharta calycina* Undescribed Alliance	50-80% *Ehrharta calycina* ; 10-15% *Bromus* sp.; 7-25% *Carpobrotus* sp.; 0-7% *Artemisia californica* ; 0-5% *Baccharis pilularis* ; 0-5% *Ericameria ericoides* ; 0-5% *Rhus integrifolia*

*Species cover and composition varied by location; alliance assignments represent the best fit among described alliances (J. Sawyer et al 2009); cover of non-dominant species was ony noted where doing so helped clarify alliance assignments

Table 3-9: Area of permanent vegetation impacts following the Manual of California Vegetation

Common Name	Alliance Name	Total
Annual Grassland	*Avena* spp. - *Bromus* spp. Herbaceous Semi-Natural Alliance	**1.45**
Arroyo Willow Thicket	*Salix lasiolepis* Shrubland Alliance	**0.35**
Australian Wattle Patch	*Acacia* spp. - *Grevillea* spp. - *Leptospermum laevigatum* Shrubland Semi-natural Alliance	**0.31**
Mixed Bush Lupine Scrub / Annual Grassland	mixed *Lupinus arboreus* Shrubland Alliance and *Avena* spp. - *Bromus* spp. Herbaceous Semi-Natural Alliance	**0.27**
Coyote Brush Scrub	*Baccharis pilularis* Alliance	**1.27**
Mixed Coyote Brush Scrub / Iceplant Mat	mixed *Baccharis pilularis* Alliance and *Mesembryanthemum* spp. - *Carpobrotus* spp. Herbaceous Semi-Natural Alliance	**6.73**
Fennel Patches	*Conium maculatum* - *Foeniculum vulgare* Herbaceous Semi-Natural Alliance	**0.07**
Iceplant Mat	*Mesembryanthemum* spp. - *Carpobrotus* spp. Herbaceous Semi-Natural Alliance	**4.12**
Mixed Iceplant Mat / Annual Grassland	Mixed *Mesembryanthemum* spp. - *Carpobrotus* spp. Herbaceous Semi-Natural Alliance and *Avena* spp. - *Bromus* spp. Herbaceous Semi-Natural Alliance	**0.12**
Lemonade Berry Scrub	*Rhus integrifolia* Shrubland Alliance	**0.84***
Mixed Lemonade Berry Scrub / Veldt Grass	mixed *Rhus integrifolia* Shrubland Alliance and *Ehrharta calycina*	**9.50**
Monterey Cypress & Pine Stand	*Hesperocyparis macrocarpa* - *Pinus radiata* Forest & Woodland Semi-Natural Alliance	**0.57**
Mock Heather Scrub	*Lupinus chamissonis* - *Ericameria ericoides* alliance	**0.07**
Needle Grass Grassland	*Nassella* spp. - *Melica* spp. Herbaceous Alliance	**1.10**
Poison Oak Scrub	*Toxicodendron diversilobum* Shrubland Alliance	**1.24**
Mixed Poison Oak Scrub / Iceplant Mat	mixed *Toxicodendron diversilobum* Shrubland Alliance and *Mesembryanthemum* spp. - *Carpobrotus* spp. Herbaceous Semi-Natural Alliance	**0.07**
Veldt Grass	*Ehrharta calycina* Undescribed Alliance	**4.41**
	Total Vegetation Permanent Impacts	**32.47**
Developed	Developed - Unvegetated	4.98
	Total Site Area	**37.45**

* 0.80 acres of lemonade berry scrub, trimmed along Honda Canyon Road (not removed); 0.04 acres of lemonade berry scrub removed within firebreak; however, CCC ecologist reviewed new vegetation survey information and determined that the area does not meet the definition of ESHA.

Reporting

The DAF would send an annual report to the Commission on all monitoring work conducted for biological resources and outline the data and results collected to date, and any initial conclusions regarding potential effects to the species as a result of the Proposed Action. The report will include the acres of vegetation types and habitat enhanced annually (meets or exceeds 24.54 ac [9.93 ha]), annual reports prepared for the USFWS for SNPL and CRLF, and bat monitoring. In addition, the DAF would provide a report to the Commission 5 years from project implementation on how the Phantom project is, or is not, impacting the surrounding special-status species and their habitats.

Consistency Review Conclusion

The Space Force and USFWS completed formal consultation for impacts resulting from the Proposed Action that may affect, but are not likely to adversely affect the TWG, California condor, MAMU, and SNPL, and that may affect and are likely to adversely affect the CRLF.

The Space Force has determined that the Proposed Action would not result in population-level impacts on any biological resource and that native vegetation communities would be preserved to the maximum extent practicable. Further, restoration of temporarily disturbed sites would occur and all EPM's would be followed (Appendix A). Therefore, the Proposed Action would be consistent to the maximum extent practicable with Section 30240 (b) of the CCA.

Archaeological or Paleontological Resources

Proposed launch sites and launch activities may occur in areas where archaeological or paleontological resources exist; however, protective measures would be implemented to ensure no adverse effects would occur. Four archaeological sites are present within the Action Area. Of the four archaeological sites, two sites (CA-SBA-538 and CA-SBA-2230) were determined to be ineligible for the National Register of Historic Places (NRHP), one is an NRHP-eligible site (CA-SBA-670), and one site (CA-SBA-2934) was considered not an historic property and potential ineligible for the NRHP because the site has appeared to be destroyed during construction of SLC-5. As part of development of the EA, three shovel test pits were conducted at the locations of three previously recorded isolated artifacts and one newly discovered isolated artifact. However, subsurface testing confirmed that all of the isolated artifacts were truly isolated and not surface manifestations of archaeological sites.

Of the four archaeological sites, only one is in an area that would require improvements to existing roads for improved fire safety and access. NRHP-eligible site CA-SBA-670 is bisected by Honda Canyon Road, which provides access to the launch site. However, the portion of Honda Canyon Road within CA SBA-670 would not require improvements, and the proposed activities within the site would be limited to removal of vegetation from the existing paved road segment. Based on this information and discussions with VSFB cultural resources personnel, no testing was required at this site. However, based on prior excavation results along the south side of Honda Canyon Road just east of the intersection of Coast, Surf, and Honda Canyon Roads, intact buried deposits associated with CA-SBA-670 could exist along Honda Canyon Road. The Proposed Action is a federal undertaking subject to compliance with Section 106 of the National Historic Preservation Act (NHPA) of 1966 as amended (16 U.S.C. § 470 et seq.). The DAF has completed Section 106 consultation with California State Historic Preservation Office (SHPO) concurrence under 36 C.F.R. Part 800. Exclusionary fencing is required where vegetation clearance is proposed within the boundaries of CA-SBA-670 to prevent accidental incursion into these deposits. With implementation of this protective measure, activities associated with the Proposed Action would have no adverse effect archaeological Resources.

Conclusion

Proposed launch site and activities may occur where archaeological or paleontological resources exist. However, protective measures currently in place would be implemented to ensure no adverse effects would occur. Therefore, the Proposed Action is consistent to the maximum extent practicable with Section 30244 of the CCA.

3.2.7 Article 6: Development

Policies

CCA Section 30251 – "Scenic and visual qualities" states:

> *The scenic and visual qualities of coastal areas shall be considered and protected as a resource of public importance. Permitted development shall be sited and designed to protect views to and along the ocean and scenic coastal areas, to minimize the alteration of natural land forms, to be visually compatible with the character of surrounding areas, and, where feasible, to restore and enhance visual quality in visually degraded areas. New development in highly scenic areas such as those designated in the California Coastline Preservation and Recreation Plan prepared by the Department of Parks and Recreation and by local government shall be subordinate to the character of its setting.*

CCA Section 30253 – "New development" states:

> *New development shall do all of the following: (a) Minimize risks to life and property in areas of high geologic, flood, and fire hazard. (b) Assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs. (c) Be consistent with requirements imposed by an air pollution control district or the State Air Resources Board as to each particular development. (d) Minimize energy consumption and vehicle miles traveled. (e) Where appropriate, protect special communities and neighborhoods that, because of their unique characteristics, are popular visitor destination points for recreational uses.*

Consistency Review

The SLC-5 launch site was used by National Aeronautics and Space Administration between 1962 and 1994 to launch Scout space launch vehicles. At the completion of the Scout program in 1994, all facilities at SLC-5 were deactivated and then demolished between 2009 and 2012. The proposed new SLC-5 construction is located entirely within the previosuly disturbed area and in close proximity to existing infrastructure to support operations. Adjacent land is used for similar operations. Therefore, the Proposed Action is consistent to the maximum extent practicable with Section 30250(a) of the CCA.

Scenic and visual qualities of coastal areas as a resource of public importance in developing the proposed launch site were considered. The former launch site (SLC-5) would be used for the proposed launch program. Proposed activities would be similar to launch activities that have been historically performed at this site and nearby launch sites on VSFB. Proposed construction at the launch site would not be in a highly scenic area for the public and viewsheds would not be substantially degraded because the project would still be consistent with launch operations and the operational character of the area. The proposed activities would not result in impacts on visual resources. Therefore, the Proposed Action is consistent to the maximum extent practicable with Section 30251 of the CCA.

The proposed launch site will not occur within the floodplain and will implement all appropriate Best Management Practices (BMP's) in stormwater management plans to prevent erosion. This project will not cause any changes to the Space Force hazardous operations or range safety procedures, nor cause exceedance of air quality standards or health-based standards for non-criteria pollutants. Therefore, the Proposed Action is consistent to the maximum extent practicable with Section 30253 of the CCA.

4 STATEMENT OF CONSISTENCY

The Space Force has reviewed the CCMP and has determined that the policies identified in Section 3.1 (Enforceable Policies of the California Coastal Management Program That Are Not Applicable to the Proposed Action) of this CD do not apply to the Proposed Action. In addition, the Space Force has determined that all or parts of the policies reviewed in Section 3.2 (Enforceable Policies of the California Coastal Management Program That Are Applicable to the Proposed Action) of this CD are applicable for purposes of assessing whether the project would be consistent to the maximum extent practicable with the CCMP. These policies include Sections 30210, 30211, 30220, 30230, 30231, 30232, 30234, 30234.5, 30240(b), 30244, 30250(a), 30251, and 30253.

An effects test was conducted by the Space Force to analyze how and to what degree the Proposed Action would affect California coastal zone uses and resources, as defined in the applicable, enforceable policies. The results of the effects test demonstrate that some components of the Proposed Action could have short-term, temporary effects to California coastal zone uses and resources. While some biological species may be affected, the Proposed Action would not have population-level effects. The Space Force would implement standard operating procedures and EPMs for the Proposed Action (Appendix A), which would reduce the potential impacts of its proposed activities on coastal zone uses and resources. The Space Force completed formal consultation with the USFWS and has completed informal consultation with NMFS for potential impacts on species listed under the ESA. NMFS has issued an LOA to the Space Force for potential Level B Harassment of marine mammals due to rocket, missile, or aircraft activities from VSFB. In addition, the Space Force completed consultation with the SHPO regarding effects of their actions on cultural properties listed in or eligible for inclusion in the NRHP. Therefore, the Proposed Action is consistent to the maximum extent practicable with the enforceable policies of the CCMP.

The Space Force requests the CCC concur that implementing SLC-5 construction and launch operations at this pre-existing launch site on VSFB would be consistent with CCA enforceable policies, to the maximum extent practicable.

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APPENDIX A – ENVIRONMENTAL PROTECTION MEASURES

Implementing the environmental protection measures (EPMs), outlined in Tables A.1-1 through A.9-1, would avoid or minimize potential adverse effects to various environmental resources during executing of the Preferred Alternative. Qualified Phantom personnel or contractor staff would oversee fulfilling EPMs.

A.1 Air Quality

The Santa Barbara County Air Pollution Control District (SBCAPCD) and California Air Resources Board (CARB) requires the dust control measures described in Table A.1-1 to decrease fugitive dust emissions from ground disturbing activities, as applicable to the Proposed Action.

Table A.1-1: Dust Control Measures

Air Quality – Dust Control Measures	
Measure	**Description/Purpose**
Water—preferably reclaimed—shall be applied at least twice daily to dirt roads, graded areas, and dirt stockpiles created during construction and demolition activities.	Prevents excessive dust at the staging areas. Watering frequency would be increased whenever wind speed exceeds 15 miles per hour.
After completing construction/demolition activities, disturbed soil shall be treated by watering, revegetating, or spreading soil binders.	Prevents wind erosion of the soil.
All fine material transported off-site shall be either sufficiently watered or securely covered	Prevents excessive dust.
All haul trucks, if needed and if driving off of paved surfaces, would be required to exit the site.	Must exit via an access point where a gravel pad or grizzly has been installed.
Stockpiles of soil or other fine loose material shall be stabilized by watering or another appropriate method.	Prevents wind-blown fugitive dust.
On-site vehicle speeds shall be limited.	Speed limit of 15 miles per hour.
Ground disturbance shall be limited.	Limited to the smallest practical area and to the least amount of time.
Designated personnel shall monitor project activities.	Meant to ensure that excessive dust is not generated at demolition sites.
The Proposed Action shall comply with storm water management plans, including Best Management Practices (BMPs).	To reduce dust emissions.
Any portable equipment powered by an internal combustion engine with a rated horsepower of 50 brake horsepower or greater used for this project shall be registered in the California State-wide Portable	Comply with State and local regulations.

Air Quality – Dust Control Measures	
Measure	**Description/Purpose**
Equipment Registration Program or have a valid SBCAPCD Permit to Operate.	
Earth moving shall comply with SBCAPCD Rule 345, Control of Fugitive Dust from Construction and Demolition Activities.	Under Rule 345, construction, demolition, or earthmoving activities are prohibited from causing discharge of visible dust outside the property line and must utilize standard BMPs to minimize dust from truck hauling, track-out/carry-out from active construction sites, and demolition activities.
Off-road construction equipment shall comply with all Federal, State, and local regulations.	Comply with Federal, State, and local regulations.

The following control measures listed in Table A.1-2 may be implemented to decrease diesel emissions, as applicable.

Table A.1-2: Control Measures to Decrease Diesel Emissions

Diesel Emissions Control Measures
✓ When feasible, the contractor may use equipment powered with Federally mandated "clean" diesel engines.
✓ The size of the engine in equipment and number of pieces of equipment operating simultaneously for the project should be minimized.
✓ Engines should be maintained in tune per manufacturer or operator's specification.
✓ U.S. Environmental Protection Agency or CARB-certified diesel catalytic converters, diesel oxidation catalysts, and diesel particulate filters may be installed on all diesel equipment.
✓ When practicable, diesel equipment should be replaced with electrical equipment.
✓ The construction period should be lengthened during smog season (May through October), to minimize the number of vehicles and equipment operating at the same time.
✓ Alternatively, fueled construction equipment, such as compressed natural gas, liquefied natural gas, or electric, should be used if feasible.

A.2 Terrestrial Biological Resources

The EPMs listed below would be implemented to avoid, minimize, or characterize the effects of the Proposed Action on terrestrial biological resources. These EPMs require various levels of biological competency from personnel completing specific tasks, as defined in Table A.2-1.

Table A.2-1: Biological monitoring qualifications

Biologist Level	Necessary Qualifications
Permitted Biologist	Biologist with a valid and current USFWS section 10(a)(1)(A) Recovery Permit or specifically named as an approved biologist in a project-specific Biological Opinion. The Space Force will coordinate with the USFWS prior to assigning permitted biologists to this project
USFWS Approved Biologist	Biologist with the expertise to identify ESA listed species and species with similar appearance. The Space Force will review and approve the resumes from each individual, and then submit them to the USFWS for review and approval no less than 15 days prior to the start of the Proposed Action. Each resume will list their experience and qualifications to conduct specific actions that could potentially affect listed species and their habitats. A USFWS approved biologist could train other biologists and personnel during surveys and project work; in some cases, a USFWS approved biologist could also provide on-site supervision of other biologists.
Qualified Biologist	Biologist trained to accurately identify specific federally listed species and their habitats by either a Permitted or USFWS Approved biologist. This person could perform basic project monitoring but would need to have oversight from a permitted or USFWS approved biologist. Oversight will require a permitted or USFWS approved biologist to be available for phone/email consultation during the surveys and to have the ability to visit during monitoring/survey activities if needed.

A.2.1 General Measures

The measures described in Table A.2-2 would be implemented to minimize the potential impacts on terrestrial biological resources.

Table A.2-2: General Measures

Terrestrial Biological General Measures
✓ Disturbances shall be kept to the minimum extent necessary to accomplish project objectives.
✓ All excess materials excavated shall be removed and transported to a designated waste or fill site.
✓ All erosion control materials used would be from weed-free sources and, if left in place following project completion, constructed from 100% biodegradable erosion control materials (e.g., erosion blankets, wattles).
✓ All human-generated trash at the project site shall be disposed of in proper containers and removed from the work site and disposed of properly at the end of each workday. Large dumpsters can be maintained at staging areas for this purpose. All construction debris and trash shall be removed from the work areas upon completion of the project.

Terrestrial Biological General Measures
✓ Equipment vehicles (dozers, mowers, etc.) shall be cleaned of weed seeds prior to use in the project area to prevent the introduction of weeds and be inspected by a qualified biological monitor to verify weed free status prior to use. Prior to site transport, any skid plates shall be removed and cleaned. Equipment should be cleaned of weed seeds daily especially wheels, undercarriages, and bumpers. Prior to leaving the project area, vehicles with caked-on soil or mud shall be cleaned with hand tools such as bristle brushes and brooms at a designated exit area; vehicles may subsequently be washed at an approved wash area. Vehicles with dry dusted soil (not caked-on soil or mud), prior to leaving a site at a designated exit area, shall be thoroughly brushed; vehicles may alternatively be air blasted on site.
✓ Fueling of equipment will be conducted in a pre-designated location within the staging area and spill containment materials will be placed around the equipment before refueling.
✓ A qualified biological monitor shall inspect any equipment left overnight prior to the start of work. Equipment would be checked for presence of special status species in the vicinity and for fluid leaks.
✓ Plywood sheets or steel plates may be used to cover holes or trenches or an escape ramps for wildlife would be installed if left open overnight. The biological monitor will inspect these locations before the resumption of work.
✓ If it is not practical to stage or operate project vehicles or equipment on paved or existing roadways and trails, vehicles and equipment will be staged and operated on non-native vegetation to the maximum extent practicable.
✓ Vegetation clearing would occur during daylight hours during periods where there is no rainfall.
✓ Phantom would provide a seeding and planting plan for approval from CEIEA. The planting/seed mix would be similar to surrounding native vegetation. Native seeds may be collected on site where vegetation is removed. Soil would be properly prepared to provide seed germination. Amendments may be necessary. Weed control would be conducted for one-year post-construction to achieve at least the same amount or more of pre-construction native plant cover. After one year, Phantom would provide a report with plant list and cover, then coordinate site inspection with CEIEA for approval. Approval is dependent upon amount of native plant cover achieved.
✓ Permitted or USFWS Approved biologist(s) shall be responsible for delineating areas where special status species are located or concentrated, relocating special status species during construction activities, and inspecting equipment and equipment staging areas for cleanliness and gas and oil leaks.
✓ Permitted or USFWS Approved biologist(s) shall brief all project personnel prior to participating in construction activities. At a minimum, the training would include a description of the listed species and sensitive biological resources occurring in the area, the general and specific measures, and restrictions necessary to protect these resources during project implementation, the provisions of the ESA and the necessity of adhering to the provisions of the ESA, and the penalties associated with violations of the ESA.
✓ Permitted or USFWS Approved biologist(s) shall be present and monitor activities during construction at appropriate times when California red-legged frogs are more likely to be encountered and required to be relocated.
✓ Prior to initial site preparation qualified biologist would survey the site and relocate any native wildlife that may be in harm's way. A qualified biologist would also be present during site preparation (e.g., clearing/grubbing, discing, mowing, etc.) to monitor for special status species.

Terrestrial Biological General Measures
The biologist would attempt to capture and relocate any native wildlife found that is potentially in harm's way. Animals would be relocated to the nearest suitable habitat outside the Proposed Action Area.
✓ Biologist(s) will repeat surveys following any precipitation event greater than 0.2 inch (0.5 cm) during a 24-hour period.
✓ During construction of the launch site, the following measures will be implemented: o The launch construction site will be encircled with minimum 3-ft-high (1-m-high) silt fencing, anchored with metal T-posts, and buried along the bottom edge to inhibit terrestrial wildlife, including CRLF, from entering the site. A qualified biologist will inspect the fence daily and direct maintenance to ensure its efficacy. o All work will occur during daylight hours during periods when there is no rainfall. o If a trench, hole, or pipeline route is to remain open for an extended period with no activity, then personnel will cover it or provide a wildlife escape route. o Precipitation Events: Construction activities will not occur until 24 hours after an actual precipitation event greater than 0.2-inch (0.5-cm) accumulating within a 24-hour period. o No overnight staging of equipment or supplies would occur within 0.10 mi (0.16 km) of aquatic habitat in undeveloped areas, unless a designated staging area is identified, cleared for CRLF by a qualified biologist, and measures are implemented that would preclude CRLF from accessing the supplies or equipment (e.g., drift fence barrier installed). o A qualified biologist will survey the site, including any open holes or trenches, each day prior to initiation of work.

A.2.2 Special Status Species

The Space Force and qualified Phantom personnel or contractor staff would ensure that all non-discretionary measures included in the USFWS BO issued for the Proposed Action, listed in Table A.2-3 would be implemented during site preparation, construction, and operation of Phantom's launch program at SLC-5.

Table A.2-3: Special Status Species Measures

General Measures
✓ A Permitted or USFWS Approved biologist(s) shall be responsible for delineating areas where special status species are located or concentrated, relocating special status species during construction activities, and inspecting equipment and equipment staging areas for cleanliness and gas and oil leaks.
✓ A Permitted or USFWS Approved biologist(s) shall brief all project personnel prior to participating in construction activities. At a minimum, the training would include a description of the listed species and sensitive biological resources occurring in the area, the general and specific measures, and restrictions necessary to protect these resources during project implementation, the provisions of the ESA and the necessity of adhering to the provisions of the ESA, and the penalties associated with violations of the ESA.
✓ If vegetation clearing occurs during the nesting period for non-raptor species (15 February through 15 August) a qualified biologist would survey the area for nesting birds and delineate buffers around any nests that are found that are of sufficient size to prevent disturbance in order to reduce risk of nest abandonment.

California Red-legged Frog Measures
✓ Permitted or USFWS Approved biologist(s) shall be present and monitor activities during construction at appropriate times when CRLF are likely to be encountered and required to be relocated.
✓ Pre-Project Surveys: A USFWS Approved Biologist will conduct pre-project surveys for CRLF. Additional surveys may be conducted on an as needed basis, determined by the biologists. Biologists will follow these measures: o From 15 November to 31 March, a USFWS approved or qualified biologists(s) (as needed) will conduct a pre-construction survey of Action Area within suitable aquatic, adjacent upland, or dispersal habitat (690 ft [210 m] from aquatic habitat or other distance as determined by a USFWS approved biologist following adaptive habitat assessment procedures) immediately before the onset of all work activities. o From 1 April to 14 November, a USFWS approved or qualified biologists(s) (as needed) will conduct a pre-project survey of the Action Area within suitable aquatic or upland habitat (140 ft [43 m] from aquatic habitat or other distance as determined by a USFWS approved biologist following adaptive habitat assessment procedures) to identify potential artificial water or shelter resources that may contain sheltering CRLF. o A USFWS approved or qualified biologist(s) (as needed) will repeat surveys following any precipitation event greater than 0.2 inches (0.5 centimeters) during a 24-hour period. o A USFWS approved or qualified biologist(s) (as needed) will monitor any initial ground disturbance or vegetation removal within suitable aquatic, adjacent upland, or dispersal habitat identified following the adaptive habitat assessment procedures. However, after the initial ground disturbance/vegetation removal is complete, no further monitoring would be required within these bare-dirt areas.
✓ During construction of the launch site, the following measures will be implemented: o The launch construction site will be encircled with minimum 3-ft-high (1-m-high) silt fencing, anchored with metal T-posts, and buried along the bottom edge to inhibit terrestrial wildlife, including CRLF, from entering the site. A qualified biologist will inspect the fence daily and direct maintenance to ensure its efficacy. o All work will occur during daylight hours during periods when there is no rainfall. o Any open holes or trenches will be covered with plywood or metal sheets if left overnight to minimize the risk of entrapment of CRLF. o Precipitation Events: Construction activities will not occur until 24 hours after an actual precipitation event greater than 0.2-inch (0.5-centimeter) accumulating within a 24-hour period. o No overnight staging of equipment or supplies would occur within 0.10 mi (0.16 km) of CRLF aquatic habitat in undeveloped areas, unless a designated staging area is identified, cleared for CRLF by a qualified biologist, and measures are implemented that would preclude CRLF from accessing the supplies or equipment (e.g., drift fence barrier installed). o A qualified biologist will survey the site, including any open holes or trenches, each day prior to initiation of work.
✓ CRLF Relocation: A USFWS approved biologist would conduct any CRLF relocation. If CRLF are found within the Action Area during pre-project surveys, daily monitoring where required, or at any other

time, all construction activity within the vicinity of the CRLF occurrence (if any) will cease and the following measures will occur: ○ If the project site is large and if the USFWS approved biologist is satisfied that work in a different area of the project can continue with no threat to CRLF, then that work can continue after workers have received a briefing on the area to avoid. ○ Construction activities within the vicinity of the CRLF occurrence will not begin or resume until a USFWS approved biologist relocates the CRLF or contacts the USFWS for alternate guidance. ○ Using the Declining Amphibians Task Force Fieldwork Code of Practice (DAPTF 2019), the USFWS approved biologist will relocate all life stages of CRLF the shortest distance possible to a location that is (1) within the same drainage, (2) contains suitable aquatic/upland habitat, and (3) is outside of the project impact area
✓ Any water retention basins would be designed to exclude access by CRLF. If such exclusion is not possible, and water is present in retention basin overnight, the basin will be checked daily for CRLF by a qualified biologist prior to pumping. The pump will be screened with 1/8-inch mesh
✓ Artificial Lighting: ○ Except when necessary for safety or performance of launch operations, or maintenance, artificial lighting at SLC-5 will be minimized during the hours of darkness. ○ The lighting plan would be designed such that lights are directed away from Honda Canyon and would be shielded to reduce scatter into undeveloped areas. Lighting plan design will minimize illumination of Honda Canyon such that that lighting levels of 1-foot candle would not extend beyond the SLC-5 facility.
✓ CRLF Baseline and Launch Monitoring: ○ The Space Force will conduct quarterly night surveys for CRLF and spring tadpole surveys of lower Honda Creek within the Maximum Sound Level (L_{max}) 120 unweighted decibels (dB) Laguna-E noise contour and a control site beginning the first calendar year of Phantom launch operations. The control site will be located at San Antonio Creek, west of Highway 1, an area that is outside of launch noise impacts on VSFB. The approach allows the Space Force to establish a baseline and assess if there are any changes in CRLF habitat occupancy, breeding behavior (calling), and breeding success (egg mass and tadpole densities) on lower Honda Creek and the control site as Phantom's launch and static fire tempo gradually increases over six years to reach full cadence. The following would be recorded and measured during the surveys: ▪ CRLF detection density (number of frogs per survey hour), following the same survey methods conducted previously at these sites and throughout VSFB. ▪ CRLF locations and breeding evidence (e.g., calling, egg masses). ▪ Environmental data during surveys (temperature, wind speed, humidity, and dewpoint) to determine if environmental factors are affecting CRLF detection or calling rates. ▪ Annual habitat assessments to measure flow rates, stream morphology, depths, and sediment to determine if any changes in CRLF metrics are associated with other environmental factors, such as drought. ▪ Locations and densities of co-occurring anurans, including bullfrogs (*Lithobates catesbeianus*) and Baja California tree frogs (*Pseudacris hypochondriaca*). ○ Bioacoustic monitoring would be conducted annually during CRLF breeding season (typically November through April, depending on rainfall) to characterize the baseline noise environment and determine if there are changes in calling behaviors as launch

and static fire tempo gradually increase over six years. Passive noise recorders and environmental data loggers (temperature, relative humidity, dew point) would be placed at two suitable breeding locations on lower Honda Creek within the 120 dB L_{max} Laguna-E noise contour and at two suitable breeding locations at the control site. The bioacoustic monitoring would also allow any impacts of launch and static fire events during the breeding season on calling behavior to be characterized and analyzed to assess whether CRLF calling frequency is affected by Phantom's gradual increase in launch and static fire tempo.

- The Space Force will report on monitoring results in an annual report.
- If CRLF occupancy, calling frequency, or tadpole densities decline from baseline by 15 percent (%) or more, the 15% decline from baseline is maintained for two consecutive years, and the decline is attributed to an increase in Phantom's launch and static fire operations, VSFB would mitigate for the loss of suitable habitat, as discussed below.
- The Space Force would discontinue monitoring after concurrence from the USFWS if no adverse effects to CRLF occupancy, calling frequency, or tadpole densities are demonstrated after three years of monitoring once Phantom has achieved full or near full tempo.

- ✓ CRLF Mitigation
  - The Space Force would create new CRLF breeding habitat at a 2:1 ratio (habitat enhanced: habitat affected) for adverse effects to occupied CRLF habitat, as determined above, at the San Antonio Creek Oxbow Restoration Area, an established wetland mitigation site that is located outside of areas impacted by launch noise on VSFB. Historically occupied by riparian vegetation, restoration efforts would focus on enhancing this abandoned tract of agricultural land to improve San Antonio Creek and provide breeding habitat for CRLF.
  - Restoration, which has already been conducted at this site for other projects, would be conducted in the "expansion area" adjacent to existing restoration, will involve digging a channel that reaches ground water and using the spoils to create a berm that will be planted with willows. This method is already being used at the site and has proven successful at creating deep water aquatic habitat, suitable for CRLF breeding, and riparian woodland that simulate naturally occurring high-flow channels.
  - Actions taken within this area would include site preparation via herbicide application, plowing, container plant installation, seeding, willow pole planting (via water jet, hand-held power auger, or manually driving a steel rod into the ground), and watering via water truck. The mitigation actions for CRLF are included under an existing USFWS BO (2016-F-0103; USFWS 2018) and all applicable avoidance, minimization, and monitoring measures required under BO 2016-F-0103 would be implemented.
- ✓ The Space Force will track and report on restoration efforts and success within an annual report.

Western Snowy Plover Measures

- ✓ SNPL Monitoring
  - The Space Force would augment the current SNPL monitoring program on VSFB by performing acoustic monitoring and geospatial analysis of nesting activity on South Surf Beach and a control site (Minuteman Beach) to assess potential adverse effects from Daytona-E and Laguna-E launch and static fire activities.

- The current Base-wide SNPL monitoring program estimates breeding effort, nest fates, and fledging success while recording patterns of habitat use through the season. This program would be augmented for the Proposed Action by placing sound level meters (SLMs) immediately inland of South Surf Beach within the Daytona-E and Laguna-E noise footprint and the control site to characterize the noise environment. - Acoustic monitoring would begin during the first calendar year of Phantom launch operations and continue annually during the breeding season as Phantom's program gradually increases over six years to full cadence. Geospatial analysis would be performed annually to assess whether patterns of nesting activity, nest fates, or fledgling success are negatively impacted by noise from the Proposed Action as Phantom's launch and static fire tempo increases to full cadence. - The Space Force will report on monitoring results within an annual report. o If geospatial analysis shows that a statistically significant decline (defined as a decline greater than the baseline annual variation in these variables over the past 10 years at South Surf Beach) in breeding effort or nest success that continues over two consecutive years within the areas impacted by noise from the Daytona-E and Laguna-E and that is attributable to the Proposed Action, as opposed to increased predation, coastal flooding, or other factors, the Space Force would mitigate for this impact (see below). o The Space Force will discontinue monitoring after concurrence from USFWS if no adverse effects attributable to the Proposed Action are documented after three years of monitoring once Phantom has reached full or near full tempo. o
✓ SNPL Mitigation o The Space Force would increase predator removal efforts to include the non-breeding season, particularly focusing on raven removal at and adjacent to VSFB beaches. o Given that VSFB has already or will soon (under current planning) restore all available SNPL nesting habitat on Base, the biggest factor reducing nesting success is nest predation with significant impacts from ravens. The raven population, which is historically absent to rare in the region, has increased substantially over the past two decades to the species now being common due to human-related factors that have allowed their numbers to increase and range to expand. As documented, the raven population continues to increase each year. Offseason depredation will help reduce the population on Base prior to the breeding season which should increase nest success. o Predator control actions would include trapping, shooting, and tracking SNPL predators from VSFB beaches and surrounding areas on Base. The mitigation actions for SNPL are permitted under an existing USFWS BO (8-8-12-F-11R; USFWS 2015a) and all applicable avoidance, minimization, and monitoring measures required under BO 8-8-12-F-11R would be implemented. VSFB also maintains a USFWS depredation permit. ✓ The Space Force will report on predator removal efforts and success within an annual report.
California Condor Measures
✓ Prior to any launch, the Space Force will determine if any condors are present by coordinating with Ventana Wildlife Society and USFWS personnel prior to launch. (Note: VSFB computers are unable

	to review the Service's "Daily Snapshot – California Condor Population" Google Earth imagery). The Space Force will contact the USFWS if condors appear to be near or within the area affected by a launch from SLC-5. If nearby, qualified biologists will monitor condor movements in the vicinity of VSFB and analyze data before, during, and after launch events to determine whether there was an effect on condor movement patterns.
✓	The Space Force will coordinate with current USFWS personnel, including Molly Astell, Wildlife Biologist, USFWS California Condor Recovery Program, at molly_astell@fws.gov or (805) 451-0379, Joseph Brandt, Wildlife Biologist, USFWS, at joseph_brandt@fws.gov, 805-677-3324, or 805-644-1766 extension 53324, or Steve Kirkland, California Condor Field Coordinator, USFWS California Condor Recovery Program, at steve_kirkland@fws.gov or 805-644-5185, extension 294. Ventana Wildlife Society contact information: Joe Burnett, joeburnett@ventanaws.org or 831-800-7424.

A.3 Marine Biological Resources

The Space Force and qualified Phantom personnel or contractor staff would ensure that all applicable minimization, monitoring, and avoidance measures in VSFB's LOA, listed in Table A.3-1, would be implemented during operation of Phantom's launch program at SLC-5.

Table A.3-1 Minimization, Monitoring, and Avoidance Measures

Minimization, Monitoring, and Avoidance Measures
✓ Sonic boom modeling would be completed prior to each launch to verify and estimate the overpressure levels and footprint.
✓ Between 1 January and 30 June, pinniped monitoring at south Base haulout locations would commence at least 72 hours prior to a launch event and continue until at least 48 hours after each event. Monitoring data collected would include multiple surveys each day that record the species, number of animals hauled out, general behavior, presence of pups, age class, and gender. Environmental conditions such as tide, wind speed, air temperature, and swell would also be recorded.

A.4 Water Resources

The following measures, as described in Table A.4-1, would be implemented to minimize impacts on water resources and stormwater:

Table A.4-1: Water Resources and Stormwater Measures

Water Resources and Stormwater Measures
✓ The site will be secured from potential erosion resulting from rain and wind events. Existing vegetation will be preserved to the extent feasible.
✓ Phantom would install hydroseed and erosion control measures on areas where temporary disturbances occur and any areas that may be prone to erosion. Phantom would use erosion control devices made from biodegradable materials and/or mulched native vegetation produced while clearing vegetation at the site. The hydroseed mix would be comprised of native plant species, developed in coordination with the 30 CES/CEI botanist.
✓ All equipment will be properly maintained and free of leaks during operation, and all necessary repairs carried out with proper spill containment.

✓ Fueling equipment will only occur in pre-designated areas with spill containment materials placed around the equipment before refueling. Stationary equipment will be outfitted with drip pans and hydrocarbon absorbent pads.
✓ Fuel storage on site would include secondary containment of 100% of the capacity of the largest tank in the containment area plus the volume for a 24-hour, 25- year storm (if the area is uncovered).
✓ All necessary equipment maintenance and repairs would be performed in pre-designated controlled, paved areas to minimize risks from accidental spillage or release. Prior to construction and site operation, a SPCC plan would be submitted to SLD 30 Environmental Compliance Section for approval.
✓ Phantom would ensure employees and contractor staff are trained in proper prevention and cleanup procedures.
✓ Per 40 C.F.R. 112, SPCC plan, Phantom would place chemicals, drums, or bagged materials on a pallet and, when necessary, secondary containment.
✓ Adequate spill response supplies will be maintained at the site during construction and operation for immediate response and clean up of any fuel spills.
✓ Hazardous materials will be stored in proper containers, placed in proper containment facilities covered prior to rain events.
✓ Vehicles and equipment will only be washed within staging areas. Performing high-pressure washing of undercarriages and wheel wells shall be prohibited at the project site.
✓ Trash disposal containers will be covered at all times. Any trash that escapes from containers will be picked up at the end of each day.
✓ Portable toilets must be properly secured to prevent tipping in windy conditions.
✓ Phantom would enroll in RWQCB's General Waiver for Specific Types of Discharges (or other state discharge permit) prior to discharging any water out of the deluge water retention basin. Any deluge water that remains after launches or stormwater that accumulates within the basin will be tested for contamination. If contamination is encountered, the contents would be pumped out and disposed of per the waiver/permit and state and Federal regulations.
✓ Phantom would enroll in RWQCB's General Waiver for Specific Types of Discharges prior to discharging any water out of the flame bucket or deluge water retention basin.
✓ Improvements to dirt roads would follow standard recommended practices to avoid and minimize erosion potential (e.g., Bloser et al. 2012) and would be inspected after rainstorms for indications of erosion, and repairs made promptly.
✓ Vegetation removal on the steep slopes on the east side of the site would be avoided to the extent practicable, unless necessary for fire safety.
✓ Concrete curing compounds, concrete waste, and washout water will be properly managed to prevent pollution. Concrete washout water will be contained for evaporation.
✓ Phantom would design any septic system in accordance with the regulations set forth in the RWQCB OWTS Manual.
✓ All excess materials excavated shall be removed and transported to a designated waste or fill site.
✓ All erosion control materials used would be from weed-free sources and, if left in place following project completion, constructed from 100% biodegradable erosion control materials (e.g., erosion blankets, wattles).

A.5 Cultural Resources

Phantom personnel or contractor staff will ensure the following measures, described in Table A.5-1, would be implemented to minimize impacts on sensitive archaeological resources:

Table A.5-1: Cultural Resources Measures

Cultural Resources Measures
✓ If previously undocumented cultural resources are discovered during maintenance activities, work would stop, and the procedures established in 36 C.F.R. 800.13 and the VSFB Integrated Cultural Resources Management Plan shall be followed.
✓ Exclusionary fencing required where vegetation clearance is proposed within the boundaries of CA-SBA-670.

A.6 Transportation

Phantom personnel or contractor staff will ensure the following measures, described in Table A.6-1, would be implemented to minimize the potential for adverse impacts on transportation resources:

Table A.6-1: Transportation Measures

Transportation Measures
✓ Employees may be encouraged to carpool and eat lunch on site.
✓ Truck trips should be scheduled during non-peak traffic hours to the greatest extent practicable.
✓ Phantom would coordinate with California Department of Transportation and the California Highway Patrol when necessary for the transportation of materials to the project site and for accessing the site through State Route 246.
✓ Warning signs, cones, and flaggers would be provided when necessary to warn roadway users of truck crossings on SR 246, and to control traffic flow if necessary.
✓ Construction equipment would not be parked along the shoulder of primary roadways during non-construction periods.

A.7 Human Health and Safety

Phantom personnel or contractor staff will ensure the following measures, described in Table A.7-1, would be implemented to minimize the potential for adverse impacts on human health and safety:

Table A.7-1: Human Health and Safety Measures

Human Health and Safety Measures
✓ Comply with Occupational Safety and Health Administration, Air Force Occupational Safety and Health, California Division of Occupational Safety and Health regulations, and other recognized standards and applicable Department of the Air Force regulations or instructions.
✓ Restrict general access to the proposed construction site through use of signs and fencing if feasible.
✓ Provide for the health and safety of workers and all subcontractors who may be exposed to operations or services. Submit a health and safety plan to VSFB and appoint a formally trained

Human Health and Safety Measures
individual to act as safety officer. The appointed individual would be the point of contact on all problems involving job site safety.
✓ Coordinate with the Air Force Civil Engineer Center Environmental Operations Division Mitigation, Monitoring, and Reporting Program manager and contact with the weapons safety specialist for information on VSFB policies on unexploded ordnance safety for construction work at VSFB.
✓ Site-wide anomaly avoidance would be implemented since it is possible UXOs may be encountered outside of MMRP boundaries.
✓ Comply with all provisions and procedures prescribed for the control and safety of personnel and visitors to the job site.

A.8 Hazardous Materials and Waste Management

Phantom personnel or contractor staff will ensure the following measures, described in Table A.8-1, would be implemented to minimize impacts on hazardous materials and waste management:

Table A.8-1: Hazardous Materials and Waste Management Measures

Hazardous Materials and Waste Management Measures
✓ Proper disposal of hazardous waste would be accomplished through identification, characterization, sampling (if necessary), and analysis of wastes generated.
✓ All hazardous materials would be properly identified and used in accordance with manufacturer's specifications to avoid accidental exposure to or release of hazardous materials required to operate and maintain construction equipment.
✓ Hazardous materials would be procured through or approved by the Vandenberg Hazardous Materials Pharmacy (HazMart). Monthly usage of hazardous materials would be reported to the HazMart to meet legal reporting requirements.
✓ All equipment would be properly maintained and free of leaks during construction and maintenance activities. All necessary equipment maintenance and repairs would be performed in pre-designated controlled, paved areas to minimize risks from accidental spillage or release. Prior to construction, a SPCC plan would be submitted to SLD 30 Environmental Compliance Section for approval.
✓ Phantom would ensure employees and contractor staff are trained in proper prevention and cleanup procedures.
✓ Any activity requiring the connection to and the drawing of bulk water from the drinking water distribution system to support construction and repair projects shall require the approval and coordination of the Vandenberg Cross Connection Control and Backflow Prevention Program Manager.
✓ Phantom would store liquids, petroleum products, and hazardous materials in approved containers and drums and would ensure that any open containers are covered prior to rain events.
✓ Phantom would place chemicals, drums, or bagged materials on a pallet and, when necessary, secondary containment.

A.9 Solid Waste Management

Solid waste would be minimized by strict compliance with VSFB's Integrated Solid Waste Management Plan. Phantom personnel or contractor staff will ensure the following measures, described in Table A.9-1, would be implemented to further minimize the potential for adverse impacts associated with solid waste:

Table A.9-1: Solid Waste Management Measures

Solid Waste Management Measure
✓ All materials that are disposed of off base would be reported to the SLD 30/CEI Solid Waste Manager.

APPENDIX B – SENSITIVE SPECIES AND WILDLIFE OCCURRENCE WITHIN THE PROPOSED ACTION AREA

Figure B-1 includes all special status species records and survey locations from multiple sources in the vicinity of the SLC-5 construction footprint. Figures B-2 through B-5 include federally listed species localities within the Phantom Laguna-E noise footprint, which are discussed further below. Figures B-6 through B-9 include localities of additional special status species withing the Laguna-E noise footprint, gathered from Space Force long-term monitoring and annual survey efforts and the CNDDB. Note that there were no special status amphibian species listed in the CNDDB within the project footprint, except for the California red-legged frog (CRLF; *Rana draytonii*), which are duplicative records of those shown in Figure B-2. Also note that special status plant species are only shown in Figure B-1 since they are only relevant to the SLC-5 construction footprint and would not be affected by noise.

Table B-1: Federal and State Special Status Species Occurrence Within the Proposed Action Area

Species	Status		Occurrence within the Proposed Action Area
	USFWS	CDFW	
Invertebrates			
Crotch bumble bee (*Bombus crotchii*)	-	SSC	Expected: may forage and nest in the construction area.
Monarch butterfly (*Danaus plexippus*)	Proposed	Special Animal*	Overwintering stands within noise footprint.
Fish			
Tidewater goby (*Eucyclogobius newberryi*)	FT	-	Historic occurrence in Honda Creek; but unlikely to be present.
Unarmored Threespine Stickleback (*Gasterosteus aculeatus*)	FE	SE	Historic introduction in Honda Creek; but extirpated.
Arroyo chub (*Gila orcuttii*)	-	SSC	Not present on Honda Creek; present on San Antonio Creek.
Amphibians			
California red-legged frog (*Rana draytonii*)	FT	SSC	Documented in Honda Creek. May be found in construction footprint due to proximity of aquatic habitat. Occurs within the noise footprint.
Reptiles			
Northern legless lizard (*Anniella pulchra*)	-	SSC	Assumed present within the construction footprint due to suitable habitat and adjacent CNDDB record.
Southwestern pond turtle (*Actinemys pallida*)	-	SSC	Documented in the upper reach of Honda Creek. May be found in construction area due to proximity of aquatic habitat.

Species	Status		Occurrence within the Proposed Action Area
	USFWS	CDFW	
Two-striped garter snake (*Thamnophis hammondii*)	-	SSC	Documented in Honda Creek. May be found in construction area due to proximity of aquatic habitat.
Birds			
Allen's hummingbird (*Selasphorus sasin*)	BCC	-	Likely: foraging habitat in the construction area; nesting habitat in the nearby riparian habitat of Honda Canyon.
Black oystercatcher (*Haematopus bachmani*)	BCC	-	Documented on sandy beaches and cliffs of VSFB shoreline within the noise footprint.
Black skimmer (*Rynchops niger*)	BCC	-	Documented on nearshore ocean within the noise footprint.
Brant (*Branta bernicla*)	-	SSC	Documented on nearshore ocean within the noise footprint
Burrowing owl (*Athene cunicularia*)	BCC	SSC	Likely: winters in burrows in grassland areas impacted by noise. Breeding on VSFB has not been documented in optimal breeding habitat on Base since 1984 (reflects a well-documented county-wide decline of the species). The construction area is poor breeding habitat and would only support temporary or opportunistic occurrences in the non-breeding season.
California brown pelican (*Pelecanus occidentalis californicus*)	-	Fully Protected	Documented in nearshore ocean waters and roosts on beaches and rocks within the noise footprint.
California condor (*Gymnogyps californianus*)	FE	SE	Unlikely: may stray into region on occasion. One documented brief occurrence on VSFB in 2017.
Costa's hummingbird (*Calypte costae*)	BCC	-	Likely: foraging habitat in the construction area. Nesting habitat in Honda Canyon and erosional wash habitat impacted by noise.
Golden eagle (*Aquila chrysaetos*)	BGEPA	Fully Protected	Likely: occasionally observed on VSFB in areas within the noise footprint.

Species	Status		Occurrence within the Proposed Action Area
	USFWS	CDFW	
Lawrence's goldfinch (*Spinus lawrencei*)	BCC	-	Likely: may forage and nest in construction area and areas within the noise footprint.
Loggerhead shrike (*Lanius ludovicianus*)	BCC	SSC Nesting	Likely: may forage and in the construction area and habitat within the noise footprint.
Long-billed curlew (*Numenius americanus*)	BCC	-	Documented on sandy beaches of VSFB shoreline within the noise footprint.
Marbled godwit (*Limosa fedoa*)	BCC	-	Documented on sandy beaches of VSFB shoreline within the noise footprint.
Marbled murrelet (*Brachyramphus marmoratus*)	FT	SE	Documented in offshore ocean waters within the noise footprint.
Northern harrier (*Circus hudsonius*)	-	SSC Nesting	Assumed present due to suitable foraging habitat in the construction area and likely to nest in grassland habitats within the noise footprint
Nuttall's woodpecker (*Dryobates nuttallii*)	BCC	-	Assumed present due to suitable nesting riparian habitat within the noise footprint.
Oak titmouse (*Baeolophus inornatus*)	BCC	-	Assumed present due to suitable nesting riparian habitat within the noise footprint.
Peregrine falcon (*Falco peregrinus anatum*)	BCC Nesting	Fully Protected Nesting	Documented foraging and nesting in coastal habitat within the noise footprint.
Short-billed dowitcher (*Limnodromus griseus*)	BCC	-	Documented on sandy beaches and rocky coastline of VSFB within the noise footprint.
Whimbrel (*Numenius phaeopus*)	BCC	-	Documented on sandy beaches and rocky coastline of VSFB within the noise footprint.
Western snowy plover (*Charadrius nivosus nivosus*)	FT; BCC	SSC Nesting	Documented on sandy beaches of VSFB within the noise footprint.
Willet (*Tringa semipalmata*)	BCC	-	Documented on sandy beaches of VSFB within the noise footprint.

Species	Status		Occurrence within the Proposed Action Area
	USFWS	CDFW	
White-tailed kite (*Elanus leucurus*)	-	Fully Protected Nesting	Assumed present due to suitable foraging habitat within the construction area and nesting habitat in riparian and non-native tree habitat within the noise footprint.
Yellow warbler (*Setophaga petechia*)	BCC	SSC Nesting	Assumed present due to suitable riparian habitat within the noise footprint.
Terrestrial Mammals			
Pallid bat (*Antrozous pallidus*)	-	SSC	Documented within the noise footprint.
Townsend's big-eared bat (*Corynorhinus townsendii*)	-	SSC	Documented within the noise footprint.
Spotted bat (*Euderma maculatum*)	-	SSC	Documented within the noise footprint.
Western red bat (*Lasiurus blossevillii*)	-	SSC	Documented within the noise footprint.
Western mastiff bat (*Eumops perotis californicus*)	-	SSC	Documented within the noise footprint.
San Diego desert woodrat (*Neotoma lepida intermedia*)	-	SSC	Documented within the noise footprint.
American badger (*Taxidea taxus*)	-	SSC	Assumed present due to suitable habitat within and adjacent to the construction area and nearby documented localities.

Notes: BGEPA = Bald and Golden Eagle Protection Act; FE = Federally Endangered Species; FT = Federally Threatened Species; SE = State Endangered Species; SSC = California State Species of Special Concern; SE = State Endangered Species; SSC = State Candidate Species; BCC = Federal Bird of Conservation Concern

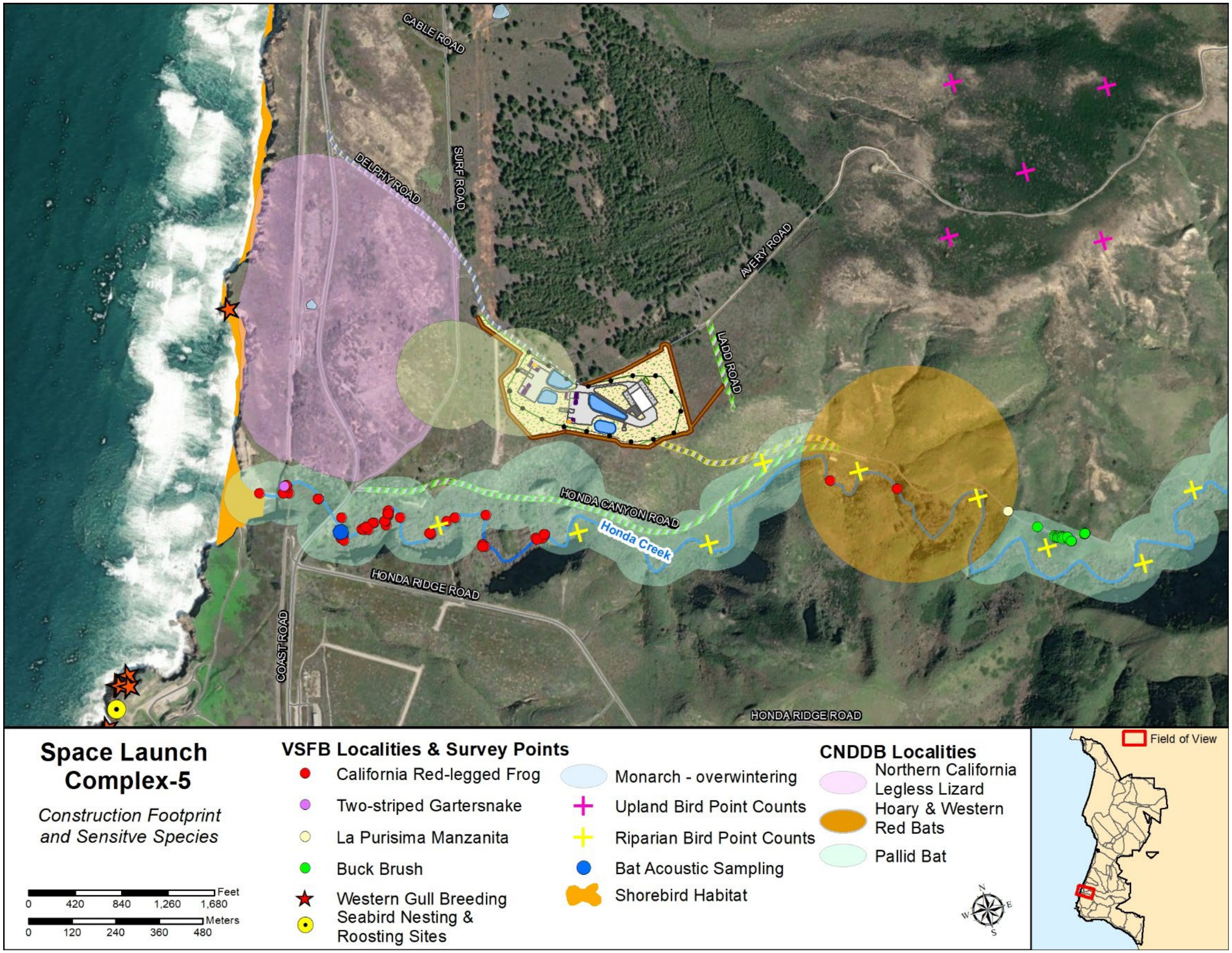

Figure B-1: Special status species localities and survey points in the vicinity of the SLC-5 construction footprint

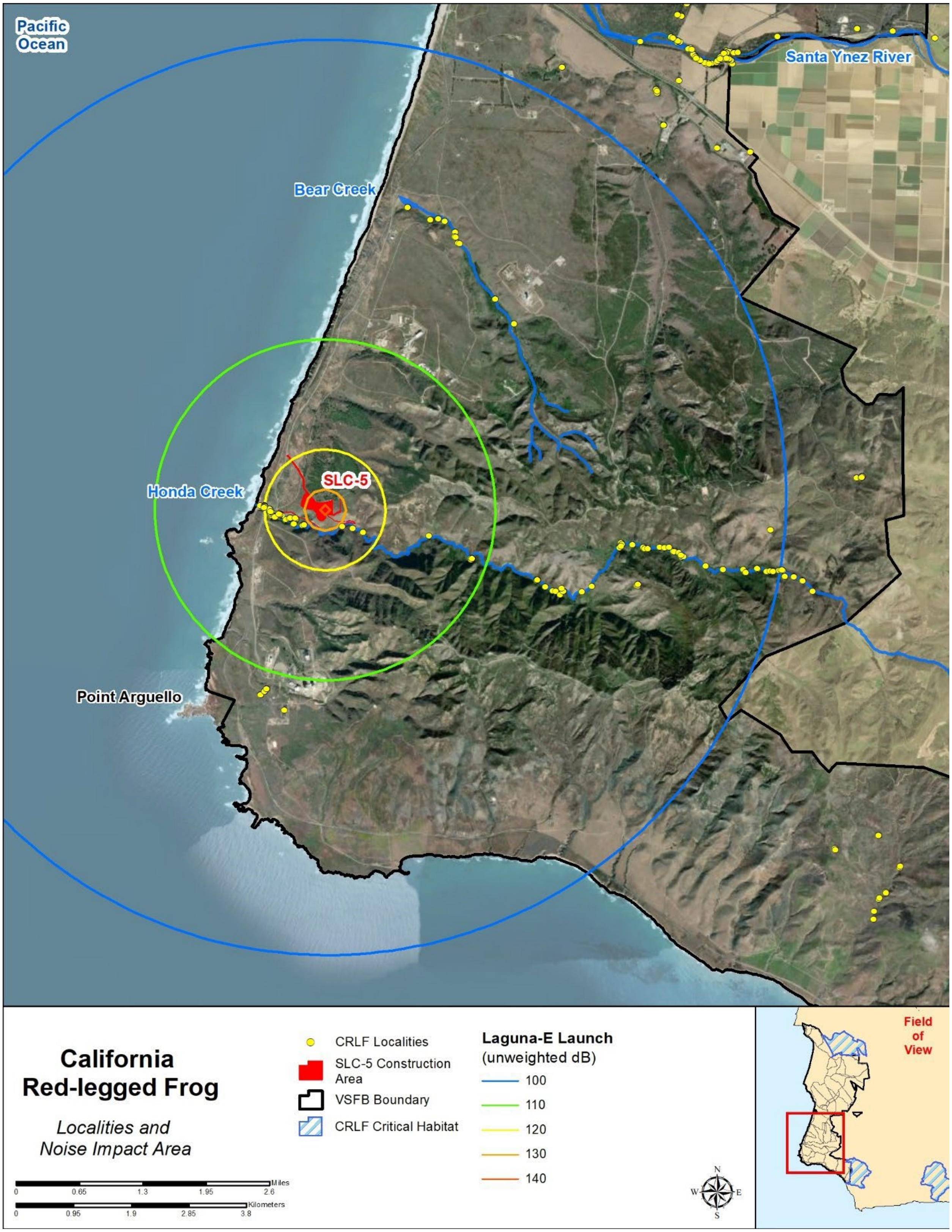

Figure B-2: California red-legged frog localities within the Laguna-E noise footprint (Source: USSF long term annual surveys and monitoring)

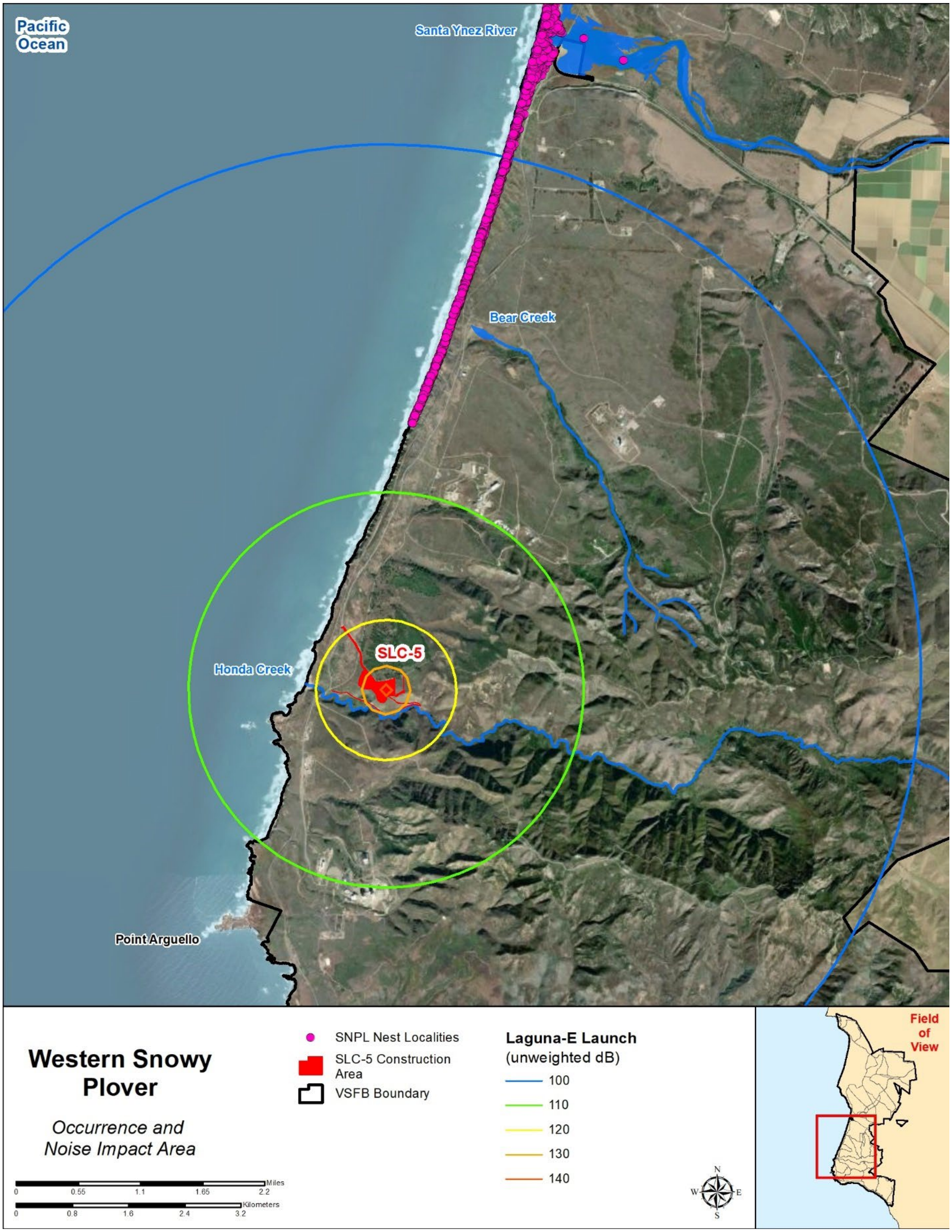

Figure B-3: Western snowy plover nest localities within the Laguna-E noise footprint (Source: USSF long term annual surveys and monitoring)

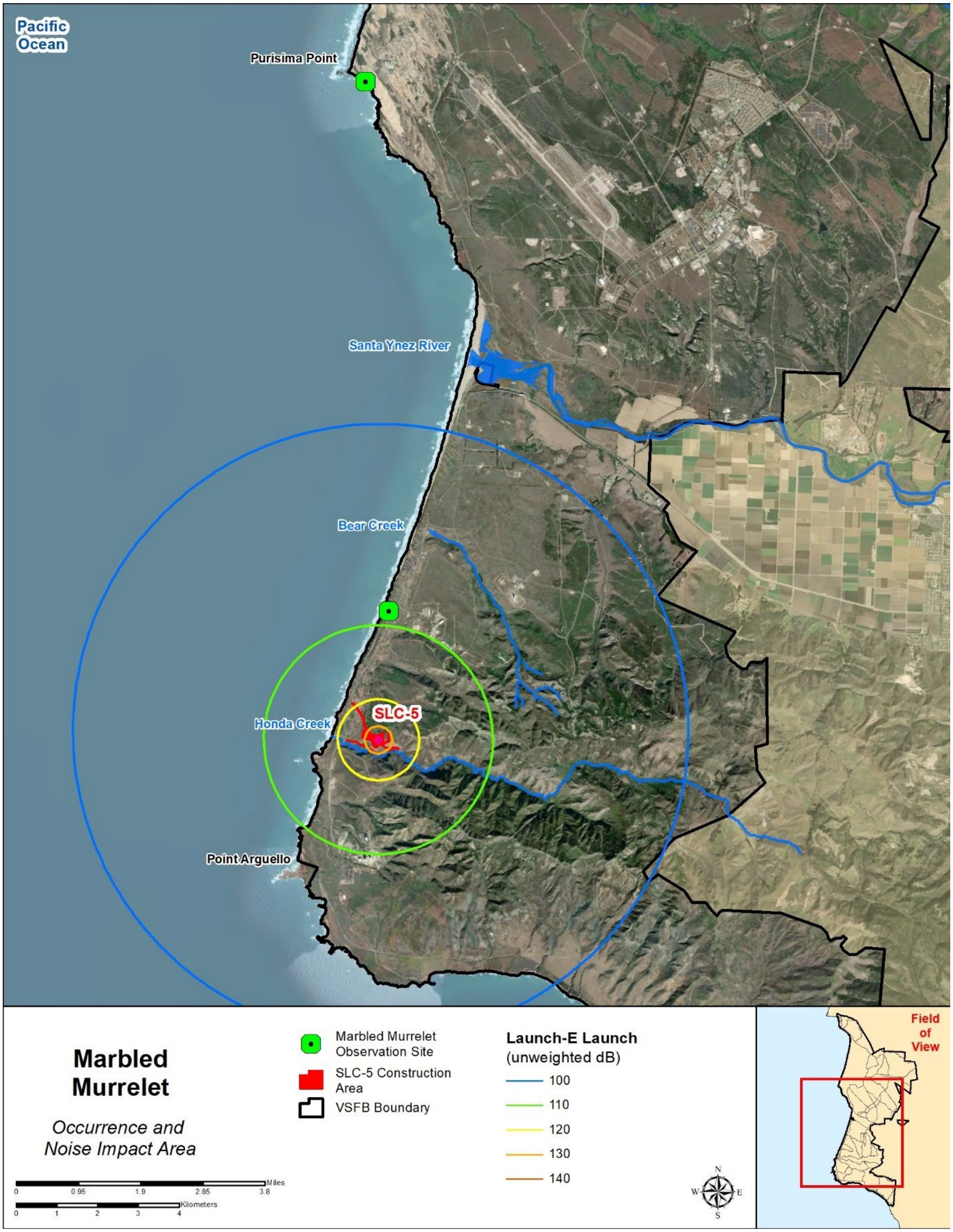

Figure B-4: Marbled murrelet observation sites within the Laguna-E noise footprint. (Note: the observation sites represent the location of the surveyor; the birds were observed in the ocean hundreds to thousands of feet offshore; Source: eBird 2022)

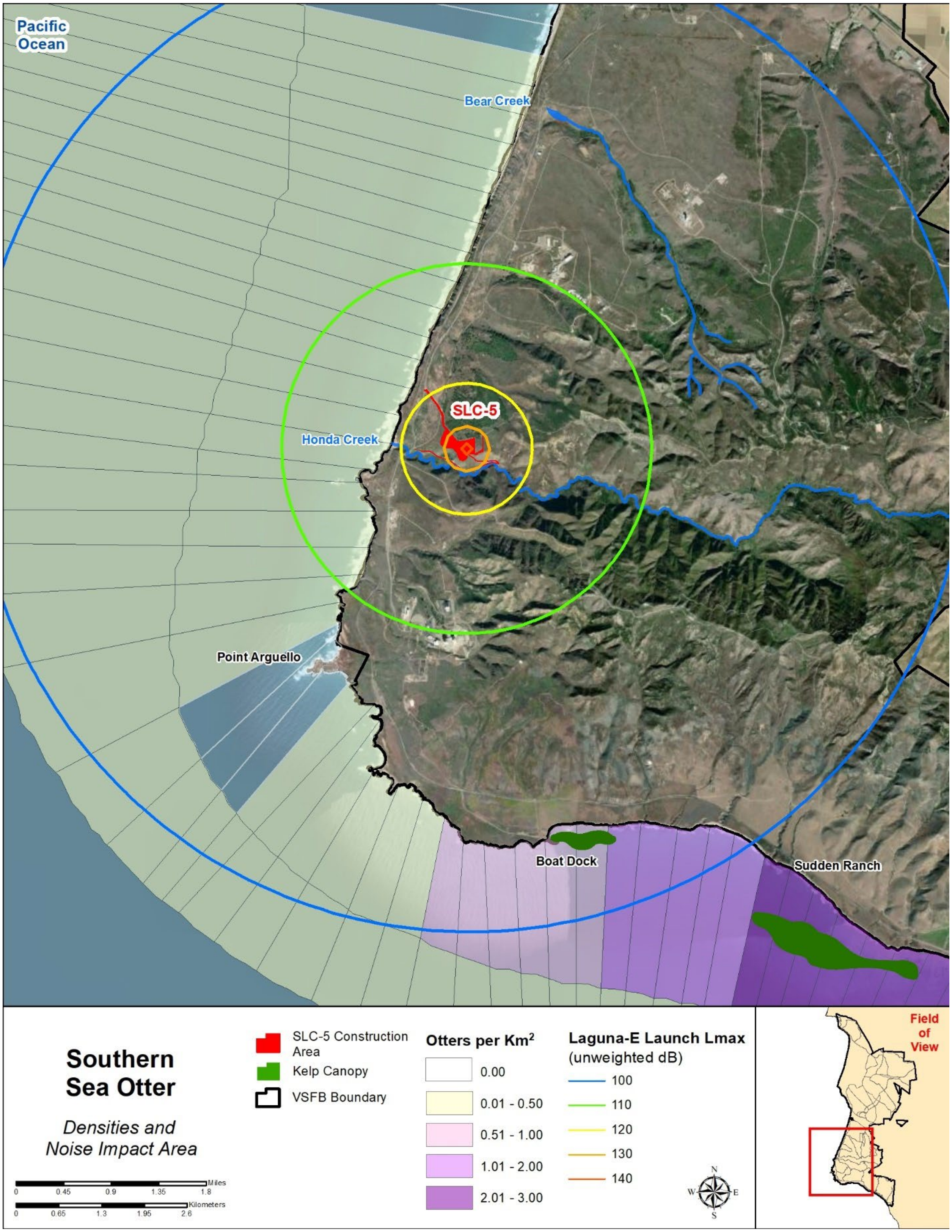

Figure B-5: Southern sea otter densities offshore within the Laguna-E noise footprint (Source: USGS 2019)

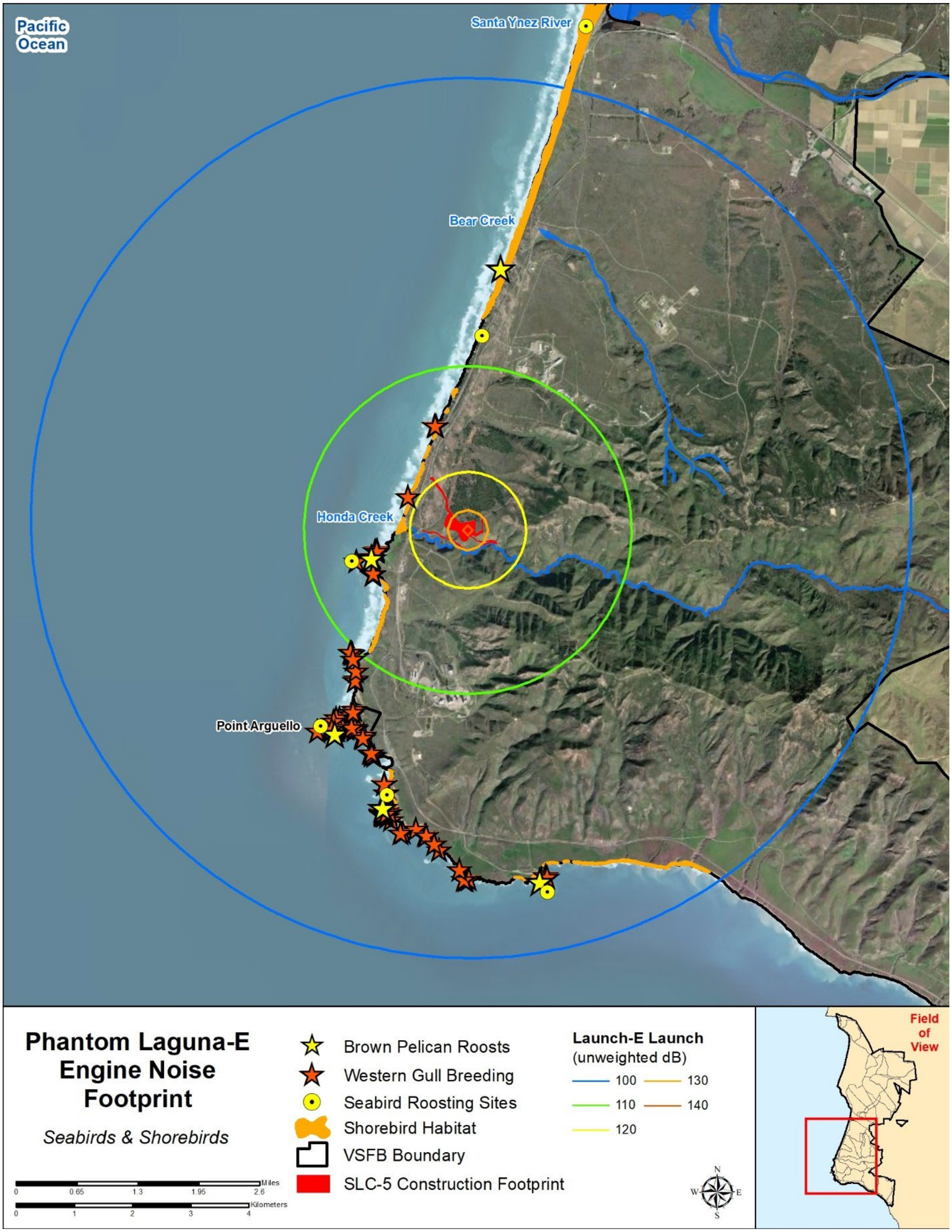

Figure B-6: Seabird roosting and breeding areas and shorebird habitat within the Laguna-E noise footprint (Source: USSF long term annual surveys and monitoring)

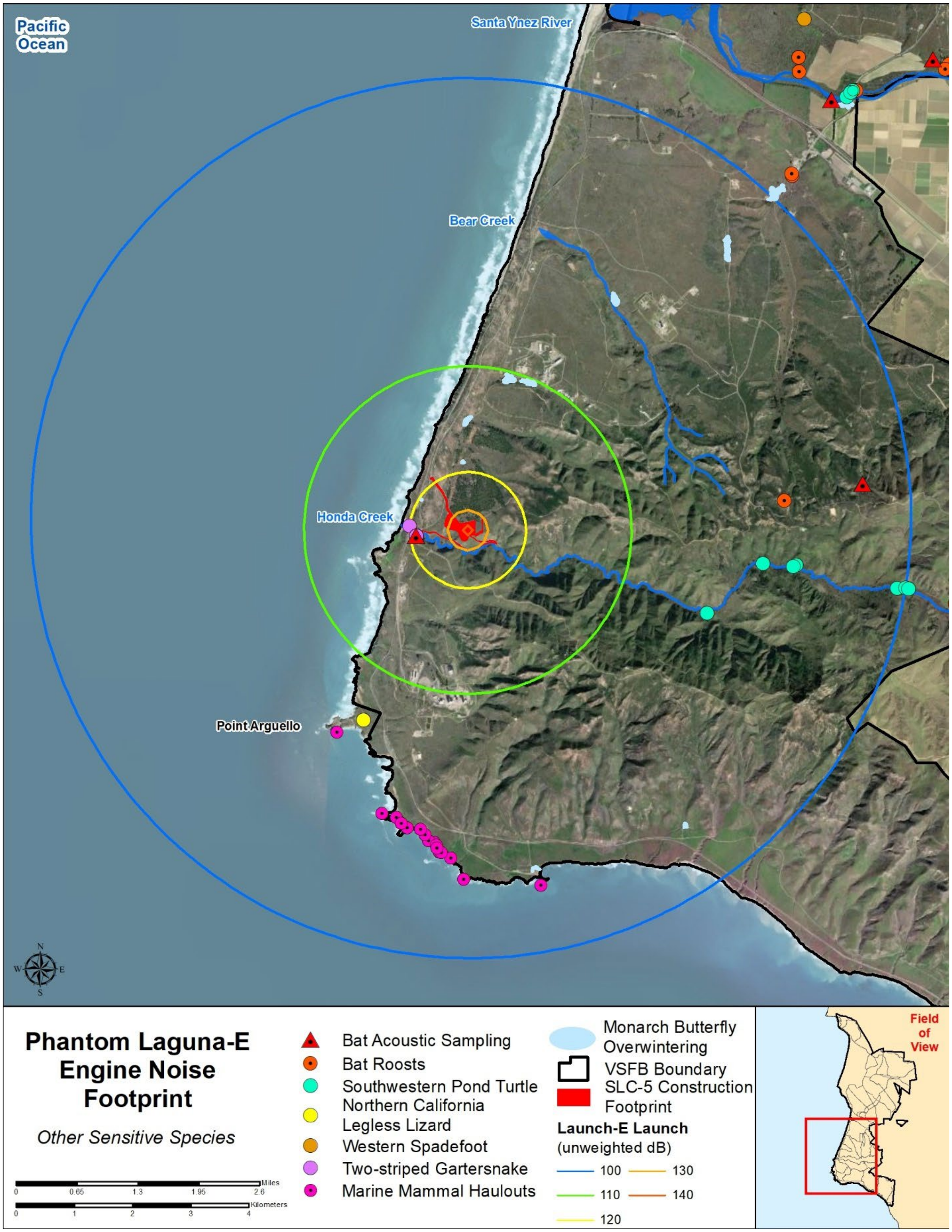

Figure B-7: Other special status species within the Laguna-E noise footprint (Source: USSF long term annual surveys and monitoring)

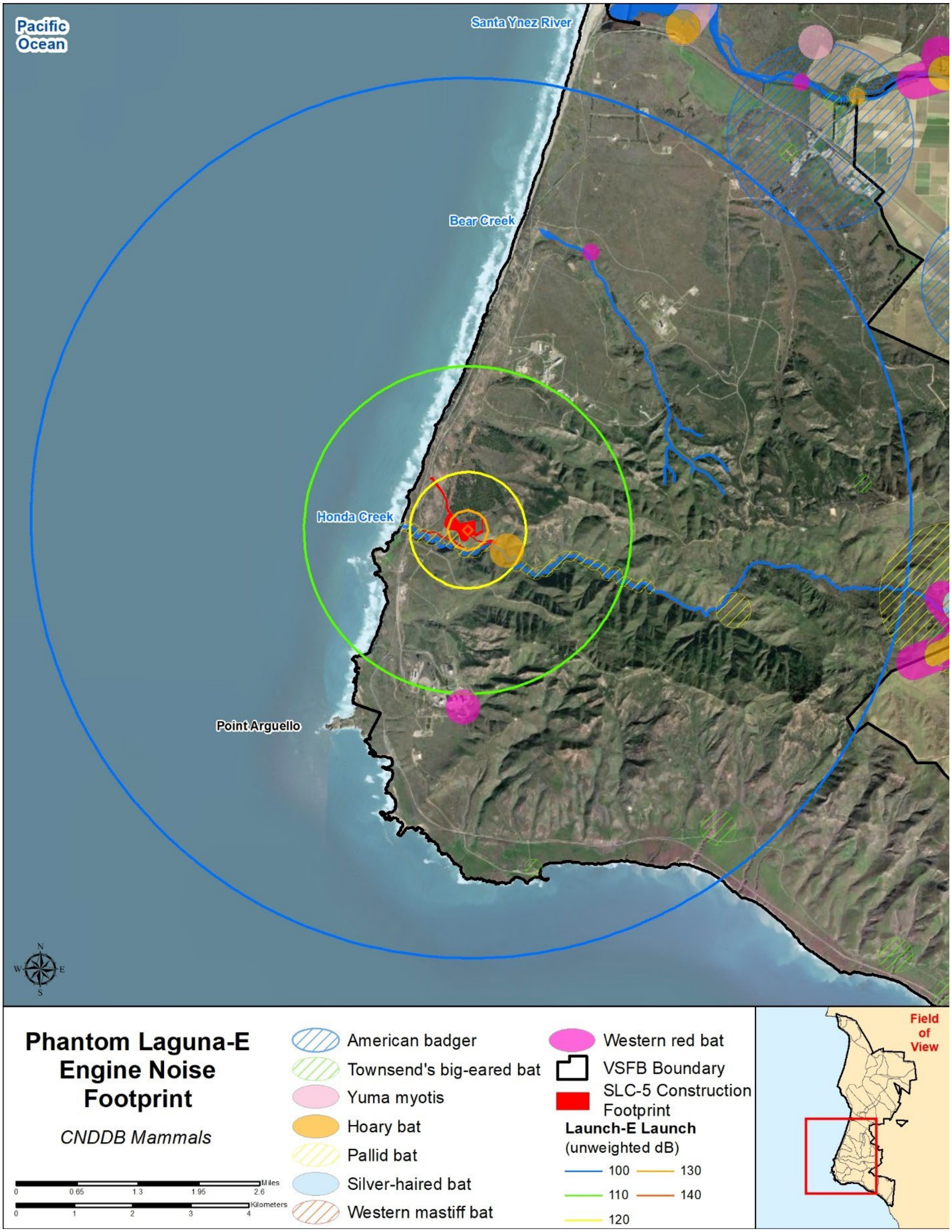

Figure B-8: Special status mammal CNDDB localities within the Laguna-E noise footprint

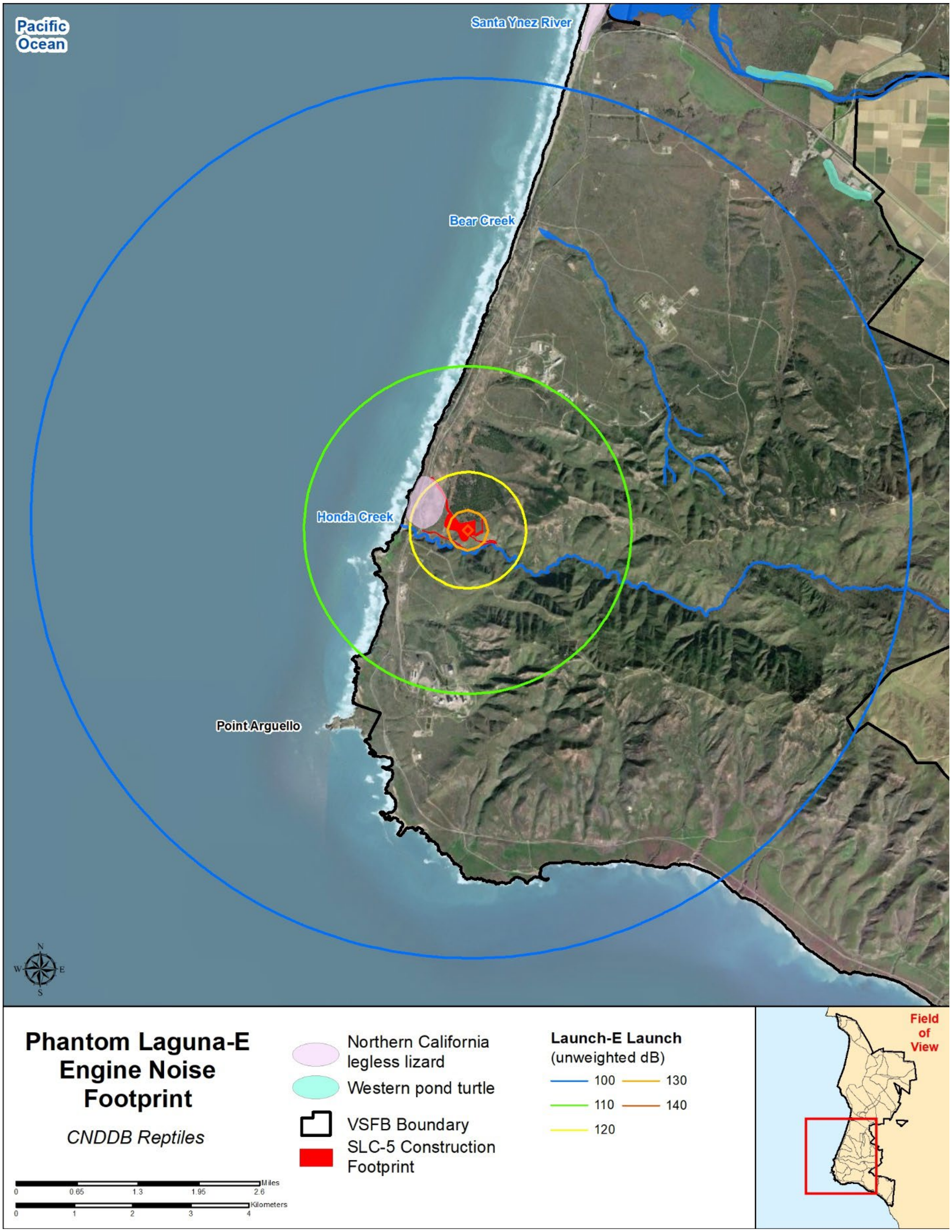

Figure B-9: Special status reptile CNDDB localities within the Laguna-E noise footprint

APPENDIX C – RESUMES

ManTech International Corporation.
ManTech SRS Technologies, Inc.
300 North G Street
Lompoc, CA 93436

Dr. John LaBonte – Program Manager/Senior Biologist	**Experience: 27 Years**
Position:	Program Manager / Senior Wildlife Biologist
Status:	Full-Time Employee
Education:	Ph.D. – 2008, Department of Ecology, Evolution, & Marine Biology, University of California, Santa Barbara, CA B.S. Ecology, Behavior, & Evolution – 1997, Department of Biology, University of California, San Diego, CA Minor: Engineering Sciences
Professional Certifications:	➢U.S. Fish and Wildlife recovery permit under section 10(a)(1)(A) of the Endangered Species Act for: ○ **California tiger salamander** - aquatic and terrestrial survey, trap, handle, collect tissue, and restore breeding habitat. ○ **California red-legged frog** - survey, capture, handle, and test for chytrid fungus. ○ **Federally listed species of fairy shrimp and tadpole shrimp** in California - wet season protocol presence/absence surveys for; capture, handle, and release. ○ **El Segundo blue butterfly** - survey by pursuit adults of the federally endangered El Segundo blue butterfly and collect seed from its host plant seacliff buckwheat. ○ **Unarmored threespine stickleback** - capture, handle, and release unarmored threespine stickleback. ➢California Department of Fish and Game Scientific Collecting Permit and Memorandum of Understanding. ➢Federal Falconry License with falconry abatement experience.
Other Certifications/Training:	➢USFWS qualified individual for monitoring tidewater goby ➢USFWS qualified to for Gaviota tarplant, Lompoc yerba santa, and beach layia.
Total Experience:	27 years

ManTech SRS Technologies, Inc., a subsidiary of ManTech International Corporation
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Leading the Convergence of National Security and Technology™

Areas of Expertise:

- Project impact analysis including the preparation of biological assessments for section 7 consultations with the USFWS and NOAA Fisheries.

- Preparation of environmental assessments under NEPA.

- Preparation of Incidental Harassment Authorization applications to NOAA Fisheries.

- Development and oversight of implementation of mitigation and monitoring plans.

- Production of management plans for sensitive species and habitats, including invasive species eradication, habitat restoration, and predator control.

- Designing and conducting statistically rigorous experiments, surveys, and monitoring protocols for sensitive reptile, amphibians, mammal, bird, and plant species.

- Natural history of southwestern United States including southern and central California, the Great Basin, Mojave, Sonoran, and Chihuahua deserts with special emphasis on amphibian and reptile communities.

Work History:

Environmental Program Manager/Senior Wildlife Biologist

2010-Present **ManTech SRS Technologies, Inc.**

Program Manager for Environmental Support Services contracts, primarily serving the U.S. Air Force and U.S. Navy, out of Lompoc, California. Services include all aspects of the natural and cultural resources programs, and the environmental compliance program. Manage staff of 30 employees, and contracts of over $5M annually. Provide project management and decision support to properly prioritize work, establish budgets, ensure focused scope of work and deliverables are provided on time. Ensure fiscal responsibility. Manage subcontracting efforts as required to support tasks. Implement corporate policies and procedures and ensure compliance with Human Resources policies. Prepare technical proposals and cost estimates in response to requests for task support from the government and private entities.

Prepare regulatory documents in support of NEPA, section 7 consultations for impacts to ESA listed species, NOAA Fisheries IHA's and LOA's, and mitigation and monitoring plans. Continue to conduct field biology and monitoring, including protocol surveys and assessments for vernal pool branchiopods, California tiger salamander and other ESA listed species, design restoration plans for the enhancement of vernal pools, including occupied and potential habitat for ESA-listed vernal pool branchiopods and California tiger salamander. Extensive field experience with California tiger salamander in Santa Barbara County and the Central Valley of California and vernal pool branchiopods throughout California and some parts of Arizona. Supervisor: Karen Waller

President/Senior Biologist

2015-Present **Wildlands Conservation Science, LLC**

P.I. and lead biologist on a USFWS Section 6 Grant to study the impacts of an invasive tiger salamander on the population status and conservation of the California tiger salamander in Santa Barbara County. Develop relationships with private land owners to arrange for access to breeding ponds, perform aquatic sampling, pitfall trapping, and tissue collection. Collaborate with Dr. Bradley Shaffer (UCLA) for genetic analysis of tissue. Develop potential control strategies for invasive tiger salamanders.

Post-doctoral Researcher

2008-2018 **University of California, Santa Barbara, CCBER**

Studying conservation of sensitive amphibian species in Central California, including the effects of chytrid fungus on the California red-legged frog, the impacts of an introduced non-native tiger salamander on the California tiger salamander, and the ecology and distribution of a new species of slender salamander.

Trained under Dr. Samuel Sweet in the biology, ecology, conservation, and field survey techniques for salamanders and anurans, including the California tiger salamander and California red-legged frog. Supervisor: Dr. Samuel Sweet.

Wildlife Biologist

2004-2010 **ManTech SRS Technologies, Inc.**

Conduct and coordinate a wide variety of tasks involving biological resources, primarily on VAFB. Activities include: conducting special status plant and animal surveys; vernal pool branchiopod surveys, habitat assessments, and habitat enhancement; riparian biological inventories and monitoring; herpetological surveys; protocol amphibian presence/absence surveys and monitoring; population census for southern sea otter and other marine mammals; space launch related impact monitoring of breeding pinnipeds on San Miguel Island and VAFB; small mammal trapping; bird surveys and banding; biological compliance monitoring; habitat restoration activities; predator/pest management and control. Perform resource mapping in field and GIS support for projects (ArcPad, ArcInfo), write management plans for natural resources of VAFB, prepare biological assessments in support of Section 7 consultations with the U.S. Fish and Wildlife Service, and design and implement habitat restoration plans. Perform environmental compliance review, assessment, and monitoring for projects and activities occurring throughout VAFB to ensure implementation processes are in compliance with regulatory requirements, and to provide guidance for minimizing and avoiding non-compliance issues. Authorized individual on numerous USFWS Biological Opinions to survey for, capture, and translocate California red-legged frogs out of project areas and provide qualified onsite compliance monitoring.

Trained under Dr. Brent Helm on field survey techniques, identification, and ecology of California's brachiopods. Trained under Dr. Richard Arnold and Dr. Gordon Pratt on field survey techniques, identification, and ecology of El Segundo blue butterfly. Trained under Carl Page on field survey techniques, identification, and ecology of unarmored threespine stickleback. Supervisor: Paloma Nieto

Adjunct Curator

2001-2012 **University of California, Santa Barbara, CCBER**

Collect, prepare, catalog, and maintain specimens in the Herpetology Collection at the Cheadle Center for Biodiversity and Ecological Restoration (CCBER) for research and teaching purposes. Primary focus of my collection efforts has been in Santa Barbara County, CA, east and southeast California, Arizona, and New Mexico. Additional responsibilities include educational lectures, community outreach, and docent training on the identification, ecology, behavior, and conservation of herpetofauna. Assist in surveys for California tiger salamanders and removal of non-native barred tiger salamanders in Santa Barbara County, CA under the supervision of Dr. Samuel Sweet.

Doctoral Graduate Student

1999-2007 **University of California, Santa Barbara**

Designed and implemented a laboratory and field research program to study developmental changes in foraging behavior and digestive physiology of the Pacific Rattlesnake (*Crotalus oreganus helleri*). Performed all aspects of field work involving radiotracking and surveying for rattlesnakes as well as extensive lab experiments involving foraging and feeding trials and metabolic measurements. Supervisor: Dr. Sam Sweet

Teach Assistant/Instructor/Teacher Trainer

1999-2006 **University of California, Santa Barbara**

Teaching assistant, lab instructor, and teacher trainer for a variety of courses and labs in the biological sciences at UCSB. Taught Herpetology, Zoology, Biological Statistics, Comparative Vertebrate Anatomy, Evolution, Vertebrate Ecology, and other general biology and ecology courses. Experience included independent lab and discussion section instruction, preparation of teaching materials, review of student performance, training teaching assistants, and leading field trips to the Mojave and Great Basin deserts for Herpetology Lab. Supervisors: various UCSB faculty

Graduate Student Researcher

1999-2003 **University of California, Santa Barbara**

Conducted a comprehensive survey of the herpetofauna of the University of California. Sedgwick Reserve, including amphibian and reptile presence/absence surveys, and compiled a reptile and amphibian field guide for the reserve.

Field Technician

1998-1999 **U.S. Geological Survey, Biological Resources Division**

Assisted in standard protocol California red-legged frog (*Rana draytonii*) and arroyo toad (*Bufo californicus*) presence/absence surveys of watersheds in San Diego, Riverside, and Orange Counties. Supervisors: Dr. Robert Fisher, Mr. Ed Erwin

Laboratory Technician

1997-1999 **University of California, San Diego**

Conducted a radio-tracking study of the coastal horned lizard (*Phrynosoma coronatum*), surveyed San Diego area ant communities, keyed out ant specimens to species level identification, trained and supervised volunteers and student researchers, and assisted with data entry and analysis. Supervisors: Dr. Ted Case, Dr. Robert Fisher, Dr. Andrew Suarez

Field Technician

1996-1997 **University of California, San Diego**

Assisted in a survey of the herpetofaunal species of the coastal sage scrub community of San Diego County. Supervisor: Dr. Robert Fisher

Peer Reviewed Publications:

A. Adams, LaBonte, J.P., and Ball, M. In Prep. Persistence of California Red-legged Frogs in Central California despite Evidence of Long-term *Batrachochytrium dendrobatidis* Infection and the Presence of an Invasive Congener.

LaBonte, J.P. In Prep. The ontogeny of maximum gape, head size, and prey utilization in the Southern Pacific rattlesnake, *Crotalus oreganus helleri*.

Adams, A.J., J.P. LaBonte, M.L. Ball, K.L. Richards-Hrdlicka, M.H. Toothman, and C.J. Briggs. 2015. DNA Extraction Method Affects the Detection of a Fungal Pathogen in Formalin-Fixed Specimens Using qPCR. PLoS ONE 10(8): e0135389. doi:10.1371/journal.pone.0135389

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ManTech International Corporation.

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Resume for Alice Abela

Position:	Senior Wildlife Biologist
Status:	Full-Time Employee
Education:	B.S. Biology, 2003 California Polytechnic State University, San Luis Obispo, CA
Professional Certifications:	➢U.S. Fish and Wildlife recovery permit under section 10(a)(1)(A) of the Endangered Species Act to survey, capture, handle, and test for chytrid fungus the federally threatened **California red-legged frog**, survey by pursuit adults of the federally endangered **El Segundo blue butterfly** and collect seed from its host plant seacliff buckwheat (*Eriogonum parvifolium*); wet season protocol presence/absence surveys for federally listed species of **fairy shrimp and tadpole shrimp** in California; capture, handle, and release the federal endangered **unarmored threespine stickleback**. ➢Subpermitee under a U.S. Fish and Wildlife recovery permit to survey for, trap and handle **California tiger salamander**. ➢Federal Bird Banding Subpermit with authority to use mist nets.
Other Certifications/Training:	➢NOAA NMFS qualified marine mammal monitor. ➢USFWS Qualified Individual for monitoring **tidewater goby** ➢Basic Wetland Delineation, Wetland Training Institute (2006). ➢USFWS Carlsbad Office El Segundo blue butterfly identification exam – passed 100%. ➢USFWS approved training course Fairy Shrimp of California (Instructor: Mary Belk) – passed 100%. ➢USFWS qualified for Gaviota tarplant, Lompoc yerba santa, Gambel's watercress, beach layia, and Vandenberg Monkey Flower. – proficient at identifying and assessing potential habitat. ➢40hr HAZWOPER certified, 2011.
Total Experience:	22 years

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Leading the Convergence of National Security and Technology™

Areas of Expertise: Expert in plant, bird, mammal, reptile, amphibian and insect identification, handling, and specimen preparation. Experienced with ecology of central, coastal and southeastern desert systems of California and vegetation sampling methodologies. Proficient in ArcPad and ArcInfo and with Garmin and Trimble products. Extensive experience in preparation of Biological Assessments and sections of Environmental Assessments pertaining to biological resources including evaluation and analysis of project related impacts. Wetlands delineations.

Work History:

Project Manager/Senior Biologist
2001-Present **ManTech SRS Technologies, Inc.**

Perform biological inventories of flora and fauna including special status species surveys, vegetation sampling, resource mapping (using ArcMap, ArcPad and ArcInfo), *marine mammal monitoring and population censuses,* small mammal and reptile mark and recapture, and avian point count surveys. Perform environmental compliance review, assessment, and monitoring for projects and activities occurring throughout Vandenberg SFB to ensure implementation processes are in compliance with regulatory requirements, and to provide guidance for minimizing and avoiding non-compliance issues. Write Biological Assessments in support of U.S. Fish and Wildlife Service section 7 consultations. Assist in the preparation of Environmental Assessments. Draft reports and habitat restoration plans. Perform wetlands delineations in support of state and federal permits, and environmental documentation. Monitor resources and special status plant and animal species during project implementation and space launches including surveys and censuses of southern sea otters, pinnipeds, California brown pelicans, unarmored threespine stickleback and breeding birds on Vandenberg SFB, and *conduct breeding pinniped monitoring on the Northern Channel Islands*. Project lead for special status plant surveys, including GIS mapping of coverages and field surveys for the federally endangered Gaviota tarplant, Lompoc yerba santa, Gambell's watercress and beach layia. Project lead for a basewide invertebrate inventory (including collection and processing of specimens), basewide El Segundo blue butterfly surveys and co-lead in a vernal pool fairy shrimp basewide inventory. Conduct California red-legged frog surveys and testing for chytrid fungus, large branchiopod surveys and El Segundo blue butterfly surveys. Conduct monthly marine mammal population surveys. Conduct vegetation monitoring using methods such as California Native Plant Society releves, point-intercepts, line intercepts, point quadrats, and belt transects. Assist permitted biologists in monitoring of western snowy plover and running the Monitoring Avian Productivity and Survivorship (MAPS) station at Vandenberg SFB. Conducted a study on the composition of the diets of coastal coyotes on Vandenberg SFB and presented a poster at the 2004 American

Society of Mammalogists conference. Conducted vernal pool surveys, vegetation sampling, reptile amphibian, and avian surveys at Beale Air Force Base. Authorized individual on numerous USFWS Biological Opinions to survey for, capture, and translocate California red-legged frogs out of project areas and provide qualified onsite compliance monitoring.

Wildlife Biologist

2006-2018 **California Department of Fish & Game – Resource Assessment Program**

Part-time wildlife biologist conducting protocol California red-legged frog surveys, western pond turtle, western spadefoot, and general reptile, amphibian and bird surveys, avian point counts, and small mammal trapping surveys on the Chimineas Unit of Carrizo Plain Ecological Reserve.

Collections Volunteer

2005-2020 **Santa Barbara, Cheadle Center for Biodiversity and Ecological Restoration**

Collections volunteer, collecting mammal, bird, reptile, and amphibian species from throughout Central California as well as the Mojave, Great Basin, Sonoran, and Chihuahuan deserts of California, Arizona and New Mexico. Assisting in eradication efforts for a central coast population of non-native barred tiger salamanders.

Insect Curator

2003 **California Polytechnic State University, San Luis Obispo**

Curator of California Polytechnic State University's insect collection. Responsible for the maintenance and organization of the Cal Poly Invertebrate collection and the identification and incorporation of new material into the teaching collection.

Technician

2001-2003 **California Polytechnic State University, San Luis Obispo**

California Polytechnic State University Reptile Room Technician responsible for the care and maintenance of 15 different species of native and exotic reptiles and amphibians.

Teaching Assistant

2001-2002 **California Polytechnic State University, San Luis Obispo**

Teaching assistant for Herpetology and Entomology. Duties included presenting lab material, and managing the teaching collections.

STATE OF CALIFORNIA - NATURAL RESOURCES AGENCY GAVIN NEWSOM, GOVERNOR

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F8b

CD Filed:	11/23/2022
60th Day:	1/22/2023
Extended to:	12/15/2023
Staff:	HW-SF
Staff Report:	11/30/2023
Hearing Date:	12/15/2023

STAFF REPORT: REGULAR CALENDAR

Application No.: **CD-0010-22**

Applicant: **Department of the Air Force, U.S. Space Force**

Location: Vandenberg Space Force Base, Santa Barbara County

Project Description: Construct a new commercial space launch facility at the former site of Space Launch Complex 5 on Vandenberg Space Force Base and carry out up to 48 rocket launches and 48 static fire engine tests per year.

Staff Recommendation: Concurrence

SUMMARY OF STAFF RECOMMENDATION

The Department of the Air Force (DAF) has submitted a consistency determination for the construction and operation of a new commercial space launch facility by the Phantom Space Corporation (Phantom) at the former site of Space Launch Complex 5 (SLC-5) on Vandenberg Space Force Base (VSFB), located in northern Santa Barbara County. The proposed project involves construction of two 1,500 square foot concrete launch pads and associated infrastructure as well as implementation of a space launch program with a maximum frequency of 48 rocket launches and 48 static fire engine tests annually.

The proposed project has the potential to result in a variety of effects to California coastal resources, including through the release of debris into the ocean and disturbance of environmentally sensitive habitat areas (ESHA) near the proposed launch complex due to elevated sound levels and night lighting.

With respect to marine debris, the proposed project includes two sources: weather balloons and the “first stage” and “fairings” sections of the rockets. Up to six weather balloons would be released prior to each launch to measure upper atmosphere conditions and would then fall to the ocean below in state or federal waters. Due to the height it would fall from and large ocean area it may land in, it would not be feasible to recover each weather balloon and associated 1.5-pound instrument array. DAF has therefore committed to ensure that Phantom provide a monetary donation to UC Davis’ California Lost Fishing Gear Recovery Project to offset this source of marine debris through the recovery of lost and abandoned fishing nets and other gear.

Each rocket launch would also involve the release of the rocket’s first stage in the upper atmosphere. This section of the rocket would weigh between 2,600 and 7,200 pounds, is made primarily of aluminum, and would land and sink in the international waters off the coast of Baja California, Mexico. This material is also expected to be unrecoverable. Although it would be released into the ocean far from shore outside of the coastal zone and is unlikely to be buoyant enough to move into the coastal zone or affect coastal resources, Commission staff has encouraged DAF to take steps to recover the first stage or offset its release into the ocean by collecting and removing other types of marine debris. DAF has not committed to taking any such steps, however, and has stated that the release of this material into the ocean would not have an adverse effect on coastal resources.

With respect to ESHA impacts, the proposed project would result “spillover” effects to sensitive wildlife[1] habitat adjacent to the site, primarily through elevated sound levels from launches. However, DAF has conducted extensive monitoring across VSFB to understand wildlife responses to launch activity and has found that no adverse impacts have occurred and that significant wildlife populations continue to be present despite periodic launch events and elevated sound levels. However, the proposed project would increase the frequency of launches on VSFB and raises questions about how representative past monitoring results will be to future conditions. To demonstrate that adverse impacts to sensitive wildlife and habitats continue to be absent and that the increased launch frequency remains compatible with the continued use of adjacent ESHA, DAF will implement an enhanced monitoring program focused on the sensitive species and habitats most likely to be found in the project area, California reg-legged frog, western snowy plover (snowy plover), marine mammal haul-out areas, and two

[1] Wildlife species include: California red-legged frogs, western snowy plover, pallid bat, and western red bat.

species of bat designated by the California Department of Fish and Wildlife as state Species of Special Concern. The proposed monitoring programs were developed in coordination with the U.S. Fish and Wildlife Service, National Marine Fisheries Service and bat biologists with national and international expertise.

With regard to commercial and recreational fishing, the proposed project has the potential to affect fish activities through notices to mariners advising closures off the coast of VSFB. DAF and Phantom have coordinated with the Port San Luis Commercial Fishing Association to identify timing for launches that would be least impactful to the fishing fleet, and Phantom has committed to submitting a Fisheries Communication and Coordination Plan to the Executive Director for review and feedback to ensure ongoing appropriate communications about scheduled launches with the fishing fleet.

Finally the proposed project is one of many projects proposing increased launch frequency at VSFB. The average launch frequency at VSFB has been 4.4 launches annually over the past five years, although VSFB has contracted to conduct up to 92 space launches annually. In addition to the 48 launches annually proposed under this project, SpaceX was recently approved to increase their launch frequency to 36 launches annually (ND-0009-23) and the proposed Blue Origin project includes up to eight launches annually. To address concerns about overall launch frequency and impacts at VSFB, DAF has committed to coming back to the Executive Director in five years, before the full launch frequency starts, to report on the findings of their environmental monitoring.

With implementation of these commitments and the additional coastal resource protection measures described in the report below and included in **Exhibit 1**, the staff recommends that the Commission **concur** with DAF consistency determination (No. CD-0010-22) and find the proposed project consistent to the maximum extent practicable with the enforceable policies of the California Coastal Management Program. The motion to concur is on **page 5**.

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APPENDICES

Appendix A: Substantive File Documents

Appendix B: Works Cited

EXHIBITS

1. DAF Commitment Letter
2. Narrative of Current and Recent DAF Launch Programs and Map of launch locations
3. Vandenberg Map
4. Site Plan
5. Historical and Proposed Development
6. Vegetation Alliances at the Project Site
7. Wildlife Species and Engine Noise Maps
8. Preliminary Site Lighting Plan
9. Predicted First Stage Splashdown Map
10. Sonic Boom Maps
11. Fishing Blocks Map with Range of Launch Angles

I. FEDERAL AGENCY'S CONSISTENCY DETERMINATION

Space Launch Delta 30 of the Department of the Air Force, United States Space Force (DAF), has determined that the project is consistent to the maximum extent practicable with the California Coastal Management Program (CCMP).

II. MOTION AND RESOLUTION

Motion:

> I move that the Commission concur with Consistency Determination CD-0010-22 on the grounds that the project described therein would be fully consistent, and thus consistent to the maximum extent practicable, with the enforceable policies of the CCMP.

Staff Recommendation:

Staff recommends a YES vote on the forgoing motion. Passage of this motion will result in a concurrence with the determination of consistency, and adoption of the following resolution and findings. An affirmative vote of a majority of the Commissioners present is required to pass the motion.

Resolution:

> The Commission hereby concurs with Consistency Determination CD-0010-22 on the grounds that the project is fully consistent, and thus consistent to the maximum extent practicable, with the enforceable policies of the CCMP.

III. APPLICABLE LEGAL AUTHORITIES

A. STANDARD OF REVIEW

The proposed space launch complex would not be a government facility and would be constructed and operated solely by a private entity, the Phantom Space Corporation (Phantom), on a portion of Vandenberg Space Force Base that would be leased to Phantom by the Department of the Air Force (DAF). DAF nevertheless has determined that the proposed project is a "federal agency activity," as defined in the Coastal Zone Management Act's federal consistency regulations and has therefore prepared a consistency determination for the Commission's review. The federal consistency regulations at 15 C.F.R. Section 930.31(a) state that:

> The term "Federal agency activity" means any functions performed by or on behalf of a Federal agency in the exercise of its statutory responsibilities. The term "Federal agency activity" includes a range of activities where a Federal agency makes a proposal for action initiating an activity or series of activities when coastal effects are reasonably foreseeable, e.g., a Federal agency's proposal to physically alter coastal

> resources, a plan that is used to direct future agency actions, a proposed rulemaking that alters uses of the coastal zone. "Federal agency activity" does not include the issuance of a federal license or permit to an applicant or person (see subparts D and E of this part) or the granting of federal assistance to an applicant agency (see subpart F of this part).

Commission staff questioned this interpretation and the Commission's review of a consistency determination for the project by DAF rather than a coastal development permit application or consistency certification by Phantom since those are the standard mechanisms by which the Commission reviews activities proposed by private entities within the coastal zone and/or affecting any coastal use or resource. In response, DAF stated that "All activities taking place on federally owned [Department of Defense] land, including those that utilize private entities, are done so in a manner exercising our statutory responsibilities." Although the Commission has a long history of reviewing and authorizing development activities carried out by private entities on federally owned land, including Vandenberg Space Force Base, through the coastal development permit application or consistency certification processes, DAF maintains that the proposed project is different due to the unique partnership arrangement it has with commercial space launch companies like Phantom. In short, because the federal government no longer carries out space launch activities, DAF relies on private companies such as Phantom to send government payloads to space and to be available to support DAF needs and priorities. Accordingly, while the project would be built, maintained and operated by a private company to serve its business objectives and would only occasionally launch materials at the behest of DAF, it would also help meet the needs of the federal government. Based on this mixed purpose and at the request of DAF, Commission staff agreed to bring forward the proposed project for the Commission's consideration as a consistency determination from DAF. However, future projects will continue to be considered on a case-by-case basis and different review approaches will be used when appropriate.

The federal Coastal Zone Management Act (CZMA), 16 U.S.C. §§ 1451-1464, requires that federal agency activities affecting coastal resources be "carried out in a manner which is consistent to the maximum extent practicable with the enforceable policies of approved State management programs." *Id*. at § 1456(c)(1)(A). The implementing regulations for the CZMA (federal consistency regulations), at 15 C.F.R. Section 930.32(a)(1), define the phrase "consistent to the maximum extent practicable" to mean:

> … fully consistent with the enforceable policies of management programs unless full consistency is prohibited by existing law applicable to the federal agency.

This standard allows a federal activity that is not fully consistent with California's Coastal Management Program (CCMP) to proceed, if full compliance with the CCMP would be "prohibited by existing law." In its November 2023 consistency determination, DAF did not argue that full consistency was prohibited by existing law or provide any documentation to support a maximum extent practicable argument. Therefore, there is no basis to conclude that existing law applicable to the federal agency prohibits full consistency. Since DAF has raised no issue of practicability, as so defined, the standard before the Commission is full consistency with the enforceable policies of the CCMP, which are the policies of Chapter 3 of the Coastal Act (Cal. Pub. Res. Code §§ 30200-30265.5).

However, the Commission has the ability under the federal consistency regulations to re-open this consistency determination should the proposed federal activity have effects on any coastal use or resources substantially different from those originally described in DAF's consistency determination. Should this scenario occur, the Commission's finding that the project is "fully consistent" with the enforceable policies of the CCMP could be re-examined in light of new circumstances.

B. Federal Lands Excluded from the Coastal Zone

Under the federal CZMA, the Commission is authorized to review federal agency activities and actions that occur within or outside of California's coastal zone and that affect any land or water use or natural resource of the coastal zone. However, the CZMA defines "coastal zone" to exclude certain land under the ownership and sole control of the federal government.[2] Thus, in cases such as this where a proposed project that is being reviewed under the Commission's federal consistency authority is to be located on federal land (i.e., on VSFB), the Commission's review is limited to evaluating whether the activities will result in effects that extend outside of the federal property and will "spill over" into the coastal zone. For example, public safety zones implemented during rocket launches such as those proposed in the current project would extend outside of VSFB and could result in the closure of public beaches and campgrounds, including those at Jalama Beach County Park. This would affect public beach access and recreation within the coastal zone even though the space launch complex would be located on the federal land of VSFB. In addition, the loss and disturbance of sensitive habitats and wildlife species, such as snowy plover and California red-legged frogs, on VSFB can imperil the survival and health of those same habitats and species outside of VSFB. As such, the Commission has the authority to review federal agency activities on federal property like VSFB, albeit in a somewhat different manner than the Commission's typical review of development activities under the California Coastal Act.

IV. FINDINGS AND DECLARATIONS

A. Background and Project Location

Vandenberg Space Force Base (VSFB) is located in Santa Barbara County, west of the City of Lompoc and encompasses an area of 99,100 acres. VSFB was originally used

[2] Coastal Zone Management Act § 304(1) excludes from the coastal zone "all lands held in trust by or whose uses are subject solely to the discretion of the federal government."

by the U.S. Army and was transferred to the U.S. Air Force (DAF) in 1957.[3] DAF selected VSFB as a site for what would eventually become the Western Range[4] because of the isolated location, ability for year-round operations, and because the base could support space and rocket launches with flight paths that did not extend over large civilian populations.[5] VSFB retains these characteristics today and it is one of very few federal facilities that supports space launch activities.[6] Throughout the 1950s, VSFB was used extensively for testing various missile systems and also for the launch of the first polar orbiting satellite, Discoverer 1, in 1959. Space exploration then became the primary focus for activities at VSFB.[7] The Commission has reviewed consistency and negative determinations from the Department of the Air Force for various space programs at VSFB since the early 1980s, including the Space Shuttle Program (CD-21-82), multiple rocket launching programs (Atlas, Titan, etc.), and, more recently, launch activities carried out by the commercial Space Exploration Company, SpaceX (ND-103-03, ND-088-05, ND-055-10, ND-0035-14 and ND-0009-23). In 2021, the 2,000th launch from VSFB was completed.

Current and Proposed Launch Programs

VSFB's existing space launch programs occur over seven space launch complexes and involve five different space launch companies, including Space X, United Launch Alliance (ULA) and Firefly Aerospace. In total, DAF's existing contracts allow for up to 92 total space launches annually by all companies operating on VSFB. A review of Commission records shows that over the past 29 years, the Commission has concurred with launch programs totaling up to 64 potential launches annually, as shown in the table below. However, such high numbers of space launches have never occurred, as explained further below.

DAF has additionally developed eight missile launch sites and expects to launch up to 23 missiles annually. The Commission has previously concurred with up to 30 ballistic missile launches in CD-06-99. A map of the proposed project location on VSFB and a map of all missile and space launch complexes on VSFB is available in **Exhibit 2 and Exhibit 3**. The launch sites on VSFB are arranged from north to south, close to the coast. Tables of contracted and proposed/under Commission review annual space launches and expected annual missile launches are provided below. A narrative summary of each launch program, its location, and operations is available in **Exhibit 2**.

[3] https://www.vandenberg.spaceforce.mil/About-Us/History/

[4] The Western Range is the area over which rockets are fired for testing and tracking. The Western Range extends from the West Coast of the United States to 90 degrees east longitude in the Indian Ocean, where it meets the Eastern Range.

[5] https://www.vandenberghousing.com/history

[6] Nearly all of the space launches in the U.S. are carried out at VSFB and Cape Canaveral in Florida.

[7] https://militarybases.com/california/vandenberg/

Table 1: Current Annual Launches on VSFB

Launch Complex Name	Launch Vehicle Name	Maximum Contracted Number of Launches	CCC Application No.	Number of Launches in CCC Concurrence	Launch Vehicle Category*	Maximum Launch Vehicle Height
TP-01	Minotaur	6	n/a	--	Small	78 feet
SLC-2W	Firefly Alpha	11	CC-30-96**	10	Medium	95 feet
576-E	ABL RS1	12	ND-0020-21	12	Small	88 feet
SLC-3E	ULA Vulcan Centaur	6	ND-0027-20	6	Medium	220 feet
SLC-4E and SLC-4W	Falcon 9	36***	ND-0009-23***	36 launches from SLC-4E*** 6 landings at SLC 4-W	Medium	230 feet
SLC-8 (multi-user pad)	Minotaur	15	n/a	--	Small	55-79 feet
Total Launches:		*92*	*Total Number of Launches across all programs concurred with by the CCC (does not include landings):*	*64*		

** Categories are based on payload capacity. Small vehicles carry less than 4,400 lb., medium vehicles carry between 4,400 lb. and 44,000 lb., and heavy vehicles carry between 44,000 and 110,000 lb.*

*** These Commission concurrences were for earlier launch programs or missile programs at these space launch complexes on VSFB. For more details, please see Exhibit 2.*

**** This launch program is currently being reassessed by the Commission.*

Table 2: Proposed Annual Launches on VSFB under Commission Review

Launch Complex Name	Launch Vehicle Name	Maximum Permitted Number of Launches	CCC Application No.	Launch Vehicle Category	Maximum Launch Vehicle Height
SLC-9	Blue Origin New Glenn	8	CD-0010-21	Heavy	360 feet
SLC-5	Phantom Daytona-E and Laguna-E	48	CD-0010-22 (subject of this report)	Small	79 feet
Total Proposed Launches:		*56*			

Table 3: Expected Annual Missile Launches on VSFB

Missile Name	Maximum permitted number of Launches
MDA	12
Minuteman III	5
GBSD	6
Total Missiles	*23*

Although DAF contracts and Commission authorizations cover a large number of launch activities, there is a significant discrepancy between those numbers and the actual number of launches that occurs annually at VSFB. From 2017 through 2021, VSFB supported an average of 4.4 rocket launches per year, with a maximum of 7 launches in both 2017 and 2018. These numbers are similar to those considered by the Commission during its last comprehensive evaluation of base-wide launch operations; carried out in 1998 as part of Consistency Determination No. CD-049-98. At that time, the Commission reviewed scheduled launches from 1998 through 2002 and noted that an average of eight launches and maximum of 14 launches would occur per year. The current number of annual launches is a small percent of the maximum number of launches DAF has indicated are available under contract with the various launch providers. Many of the commercial launch providers operating at VSFB are newer “start-up” companies working to establish new space launch programs and have proposed what are generally considered to be optimistic or aspirational targets for annual launch frequencies. These frequencies typically assume that research and development efforts will proceed smoothly and without significant delay and that adequate investment capital will be provided. These aspirational launch frequencies are used in NEPA and CZMA review; however, the realities and challenges of funding and developing a complicated aeronautics and space program from scratch – and securing sufficient customers to implement it - means that the proposed launch frequencies have never previously been met. Therefore Commission staff's review efforts in the past have focused primarily on the actual number of launches being carried out and adherence to adverse impact avoidance and minimization measures (such as those discussed in the Public Access and Recreation Section of this report) and less on the aspirational or maximum numbers of launches proposed. In recent years, however, some private companies such as SpaceX, have begun to approach their launch frequency goals and have expressed increased interest in performing additional commercial space launches at VSFB.

Although it remains incomplete pending the submittal of additional information, DAF submitted a consistency determination (CD-0010-21) in 2021 for a proposal from Blue Origin to construct a new space launch complex and carry out associated operations for up to 8 launches of medium-heavy-lift class rockets. Additionally, the existing SpaceX launch program at VSFB recently increased the annual number of launches of its space vehicles from 6 to 36 annually at SLC-4E, which was reported to the Commission at its June 2023 hearing as negative determination no. ND-0009-23.[8] The proposed Phantom project, as described below, would slowly build up to 48 launches annually and would increase the number of contracted launches by 52 percent. In addition, DAF has indicated that a consistency determination is being prepared for submittal in the coming months to expand SpaceX operations to an additional existing launch complex and to increase its annual number of space launches to 100 per year. Further, DAF is in the initial stages of a planning process for a project referred to as "Spaceport of the Future" that would involve the construction and operation of several new launch complexes and other support facilities and infrastructure throughout VSFB as well as further increases in space launches. Additional information and details about the scope and timeline for this large-scale effort to significantly expand VSFB's facilities and operations are expected to be available next year. In combination with the proposed project, these future projects have the potential to dramatically increase the total number of space launches from VSFB and expand them from the current level of approximately one per month to a future level of two or more per week.

Project Location

The proposed project would be located on VSFB at the former site of Space Launch Complex-5 (SLC-5). Maps of the SLC-5 site location within VSFB, and the proposed project development areas are available in **Exhibit 3** and **Exhibit 4**, respectively. Portions of the site were previously developed and used by the National Aeronautics and Space Administration (NASA) to launch Scout space vehicles. When the Scout program ended in 1994, all facilities at SLC-5 were deactivated and then demolished between 2009 and 2012. Buildings were removed and the concrete pad used for launches was covered by new fill soil. A map showing the extent of historical

[8] This program is currently being reassessed by the Commission.

development at SLC-5, compared to the proposed development area is available in **Exhibit 5**.

Project History

A staff report was previously prepared for the proposed Phantom project and was scheduled for the Commission's June 2023 hearing. Consideration of the proposed project was postponed at the request of DAF. On November 9, 2023, DAF submitted a revised consistency determination to the Commission for consideration. Changes have been made to the proposed project in the revised consistency determination, including changing the alignment of a proposed fire break to avoid an area supporting a vegetation alliance identified as vulnerable by the California Native Plant Society's Manual of California Vegetation. The exhibits and analysis below reflect the project described in the revised consistency determination.

B. Project Description

Within VSFB, Phantom Space Corporation (Phantom) proposes to construct two 1,500 square foot concrete launch pads, associated infrastructure, and a 7,500 square foot horizontal integration facility at the former site of the SLC-5 launch complex. This new launch complex would be constructed and operated by Phantom for its Daytona-E and Laguna-E launch programs. The project would also include installing utilities such as electrical and communication lines, firebreaks, and improvements to fire access roads. Utilities would be installed along existing roadways and utility corridors.

Rocket and payload (e.g. satellite) assembly would be conducted at the existing Phantom factory in Tucson, Arizona. Once assembled, the rockets would be shipped via commercial truck transport to VSFB. Payloads would be shipped from several locations including Arizona, Florida, Colorado, and elsewhere in California. Final assembly of the rocket and payload would occur at the proposed space launch complex within the horizontal integration facility. The flight-ready rocket would then be transported within the site to one of two proposed launch pads at the complex and prepared for vertical tests or launch. Vertical tests would be performed a few days prior to each launch to show that the engine is performing as expected when fired at full thrust. Phantom proposes to perform up to 48 launches annually in addition to up to 48 vertical or static fire tests. Static fire tests involve ignition of the rocket engine in a controlled manner to determine proper functioning prior to a launch attempt.

The maximum number of launch and static fire tests carried out each year under the proposed project would gradually increase over the course of six years, as shown below in Table 4.

Table 4: Projected Phantom Launches and Tests by Calendar Year

Operational Year	Number of Launches (max.)	Number of Static Fire Tests (max.)
1	1	1
2	2	2
3	5	5
4	12	12
5	24	24
6	48	48

The purpose of the proposed project is to provide low-cost access to satellite technology by mass manufacturing launch vehicles, satellites, and space propulsion systems. DAF states that:

> The purpose of the Proposed Action is to address lack of accessible U.S. enterprise access to space and to fulfill requirements of commercial and governmental entities in the small satellite orbital and suborbital market. Phantom's mission is to provide low-cost access to satellite technology by mass manufacturing launch vehicles, satellites, and space propulsion systems. Over the past several years, the Department of Defense (DOD) and intelligence community have shifted from the use of U.S. government-developed rockets to nearly exclusive reliance upon the commercial space transportation industry for reliable, affordable, and agile access to space for national security missions. This new model has proven valuable and the shift to commercial launch service providers for national security missions is now DOD's standard practice.

Additional details about Phantom's proposed launch pad and other facility construction, utility and road improvements, construction phasing, and launch schedules can be found in **Appendix A**.

C. Other Agency Approvals and Consultations

United States Fish and Wildlife Service

DAF has completed a formal consultation with the U.S. Fish and Wildlife Service (USFWS) for federally listed species protected under the federal Endangered Species Act that may be affected by the proposed project. The biological opinion issued by the USFWS, dated April 24, 2023, found that the proposed project "may affect but is not likely to adversely affect" marbled murrelet, southern sea otter, California condor, unarmored threespine stickleback and tidewater goby. The USFWS further found that the proposed project would not likely jeopardize the continued existence of California red-legged frogs or snowy plovers. The USFWS made these determinations due to the protection and mitigation measures that DAF has agreed to implement. These protection and mitigation measures are available in **Appendix A**.

National Marine Fisheries Service

DAF has consulted with the National Marine Fisheries Service (NMFS) regarding rocket and missile launches and aircraft operations at VSFB under the Marine Mammal Protection Act and received a Letter of Authorization (LOA) from NMFS in 2019. The LOA is provided in **Appendix A**. The LOA is valid for five years and allows for up to 110 rocket launches annually across all launch facilities at VSFB. DAF indicates in its consistency determination that the proposed project falls within the scope of the activities covered by the LOA.

According to the consistency determination and the draft environmental assessment prepared for the proposed project, DAF also conducted informal consultation with NMFS for potential adverse impacts to marine species listed under the Endangered Species Act such as certain whales and sea turtles. On May 4, 2022, NMFS concurred with DAF that the proposed project "is not likely to adversely affect the NMFS ESA-listed species and/or designated critical habitat."

Federal Aviation Administration

The Federal Aviation Administration (FAA) has a role in licensing commercial space launch operations and approving airspace closures for launch operations. Phantom submitted a launch license application to the FAA in April 2023 and the FAA will consider the application after DAF completes its NEPA process.

Tribal Outreach and Consultation

DAF performed tribal consultation in 2022 with the Santa Ynez Band of Chumash Indians (Santa Ynez Band) under Section 106 of the National Historic Preservation Act. No ground disturbance is expected at any archaeological sites and DAF has indicated to the Commission that the Santa Ynez Band of Chumash requested the presence of a tribal monitor only during ground disturbance in and near known archaeological sites.

Consistent with the Commission's Tribal Consultation policy, Commission staff received a list of Tribes with potential cultural connections to the project area from the Native American Heritage Commission and completed outreach to those Tribes in January of 2023. Consultation invitations were mailed to the Barbareño/Ventureño Band of Mission Indians, the Chumash Council of Bakersfield, the Coastal Band of the Chumash Nation, the Northern Chumash Tribal Council, the San Luis Obispo County Chumash Council, and the Santa Ynez Band of Chumash Indians. The Commission received a response from the Northern Chumash Tribal Council requesting consultation. The Commission held a consultation meeting with Northern Chumash Tribal Council representatives on May 25, 2023. Further discussion of this tribal consultation and potential project effects on cultural resources is available in the Cultural Resources section of this report below.

D. Environmentally Sensitive Habitat Areas

Coastal Act Section 30240(b) states:

> Development in areas adjacent to environmentally sensitive habitat areas and parks and recreation areas shall be sited and designed to prevent impacts which would significantly degrade those areas, and shall be compatible with the continuance of those habitat and recreation areas.

Coastal Act Section 30107.5 defines environmentally sensitive area:

> "Environmentally sensitive area" means any area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which could be easily disturbed or degraded by human activities and developments.

Environmentally Sensitive Habitat Areas or ESHA are areas where plant communities or species are rare or especially valuable and easily disturbed or degraded by human activities. There are several types of ESHA adjacent to the project site including: Lemonade Berry Scrub, riparian habitat in Honda Creek, and western snowy plover nesting habitat. Section 30240(b) requires development adjacent to ESHA be sited and designed to prevent impacts that would significantly degrade ESHA habitat and be compatible with continued use of ESHA habitat. The proposed project has the potential to adversely affect ESHA adjacent to the project site in two ways: through the use of artificial night lighting at the complex that would extend into adjacent habitat areas, and due to the elevated levels of noise produced by the proposed launches and static fire tests at the launch complex.

DAF states in its consistency determination that the proposed project is consistent with Section 30240. DAF has sited and configured the proposed project to avoid and minimize adverse impacts to rare or especially valuable species and habitats adjacent to the project site and has also proposed monitoring and reporting to help determine if unexpected adverse impacts occur.

Types of Environmentally Sensitive Habitat Areas

The proposed project would be sited entirely within the former footprint of a space launch complex, SLC-5, that was in use for several decades and then decommissioned and removed from 2009 to 2012. As shown in **Exhibit 6**, the vegetation and fire management area that would surround the new proposed facility would be adjacent to a vegetation community identified as Lemonade Berry Scrub. Lemonade Berry Scrub is a rare vegetation community that the Commission has previously identified as ESHA.

As described in the background section above, DAF submitted a revised consistency determination for this project in November 2023 that changed the alignment of the vegetation and fire management area from an earlier proposal. The change in alignment meant that the area identified as Lemonade Berry Scrub is now outside of the area that would be periodically cleared of vegetation for the proposed fire break.

In addition to the area of Lemonade Berry Scrub directly adjacent to the proposed vegetation and fuel management area, the launch complex is also located above and approximately 250 feet north of Honda Canyon at its closest point. Within Honda Canyon is Honda Creek and riparian habitat that supports sensitive wildlife. Areas known to support nesting by snowy plovers are also near the proposed launch complex (approximately 3.5 miles to the northwest) and within the zone that would experience elevated sound levels during launch activities and static fire engine testing.

Lemonade Berry Scrub

Lemonade Berry (*Rhus integrifolia*) is an aromatic evergreen shrub found within the coastal zone and very close to the coast from Santa Barbara County down through Baja California. Lemonade Berry Scrub is a vegetation alliance dominated by lemonade berry and comprised of coastal scrub species, such as California sagebrush (*Artemisia californica),* Coyote bush *(Baccharis pilularis),* Mediterranean broom (*Genista linifolia*), Laurel sumac (*Malosma laurina),* or orange bush monkey flower *(Diplacus aurantiacus).* Lemonade Berry Scrub has been identified with a Global (G) and State (S) rarity ranking of 3 in the Manual of California Vegetation (Manual). Global and State level 3 communities and species are identified are identified in the Manual as vulnerable which denotes, "a moderate risk of extinction due to a restricted range, relatively few populations (often <80), recent and widespread declines, or other factors." These rarity rankings are developed considering the range, extent, area of occupancy, number of occurrences and the number of high-quality occurrences of a vegetation alliance.[9] In the specific case of Lemonade Berry Scrub, a ranking of G3/S3 means that is it considered vulnerable both worldwide and statewide, with an estimated 21 to 100 total occurrences.

In addition to its rarity, Lemonade Berry Scrub is vertically diverse habitat type, which makes it suitable for roosting, nesting, denning, and foraging for native animals. Its canopy is around 10 feet in height, and it has both an understory layer of numerous native shrubs and an herbaceous layer on the ground of various native species of grasses and forbs. This vegetation alliance is also considered to be particularly vulnerable and sensitive to disturbance from vegetation removal and development because its seeds are not viable over long time periods, and it has low recruitment (reproduction). Additionally, the composition of this vegetation alliance is changing due to increasing cover of invasive plants, such as fountain grasses. As such, the Commission's staff ecologist has determined that this habitat type adjacent to the project area meets the definition of ESHA under Coastal Act Section 30107.5. Lemonade Berry Scrub species are also part of Coastal Sage Scrub and Chaparral communities in the coastal zone, and occurrences of Lemonade Berry are found south

[9] CDFW defines natural communities, animals, and plants with a global or state ranking of 1, 2, or 3 as rare and the CCC typically finds these to be ESHA. CCC also typically considers plant and animal species listed by the federal and state endangered species acts (ESA and CESA, respectively) and/or identified under other special status categories (e.g., California Species of Special Concern) and/or identified by the California Native Plant Society (CNPS) as '1B' and '2' plant species as constituting ESHA.

of VSFB along the Gaviota Coast in Santa Barbara County.[10] Lemonade Berry Scrub relies on animals for seed dispersal; the stand of Lemonade Berry Scrub on VSFB provides a significant source of seeds for dispersal into the coastal zone and creates a higher potential for this vulnerable habitat type to establish itself and persist in the coastal zone.

Honda Creek Riparian Habitat

California red-legged frog

The Commission's staff ecologist has determined that the riparian habitat in Honda Creek meets the definition of ESHA because it provides breeding habitat, forage and refuge for California red-legged frogs, a species listed as threatened under the federal Endangered Species Act and by the California Department of Fish and Wildlife as a Species of Special Concern. A habitat assessment and population status report on California red-legged frogs, provided as part of the consistency determination, found that Honda Creek supports a high number of adult frogs compared to many other areas of frog habitat on VSFB, such as San Antonio Terrace or ABRES-A Lake. Honda Creek also serves as a refugia and provides consistent breeding habitat for frogs during extended drought conditions.

The rarity of California red-legged frogs is widely recognized and has resulted in its state and federal special species designations. California red-legged frogs are sensitive to disturbance and their habitat could be easily disturbed or degraded from development including direct habitat loss due to stream alteration, loss of aquatic habitat, and indirect effects of expanding urbanization affecting their dispersal and migration into new habitats, as noted in the USFWS Biological Opinion. California red-legged frogs are found outside of VSFB in the coastal zone in streams along the coast and transverse ranges of California. The nearby Los Padres National Forest is known to provide habitat for California Red-legged frogs and the USFWS identified them as being prevalent along the coast of Santa Barbara County (USFWS 2022). The populations on VSFB add to the genetic diversity and population of frogs outside of the base, particularly because California red-legged frogs are known to make long-distance overland migrations to suitable breeding habitat elsewhere. These long-distance migrations may be up to 1.75 miles in wet environments and the USFWS notes that coastal California red-legged frog populations in Santa Barbara county and to the north show genetic connectivity. This indicates that there is migration and gene flow between California red-legged frog populations on VSFB and those in the coastal zone outside of federal property (USFWS 2023). The loss of the frog population from VSFB would reduce genetic diversity and gene flow between frog populations, which could affect the overall population of California red-legged frog in the coastal zone outside of the base. For rare species, maintaining genetic diversity is particularly critical in the face of climate change due to the variety of environmental stressors it can bring and the need for adaptation and new traits that will enable survival.

[10] https://calscape.org/Rhus-integrifolia-(Lemonade-Berry)?srchcr=sc6466a34ca91d7

Pallid Bat and Western Red Bat

The pallid bat and western red bat are also known to be present within the riparian habitat of Honda Creek. These bat species have been designated by the California Department of Fish and Wildlife (CDFW) as Species of Special Concern. Bats play a special role in the ecosystem due to their high metabolic needs and extensive feeding on insects. In general, CDFW designates certain animals as "Species of Special Concern" when they:

- Occur in small, isolated populations or in fragmented habitat, and are threatened by further isolation and population reduction;
- Show marked population declines; or
- Depend on a habitat that has shown substantial historical or recent declines in size and/or quality or integrity, among other factors (CDFW 2023).

CDFW identified pallid bats as a Species of Special Concern because they have experienced a marked population decline in recent years in California. Pallid bats are not tolerant of suburban or urban development, and habitat conversion has led to their decline (CDFW 1998). CDFW identified Western red bats as a Species of Special Concern because they face increased predation from species associated with human development (jays and opossums), and their primary habitat in riparian corridors is under consistent threat of conversion to other land uses, specifically agriculture (CDFW 1998). CDFW's findings show that the habitat of both bat species is easily disturbed or degraded by development, leading to population declines. Both pallid bats and western red bats are more common globally than within California. They each have a rarity ranking of G4/S3, meaning that their populations are apparently secure and at low risk for extinction globally, but within California they are vulnerable and at moderate risk for extinction due to a restricted range, relatively few populations or recent and widespread declines. Populations of these species and bat populations in general are at risk for significant declines in California, as white-nose syndrome has been found on the west coast in recent years. This illness is believed to be caused by a fungal infection that bats are particularly susceptible to and frequently results in high mortality rates and the catastrophic loss of entire bat colonies (CDFW 2023). The special role of these bat species in the ecosystem and their vulnerability to population declines supports identification of their roosting habitat as ESHA.

Acoustic data collection carried out by DAF biologists within Honda Creek have identified the presence of multiple bat species, including pallid bat and western red bat. Although formal surveys for roosting areas have not been conducted, the riparian habitat and geology of Honda Canyon provides characteristic roosting habitat and bats are expected to engage in roosting behavior there. As shown in **Exhibit 7**, the California Natural Diversity Database includes records of Western red bat and pallid bat in Honda Canyon.

These bat species occur both on VSFB and outside of VSFB in the coastal zone of Northern Santa Barbara County, as shown in **Exhibit 7**. Adverse impacts to the populations on VSFB would have spillover effects to outside areas, including within the coastal zone, by reducing overall carrying capacity[11] and genetic diversity of western red bats and pallid bats in Santa Barbara County.

Western Snowy Plover Nesting Habitat

Surveys carried out by Point Blue Conservation Science, an independent avian research organization, for DAF and provided to Commission staff as part of the consistency determination have documented snowy plover nesting habitat on the beach approximately 3.5 miles northwest of the proposed project site within VSFB (USFWS 2023). The rarity and vulnerability of snowy plovers is well established, with the species being listed as threatened under the federal Endangered Species Act since 1993. The recovery objective west coast-wide for snowy plover is 3,000 birds, and the current estimate falls over 20% below that at 2,371 birds. The USFWS notes that threats to snowy plover and their habitat include “habitat loss and degradation attributed to human disturbance, urban development, introduced beachgrass, and expanding predator populations,” indicating that snowy plover nesting habitat is easily degraded by human activities and developments (USFWS 2023). The USFWS additionally identified that active efforts to improve habitat at breeding beaches have improved snowy plover population numbers (USFWS 2023). Therefore, snowy plover habitat has been identified as ESHA by the Commission.

Snowy plovers are present throughout the coastal zone in California, both north and south of VSFB. In the winter, snowy plovers migrate to non-nesting beaches to forage (USFWS 2023). The populations of snowy plover nesting and reproducing on VSFB therefore disperse to other beaches throughout the state in the winter and may use beaches in the coastal zone for nesting the following year. Thus, nesting habitat on VSFB contributes to snowy plover population growth within the coastal zone. Impacts to snowy plover nesting habitat on VSFB would affect snowy plovers in the coastal zone due to species movement during the winter season and reduced population viability.

Preventing the degradation of this nesting habitat is important for the continued population growth and recovery of snowy plover. VSFB contributes to the largest sub-population of snowy plovers from San Luis Obispo County through Ventura County. The population target established by the USFWS for snowy plover in San Luis Obispo, Santa Barbara, and Ventura Counties is 1,200 breeding adults. In 2022, the USFWS found that the population remains well below this target at 804 breeding adults (USFWS 2023). This comparatively large population is critical to maintain and grow for long-term success of the species across the west coast.

[11] Carrying capacity is the maximum number of animals that can be supported by a given area or habitat.

Potential Impacts to ESHA

Vegetation and Fire Management

The proposed project would involve rocket launches and result in the discharge of waves of high temperatures, combustion and open flame at and around the launch pad area that would be constructed. To minimize the number and size of areas exposed to fire during launches and reduce the extent of required vegetation management around the proposed space launch complex, the site would be configured to include a “flame bucket” that would direct flames into a limited portion of the site. Even with this configuration, DAF states that vegetation removal is necessary to ensure that launch operations do not spark wildfires, and the vegetation and fire management area would involve removing vegetation down to bare ground. As discussed above, the alignment of the vegetation and fire management area is adjacent to a roughly 4-acre stand of Lemonade Berry Scrub but would not involve any direct removal of Lemonade Berry Scrub. DAF has committed to implement environmental protection measures during the vegetation removal at the project site and facilities construction, including:

- Staging will occur from paved or existing roadways, and if this is not possible, from patches of non-native vegetation.
- Any seeds will be cleaned from construction equipment to prevent invasive species establishment.
- Standard erosion control measures will occur during grading, including the use of silt fences, and hydroseeding where temporary disturbances occur with a native hydroseed mix.
- A qualified biological monitor will inspect any equipment, trenches or holes left overnight and the work area, prior to the start of work for special-status species. The biological monitor will relocate any found special status species to comparable habitat outside of the work area.
- Construction activities would not occur until 24 hours after a precipitation event greater than 0.2 inch.

A full list of environmental protection measures is included in **Appendix A**. The alignment of the vegetation management area and fuel break would protect the Lemonade Berry Scrub from disturbance and would enable it to remain a source of seeds for this habitat in the Coastal Zone. Additionally, the environmental protection measures, particularly staging from roadways and ensuring seeds are cleaned off of equipment, would help to prevent invasive species from establishing in the Lemonade Berry Scrub. Therefore, the proposed alignment of the vegetation and fire management area, with the proposed environmental protection measures, will be compatible with the continued existence and use of Lemonade Berry Scrub adjacent to the vegetation and fire management area.

Engine Noise

The proposed project has the potential to cause adverse impacts to wildlife use of riparian habitat in Honda Creek and snowy plover nesting habitat in nearby shoreline areas through exposure to elevated sound levels during static fire tests and launches. Launch noise would be expected to last for around 1 minute and static fire noise would be expected to last for 30 seconds. Maps of nearby wildlife occurrences, including California red-legged frogs, pallid bat, western red bat, and snowy plover along with expected sound levels from launch and engine testing activities are available in **Exhibit 7**. Phantom proposes to eventually conduct up to 48 static fire tests and 48 launches annually, leading to a total of 96 proposed events with elevated sound levels. This would result in a total of approximately 72 minutes of elevated sound divided between 96 events spread throughout the year. During these events, the maximum decibel (dB) levels found in the riparian area of Honda Creek, where bats are present, would be expected to reach between a maximum 130 and 140 dB, based on modeling carried out by DAF. The areas of Honda Creek that contain California red-legged frogs would receive up to 130 dB. The snowy plover nesting habitat would receive lower sound levels between 100 and 110 dB. The extent to which these sound levels could significantly degrade wildlife habitat would be dependent on each species' individual sensitivity.

Bats

The bat species found in Honda Canyon are very sensitive to sound, as they use echolocation to navigate around obstacles and hunt in the dark. A 2016 report from Caltrans notes:

> In bats, damage to high frequency hearing cells would likely result in impaired echolocation. Damage to the lower frequency hearing cells would likely result in impaired capacity for passive listening. Either effect could potentially be life threatening. Failure to accurately assess the locations of trees, branches, and other obstacles in their flight path could result in fatal collisions or debilitating injury. Failure to accurately detect and determine the precise location and movement patterns of prey (both aerial and ground) would likely result in significantly diminished capture success. Similarly, failure to detect the approach of a predator could be fatal. Because bats simply do not have the luxury of extended recovery time, even temporary shifts in hearing abilities have the potential to result in negative effects on affected individuals.

DAF's integrated resources management plan states that studies on the hearing sensitivity of bat species show that they have excellent hearing in the higher frequency ranges (above 20 kHz) but are insensitive to lower frequencies where launch noise has most of its energy (e.g., highest decibel measurements). This may reduce potential impacts to bats and to continued use of their habitat, but as noted in the Caltrans report cited above, damage to lower frequency hearing cells in bats would still affect their passive listening abilities.

Consultations between Commission staff and staff of the California Department of Fish and Wildlife (CDFW) during the course of this project's review have indicated that birds and bats can experience permanent hearing loss at continuous sound exposure above 110 dB. CDFW staff recommend that continuous sounds be kept below the temporary threshold shift or temporary hearing loss threshold of 93 dB and that impulse noise should not exceed 110 dB at any point in operations measured at bat roosting locations. Bat habitat in Honda Canyon is expected to receive engine noise exceeding these thresholds, as described above. However, there is very little research on rocket engine noise and its impact on bats. Existing studies on the impacts of other types of noise on bats may not be very representative of bat response to rocket engine noise. This is because engine noise exposure is very intermittent, with long periods of quiet between launches or static fire tests, and very short periods of elevated sounds (e.g. one minute or less).

With Phantom's proposed launch schedule, bat habitat in Honda Creek would receive engine noise from launches and static fire tests for a total of one minute and 30 seconds during the first year of operations. During the second year, bat habitat would receive engine noise for a total of up to three minutes. Even at full launch cadence in year six, bat habitat would receive less than a minute and thirty seconds of engine noise across the over 10,000 minutes that pass in a week, meaning that no sound would be generated for the vast majority of the time. Finally, DAF actively monitors bat diversity and distribution on VSFB, and has found that bat species use wetland, riparian, and forest habitats, despite launch activities on-base (Heady and Frick 2013). DAF's Integrated Natural Resources Management Plan states that:

> 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.

Due to the intermittent nature of engine noise, the very short duration of engine noise relative to periods of quiet, and DAF's existing monitoring demonstrating that bats have used habitat on VSFB despite engine noise and launches, significant degradation of bat habitat in Honda Canyon is unlikely, despite exceeding CDFW's sound exposure level recommendations for other types of projects.

Although prior monitoring has not demonstrated adverse impacts to or degradation of bat habitat on VSFB, an average of only 4.4 rocket launches per year occurred during the course of that monitoring (2017-2021). In contrast, Phantom would carry out a greater frequency of launch activities, approximately doubling each year before reaching a maximum of 48 launches and 48 static fire tests after six years. To confirm that elevated sound levels from this increased launch frequency will not be incompatible with the continued use of bat habitat, DAF has committed to conducting acoustic monitoring within the noise footprint of the launches, as shown in **Exhibit 7**, to determine the extent to which bat species are present in Honda Canyon and to record and assess their call rates before and after rocket launches. This monitoring program would augment DAF's existing bat monitoring programs on VSFB under its Integrated Natural Resources Management Plan. DAF has also committed to providing the Executive Director with annual written reports on the data and results of its biological monitoring.

In addition to providing annual reports, DAF has also committed to reporting back to the Executive Director five years into the project's operation, when Phantom is expecting to conduct 24 launches and 24 static fire tests annually. The 5-year report would provide information on how the overall launch increases are affecting the environment and would synthesize the information developed in the prior annual reports. The timing of the 5-year report would also enable DAF and the Commission to learn if unexpected adverse impacts are occurring prior to Phantom starting its full launch schedule, which would allow for adaptive management actions to be taken.

If this monitoring demonstrates that launch activity results in significant degradation of bat habitat in Honda Canyon, as measured by bat call rates before and after launches, DAF would work with the Executive Director to determine the additional measures necessary to minimize the likelihood of further impacts to bat habitat. These measures would include offsets by providing additional habitat or improving existing habitat for the species for which effects were documented. These actions could include providing additional shelter by installing bat boxes, retrofitting existing infrastructure to make suitable for bat roosting, and/or improvement of native riparian habitat. In such a situation, DAF would also share information with the Executive Director to help determine if the activity is being conducted or is having an effect on any coastal us or resource substantially different than originally described and, as a result, is no longer consistent with the enforceable policies of the CCMP.

With the information provided by DAF on the potential effects of engine noise on bat habitat in Honda Canyon, the absence of data demonstrating adverse over the past roughly 20 years of monitoring bat populations at VSFB, the monitoring that would continue to be carried out as part of the proposed project, and DAF's commitment to working the Executive Director to address any unexpected impacts on bat habitat, the Commission finds that the proposed project would not significantly degrade bat habitat in Honda Canyon.

California red-legged frogs

All life stages of California red-legged frogs can detect noise and vibrations (DAF 2023) and are assumed to be able to perceive the engine noise produced by rockets. The proposed project thus has the potential to adversely affect California red-legged frog habitat in Honda Creek approximately 500 feet from the proposed launch complex. DAF states:

> Engine noise would likely trigger a startle response in California red-legged frog, causing them to flee to water or attempt to hide in place. It is likely that any reaction would be dependent on the sensitivity of the individual, the behavior in which it is engaged when it experiences the noise, and the sound level (e.g., higher stimuli would be more likely to trigger a response). Regardless, the reaction is expected to be the same – the frog's behavior would be disrupted, and it may flee to cover in a similar reaction to that of a frog reacting to a predator. As a result, there could be a temporary disruption of California red-legged frog behaviors including foraging, calling, and mating (during the breeding season). However, frogs tend to return to normal behavior quickly after being disturbed.

DAF also provided estimates of the number of California red-legged frogs that are expected to be present within each noise level contour of the areas affected by launch noise.

Table 5: California Red-legged frog life stage estimates within each noise level contour from the Phantom project

Sound Level (unweighted dB Lmax)	Adult	Metamorph	Larvae	Egg Mass
100	19	2	90	13
110	12	1	50	13
120	2	0	0	3
130	0	0	0	0

There are no known studies on the impacts of launch sound on the hearing capabilities of California red-legged frogs, however Simmons et al. (2014) found hearing damage to American bullfrogs, which are in the same family as California red-legged frogs, when they were exposed to sounds greater than 150 dB. After hearing damage, the bullfrogs showed full functional recovery of their hearing within 3 to 4 days. California red-legged frogs likely have similar hearing structures and a similar resilience to sounds below 150 dB as well as an ability to recover from hearing damage. In its review of potential project impacts to California red-legged frogs, the USFWS states that, "the Service does not anticipate physiological effects to California red-legged frog's inner ears at this time due to the short duration and lower noise levels of the project's anticipated noise disturbance events." However, the USFWS did find that operational noise may impact frog behavior, including calling frequency, and lead to increased risk of predation due to a "freeze" response to excessive sound. Despite anticipating some local negative effects, the USFWS found overall that:

> Using the available information and considering minimization measures, including potential mitigation ensuring no net loss, we expect adverse effects to the recovery of California red-legged frogs on VSFB would be low. Therefore, we conclude that the proposed action would not appreciably reduce the likelihood of recovery of the California red-legged frog on VSFB, in the Northern Transverse Ranges and Tehachapi Mountains Recovery Unit, or rangewide.
>
> …
>
> After reviewing the current status of the California red-legged frog, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the California red-legged frog.

As discussed above, DAF has conducted long-term monitoring on VSFB to assess wildlife populations, including California red-legged frogs, and their response to launch activities. DAF has consistently found that launch activities have not decreased California red-legged frog populations or led to the abandonment of habitat areas and have only produced temporary observable changes in behavior. To further demonstrate that an increased frequency in elevated sound levels from launches will not be incompatible with the continued use of frog habitat near the proposed project site, DAF has committed to monitoring and mitigation as part of its Biological Opinion with the USFWS.

In the Biological Opinion, DAF committed to placing passive bioacoustic recorders in Honda Creek and conducting California red-legged frog surveys there as well. This monitoring program will be designed to track habitat occupancy, breeding behaviors (calling), and breeding success (egg mass and tadpole density). If habitat occupancy, calling frequency, or tadpole densities decline from baseline by 15% or more over two years, and the decline cannot be confidently attributed to other natural or human caused factors such as drought or wildfire, DAF will mitigate for impacts to California red-legged frog breeding habitat. To offset any impacts found, DAF will create new California red-legged frog breeding habitat at the San Antonio Creek Oxbow Restoration Area, an established wetland site on VSFB that is located outside of areas currently affected by launch noise and artificial lighting. A detailed description of this commitment is available in the Biological Opinion excerpt in **Appendix A.**

As discussed above, DAF has also committed to providing the Executive Director with written annual reports on the findings of its monitoring efforts as well as a comprehensive 5-year report on how the Phantom project is or is not adversely affecting its surrounding environment. If this monitoring demonstrates that launch activity results in significant degradation of California red-legged frog habitat in Honda Creek, as measured by habitat occupancy and breeding success, DAF would work with the USFWS and Executive Director to determine the measures necessary to minimize the likelihood of further degradation to California red-legged frog habitat, including habitat enhancements and restoration. In such a situation, DAF would also share information with the Executive Director to help determine if the activity is being conducted or is having an effect on any coastal use or resource substantially different than originally described in the CD and, as a result, is no longer consistent with the enforceable policies of the CCMP.

With the information provided by DAF on the potential effects of engine noise on California red-legged frog habitat in Honda Canyon, the absence of data demonstrating adverse effects from launch activities, the monitoring that would continue to be carried out as part of the proposed project, and DAF's commitment to working the Executive Director to address any unexpected impacts on California red-legged frog habitat, the Commission finds that the proposed project would not significantly degrade California red-legged frog habitat in Honda Creek.

Western Snowy Plover
As mentioned above, snowy plover nesting habitat is farther away from the proposed project site and would therefore be exposed to lower sound levels. Additionally, the high levels of ambient sound in beach areas due to ocean and wave noise is anticipated to mask all but the highest sound levels generated during launches. DAF has conducted monitoring of snowy plover nests during numerous launches at VSFB. In its consistency determination, DAF states:

> Direct observations of wintering birds were made during a Titan IV and Falcon 9 launch from SLC-4E (SRS Technologies, Inc. 2006b; Robinette and Ball 2013). The Titan IV launches resulted in sound levels of 130 dBA Lmax. SNPL [snowy plover] did not exhibit any adverse reactions to these launches (SRS Technologies, Inc. 2006b; Robinette and Ball 2013) with the exception of one observation. During the launch of a Titan II from SLC-4W in 1998, monitoring of SNPL found the nest located closest to the launch facility had one of three eggs broken after the launch (Applegate and Schultz 1998). The cause of the damaged egg was not determined.
>
> More recently on 12 June 2019, SNPL response was documented during a SpaceX Falcon 9 launch and first stage recovery at SLC-4. The return flight of the first stage to VSFB produced a 3.36 psf sonic boom and landing engine noise of 138 dB Lmax and 130 dB SEL, as measured on South Surf Beach. SNPL response to the noise impacts was documented

> via pre- and post-launch monitoring and video recording during the launch event. Incubating SNPL captured on video were observed to startle and either jump or hunker down in response to the sonic boom. One SNPL egg showed signs of potential damage. This egg was part of a three-egg clutch in which the other two eggs successfully hatched. It is not uncommon for one or more eggs from a successful nest to not hatch. Failure of the egg to hatch could not be conclusively tied to the launch event (Robinette and Rice 2019).

The USFWS has also reviewed the potential for launch noise to impact snowy plover, and states, "Considering past monitoring results, we do not expect the proposed project's individual launch and static fire events to result in short term observable effects, such as birds flushing from the nest. However, non-observable effects, such as increased heart rate or increased stress hormone levels could routinely occur. Consequently, the proposed project has the potential to contribute to long-term adverse effect that result from routine intermittent acute noise disturbance."

However, with DAF's proposal to monitor and mitigate for any impacts at the local level to achieve no net loss of the species, the USFWS ultimately concluded that:

> After reviewing the current status of the western snowy plover, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the western snowy plover.

As discussed above, DAF has conducted long-term monitoring on VSFB to assess wildlife populations, including snowy plover, and their response to launch activities. DAF monitoring to date has consistently found that launch activities have not decreased snowy plover populations and have only produced temporary observable changes in behavior. To further demonstrate that an increased frequency in elevated sound levels from launches will not be incompatible with the continued use of snowy plover nesting habitat, DAF has committed to monitoring and mitigation as part of its Biological Opinion with the USFWS.

In the Biological Opinion, DAF committed to augmenting the existing snowy plover monitoring program on VSFB, which records habitat use, nesting efforts, nest fates, fledgling survival, and population size through each breeding season, with geospatial analysis of snowy plover nesting and the noise environment. Sound meters will be deployed immediately inland of South Surf Beach and a control site to characterize the noise environment during the breeding season within the noise footprint of Phantom launches. Geospatial analysis will be performed annually as Phantom's launch frequency increases to assess whether patterns of nesting activity, nest fates, or fledgling success are negatively impacted by noise from Phantom operations. If the geospatial analysis shows that a statistically significant decline in breeding effort or nest success over two consecutive years, and this decline cannot confidently be attributed to other natural or human caused factors, DAF will offset this impact by increasing predator removal efforts on VSFB to include the non-breeding season, particularly focusing on raven removal adjacent to VSFB beaches with a goal of achieving no net loss of the species. A more detailed description of this commitment is available in the Biological Opinion in **Appendix A**.

As discussed above, DAF has also committed to providing written annual reports to the Executive Director on the findings of its monitoring efforts and a comprehensive 5-year report on how the Phantom project is or is not impacting its surrounding environment. If this monitoring demonstrates that launch activity results in a statistically significant decline of snowy plover breeding effort or nesting success, as measured by nesting activity, nest fates and/or fledgling success, DAF would work with the USFWS and Executive Director to determine the measures necessary to minimize the likelihood of further degradation to snowy plover nesting habitat, including predator control, as described above. In such a situation, DAF would also share information with the Executive Director to help determine if the activity is being conducted or is having an effect on any coastal use or resource substantially different than originally described in the CD and, as a result, is no longer consistent with the enforceable policies of the CCMP.

With the information provided by DAF on the potential effects of engine noise on snowy plover nesting habitat, the absence of data demonstrating adverse effects from launch activities, the monitoring that would continue to be carried out as part of the proposed project, and DAF's commitment to working the Executive Director to address any unexpected impacts on snowy plover habitat, the Commission finds that the proposed project would not significantly degrade snowy plover nesting habitat.

Engine Noise and Cumulative Impacts

Engine noise occurs at and near launch facilities across VSFB. Engine noise from launches and static fire tests may incrementally contribute to cumulative effects to coastal resources. The addition of the proposed number of launches in the Phantom project to the currently contracted launches at VSFB would cause a 52 percent increase in the number of contracted launches within six years (assuming no other increases in launch operations by other operators occur). The cumulative effects of engine noise from space launch activity are influenced by the geographic distance between launch sites, the timing of launches, the size and engine noise intensity created by different launch vehicles, and the actual number of launches that take place (as noted above, the number of actual launches has traditionally been ten percent or less of the authorized number).

Launch activities are spread out across the geography of VSFB. The geographic distance between launch facilities reduces the frequency of intense impacts on any one population of wildlife near a particular launch facility but also spreads less intense impacts across a larger geographic space. With construction and operation of the proposed project, the highest number of contracted launches would be launched from the areas of SLC-5, the site of the proposed Phantom project, and SLC-4E, the site of launches for the SpaceX Falcon 9 program, which is currently contracted for 36 launches annually. Both of these sites are shown in **Exhibit 2** and are located in the southern portion of VSFB. The habitats considered here would be affected by engine noise from several launch facilities. The USFWS found, in its biological opinion, that habitat in Honda Creek would be exposed to elevated sound levels of at least 100 dB from SpaceX Falcon 9 (SLC-4), Minotaur (SLC-8), ULA Vulcan (SLC-3E), Blue Origin New Glenn (SLC-9)[12], Relativity Terran 1 (SLC-11)[13], and Phantom Daytona-E (SLC-8). The USFWS found:

> If all these programs, including the proposed project, achieve full launch tempo by 2028, a combined total of up to 157 launch disturbance events of at least 100 dB Lmax would impact Honda Creek each year as a result of launch and static fire.

Similarly, the USFWS found that snowy plover habitat on Surf Beach would experience noise levels of at least 100 dB from SpaceX Falcon 9 (SLC-4), ULA Vulcan (SLC-3E), Blue Origin New Glenn (SLC-9)[12], and Relativity Terran 1 (SLC-11). The USFWS found:

> The proposed project in combination with other planned and permitted launch programs would produce a total of 154 noise disturbance events of at least 100 dB annually that would impact South Surf Beach.

Not all space launch vehicles create the same amount of engine noise, however. Table 6 below provides a summary of the engine noise produced at the launch pad by different space launch programs at VSFB.

[12] Blue Origin New Glenn is under regulatory review and has not been constructed.
[13] Relativity has discontinued their request to use SLC-11 for the Terran R program. Relativity has not completed any launches at VSFB to date, nor have they submitted any other requests to use VSFB for their launch program.

Table 6: Maximum Engine Noise produced at the Launch pad from space launch vehicles at VSFB

Space Launch Vehicle	Maximum Engine Noise at the Launch Pad During Launch (dB)	Space Vehicle Height
Minotaur	unknown	63 feet
Firefly Alpha	150 dB	95 feet
ABL RS1	120 dB	88 feet
New Glenn (proposed)	115 dB	360 feet
Vulcan Centaur	120 dB	200 feet
Falcon 9	150 dB	178 feet
Laguna-E (proposed)	144 dB	78.7 feet
Daytona-E (proposed)	130 dB	54.4 feet
Delta IV	85 dBA (A-weighted)	236 feet

In total, VSFB has contracted for up to six launches of heavy space launch vehicles, 53 launches of medium space launch vehicles, and 33 launches of small space launch vehicles annually. If approved, the proposed Phantom project would increase the contracted number of small space launch vehicles to 81. Additionally, up to 23 missiles are launched from the north portion of VSFB annually. These missiles are smaller, and do not produce the same level of engine noise as space launch vehicles.

As mentioned in the background section, the significant discrepancy between contracted launches and actual launches at VSFB influences the cumulative effects of VSFB's launch programs. From 2017-2021, an average of 4.7 percent of the total number of contracted launches were carried out at VSFB. This means that although NEPA review and DAF agreements allow a high number of launches, the actual number of launches and their resulting sound effects are significantly lower. DAF has stated that the discrepancy between permitted launches and actual launches is due to the availability and need for each specific rocket. Rockets often require updates or become unavailable for extended periods of time. Authorization for launches beyond what is required allows for DAF to shift government contracts and payloads to another rocket or provider, when necessary. Additionally, DAF states:

> There is variability in need for payloads to be delivered into orbit - the higher number of launches available at each site increases the flexibility of our national defense program. We also need to be primed and ready should there be an attack on our satellites/resources in orbit. We need to ensure there are enough resources available to get additional satellites

> into orbit to support our warfighters and defend our nation should the need arise.

Given the current situation, DAF believes that the discrepancy between allowable launches and actual launches will continue. Ultimately, DAF has determined that the Western Range[4] can support a maximum number of 110 space launches, and a maximum number of 15 missile launches annually. These limitations are due to personnel and range safety considerations, and the maximum number of launches remains below the potential total contracted number of launches, should all proposed space launch projects move forward.

DAF's long-standing monitoring of sensitive species and their responses to space launch vehicle engine noise has only documented temporary observable changes in wildlife behavior as a result of launch activities and has not shown changes in habitat occupancy or population numbers. The proposed monitoring provided as part of the Phantom project would include monitoring of California red-legged frog habitat, snowy plover nesting sites and bat habitat for adverse impacts from launch activities. Although the focus of this monitoring would be on the Phantom project, the monitoring design would also capture adverse impacts to these species and their habitats from other launch activities at VSFB. If negative effects are observed and cannot be confidently attributed to other human-caused or natural causes, DAF will proceed with mitigation or habitat enhancement, as described above. Additionally, DAF will work with the Executive Director to determine the measures necessary to minimize the likelihood of further degradation to sensitive habitats. Additionally, the USFWS considered the impacts of multiple launch programs when working with DAF to design monitoring for federally listed species and developing its Biological Opinion and concluded that the proposed project, both individually and cumulatively in combination with other existing activities, is not expected to interfere with the recovery goals for California red-legged frog or western snowy plover.

Lighting

Artificial night lighting also has the potential to negatively impact California red-legged frogs and their use of habitat areas such as those located near the proposed project site. In studies on wood frogs, experimental exposure to artificial light at night was found to make them more vulnerable to other stressors such as parasites and pollution (DAF 2023). Another study focused on common toads found that artificial lighting reduced activity in male toads by half during the breeding season and changed their energy metabolism, which has the potential to adversely affect reproduction and overall fitness (DAF 2023). The effects of artificial lighting on frogs are inconsistent and vary by species and life stage; however available research indicates a risk to California red-legged frog breeding habitat from the proposed project.

To address this risk, DAF has committed to minimizing the use of artificial lighting during the hours of darkness at the Phantom facility. DAF states, "The lights would be designed with the minimum lumens needed to meet operational and security requirements and would be shielded to minimize stray light from entering Honda Canyon." Artificial lighting would only be used for necessary safety or performance of launch operations at night. The proposed launch complex would be used infrequently, especially during the first four years of project operations, further minimizing the use of night lighting at the project site. Modeling of the preliminary lighting plan, as shown in **Exhibit 8**, shows that lighting levels of 1-foot candle would not extend beyond the proposed facility.

As stated above, the USFWS reviewed the potential impacts of the Phantom project, including site lighting and excess sound to California red-legged frogs. The USFWS found that, with the commitments provided by DAF, the proposed Phantom project was not likely to jeopardize the recovery of California red-legged frogs.

With the available information from DAF's monitoring programs and the commitments provided by DAF for minimized site lighting, enhanced future monitoring and reporting prior to the full launch schedule, the proposed project is designed to prevent adverse impacts that would significantly degrade California red-legged frog habitat and will be compatible with the continued use of Honda Creek by California red-legged frogs.

Conclusion

As described above, DAF has sited, configured and designed the proposed project to avoid, minimize, and offset adverse effects on adjacent ESHA, by:

- Designing and shielding artificial lighting to limit potential spillover to riparian habitat at Honda Creek; and by
- Committing to implementing a set of monitoring and management programs for special-status wildlife and their habitats.

With these efforts and commitments, the Commission finds that the proposed project is consistent with Section 30240(b) of the Coastal Act.

E. WATER QUALITY AND MARINE RESOURCES

Coastal Act Section 30230 states:

> Marine resources shall be maintained, enhanced, and, where feasible, restored. Special protection shall be given to areas and species of special biological or economic significance.

Coastal Act Section 30231 states:

> *The biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored through…controlling runoff, preventing depletion of ground water supplies and substantial interference with surface waterflow, [and] maintaining natural vegetation buffer areas that protect riparian habitats*.

The proposed project has the potential to negatively affect water quality in Honda Creek and the Pacific Ocean due to construction activities, the use of deluge water during launch events, and ocean release of the rockets' first stage. The proposed project has the potential to contribute to the depletion of groundwater supplies and interfere with surface water flow due to its water supply needs. The proposed project also has the potential to adversely affect marine resources due to inputs of marine debris. Finally, the proposed project also has the potential to adversely impact marine mammals, including in areas of special biological significance such as breeding and haul-out sites, due to launch noise.

Water Quality

Stormwater Runoff
Constructing the Phantom project at the former SLC-5 launch site would disturb soils, remove vegetation, increase impermeable surfaces and result in greater stormwater runoff from the site to coastal waters, including portions of Honda Creek that flow into the Pacific Ocean. Section 30231 of the Coastal Act requires that the quality of coastal waters and streams be maintained through controlling runoff. DAF has committed to controlling stormwater runoff and erosion during construction and operations through stormwater management measures, including:

- Installing hydroseed and erosion control measures on areas where temporary disturbances occur, and any areas that would be prone to erosion to protect sediment impacts to Honda Creek.
- Vegetation removal on the steep slopes on the east side of the site will be avoided to the extent practicable, unless necessary for fire safety.
- Securing the site from potential erosion resulting from rain and wind events including through preserving existing vegetation, to the extent feasible.
- Improvements to dirt roads would follow standard recommended practices to avoid and minimize erosion potential.

A full list of stormwater protection measures proposed to be implemented as part of the project is available in **Appendix A**. Implementation of these measures would protect and maintain the quality of coastal waters and streams from stormwater runoff consistent with the requirements of Coastal Act Section 30231.

Deluge Water
Operation of the proposed space launch complex would include the use of deluge water during launches. The proposed launch pads at the new launch complex would have launch stools, where the rocket would be placed, and underneath the launch stool would be a flame bucket and flame deflector system. The flame bucket would be filled with an estimated 6,500 to 8,000 gallons of deluge water per launch. The deluge water would absorb vibration and heat from the rocket during the launch. Immediately downstream of the flame deflector, a concrete deluge containment basin would be constructed that would collect deluge water runoff. The design of the deflector would direct exhaust away from Honda Canyon as well. The deluge water has the potential to

become contaminated with hydrocarbons during launches and could adversely impact the quality of coastal waters if it is discharged into Honda Creek and flows to the ocean approximately 0.75 miles downstream of the project site.

DAF has stated that it will require Phantom to test the water in the deluge water retention basin for hydrocarbon contamination after each launch and also after storm events. This would include the use of a certified laboratory for the water quality testing. If the testing indicates that the water is of appropriate quality, it would be sent to the Industrial Wastewater Treatment Ponds on VSFB or discharged into the stormwater management area indicated in **Exhibit 4**. Water discharged into this area would be expected to infiltrate directly into the ground. DAF has also stated that it will require Phantom to obtain a General Waiver for Specific Types of Discharges from the Regional Water Quality Control Board or other appropriate discharge permit prior to discharging any water out of the deluge water retention basin. Implementation of these measures would protect and maintain the quality of coastal waters and streams.

Water Supply
Operation of the proposed space launch complex would require a water line extension to be installed from the VSFB water supply line. Water use at the Phantom site would include water for personnel and operational activities as well as deluge water for the launches, as discussed above. At the full proposed cadence of up to 48 launches per year, the annual amount of deluge water needed for Phantom operations would range between 100,800 to 480,000 gallons. In addition, up to 72,000 gallons annually would be required to support the personnel and operational activities at the proposed launch complex. The total maximum expected water supply need for the Phantom project is up to 552,000 gallons annually, which is roughly the equivalent water use of three American households annually.

Section 30231 of the Coastal Act states that proposed projects should prevent depletion of groundwater supplies and prevent substantial interference with surface water flow. The water supply for VSFB includes four wells in the San Antonio Creek Valley Groundwater Basin. Any water line to the proposed launch complex would draw water from these wells. According to the 2022 Annual Report for the San Antonio Basin Groundwater Sustainability Agency (SAGSA),[14] VSFB used up to 2,600 acre-feet of water in 2022. The majority of water users of the groundwater basin are agricultural. SAGSA found that the cumulative levels of groundwater storage in the San Antonio Creek Valley Groundwater Basin have decreased by 147,700 acre-feet between 2015 and 2022. Overall, San Antonio Basin Groundwater Sustainability Agency states:

> Current basin conditions, comparison of current and historical groundwater elevation contour maps, and the basin historical water budget presented in the [Groundwater Sustainability Plan], indicate

[14] Available online at: https://sanantoniobasingsa.org/wp-content/uploads/SACVB_2022-Annual-Report_FINAL-03-17-23.pdf

> groundwater pumping in excess of the sustainable yield has created challenging conditions for sustainable management.

However, DAF has indicated in its consistency determination that the proposed project would not increase DAF pumping or water use from the San Antonio Creek Valley Groundwater Basin. This is due to both the low water needs of the project, estimated to be approximately 0.06% of total base-wide water use, and the current maintenance requirements for water lines on the south portion of the base. In its consistency determination, DAF states:

> Water is treated and transported to south Base users through a supply line which requires routine maintenance, partly due to relatively few users on this part of VSFB. As a critical part of that maintenance, VSFB flushes the supply line periodically to maintain water quality by removing sediment, mineralization, and discolored water. This practice also improves the carrying capacity of the lines and helps identify any failing pipes or connections. SLD 30 currently flushes the water supply line on south VSFB annually…American Water, the contractor managing and maintaining VSFB's water lines, determined that the proposed water usage at SLC-5 would be entirely offset by the compensatory reduction in the volume of water discharged to grade and therefore have no effect on water extraction from the San Antonio Creek Groundwater Basin.

In essence, DAF has concluded that the increase in water use from the proposed project would be fully offset by the reduced need for flushing the water lines and discharging water to grade. Therefore, the proposed project would not be expected to result in additional pumping or contribute to the depletion of groundwater supplies.

Ocean Release of Rocket First Stage

Components of Phantom's rockets, specifically the first stage, are proposed to be discharged into the ocean offshore of Baja California, Mexico, as part of normal operations. After a successful launch, the first and second stages of the Laguna-E and Daytona-E rockets would separate during the main engine cut off flight phase. After separation, the first stage would fall back to earth and land in the ocean in international waters offshore of Baja California, Mexico. A map of the projected splashdown area for the first stage is provided in **Exhibit 9**.

The first stage may contain a limited amount of unused fuel when it reaches the ocean. A further discussion of the physical components of the first stage is included in the marine debris section below. In its consistency determination, DAF has stated that the first stage would contain no more than "a de minimis amount of fuel" and has defined this quantity as being less than 1% of the fuel needed for the launch. For the Daytona-E and Laguna-E space vehicles, this means up to 18 gallons and 40 gallons of fuel may remain in the first stage upon impact with the ocean, respectively. DAF also states in its consistency determination that the types of fuel that would be used for these space vehicles, RP-1 or Jet-A, have high volatility and evaporate quickly when exposed to the air, with over 90% of the mass of fuel remaining expected to evaporate within the first seven minutes and 99% of the mass remaining expected to evaporate within the first hour. Since this type of fuel is lighter than water, it would stay on top of the water's surface and spread into a very thin layer. This thin layer would create more surface area for evaporation and the total fuel amount would be expected to completely evaporate by the end of two days.

In its consistency determination, DAF notes that cleanup of a spill of a small amount of very light fuel, like RP-1 or Jet-A fuel, is usually not possible given the rate of its evaporation. Due to the amount and characteristics of the fuel left in the first stage at impact, and the location in international waters offshore of Mexico where the first stage would land, the Commission finds that the de minimis amount of fuel is not expected to adversely affect the quality of waters with the potential to enter California's coastal zone.

Conclusion
With the proposed stormwater protection measures in place, the testing of and appropriate discharge of deluge water, the lack of adverse impacts to available water supply, and the low volume and rapid dispersal of fuel within rocket stages released into the ocean, the Commission finds the proposed project will protect the quality of coastal waters and therefore is fully consistent with the water quality and water supply protection policies of the CCMP.

Marine Resources

The proposed project also has the potential to adversely affect marine biological resources, through inputs of marine debris to the ocean and through exposure of marine mammals and their critical habitats (rookeries, haul out areas, etc.) to engine noise and sonic booms from launches. There are two main sources of marine debris from the proposed project: pre-launch weather balloons and the physical components of the first stage. These are both discussed further below.

As mentioned above and shown in **Exhibit 7**, launches produce engine noise that may adversely affect marine biological resources. The expected engine noise during launches would affect the area between the Santa Ynez River and Sudden Ranch on VSFB. Static fire engine tests would be conducted within several days prior to each launch. During static fire testing, when the rocket is in a vertical position on the pad, the engine noise would be focused on the coast between SLC-4 and SLC-5 and would be contained entirely within VSFB, as shown in **Exhibit 7**. **Exhibit 7** also provides maps displaying the modeled noise footprint with sea otter density and marine mammal haul out locations. The launches also are expected to cause sonic booms in the ocean south and west of the Northern Channel Islands. The expected location and strength of sonic booms produced during launches is shown in **Exhibit 10**. Both engine noise and sonic boom impacts are discussed further in the findings below.

Marine Debris

Several elements of the proposed project would result in the release of marine debris. These include the release and eventual abandonment into the ocean of weather balloons, mishaps during a launch that leads to some or all of the rocket falling into the ocean, and the intentional abandonment into the ocean of the rocket first stage and fairings. Prior to launches, Phantom would release up to six weather balloons to better understand upper atmosphere wind conditions. Attached to the latex weather balloon would be a plastic device to measure atmospheric data and transmit it by radio to a ground receiver. The device is roughly the size of a shoe box and is powered by a 9-volt battery. Upon reaching an altitude of 12-19 miles above sea-level and providing the necessary data, a mechanism would be remotely triggered, and the balloon would be torn open and destroyed. Although Phantom and DAF would attempt to recover these materials, the likelihood of such recovery is small due to the extreme height at which the balloon destruction would be triggered, the trajectory of its descent and the potential for it to sink or become lost in the ocean. If the balloon and associated materials are not recovered, they would likely land in the ocean and become marine debris. Additionally, launches could contribute to marine debris if a mishap occurs, the rocket fails to launch successfully, and instead lands in ocean waters. These marine debris inputs could, depending on where they land, negatively affect areas of special biological significance, such as Channel Islands National Park, Channel Islands National Marine Sanctuary, and state-designated marine protected areas. To address these potential adverse impacts, DAF has committed to ensuring that Phantom provide contributions to the California Lost Fishing Gear Recovery Project to offset the release of unrecoverable debris in state and federal waters.

U.C. Davis' California Lost Fishing Gear Recovery Project has removed lost or discarded commercial fishing gear from California waters since 2005. Its work now focuses on gear removal from the waters of Southern California, ensuring that gear recovery is occurring close to the areas that would be affected by the proposed project. Lost fishing gear such as nets, traps and lines is hazardous to wildlife including seabirds, fish, turtles, sea otters, whales and other marine animals. The entanglement hazards posed by lost fishing gear to wildlife are similar to the entanglement hazards from the weather balloon. Lost fishing gear, specifically traps, typically have a buoy attached to several dozen feet of nylon line; similarly, the weather balloon, which is relatively buoyant, is attached with lightweight lines to heavier scientific instruments. Thus, weather balloons would be expected to pose similar entanglement risks to marine wildlife as lost fishing gear, and lost gear recovery would effectively offset adverse impacts associated with weather balloons.

On an annual basis, the amount of material potentially released into the ocean would be recorded and, for every one pound of such material, Phantom would make a compensatory donation of $10.00 to the California Lost Fishing Gear Recovery Project. The administrators of that program have confirmed this contribution would be sufficient to recover approximately one pound of lost fishing gear. This commitment is consistent with the approach used by other launch programs on VSFB for their marine debris impacts, including the SpaceX and Stratolaunch programs.

The first stages and fairings[15] of Phantom's proposed space vehicles are expendable. This means that after a successful launch, the first stages and fairings are designed to detach from the rest of the rocket and fall back to the ocean, far offshore in international waters. DAF expects the fairings and first stages from Phantom's proposed launches to land downrange from VSFB in international waters off the coast of Mexico.

The Daytona-E's first stage would weigh approximately 2,656 pounds, and the Laguna-E's first stage would weigh approximately 7,900 pounds. Both would be primarily made up of aluminum but may also include composite materials. Upon re-entry to the atmosphere and impact with the ocean surface, the first stage would break apart into smaller pieces. At the proposed launch frequency of 48 per year, the total amount of first stage material proposed to be discarded into international waters offshore of Mexico would be a maximum of 379,200 pounds annually. DAF states in its consistency determination that these pieces of the first stage are expected to sink to the seafloor and remain in international waters. As such, DAF does not expect these materials to move into California's coastal zone or have effects that would spill over into the coastal zone. Consistent with the Commission's efforts to address activities that contribute to marine debris and the discharge of waste into the ocean, however, staff have encouraged DAF to take steps to recover the first stage or offset its release into the ocean by collecting and removing other materials. DAF has not committed to taking any such steps, however, and has stated that they would exceed its legal requirements.

Engine Noise

Engine noise impacts would range from 100 dB to 120 dB in the air over the coast and ocean during static fire tests and launches. The loudest expected engine noise would come from a Laguna-E launch. In-air engine noise of 100 dB or above would cover an area from Sudden Ranch to approximately 2 miles south of the Santa Ynez River mouth on VSFB. Maps showing the modeled engine noise are included in **Exhibit 7**. Static fire tests would not be as loud as launches and the area that would be experiencing engine noise at 100 dB or above would range from Point Arguello to the coastline just northwest of SLC-4. A map of modeled static fire engine noise is also included in **Exhibit 7**. The engine noise estimates provided here are for in-air sound, and it is worth noting that a significant amount of energy (loudness) of sound is lost when transmitting between the air-water interface, therefore underwater sound is expected to be much lower during launches.

Marine mammals are sensitive to sound and are used as indicator species to understand noise impacts on the marine environment. Marine mammals that may be present in the nearshore environment, particularly those that spend time above the water line, include southern sea otters, sea lions, and seals. To the human ear, 120 dB

[15] Fairings are designed to protect satellites and spacecraft on their way to orbit, minimizing shock and vibration, and supporting a wide variety of payloads.

would be as loud as a jet taking off and 110 dB would be as loud as amplified music at a concert. However, marine mammal hearing differs from human hearing in the frequencies they are receptive to and their sensitivity to loud sounds. To help evaluate potential adverse impacts to marine mammal hearing from elevated sound, Southall et al (2019) identifies threshold levels for various marine mammal species beyond which temporary threshold shifts (i.e. temporary hearing loss) would be expected to occur. Although elevated, the sounds anticipated to be produced by the proposed project would fall below these threshold levels. To confirm this, VSFB has conducted extensive monitoring of marine mammal responses to launch activities and has found that launch activities have not had any observable long-term consequences for marine mammal populations or their use of habitat at and around VSFB. Specifically, DAF states in its consistency determination:

> *Extensive launch monitoring has been conducted for sea otters on both north and south VSFB, with pre- and post-launch counts and observations conducted at rafting sites immediately south of Purisima Point for numerous Delta II launches from SLC-2 and one Taurus launch from Launch Facility-576E and at the rafting sites near Sudden Flats for two Delta IV launches from SLC-6. No abnormal behavior, mortality, or injury of effects on the population has ever been documented for sea otter because of launch-related disturbance (SRS Technologies, Inc. 2006a, 2006b, 2006c, 2006d, 2006e, 2006f, 2006g; MSRS 2007a, 15 2007b, 2007c, 2008a, 2008b). More recently, for the SpaceX Falcon 9 SAOCOM launch and landing…sea otters were monitored during pre- and post-launch surveys on south VSFB (MSRS 2018b). The sonic boom received at the otter monitoring location was estimated at 0.71 psf and the maximum landing engine noise at this location was estimated at 99.5 dB Lmax. Count totals of both pups and adults were similar before and after the launch and there was no discernable impact on otters on south VSFB*.

Similarly, DAF has also monitored seals and sea lions at VSFB haul-out locations during launches over the past twenty years and determined that a portion of the hauled-out animals present react (e.g., enter the water or dive under the water) to loud sounds, but that these behavior changes are temporary and have not negatively affected the numbers of seals and sea lions that make use of the shoreline at VSFB. In its consistency determination, DAF reported, “Numbers of hauled out pinnipeds [seals and sea lions] typically return to normal within 24 hours or less after a launch event.” Like sea otters, pinnipeds entering or diving under the water during launch noise will significantly reduce their exposure to elevated levels of sound due to the sound dampening effects between the air-water interface (DAF 2023).

In both its consistency determination and as part of its consultation with the National Marine Fisheries Service, DAF has committed to monitoring pinnipeds during all launches at VSFB, including those launches proposed by Phantom. Between January 1 and June 30, pinniped monitoring at south VSFB haul out locations would occur at least 72 hours prior to a launch event and would continue at least 48 hours after each event. As stated by DAF in its consistency determination, if this monitoring demonstrates that launch activity results in injury or mortality to marine mammals, DAF would immediately cease launch activities and report the incident to NMFS.[16] DAF further states in its consistency determination that launch activities would not resume until NMFS is able to review the associated data and circumstances and work with DAF to determine the additional measures necessary to minimize the likelihood of further impacts to marine mammals. In such a situation, DAF would also notify the Executive Director and share relevant information to help determine if the activity is being conducted or is having an effect on any coastal use or resource substantially different than originally described in the consistency determination and, as a result, is no longer consistent with the enforceable policies of the CCMP.

With the information provided by DAF on the potential effects of engine noise on nearshore marine mammals, the absence of data demonstrating adverse impacts during similar launches over the past roughly 20 years of monitoring marine mammal populations along the shoreline of VSFB, the monitoring that would continue to be carried out as part of the proposed project, and DAF's commitment to working with NMFS and the Executive Director to address any unexpected impacts on marine mammals, the Commission finds that the proposed project would not adversely affect the biological productivity of coastal waters or adversely affect marine species or areas of special biological significance.

Sonic Booms

In addition to the engine noise, the launches proposed by Phantom would create sonic booms with pressure waves of up to 1.5 pounds per square foot. It should be noted that the strongest potential sonic boom would come from a Daytona-E launch vehicle, not the Laguna-E launch vehicle, which creates the loudest engine noise impacts. Due to the proposed launch trajectories and timing of rocket acceleration, the sonic booms from the proposed project would occur both south and west of San Miguel Island and Santa Rosa Island, which are part of Channel Islands National Park and within the Channel Islands National Marine Sanctuary. **Exhibit 10** provides maps of the predicted sonic boom footprint of the Daytona-E and Laguna-E space vehicles. To many species of wildlife, sonic booms would sound like thunder, and most of the sonic boom strength from both space vehicles is modeled by DAF to be one pound per square foot of peak overpressure.

The closest a sonic boom would occur to Channel Island National Park would be approximately eight miles and the distance between the sonic boom and marine mammal haul out locations there would reduce the sound exposure to marine mammals that are hauled out on the beach. Additionally, the loss of energy between the air-water

[16] The DAF currently has a Letter Of Authorization (LOA) from NMFS authorizing incidental take of marine mammals under the Marine Mammal Protection Act. The LOA only authorizes harassment, not injury or mortality.

interface would protect submerged marine mammals, sea turtles, and other wildlife from sonic boom-related sounds in the Channel Islands National Marine Sanctuary and state-designated marine protected areas.

In addition, NMFS has reviewed rocket launches at VSFB and through its LOA, requires DAF to avoid launches which are predicted to produce a sonic boom over the Northern Channel Islands during the harbor seal pupping season from March through June, whenever possible. Additionally, NMFS requires increased monitoring when sonic booms are expected to exceed 2.0 pounds per square foot over the Northern Channel Islands. However, none of the proposed launches would exceed this threshold. With the information by DAF on the potential effects of sonic boom sounds and launch noise on offshore marine mammals, and DAF's commitment to working with NMFS and the Executive Director to address any unexpected impacts on marine mammals, the Commission finds that the sonic booms produced by the proposed project would not adversely affect the biological productivity of coastal waters.

Conclusion

In conclusion, with the evidence presented by DAF, including the commitment to continue monitoring and address any unexpected impacts to marine mammals, the Commission agrees with DAF's conclusion that the proposed project will maintain the biological productivity and quality of coastal waters and will appropriately protect marine resources. Additionally, with the commitment to compensate for marine debris inputs into state and federal waters, and with the evidence presented regarding the lack of significant effects from potential elevated sound, the Commission finds that the proposed project will protect areas and species of special biological significance and is consistent with Coastal Act Sections 30230 and 30231.

F. OIL SPILLS

Coastal Act Section 30232 states:

> *Protection against the spillage of crude oil, gas, petroleum products, or hazardous substances shall be provided in relation to any development or transportation of such materials. Effective containment and cleanup facilities and procedures shall be provided for accidental spills that do occur.*

The proposed project has the potential to result in the accidental release of petroleum products in two ways: potential fuel spills from construction equipment and spills from rocket fuel storage. Due to the location of the proposed space launch complex adjacent to and uphill from Honda Creek, a coastal steam that drains to the ocean, a significant spill during construction or operation of the launch complex has the potential to extend outside of VSFB and into coastal waters of the Pacific Ocean. In order for a project to be found consistent with Section 30232 of the CCMP, two tests must be satisfied. The first test requires DAF to demonstrate that they have provided for protection against spills of petroleum products or hazardous substances, and the second test requires that

DAF provide "effective containment and cleanup facilities and procedures" for any spills that may occur.

Potential Fuel Spills from Construction Equipment

During construction of the proposed facilities, accidental spills of petroleum products may occur through leaks in fuel tanks of construction equipment, leaks from fuel trucks for refueling construction equipment or accidents during refueling operations. The largest potential fuel tank on site during construction activities would be a fuel truck with a capacity of 5,500 gallons., The largest possible spill would therefore be 5,500 gallons.

To address the first test of Section 30232, DAF has committed in its consistency determination to implement spill prevention actions and procedures during construction, including:

- Ensuring all equipment will be properly maintained and free of leaks during construction activities. All necessary repairs to equipment will be performed in pre-designated, controlled, paved areas to minimize risks from accidental spillage or release.
- Fueling equipment will only occur in pre-designated staging areas on existing roadways or non-native vegetation. The staging areas are not within environmentally sensitive habitat or water bodies.
- Vehicles and equipment will only be washed within staging areas. High pressure washing of undercarriages and wheel wells will be prohibited at the project site.

To address the second test, DAF has committed in its consistency determination to implement spill response procedures during construction, including:

- Requiring that spill containment materials be placed around the construction equipment and fuel truck before refueling. Stationary equipment would be outfitted with drip pans and hydrocarbon absorbent pads.
- Requiring that Phantom maintain spill response equipment and supplies at the site during construction and operation for immediate response and cleanup of any fuel spills. The amount of response supplies determined to be "adequate" is based on guidance provided by VSFB's installation-wide Spill Prevention, Control, and Countermeasures (SPCC) Plan.
- Requiring Phantom to ensure employees and contractor staff are trained in proper prevention and cleanup procedures.
- Requiring Phantom to submit a SPCC Plan to the Santa Barbara County Certified Unified Programs Agency for approval. This plan would be required to be consistent with the criteria included in VSFB's installation wide SPCC plan. Some of the elements required in Phantom's SPCC plan include:
    - Procedures for designating responsible owners or operators who are accountable for the management and oversight of oil storage tanks and containers and oil-filled equipment.

- General annual spill prevention and response training requirements for shop-level personnel and for personnel designated to act as responsible owners or operators.
- Procedures for performing inspections and reporting results.
- Guidelines and training for using and maintaining spill response equipment.
- Procedures for storing, handling, and managing oil on the construction site.

In addition to these requirements, DAF has stated, in a letter to Commission staff dated May 22, 2023, that under 40 CFR 112, the SPCC would include elements that the Commission considers critical for these plans, including: an oil spill risk and worst-case scenario spill assessment that includes oil spill trajectories and identification of the coastal resources at risk from oil spill impacts, response capability analysis of the equipment, personnel, and strategies (both on-site and under contract) capable of responding to a worst-case spill, including alternative response technologies, oil spill preparedness training and drills, and evidence of financial responsibility demonstrating capability to pay for costs and damages from a worst-case spill.

Possible Spills from Rocket Fuel Storage

During project operations, Phantom would establish a fuel storage area for RP-1 or Jet-A, which are kerosene-based fuels for the Daytona-E and Laguna-E rockets. RP-1 or Jet-A would be stored in portable tanks. At each launch pad, up to two 5,500-gallon tanks would be used for fuel storage. These tanks would be connected to a fuel transfer manifold, which would include a 275 gallon-per-minute pump, isolation valves, and a 4-inch line from the storage area to the launch pad for fueling rockets. A leak in any of these systems has the potential to spill petroleum products at the site. The largest possible spill, if all four tanks were to be damaged and spill at once, would be 22,000 gallons or 523 barrels of fuel. In the event of a catastrophic failure with no containment or control measures, this would be enough fuel to travel from the proposed project site to Honda Creek and then to the ocean and beaches of the coastal zone outside of VSFB.

As a standard procedure on VSFB, DAF requires monthly and annual inspections and reporting for all fuel storage containers larger than 55 gallons. This would be applicable to the Phantom project. A separate inspection frequency and protocol is also required for containers less than 55 gallons. DAF also requires integrity testing for all above-ground storage tanks on a monthly basis.

Notwithstanding the measures that DAF would implement to prevent a spill from occurring, onsite secondary containment is also proposed to be constructed as part of the launch complex facility. This containment would be designed to be capable of holding the entire capacity of the single largest container as well as sufficient volume to hold precipitation from a 24-hour, 25-year storm, if the secondary containment area is uncovered. In the case of VSFB, this is an additional 3.5-4 inches of precipitation. As mentioned above, DAF would also require Phantom to maintain adequate spill response supplies at the site during operations. Finally, Phantom is required under 40 CFR 112 to develop an SPCC plan, described above, which complies with both state and federal law and includes elements that the Commission considers critical for oil spill prevention, control, and response. The detailed criteria the plan is required to meet is included in VSFB's installation wide SPCC Plan. The Commission finds these measures are adequate to respond to an accidental spill and preclude fuel from reaching Honda Creek and the coastal zone.

In conclusion, with the inspections, reporting, secondary containment, spill preparedness, and cleanup procedures discussed in these findings and the preparation of a site specific SPCC Plan, the Commission finds that the proposed project is consistent with Coastal Act Section 30232.

G. Cultural Resources

Coastal Act Section 30244 states:

> Where development would adversely impact archaeological or paleontological resources as identified by the State Historic Preservation Officer, reasonable mitigation measures shall be required.

As discussed in the consistency determination it prepared for the project, DAF has investigated whether the proposed project, including the new proposed development at the former site of SLC-5, would adversely impact archaeological resources as identified by the State Historic Preservation Officer (SHPO). DAF identified four archaeological sites within the general area of the proposed project. However, of the four sites, only one is eligible for the National Register of Historic Places.[17] The remaining three sites were ineligible because they were either destroyed and capped with concrete during the construction of SLC-5 for the NASA scout facility or are not within the proposed construction footprint for the Phantom project. When the NASA Scout launch facilities at SLC-5 were being demolished, the concrete pad was retained and covered with an overburden of several feet of clean fill soil. Phantom proposes to build on top of this clean fill and is therefore not expected to unearth or disturb any archaeological sites during site construction.

Of the archaeological sites considered, only one is eligible for the National Register of Historic Places. This site is also the only one located where it has the potential to be affected by the project; it is bisected by Honda Canyon Road. However, the portion of Honda Canyon Road within the delineated boundaries of this site would not require improvements, and the proposed activities within the site would be limited to removal of vegetation from the existing paved road segment. No ground disturbance is proposed.

[17] The SHPO reviews nominations to the national register of historic places, and a location or resource being eligible for the national register of historic places means that DAF would need to assess the impacts of their project on that resource under NEPA.

Further, DAF proposes to protect this site during vegetation removal activities by installing exclusionary fencing along both sides of Honda Canyon Road where it crosses the archaeological site. The SHPO received notice about the site and the protection measures proposed by DAF and, on May 17, 2022, concurred with DAF's determination that the proposed project would not have an adverse effect on cultural resources.

DAF also consulted with the Santa Ynez Band of Chumash Indians as part of its Section 106 process. DAF has stated to Commission staff that the Santa Ynez Band of Chumash Indians agreed with DAF's evaluation regarding the lack of potential effects to cultural resources with implementation of the proposed protective measures and concluded that tribal monitors would be necessary only if ground disturbance occurred near a known prehistoric site. As part of its review process, Commission staff also reached out to the Santa Ynez Band of Chumash Indians and several other Tribes with potential cultural connection to the project area, as indicated by the list provided to Commission staff by the Native American Heritage Commission. The Santa Ynez Band of Chumash Indians did not request additional coordination or consultation with Commission staff beyond what had already been carried out by DAF.

Commission staff, however, did receive a request for additional information and consultation from the Northern Chumash Tribal Council (NCTC). Commission staff scheduled a consultation with the NCTC and met with their representatives on May 25, 2023. During consultation, the NCTC stated that if the fill at the project site is demonstrated to be free of cultural resources, and no native soils are disturbed during construction activities, tribal cultural monitors would not be necessary. DAF confirmed that the fill material at the project site was tested and would not potentially include cultural resources and Commission staff provided this information to NCTC. The NCTC also discussed the need for early consultation with DAF on all projects at VSFB. The Commission supports the need for DAF to provide adequate outreach and to NCTC and other tribes with cultural connections to this area. Commission staff would facilitate those conversations and information sharing for future projects through implementation of the Commission's Tribal Consultation Policy.

In conclusion, with the protective measures proposed by DAF and the absence of proposed ground disturbing activities in areas that may support cultural resources, the Commission agrees with DAF and the concurrence of the SHPO that the project would not adversely impact archaeological or paleontological resources. The Commission therefore finds that the project is consistent with Section 30244.

H. Coastal Access & Recreation

Coastal Act Section 30210 states:

> In carrying out the requirement of Section 4 of Article X of the California Constitution, maximum access, which shall be conspicuously posted, and recreational opportunities shall be provided for all the people consistent

> with public safety needs and the need to protect public rights, rights of private property owners, and natural resource areas from overuse.

Coastal Act Section 30211 states:

> D*evelopment shall not interfere with the public's right of access to the sea where acquired through use or legislative authorization, including, but not limited to, the use of dry sand and rocky coastal beaches to the first line of terrestrial vegetation.*

Coastal Act Section 30214 states, in relevant part:

> *(a) The public access policies of this article shall be implemented in a manner that takes into account the need to regulate the time, place, and manner of public access depending on the facts and circumstances in each case . . .*

The closest beaches to the proposed project site with public access include Jalama Beach County Park (Jalama), Surf Beach, and Ocean Beach Park. These are some of the only publicly accessible beaches within the 64-mile stretch of northern Santa Barbara County between Point Sal and Gaviota State Beach. Due to its location and the southerly direction of proposed launches, launches at the project site would not result in public coastal access or recreation restrictions at Surf Beach or Ocean Beach Park. Proposed launches would have the potential to adversely impact public coastal access and recreation at Jalama, however.

Jalama Beach is an important public recreational resource because of its upland and water oriented recreational values and scenic resources. It is popular for surfing and wind surfing and used by people from all over the state. The Commission's California Coastal Resource Guide also describes this area as a popular fishing spot: "An offshore reef protects the nearshore waters from turbulent wave action, creating a popular sport fishing... spot." In addition, Jalama Beach County Park provides some of the only overnight beach camping sites within northern Santa Barbara County and is heavily used throughout the year. The sandy beach and estuary along Jalama Creek provide ample opportunity for the public to bird watch, walk, and passively enjoy coastal resources. The scenic resources of Jalama Beach provide a unique place to enjoy coastal recreational resources as well due to its remote location and the absence of visible development such as homes, buildings and lights in surrounding areas.

Because Jalama Beach provides unique recreational opportunities and is one of the few places along the northern Santa Barbara County coast that provides for public coastal access, potential adverse impacts on the recreational use of the beach from the proposed project are particularly significant. This is additionally the case because existing space launch activities at VSFB already result in temporary restrictions on public coastal access and recreation at Jalama. These restrictions are put in place by DAF and the Federal Aviation Administration for public safety reasons. If an accident occurs or DAF or a space launch company must destroy a rocket during take-off, debris could crash onto Jalama Beach and its campground, presenting a significant danger to the public. As such, access to these areas is often restricted for several hours in advance of a planned launch event, Jalama Rd. is closed to entry and members of the public are evacuated and required to drive approximately 30 minutes away to Highway 1 until the launch is complete and the 14-mile long Jalama Rd. is reopened. In addition, campground reservation holders are notified up to one week in advance by Santa Barbara County (the operator of the campground) of the potential need for evacuation during their stay. Based on information provided by Santa Barbara County staff, such notifications often result in cancellations and reduce the number of people camping by up to 60 percent, particularly when evacuations would occur late at night or during early morning hours. Additionally, Santa Barbara County staff noted that 20 percent of reservations were canceled after notifying reservation holders of a launch that did not require any evacuation.

As the Commission noted back in 1998 in its findings for Consistency Determination No. CD-049-98,

> In the past, the Commission has had significant concerns about public beach closures in this area. The Commission has generally agreed that beach closures are necessary part of the space launching activities at Vandenberg and the Commission has generally supported these space launching activities. However, in evaluating these activities, the Commission usually requires some mitigation for the beach closures. This mitigation is usually a limitation on the number of launches annually and other measures designed to reduce the significance of the impact. These other measures have included commitments to avoid weekend launches, especially holiday weekends, and minimizing the number of launches occurring during the peak recreation season (usually May through September). Additionally, although not required in the past, the Commission believes that there is some value for the applicant to provide to the Commission annual reports on the beach closures resulting from its launch activities.

While the Commission ultimately concurred with CD-049-98, it did so with the understanding that (1) the space launch program under consideration was proposed to replace an existing program and would therefore not increase the total number of annual launches from the base or associated coastal access restrictions; (2) DAF expected a base-wide total of eight launches per year with a maximum of 14 launches; and (3) as noted in the Commission’s findings,

> …the Air Force has modified its consistency determination to include mitigation measures that would limit or reduce the significance of the beach access impacts. Specifically, the Air Force has agreed to consider access impacts among those issues it will evaluate in determining launch schedule. For example, the Air Force will attempt to avoid holiday

> weekends and minimize the number of launches during the summer months. Additionally, the Air Force will monitor beach closures and provide an annual report to the Commission. The monitoring will provide data on the number of launches that included beach closures, the location of the closure, and the duration of each closure.

Commission and DAF staff have been unable to locate the monitoring data or annual reports described above so has instead relied on data compiled by Santa Barbara County Parks and Recreation Department staff regarding public coastal access and recreation restrictions implemented at Jalama Beach.

In prior reviews of coastal and recreational access impacts from space launch activities at VSFB, including the one cited above, adverse impacts to public coastal access and recreation have been described in terms of "beach closures." As noted above, in its concurrence with the U.S. Air Force's Consistency Determination No. CD-049-98, the Commission found that with the addition of minimization measures, an average of eight and maximum of 14 launches per year and associated temporary beach closures would be consistent with the coastal access and recreation policies of the CCMP.

Although this numeric limit was established in 1998 and prior to the authorization of a wide range of new space launch programs with significantly higher stated levels of launch activity – as further detailed in the background section of this report above – DAF adhered to it consistently through 2021. However, the number of launches from VSFB has steadily increased over the past two years and has now exceeded the limit of 14 launches per year maximum. In addition, Commission staff have learned that adverse impacts to public coastal access and recreation associated with space launch activities, particularly at Jalama, take a variety of forms and cannot simply be categorized as "beach closures."

For example, in order to provide transparency and help minimize the levels of frustration directed towards County staff, campsite reservation holders are notified between one and seven days in advance of a scheduled launch that Jalama Beach may be closed during their stay, necessitating an evacuation for several hours. Similar notices are also provided through the County's reservations website to those attempting to book a campsite during the time of a scheduled launch. These notifications result in cancellations and limit bookings, both of which reduce public coastal access and recreation. More severe adverse impacts occur as a result of the closure of the 14-mile long Jalama Rd. several hours in advance of a scheduled launch and the full closure and evacuation of the beach and campground. Full beach closures and evacuations result in significant adverse impacts to coastal access and recreation as they last three to four hours and require travel at least 30 minutes away to Highway 1. One-hundred-ten sites are available for camping reservations at Jalama and with a maximum occupancy of eight people per site, the full overnight capacity of the campground is nearly 900. This number is exceeded during the day due to day-use visitors such as surfers, fishers and beach goers.

The potential need for an evacuation at Jalama would not occur with every launch, however. In its consistency determination, DAF states that the decision to evacuate is based on a risk analysis using a standard approach developed by the Federal Aviation Administration. For each launch, DAF's Range Safety Program considers the number of people within an "impact limit line" and conducts pre-launch debris risk assessments to determine high risk areas. The population size that determines the need for an evacuation from Jalama is typically 500 people. In other words, if 500 or more people are present, an evacuation and closure is triggered. If this number is close to being exceeded, a road closure may be triggered to limit the ingress of additional people and to avoid a full closure and evacuation of the beach and park. Risk assessments carried out by DAF are also informed by launch angle (azimuth), weather forecasts and upper atmospheric wind conditions predicted for the day of the launch. It is also worth noting that because evacuations can take several hours to implement, they are carried out well in advance of a scheduled launch. On occasion, launches are delayed, cancelled or rescheduled, which can result in multiple closures and evacuations for a single launch event.

In the case of the proposed Phantom project, DAF states that the proposed launches are very unlikely to cause adverse impacts to public coastal access and recreation at Jalama. The launch angle anticipated to be used for Phantom rockets would not be anticipated to necessitate closures to the park, as the potential debris field would generally be far enough away from the park to allow it to remain open during launches. Under a conservative, worst-case scenario, DAF assumes that there may be up to two launch events per year that may necessitate consideration of evacuations at Jalama, and resulting in public access impacts. However, it is unclear if scheduled launches by Phantom would generate potential evacuation notifications to campground reservation holders or those seeking to secure reservations. DAF has affirmatively committed to working to ensure that rocket launches from the proposed Phantom space launch complex would minimally affect coastal access and recreation and Jalama Beach, including by committing to manage all space launch activities in order to remain below a "cap" of 12 beach closures or evacuations per year. DAF has already made significant progress towards minimizing the effects of base-wide operations on coastal access and recreation, including through a re-assessment of the safety protocols for Surf Beach and Ocean Park in Lompoc that now allows these shoreline areas to remain open during launch events. Similar efforts are being pursued for Jalama Beach as well and DAF is additionally working to renew an expired Memorandum of Agreement with Santa Barbara County that may result in additional public access and recreation protections and benefits.

With DAF's commitment to pursue these efforts and to remain under the numeric "cap," as well as the low likelihood of Phantom launches resulting in coastal access and recreation restrictions, the proposed project would be consistent with Coastal Act Sections 30210, 30211, and 30214 and their requirement to maximize public access in a manner that accounts for the need to restrict access based on site-specific constraints.

I. Commercial and Recreational Fishing

Coastal Act Section 30234.5 states:

> The economic, commercial, and recreational importance of fishing activities shall be recognized and protected.

The proposed project has the potential to impact commercial and recreational fishing activities off the coast of VSFB. Coastal Act Section 30234.5 requires that the commercial and recreational importance of fishing be recognized and protected.

A map of the range of Phantom's potential launch angles overlaying CDFW fishing blocks is available in **Exhibit 11**. Only a small subset of the blocks overlaid by the range of Phantom's potential launch angles would be affected by each individual launch, and only for a short period of time.

The area directly to the west of VSFB is included in Vandenberg State Marine Reserve, which does not permit any take or fishing of any living, geological, or cultural marine resource. However, the range of potential launch angles covers areas of ocean that are fished. In its consistency determination, DAF states:

> Fishing in these blocks varies and is largely conducted by vessels from the Santa Barbara Harbor, which represents 94% of the fishing in these blocks. However, fishermen from the Port San Luis and Morro Bay Harbor also fish these waters, primarily within 3 nautical miles of the shoreline and north of Point Conception…

DAF found that commercial fishing identified in these fishing blocks is "limited compared to other areas but is valuable for select species." Coastal pelagic species, marine state managed invertebrates, and groundfish dominated the landings by weight and value. In its consistency determination, DAF states:

> The top 10 species from the selected blocks represent 95% of the landings by pounds…This reveals market squid, red sea urchin, and California spiny lobster dominate the fishing and represent over two-thirds the selected blocks' landed value. Vermilion rockfish, shortspine thornyhead, brown rock crab, and red rock crab contribute substantially to state totals in these species but are much lower total value.

Launches from the proposed project would result in the US Coast Guard issuing a notice to mariners that defines a public ship avoidance area for launch events. These notices are typically unpatrolled warning areas and not hard closures. To ensure public safety, these notices to mariners are issued for no more than 4 hours on the primary launch day, with one back-up day. At the bare minimum, these warnings are issued for each launch duration with the addition of 30 minutes to account for any possible falling debris. The vehicle (vessel) hazard area identified in the notice to mariners is typically described as a corridor of 5 to 15 nautical miles on either side of the flight path to a point offshore where the risk to vessels is below safety thresholds. The size of the vessel hazard area varies based on several factors including the launch flight trajectory and simulations of variations of the trajectory, expected seasonal winds, launch vehicle reliability, launch vehicle break-up modeling in case of an anomaly, anticipated vessel traffic, and other factors. While newer space vehicles, like the Daytona-E and Laguna-E, have larger vessel hazard areas, they launch less frequently. As the proposed Phantom project increases its launch cadence, the proven reliability of its space vehicles is anticipated to allow the space covered by the vessel hazard area to shrink.

DAF and Phantom, in consultation with fishing association leaders, identified communication beyond the notices to mariners as key to successfully avoiding and minimizing adverse impacts to fisheries from launch activities. In its consistency determination, DAF states:

> Initial discussions with the chair of the Port San Luis Commercial Fishermen's Association have already identified measures that will be implemented to avoid and minimize disruptions to fishing offshore of VSFB. Phantom will provide the chairmen of local fisherman's associations with an email that includes a printable flyer showing the date and time of the launch window(s), the VHA [vehicle hazard area], and how long the VHA will be in effect. Although this duplicates the information presented in the [notice to mariners], discussion with the chair of the Port San Luis Commercial Fishermen's Association indicated that directly communicating the area and physically posting it on an announcement board used by the fishermen would be the most effective way of enabling the fishermen to plan around launch activities, if necessary.

Coordination with the fishing fleet is also proposed to be adjusted seasonally, as needed for when different fisheries are operating in the area. Through coordination with the Port San Luis Commercial Fishermen's Association, DAF learned that fishermen using the areas in the blocks that may be impacted by launches typically fish in the morning in nearshore (<3 nautical miles) shallow reef habitat. Therefore, DAF has committed to ensuring that Phantom avoid timing its launches for the morning hours and ensure that launch times are clearly communicated with the fleet to avoid impacts to commercial and recreational fisheries.

Finally, in its consistency determination, DAF states:

> Within 90-days of completing the NEPA-process for SLC-5, Phantom, with support and collaboration from SLD-30, will develop a Phantom Space Fisheries Communications and Coordination Plan that will outline the planning and execution steps to avoid and minimize impacts of Phantom launches to the commercial and recreational fishing communities. This will

> be made available to the fishing communities and California Coastal Commission for transparency, feedback, and insight. Phantom will prepare an annual report outlining the communications completed, launches conducted, successes/challenges encountered, and takeaways (e.g., best practices and recommended actions) learned.

In conclusion, because the proposed launches can be timed for hours of the day when commercial fishing and recreational fishing is not likely to be taking place, and due to DAF and Phantom's commitment to enhanced coordination with the fishing fleet to further avoid and minimize impacts, the Commission finds that the proposed project would protect the commercial and recreational importance of fishing. Therefore, the proposed project is consistent with Section 30234.5.

J. AIR QUALITY

Coastal Act Section 30253 states:

> New development shall do all of the following:
>
> (c) Be consistent with requirements imposed by an air pollution control district or the State Air Resources Board as to each particular development.

The proposed project has the potential to produce air pollution emissions through construction of the proposed project facilities and through launch activities. Coastal Act Section 30253 requires that the proposed project be consistent with the requirements imposed by the Santa Barbara County Air Pollution Control District. Construction activities for the Phantom project include both emissions from construction equipment and from the use of up to two generators during construction. As part of its draft Environmental Assessment, DAF calculated the expected operational air emissions of the proposed project and found that all annual air emissions fell below the screening threshold for the Santa Barbara County Air Pollution Control District. Table 8 below shows the expected annual emissions for air pollutants per year.

Table 8: Estimated Annual Air Pollutant Emissions from Operation of the Phantom Space Project

	Estimated Emissions (Tons)						
Year	CO	NO_x	VOC*	SO_x	$PM_{2.5}$	PM_{10}	Pb
2023	1.313	0.883	0.194	0.136	0.154	0.154	0.00
2024	2.711	1.979	0.462	0.362	0.394	0.394	0.00
2025	9.014	8.407	2.022	1.670	1.792	1.793	0.00
2026	7.943	0.017	0.002	0.000	0.001	0.001	0.00
2027	35.524	0.416	0.058	0.002	0.012	0.016	0.00
2028	71.047	0.831	0.116	0.003	0.024	0.031	0.00
Annual Screening Threshold	100	100	100	100	100	100	100
Below Threshold for all years?	Yes	Yes	Yes	Yes	Yes	Yes	Yes

* At the time of analysis, ROC emissions factors were not available for the activities analyzed in this table. VOC emissions factors were instead used as a surrogate and reported in this table.

Notes: Values report as 0.000 are less than 0.0005 units; Screening Thresholds are 100 tons per year for all emissions reported.
CO = Carbon Monoxide; NOx = Nitrogen Oxides; VOC = Volatile Organic Carbons; SO_x = Sulfur Oxides; $PM_{2.5}$ = Particulate Matter less than 2.5 Microns in Diameter; PM_{10} = Particulate Matter less than 10 Microns in Diameter; Pb = Lead

Although the project falls below the PM_{10} screening threshold, the Santa Barbara County Air Pollution Control District requires that all discretionary construction activities adhere to standard dust control measures, because Santa Barbara County exceeds the state standard for PM_{10}. DAF proposes to implement dust control measures consistent with the County's requirements. These measures include, but are not limited to:

- Water shall be applied at least twice daily to dirt roads, graded areas, and dirt stockpiles created during construction and demolition activities.
- On-site vehicle speed limits shall be limited.
- Stockpiles of soil or other fine loose material shall be stabilized by watering or another appropriate method.
- Earth moving shall comply with Santa Barbara County Air Pollution Control District's Rule 345, control of fugitive dust from construction and demolition activities.

A full list of the conservation and environmental protection measures VSFB would adhere to, including dust control measures is provided in **Appendix A**.

Similarly, the project is expected to release greenhouse gas emissions through construction and launch activities. The expected annual greenhouse gas emissions are provided in Table 9 below:

Table 9: Estimated Annual Greenhouse Gas Emissions

Year	**Metric Tons**	**Significance Threshold**	**Below Threshold?**
2023	118.56	25,000	Yes
2024	238.49	25,000	Yes
2025	925.48	25,000	Yes
2026	92.01	25,000	Yes
2027	433.31	25,000	Yes
2028	862.72	25,000	Yes

Overall, the proposed project is not expected to exceed the annual CO_2e threshold or the annual threshold for criteria pollutants.

With implementation of the dust control measures described in **Appendix A**, DAF would be consistent with the requirements imposed by an air pollution control district and thus the project would be consistent with Section 30253(c).

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Submitted via email: beatrice.kephart@spaceforce.mil

Re: Consistency Determination CD-0010-22, (Phantom Space Corporation)

Dear Chief Kephart,

On December 15, 2023, the California Coastal Commission concurred with the above-referenced consistency determination submitted by the Department of the Air Force, United States Space Force, for construction of a new commercial space launch facility and use of the new facility for up to 48 rocket launches and 48 static fire engine tests per year for Phantom Space Company at former site of Space Launch Complex 5 on Vandenberg Space Force Base, Santa Barbara County. The Commission found the proposed activities to be fully consistent, and thus consistent to the maximum extent practicable, with the enforceable policies of the California Coastal Management Program.

If you have questions, please feel free to contact Holly Wyer at holly.wyer@coastal.ca.gov.

Sincerely,

Cassidy Teufel
Director
Energy, Ocean Resources, Federal Consistency, and Technical Services

CC

Darryl York, Department of the Air Force, United States Space Force (darryl.york@spaceforce.mil)

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Kerry Kehoe, National Oceanic and Atmospheric Administration (kerry.kehoe@noaa.gov)

Appendix E

Launch Vehicle Descriptions

Daytona-E is an expendable 54.4-foot (ft) two-stage, ground-launched vehicle (Figure E-1). Both stages use liquid oxygen (LOX) and kerosene-based rocket propellant (RP-1) or Jet-A. The first stage utilizes seven Hadley engines (Figure E-2; later to be converted to a single Ripley engine), the second stage uses a single vacuum optimized Hadly engine. The Hadley engines developed by Ursa Major are pump-fed ultra-high efficiency 3D printed rocket engines. Laguna-E is also a two-stage, expendable rocket, at 78.7 ft (Figure E-1). The first stage is powered by 3 Ripley engines (Figure E-2) that utilize LOX and RP-1 or Jet-A propellants. The Ripley engines are also developed by Ursa Major and pump-fed ultra-high efficiency 3D printed rocket engines. The second stage of the Laguna-E uses a single vacuum optimized Hadley engine. Both vehicle's primary structure is high-strength, reliable aluminum alloys.

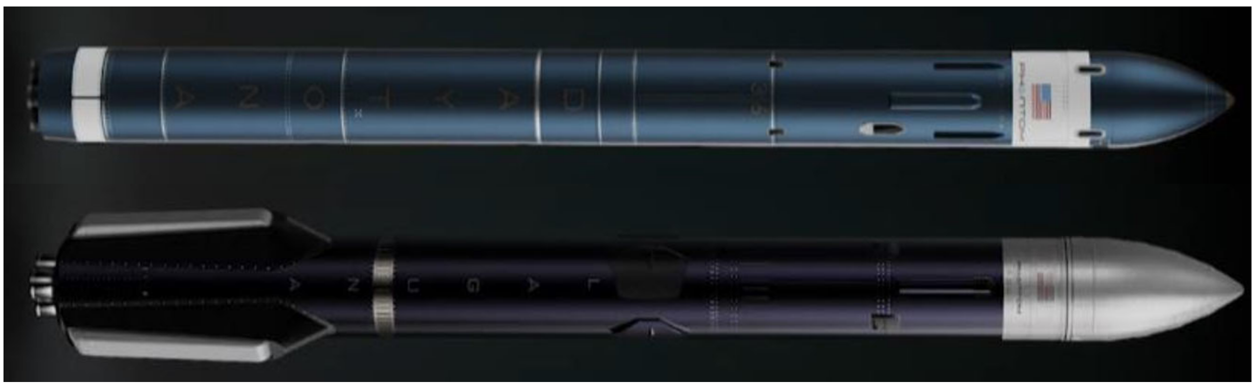

Figure E-1: Daytona-E (top) and Laguna-E (bottom) Launch Vehicles (note: images not shown to scale)

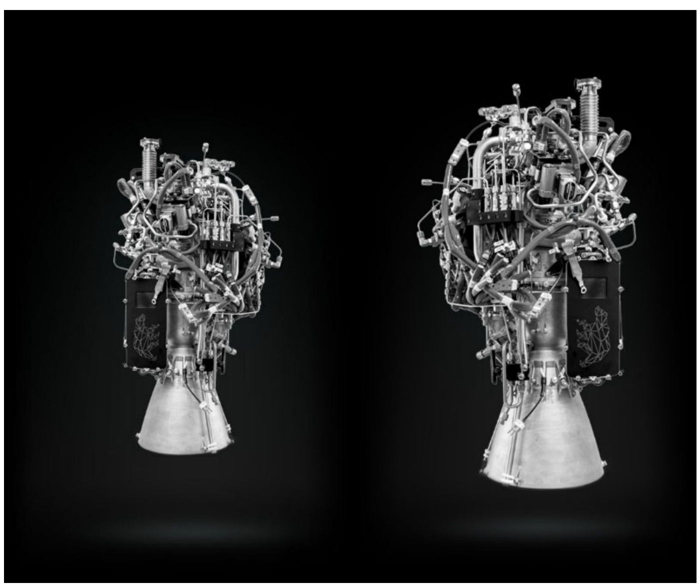

Figure E-2: Ursa Major 3-D Printed Hadley Engine (left) and Ripley Engine (right)

The Daytona-E uses approximately 1,800 gallons of LOX and 1,000 gallons of RP-1 or Jet-A. Laguna-E utilizes approximately 4,000 gallons of kerosene-based propellant (RP-1 or Jet-A) and approximately 6,500 gallons of LOX. The mobile operations center would command loading and unloading of propellants. In order to reduce risk, the amount of time the vehicle is loaded with propellants and gases would be minimized by rapidly loading them onto the vehicle immediately prior to launch through high-capacity hard lines and flex hoses. Tank pressurization on both vehicles would be achieved with helium. Daytona-E and Laguna-E both utilize hydrogen or triethylaluminum-triethylboron (TEA-TEB) ignition systems.

Table E-1: Launch Vehicle Specifications

Specification	Daytona-E	Laguna-E
Height	54.4 ft	78.7 ft
Target Mass to LEO	450 kg	1,200 kg
1st Stage Engines	7 Hadley	3 Ripley
2nd Stage Engines	1 Hadley	1 Hadley
Propellant	LOX/RP-1 or Jet-A	LOX/RP-1 or Jet-A
Total Propellant	27,000 lbs	110,000 lbs
Engine Ignition	Hydrogen/TEA-TEB	Hydrogen/TEA-TEB
Tank Pressurization	Helium	Helium
2nd Stage Attitude Control	Hydrogen Peroxide	Hydrogen Peroxide

The fairings of both vehicles are designed to protect satellites and spacecraft on their way to orbit, minimizing shock and vibration, and support a wide variety of payloads. The Daytona-E fairing, at approximately 9.2 ft by 4.1 ft, can deliver 450 kilograms (kg) to low-earth orbit (LEO; Figure E-3; Table E-1); whereas, the 11.5 ft by 6.5 ft Laguna-E fairing can deliver payloads of up to 1,200 kg into LEO (Figure E-3; Table E-1).

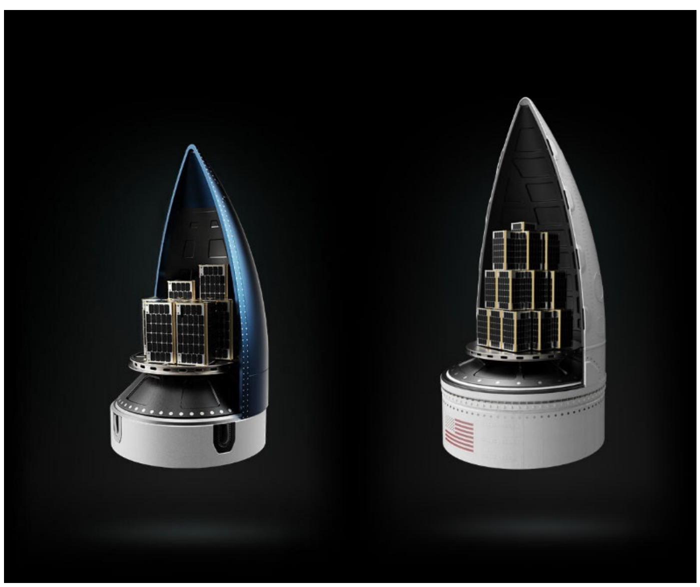

Figure E-3: Daytona-E Fairing (left) and Laguna-E Fairing (right)

Stage separation in both vehicles is performed by pneumatic pushers. Phantom plans to use an autonomous flight termination system for the Daytona-E and Laguna-E, but may initially utilize manual flight termination systems. Both systems would utilize thrust termination. Onboard power is provided by a series of lithium-ion battery cells.

Appendix F

Air Quality – Definition of Resource & Regulatory Requirements

F.1 Definition of Resource

Air quality is defined by ambient air concentrations of specific pollutants determined by the EPA to be of concern with respect to the health and welfare of the general public. Six major pollutants of concern, called "criteria pollutants," are carbon monoxide (CO), sulfur oxides (SOx), nitrogen oxides (NOx), ozone (O_3), suspended particulate matter less than or equal to 10 microns in diameter (PM_{10}), fine particulate matter less than or equal to 2.5 microns in diameter ($PM_{2.5}$), and lead (Pb). The EPA has established National Ambient Air Quality Standards (NAAQS) for these pollutants. An air quality standard defines the maximum amount of a pollutant averaged over a specified period of time that can be present in outdoor air without any harmful effects on people or the environment. Areas that violate a Federal air quality standard are designated as non-attainment areas.

Ambient air quality refers to the atmospheric concentration of a specific compound (level or amount of pollutants in a specified volume of air) that occurs at a particular geographic location. The ambient air quality levels measured at a particular location are determined by the interactions of emissions, meteorology, and chemistry. Emission considerations include the types, amounts, and locations of pollutants emitted into the atmosphere. Meteorological considerations include wind and precipitation patterns affecting the distribution, dilution, and removal of pollutant emissions. Chemical reactions can transform pollutant emissions into other chemical substances. Ambient air quality data are generally reported as a mass per unit volume (e.g., micrograms per cubic meter of air) or as a volume fraction (e.g., ppm by volume).

F.2 Pollutants

Pollutant emissions typically refer to the amount of pollutants or pollutant precursors introduced into the atmosphere by a source or group of sources. Pollutant emissions contribute to the ambient air concentrations of criteria pollutants, either by directly affecting the pollutant concentrations measured in the ambient air or by interacting in the atmosphere to form criteria pollutants. Primary pollutants, such as CO, SO_2, Pb, and some particulates, are emitted directly into the atmosphere from emission sources. Secondary pollutants, such as O_3, NO_2, and some particulates, are formed through atmospheric chemical reactions that are influenced by meteorology, ultraviolet light, and other atmospheric processes. PM_{10} and $PM_{2.5}$ are generated as primary pollutants by various mechanical processes (e.g., abrasion, erosion, mixing, or atomization) or combustion processes. However, PM_{10} and $PM_{2.5}$ can also be formed as secondary pollutants through chemical reactions or by gaseous pollutants condensing into fine aerosols. In general, emissions that are considered "precursors" to secondary pollutants in the atmosphere (such as reactive organic gases [ROG] and NO_x, which are considered precursors for O_3), are the pollutants for which emissions are evaluated to control the level of O_3 in the ambient air.

The State of California has identified four additional pollutants for ambient air quality standards: visibility-reducing particles, sulfates, hydrogen sulfide, and vinyl chloride. The CARB has also established the more stringent California Ambient Air Quality Standards (CAAQS). Areas within California in which ambient air concentrations of a pollutant are higher than the state or federal standard are considered to be non-attainment for that pollutant. Table F-1 shows both the federal and state ambient air quality standards.

Toxic air pollutants, also called hazardous air pollutants, are a class of pollutants that do not have ambient air quality standards but are examined on an individual basis when there is a source of these pollutants. The State of California has identified particulate emissions from diesel engines as a toxic air pollutant.

Table F-1: Ambient Air Quality Standards

Pollutant	Averaging Time	NAAQS[1]		CAAQS[2]
		Primary[3]	Secondary[4]	Concentration[5]
Ozone (O_3)	1-Hour	-	Same as Primary Standard	0.09 ppm (180 μg/m^3)
	8-Hour	0.070 ppm		0.070 ppm (137 μg/m^3)
Respirable Particulate Matter (PM_{10})	24-Hour	150 μg/m^3	Same as Primary Standard	50 μg/m^3
	Annual Arithmetic Mean	-		20 μg/m^3
Fine Particulate Matter ($PM_{2.5}$)	24-Hour	35 μg/m^3	Same as Primary Standard	-
	Annual Arithmetic Mean	12.0 μg/m^3	15 μg/m^3	12 μg/m^3
Carbon Monoxide (CO)	8-Hour	9 ppm (10 μg/m^3)	None	9.0 ppm (10 μg/m^3)
	1-Hour	35 ppm (40 μg/m^3)		20 ppm (23 μg/m^3)
Nitrogen Dioxide (NO_2)	Annual Average	0.053 ppm (100 μg/m^3)	Same as Primary Standard	0.030 ppm (56 μg/m^3)
	1-Hour	0.100 ppm (188 μg/m^3)		0.18 ppm (338 μg/m^3)
Sulfur Dioxide (SO_2)	Annual Arithmetic Mean	0.030 ppm	-	-
	24-Hour	0.14 ppm	-	0.04 ppm (105 μg/m^3)
	3-Hour	-	1300 μg/m^3 (0.5 ppm)	-
	1-Hour	75 ppb (196 μg/m^3)	-	0.25 ppm (655 μg/m^3)
Lead (Pb)[6]	30-Day Average	-	-	1.5 μg/m^3
	Calendar Quarter	1.5 μg/m^3	Same as Primary Standard	-
	3-Month Rolling Average	0.15 μg/m^3	Same as Primary Standard	-
Hydrogen Sulfide (HS)	1-Hour	No Federal Standards		0.03 ppm (42 μg/m^3)
Sulfates (SO_4)	24-Hour			25 μg/m^3
Visibility Reducing Particles	8-Hour (10 am to 6 pm, Pacific Standard Time)			In sufficient amount to produce an extinction coefficient of 0.23 per km due to particles when the relative humidity is less than 70 percent.

Pollutant	Averaging Time	NAAQS[1]		CAAQS[2]
		Primary[3]	Secondary[4]	Concentration[5]
Vinyl chloride[6]	24 Hour			0.01 ppm (26 μg/m^3)

[1] NAAQS (other than O_3, particulate matter, and those based on annual averages or annual arithmetic mean) are not to be exceeded more than once a year. The O_3 standard is attained when the fourth highest 8-hour concentration in a year, averaged over 3 years, is equal to or less than the standard. For PM_{10}, the 24-hour standard is attained when 99 percent of the daily concentrations, averaged over 3 years, are equal to or less than the standard. For $PM_{2.5}$, the 24-hour standard is attained when 98 percent of the daily concentrations, averaged over 3 years, are equal to or less than the standard. Contact the EPA for further clarification and current federal policies.
[2] California Ambient Air Quality Standards for O_3, CO (except Lake Tahoe), SO_2 (1- and 24-hour), NO_2, PM_{10}, and visibility reducing particles, are values that are not to be exceeded. All others are not to be equaled or exceeded.
[3] National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health.
[4] National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.
[5] Concentration expressed first in units in which it was promulgated. Ppm in this table refers to ppm by volume or micromoles of pollutant per mole of gas.
[6] The CARB has identified lead and vinyl chloride as “toxic air contaminants” with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.
Notes: ppm = part(s) per million, μg/m^3 = milligrams per cubic meter
Source: California Air Resources Board (2016)

F.3 Greenhouse Gases

Global temperatures are moderated by naturally occurring atmospheric gases, including water vapor, carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), which are known as greenhouse gases (GHGs). These gases allow solar radiation (sunlight) into the Earth’s atmosphere but prevent radiative heat from escaping, thus warming the Earth’s atmosphere. Gases that trap heat in the atmosphere are often called GHGs, analogous to a greenhouse. GHGs are emitted by both natural processes and human activities. State law defines GHGs as any of the following compounds: CO_2, CH_4, N_2O, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (California Health and Safety Code Section 38505(g)). GHGs have varying global warming potential (GWP). The GWP is the potential of a gas or aerosol to trap heat in the atmosphere; it is the “measure of the total energy that a gas absorbs over a particular period of time (usually 100 years), compared to CO_2” (U.S. Environmental Protection Agency 2013). The reference gas for GWP is CO_2; therefore, CO_2 has a GWP of 1. The other main GHGs that have been attributed to human activity include CH_4, which has a GWP of 25, and N_2O, which has a GWP of 298. CO_2, followed by CH_4 and N_2O, are the most common GHGs that result from human activity. CO_2, and to a lesser extent, CH_4 and N_2O, are products of combustion and are generated from stationary combustion sources as well as vehicles.

Emissions of GHGs are considered to have a potential incremental impact on global climate. Scientists are in general agreement that the Earth’s climate is gradually changing, and that change is due, at least in part, to emissions of CO_2 and other GHG from anthropogenic sources.

The social cost of GHG (SC-GHG) is a theoretical estimate, in dollars, of the economic damages that would result from emitting GHGs into the atmosphere. Per the CEQ 2023 interim guidance, “Agencies should exercise judgment when considering whether to apply this guidance to the extent practicable to an on-going NEPA process” (CEQ 2023) The AF guidance on applying and conducting a SC GHG Analysis is under development. The AF guidance will be release shortly which will provide specifics on applying SC GHG Analyses and a SC GHG tool that will ensure standardization across the AF. Additionally, update to the Air Conformity Applicability Model (ACAM, the USAF air quality impact assessment model) to provide GHG speciation are simultaneously under way. The GHG speciation is necessary for estimating SC GHG. Therefore, at this time, no SC GHG Analysis are conducted for EAs until ACAM is updated, and AF guidance is release.

F.4 Regional Setting

VSFB is within Santa Barbara County and under the jurisdiction of the SBCAPCD. The SBCAPCD is the agency responsible for the administration of federal and state air quality laws, regulations, and policies in Santa Barbara County, which is within the South Central Coast Air Basin (SCCAB). The SCCAB includes San Luis Obispo, Santa Barbara, and Ventura Counties.

The SCCAB, and all of Southern California, lies in a semi-permanent high-pressure zone of Eastern Pacific Region. The coastal island is characterized by sparse rainfall, most of which occurs in the winter season and hot, dry summers, tempered by cooling sea breezes. In Santa Barbara County, the months of heaviest precipitation are November through April, averaging 14.66 in. annually. The mean temperature in the VSFB area, as reported by monitors in Lompoc, is 58.4 degrees Fahrenheit (°F) and the mean maximum and mean minimum temperatures are 69.8°F and 47.0°F, respectively (Western Regional Climatic Center 2020).

Santa Barbara County is classified as an attainment/unclassified area for all criteria pollutants under the NAAQS. However, Santa Barbara County is currently designated as non-attainment for the state ozone and PM_{10} standard. Santa Barbara County is classified as an attainment/unclassified area for all other criteria pollutants under the CAAQS. While CEQA is not applicable to Federal Actions, the CEQA standards are provided as additional information in Table F-2. Rows highlighted yellow in Table F-2Table F-2: Santa Barbara County Attainment/Nonattainment Classification Summary show pollutants with non-attainment status under CAAQS (SBAPCD 2022).

Table F-2: Santa Barbara County Attainment/Nonattainment Classification Summary

Pollutant	Averaging Time	California Standards		National Standards	
		Concentration	Attainment Status	Concentration	Attainment Status
Ozone	8-hour	0.070 ppm	N	0.070 ppm	U/A
	1-hour	0.09 ppm		Revoked	—
Carbon Monoxide	8-hour	9.0 ppm (10 mg/m³)	A	9.0 ppm (10 m/m³)	U/A
	1-hour	20.0 ppm (23 mg/m³)		35.0 ppm (40 µg/m³)	U/A
Nitrogen Dioxide	annual average	0.030 ppm (56 µg/m³)	A	53 ppb	U/A
	1-hour	0.18 ppm (338 µg/m³)		100 ppb	U/A
Sulfur Dioxide	24-hour	0.04 ppm (105 µg/m³)	A	Revoked	—
	1 hour	0.25 ppm (655 µg/m³)		75 ppb	U/A
PM_{10}	Annual Arithmetic Mean	20 µg/m³	N	Revoked	A

Pollutant	Averaging Time	California Standards		National Standards	
		Concentration	Attainment Status	Concentration	Attainment Status
	24-hour	50 µg/m^3		150 µg/m^3	U
$PM_{2.5}$	annual arithmetic mean	12µg/m^3	U	12.0 µg/m^3	U/A
	24-hour	—	—	35 µg/m^3	U/A
Lead	30-day average	1.5 µg/m^3	A	—	—
	Rolling 3-month Average	—	—	0.15 µg/m^3	U/A
Sulfates	24-hour	25 µg/m^3	A	—	—
Hydrogen Sulfide	1 hour	0.03 ppm (42 µg/m^3)	A	—	—
Vinyl Chloride (chloroethene)	24-hour	0.010 ppm (26 µg/m^3)	—	—	—
Visibility Reducing Particles	8-hour (1000 to 1800 PST)	*	U	—	—

Notes: * Particles in sufficient amount to produce an extinction coefficient of 0.23 per kilometer when the relative humidity is less than 70 percent. This standard is intended to limit the frequency and severity of visibility impairment due to regional haze and is equivalent to a 10-mile nominal visual range; A = Attainment; N = Nonattainment; U = Unclassified;
U/A = Unclassifiable/Attainment; — = No Standard; mg/m3 = milligrams per cubic meter; µg/m3 = micrograms per cubic meter; ppm = parts per million; ppb = parts per billion
Source: SBAPCD (2022)

F.5 Federal Requirements

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

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

General Conformity: Under 40 C.F.R. Part 93, Federal agencies are required to demonstrate that Federal actions conform with the applicable SIP for Federal actions occurring in non-attainment or maintenance areas. Because Santa Barbara County is in attainment for all NAAQS, the General Conformity Rule does not apply to this Proposed Action at VSFB.

F.6 Local Requirements

CEQA is not required for air quality NEPA impact assessments for Federal actions because CEQA applies ONLY to California’s state and local government proposed actions. The following CEQA related information is provided independent to the air quality NEPA assessment to assist in future permitting (if necessary).

CEQA applies only to California's state and local government proposed actions and may apply to the air permitting district, SBCAPCD, to fulfill CEQA requirements for SBCAPCD permit actions. In Santa Barbara County, the SBCAPCD is the agency responsible for the administration of federal and state air quality laws, regulations, and policies. Included in the local air districts' tasks are monitoring of air pollution, maintenance of air quality standards through programs to control air pollutant emissions, and the promulgation of Rules and Regulations.

SBCAPCD regulations require that facilities building, altering, or replacing stationary equipment that may emit air pollutants obtain an Authority to Construct permit. Further, SBCAPCD regulations require a stationary source of air pollutants to obtain a Permit to Operate. The local air districts are responsible for the review of applications and for the approval and issuance of these permits. In addition, the SBCAPCD regulations require a stationary source that would emit 25 tons per year or more of any pollutant except CO in any calendar year during construction to obtain emission offsets.

F6.1 Summary of Impacts on Air Quality and Climate Change FOR CEQA

In addition to the analysis done in Chapter 4.1 (Air Quality and Climate Change), an additional air quality and climate change analysis was done in parallel and presented in this section. This additional analysis used the California Emissions Estimator Model (CalEEMod) to calculate all emissions associated with the Proposed Action and hold those emissions to the California Environmental Quality Act (CEQA) significance thresholds which are as, if not more, stringent than the federal thresholds used in Chapter 4.1.

F.6.2 Air Quality

Emissions from all activities analyzed below were calculated using the CalEEMod, save for launch emissions and fugitive emissions estimates regarding fueling activities since CalEEMod does not account for those. Regarding fugitive emissions from fueling activities, our fugitive emission estimates are included in the Launch Operations rows of Table F-3: Annual Criteria Pollutant Estimates (via CalEEMod)Table F-3; regarding all other fugitive emissions, CalEEMod accounts for off-gassing from asphalt paving and solvents used during construction phases and are included in those rows of Table F-3. Results for annual tonnage and pounds per day estimates in this chapter and compared to CEQA thresholds. Emissions for launch activities were calculated using the same methods as described in Chapter 4.1. For a detailed account of launch calculations see the Detailed Launch Activities Calculations section below in this Appendix.

Table F-3: Annual Criteria Pollutant Estimates (via CalEEMod)

Activity Phase	Activity Quantity	Estimated Emissions (Ton/yr)						
		CO	NOx	VOC[1]	SO_x[2]	$PM_{2.5}$	PM_{10}	Pb
2024								
Phase I-a Construction	-	0.233	0.166	0.023	0.000	0.006	0.029	0.000
Launch Operations	1	0.011	0.012	0.002	0.000	0.000	0.001	0.000
Backup Generators	-	0.057	0.145	0.010	0.000	0.003	0.003	0.000
Daytona Launch & Static Fire	1	0.000	0.325	0.000	0.000	0.000	0.000	0.000
2024 Total		**0.300**	**0.647**	**0.034**	**0.001**	**0.009**	**0.033**	**0.000**
Insignificance Threshold		**250**	**250**	**250**	**250**	**250**	**250**	**25**

Below Threshold?		**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
2025								
Phase I-b Construction	-	0.432	0.269	0.069	0.001	0.010	0.010	0.000
Launch Operations	2	0.021	0.023	0.003	0.000	0.000	0.001	0.000
Backup Generators	-	0.057	0.000	0.000	0.000	0.000	0.000	0.000
Daytona Launch & Static Fire	2	0.000	0.650	0.000	0.000	0.000	0.000	0.000
2025 Total		**0.510**	**0.942**	**0.072**	**0.001**	**0.010**	**0.011**	**0.000**
Insignificance Threshold		**250**	**250**	**250**	**250**	**250**	**250**	**25**
Below Threshold?		**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
2026								
Phase II Construction	-	0.241	0.224	0.037	0.001	0.015	0.015	0.000
Launch Operations	5	0.054	0.059	0.008	0.000	0.000	0.003	0.000
Backup Generators	-	0.057	0.000	0.000	0.000	0.000	0.000	0.000
Daytona Launch & Static Fire	5	0.000	1.625	0.000	0.000	0.000	0.000	0.000
2026 Total		**0.351**	**1.908**	**0.045**	**0.001**	**0.016**	**0.018**	**0.000**
Insignificance Threshold		**250**	**250**	**250**	**250**	**250**	**250**	**25**
Below Threshold?		**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
2027								
Launch Operations	12	0.128	0.140	0.019	0.001	0.000	0.006	0.000
Daytona Launches & Static Fires	12	0.000	3.900	0.000	0.000	0.000	0.000	0.000
Backup Generators	-	0.057	0.000	0.000	0.000	0.000	0.000	0.000
2027 Total		**0.185**	**4.040**	**0.019**	**0.001**	**0.000**	**0.006**	**0.000**
Insignificance Threshold		**250**	**250**	**250**	**250**	**250**	**250**	**25**
Below Threshold?		**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
2028								
Launch Operations	24	0.257	0.281	0.038	0.001	0.001	0.012	0.000
Daytona Launches & Static Fires	12	0.000	3.900	0.000	0.000	0.000	0.000	0.000
Laguna Launches & Static Fire	12	0.000	1.277	0.000	0.000	0.000	0.000	0.000
Backup Generators	-	0.057	0.000	0.000	0.000	0.000	0.000	0.000
2028 Total		**0.314**	**5.457**	**0.038**	**0.001**	**0.001**	**0.012**	**0.000**
Insignificance Threshold		**250**	**250**	**250**	**250**	**250**	**250**	**25**
Below Threshold?		**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
2029								
Launch Operations	48	2.722	0.394	0.004	0.000	0.000	0.000	0.000
Daytona Launches & Static Fires	24	0.000	7.799	0.000	0.000	0.000	0.000	0.000
Laguna Launches & Static Fires	24	0.000	2.554	0.000	0.000	0.000	0.000	0.000

Backup Generators	-	0.057	0.000	0.000	0.000	0.000	0.000	0.000
2029 Total		**2.778**	**10.747**	**0.004**	**0.000**	**0.000**	**0.000**	**0.000**
Insignificance Threshold		**250**	**250**	**250**	**250**	**250**	**250**	**25**
Below Threshold?		**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

1: At the time of analysis, ROC emissions factors were not available for the activities analyzed in this table. VOC emissions factors were instead used as a surrogate and reported in this table (see Section 3.1.2).
2: CalEEMod estimates SO_2, not SO_x. Because the data for SO_x was not available at the time of this analysis, SO_2 was used as a surrogate for SO_x.
Notes: Values report as 0.000 are less than 0.0005 units; Insignificance Thresholds are 250 tons per year for all emissions reported except lead (Pb) which is 25 tons per year; and Appendix F (Detailed Launch Activities Calculations) contains detailed calculations for the values reported above.
CO = Carbon Monoxide; NOx = Nitrogen Oxides; VOC = Volatile Organic Carbons; SO_x = Sulfur Oxides; $PM_{2.5}$ = Particulate Matter less than 2.5 Microns in Diameter; PM_{10} = Particulate Matter less than 10 Microns in Diameter; Pb = Lead

Under SBAPCD guidance, the daily emissions were calculated for all activities and were compared to CEQA daily maximum thresholds. Table F-4: Maximum Emissions Estimates of Pounds per Day by Activity shows daily emissions estimates in pounds per day by activity. Each activity's total was held against the daily threshold since these activities would occur at different times throughout the Proposed Action. Carbon Monoxide and Lead were not included in this table because there is currently no CEQA daily significance threshold defined for these pollutants (SBCAPCD, 2017).

Table F-4: Maximum Emissions Estimates of Pounds per Day by Activity (via CalEEMod)

Activity Phase	lb/day				
	NO_x	VOC[1]	SO_x[1]	$PM_{2.5}$	PM_{10}
Phase I-a Construction					
Sub Total	**9.553**	**1.110**	**0.019**	**0.527**	**0.738**
Screening Threshold	**240**	**240**	**240**	**240**	**80**
All Below Threshold?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Phase I-b Construction					
Sub Total	**9.147**	**1.016**	**0.018**	**0.460**	**0.846**
Screening Threshold	**240**	**240**	**240**	**240**	**80**
All Below Threshold?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Phase II Construction					
Sub Total	**11.967**	**1.282**	**0.021**	**4.738**	**45.498**
Screening Threshold	**240**	**240**	**240**	**240**	**80**
All Below Threshold?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Launch Operations					
Sub Total	**16.970**	**2.178**	**0.068**	**0.510**	**0.535**
Screening Threshold	**240**	**240**	**240**	**240**	**80**
All Below Threshold?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Backup Generators					

Sub Total	**20.686**	**1.471**	**0.040**	**0.421**	**0.431**
Screening Threshold	**240**	**240**	**240**	**240**	**80**
All Below Threshold?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

1: At the time of analysis, ROC emissions factors were not available for the activities analyzed in this table. VOC emissions factors were instead used as a surrogate and reported in this table (see Section 3.1.2).
2: CalEEMod estimates SO_2, not SO_x. Because the data for SO_x was not available at the time of this analysis, SO_2 was used as a surrogate for SO_x.
Notes: Values report as 0.000 are less than 0.005 units; Screening Thresholds are 240 pounds per day for all pollutants except CO and PM_{10} which are not defined and 80 pounds per day respectively; and Appendix F contains detailed calculations for the values reported above.
CO = Carbon Monoxide; NO_x = Nitrogen Oxides; VOC = Volatile Organic Carbons; SO_x = Sulfur Oxides; $PM_{2.5}$ = Particulate Matter less than 2.5 Microns in Diameter; PM_{10} = Particulate Matter less than 10 Microns in Diameter; Pb = Lead

Per CEQA guidance, Table F-5 summarizes emissions estimated from the diesel fired generators used during the operations phases. The generators used during operations phases will be onsite for more than 12 months and include:

- 799 Horsepower Site Ops Generator (backup)
- 210 Horsepower Hydraulic Power Units (backup)
- 280 Horsepower Environmental Control System Generator
- 300 Horsepower Inert Gas Compression Generator
- 1496 Horsepower Water Pump Generator (backup)

These estimates are already included in the estimates stated in Table F-3.

Table F-5: Isolated Generator as Primary Power Emissions (via CalEEMod)

Activity Phase	Annual Launch Quantity	tons/year						
		CO	NO_x	VOC[1]	SO_x[2]	$PM_{2.5}$	PM_{10}	Pb
2024 Total	**1**	**0.061**	**0.150**	**0.011**	**0.000**	**0.003**	**0.003**	**0.000**
2025 Total	**2**	**0.064**	**0.154**	**0.012**	**0.000**	**0.003**	**0.003**	**0.000**
2026 Total	**5**	**0.076**	**0.169**	**0.013**	**0.000**	**0.004**	**0.004**	**0.000**
2027 Total	**12**	**0.103**	**0.202**	**0.018**	**0.001**	**0.005**	**0.005**	**0.000**
2028 Total	**24**	**0.150**	**0.259**	**0.025**	**0.001**	**0.007**	**0.007**	**0.000**
2029 Total	**48**	**0.243**	**0.372**	**0.040**	**0.001**	**0.010**	**0.011**	**0.000**

1: At the time of analysis, ROC emissions factors were not available for the activities analyzed in this table. VOC emissions factors were instead used as a surrogate and reported in this table (see Section 3.1.2).
2: CalEEMod estimates SO_2, not SO_x. Because the data for SO_x was not available at the time of this analysis, SO_2 was used as a surrogate for SO_x.
Notes: Values report as 0.000 are less than 0.0005 units; and Appendix F contains detailed calculations for the values reported above.
CO = Carbon Monoxide; NO_x = Nitrogen Oxides; VOC = Volatile Organic Carbons; SO_x = Sulfur Oxides; $PM_{2.5}$ = Particulate Matter less than 2.5 Microns in Diameter; PM_{10} = Particulate Matter less than 10 Microns in Diameter; Pb = Lead

F.6.3 CEQA Greenhouse Gases & Climate Change

Under CEQA, the California Natural Resources Agency recently adopted amendments to the CEQA guidelines to address global climate change impacts. According to Appendix G of the CEQA Guidelines, the following criteria are considered to establish a significance threshold for GHG impacts:

Would the project:

- Generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment?
- Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHG?

As discussed in Section 15064.4 of the CEQA Regulations, the determination of the significance of GHG emissions calls for a careful judgment by the lead agency consistent with the provisions included therein. A lead agency should make a good-faith effort, based to the extent possible on scientific and factual data, to describe, calculate, or estimate the amount of GHG emissions resulting from a project. A lead agency shall have discretion to determine, in the context of a particular project, whether to

- Use a model or methodology to quantify GHG emissions resulting from a project, and which model or methodology to use. The lead agency has discretion to select the model or methodology it considers most appropriate provided it supports its decision with substantial evidence. The lead agency should explain the limitations of the particular model or methodology selected for use; or
- rely on a qualitative analysis or performance-based standards.

On 30 April 2015, the SBCAPCD adopted revisions to their Environmental Review Guidelines to CEQA by adding significance thresholds for GHG cumulative impacts. The significance threshold for GHG emissions as defined by the SBAPCD is 10,000 metric tons of CO_2e per year. As a lead agency, the SBCAPCD is required to address the cumulative impacts of GHG emissions from the project as part of their CEQA review during the permitting process, should permits be mandated. Should emissions exceed the screening threshold, mitigation measures could be required to reduce emissions of GHGs.

Table F-6: Annual Greenhouse Emissions (via CalEEMod) show the estimates of CO_2e for each year. These estimates include all of the activities carried out in each year including construction (if applicable; including fugitive emissions), generator usage, launch operations (including fugitive emissions), and launch activities.

Table F-6: Annual Greenhouse Emissions (via CalEEMod)

Year	Metric Tons CO_2e	Insignificance Threshold	Below Threshold?
2024	419.39	**10,000**	**Yes**
2025	765.47	**10,000**	**Yes**
2026	1,809.93	**10,000**	**Yes**
2027	4,195.25	**10,000**	**Yes**
2028	5,589.39	**10,000**	**Yes**
2029	11,150.18	**10,000**	**No***

CO_2e: Carbon Dioxide Equivalent
* 2028 conservatively assumes generators would be used during 48 launches; however, Phantom will likely have adequate electrical utilities by that time to fully power all launch actions.

F.6.4 Health Risk Assessment

The five diesel fired generators used during operations phases would be onsite for more than 12 months and require Health Risk Assessments (HRAs) per Santa Barbara County Air Pollution Control District's (SBCAPCD) guidance. An HRA was completed using the SBCAPCD's DICE Screening Tool for each of these 5 generators. A full break down of the DICE Screening Tool can be found on Santa Barbara County Air Pollution Control District's website (SBAPCD, 2018). Phantom Space has proposed use of the generators described below.

- 799 Horsepower Site Ops Generator
- 210 Horsepower Hydraulic Power Units
- 280 Horsepower Environmental Control System Generator
- 300 Horsepower Inert Gas Compression Generator
- 1496 Horsepower Water Pump Generator

Note that the 799 Horsepower Site Ops Generator, 210 Horsepower Hydraulic Power Units, and 1496 Horsepower Water Pump Generator will be kept onsite as backups generators. Backup generators are run 50 hours annually to ensure their integrity.

The DICE Screening tool provides a user interface where you may enter *Dispersion* (Urban -or- Rural), *Meteorological Data Set* (Santa Maria Airport -or- Santa Barbara Airport), *Building Downwash* (Include Building Downwash -or- No Building Downwash), *Engine Size, Distance from Source* (*Nearest Resident* -and- *Nearest Worker).* Figure F-1 shows the User Interface of the DICE Screening Tool:

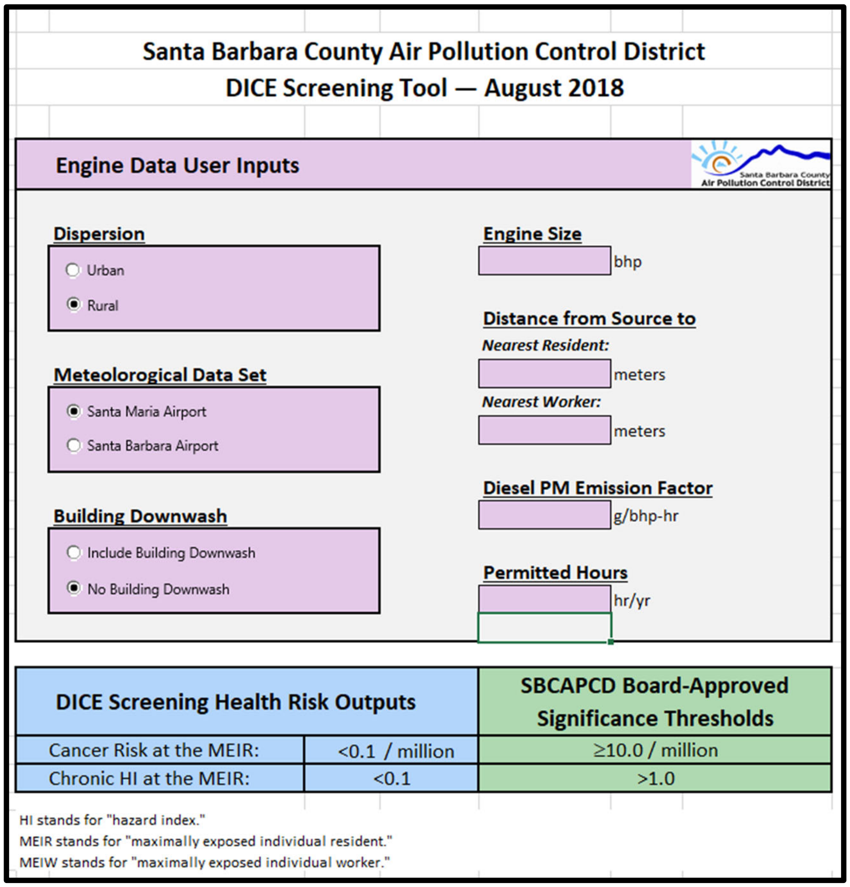

Figure F-1: DICE Screening Tool Inputs

For the proposed generators, the following values seen in Table F-7 below for the fixed parameters were held constant while using the screening tool.

Table F-7: Constant Parameter Used In Health Risk Assessments

Parameter	Value	Note/Source
Dispersion	Rural	Vandenberg Space Force Base is rural
Meteorological Data Set	Santa Maria Airport	Santa Maria Airport is closer in proximity to the launch site than Santa Barbara Airport (the other option)
Building Downwash	No Building Downwash	This does not apply to this project
Nearest Resident	20,533.6 meters	Approximate distance to Lompoc (the closest residential area)
Nearest Worker	10 m	Conservative estimate to nearest worker
Diesel PM Emission Factor	0.15 g/bhp-hour	California Air Resources Board (2022)

For the proposed generators, all HRAs are presented in Table F-8. All generators for all years are below the cancer risk at the maximally exposed individual worker and the chronic hazard index at the maximally exposed individual worker.

Table F-8: Operations Health Risk Assessments Results

Year	Hours	Value Type	DICE Screening Health Risk Outputs	Threshold	Below Threshold?
799 Horsepower Site Ops Generator					
2024	50	Cancer Risk at the MEIW	2	≥ 10/Million	Yes
		Chronic HI at the MEIW	<0.1	>1.0	Yes
2025	50	Cancer Risk at the MEIW	2	≥ 10/Million	Yes
		Chronic HI at the MEIW	<0.1	>1.0	Yes
2026	50	Cancer Risk at the MEIW	2	≥ 10/Million	Yes
		Chronic HI at the MEIW	<0.1	>1.0	Yes
2027	50	Cancer Risk at the MEIW	2	≥ 10/Million	Yes
		Chronic HI at the MEIW	<0.1	>1.0	Yes
2028	50	Cancer Risk at the MEIW	2	≥ 10/Million	Yes
		Chronic HI at the MEIW	<0.1	>1.0	Yes
2029	50	Cancer Risk at the MEIW	2	≥ 10/Million	Yes
		Chronic HI at the MEIW	<0.1	>1.0	Yes
210 Horsepower Hydraulic Power Units					
Year	**Hours**	**Value Type**	**DICE Screening Health Risk Outputs**	**Threshold**	**Below Threshold?**
2024	50	Cancer Risk at the MEIW	2	≥ 10/Million	Yes
		Chronic HI at the MEIW	<0.1	>1.0	Yes
2025	50	Cancer Risk at the MEIW	2	≥ 10/Million	Yes
		Chronic HI at the MEIW	<0.1	>1.0	Yes
2026	50	Cancer Risk at the MEIW	2	≥ 10/Million	Yes
		Chronic HI at the MEIW	<0.1	>1.0	Yes
2027	50	Cancer Risk at the MEIW	2	≥ 10/Million	Yes
		Chronic HI at the MEIW	<0.1	>1.0	Yes
2028	50	Cancer Risk at the MEIW	2	≥ 10/Million	Yes
		Chronic HI at the MEIW	<0.1	>1.0	Yes
2029	50	Cancer Risk at the MEIW	2	≥ 10/Million	Yes
		Chronic HI at the MEIW	<0.1	>1.0	Yes
280 Horsepower Environmental Control System Generator					
Year	**Hours**	**Value Type**	**DICE Screening Health Risk Outputs**	**Threshold**	**Below Threshold?**
2024	4	Cancer Risk at the MEIW	0.1	≥ 10/Million	Yes
		Chronic HI at the MEIW	<0.1	>1.0	Yes
2025	8	Cancer Risk at the MEIW	0.3	≥ 10/Million	Yes
		Chronic HI at the MEIW	<0.1	>1.0	Yes
2026	20	Cancer Risk at the MEIW	0.6	≥ 10/Million	Yes
		Chronic HI at the MEIW	<0.1	>1.0	Yes

Year	Hours	Value Type	DICE Screening Health Risk Outputs	Threshold	Below Threshold?
2027	**48**	**Cancer Risk at the MEIW**	1.5	**≥ 10/Million**	**Yes**
		Chronic HI at the MEIW	<0.1	**>1.0**	**Yes**
2028	**96**	**Cancer Risk at the MEIW**	3	**≥ 10/Million**	**Yes**
		Chronic HI at the MEIW	<0.1	**>1.0**	**Yes**
2029	**192**	**Cancer Risk at the MEIW**	6	**≥ 10/Million**	**Yes**
		Chronic HI at the MEIW	<0.1	**>1.0**	**Yes**
300 Inert Gas Compression Generator					
Year	**Hours**	**Value Type**	**DICE Screening Health Risk Outputs**	**Threshold**	**Below Threshold?**
2024	**12**	**Cancer Risk at the MEIW**	0.4	**≥ 10/Million**	**Yes**
		Chronic HI at the MEIW	<0.1	**>1.0**	**Yes**
2025	**24**	**Cancer Risk at the MEIW**	0.8	**≥ 10/Million**	**Yes**
		Chronic HI at the MEIW	<0.1	**>1.0**	**Yes**
2026	**60**	**Cancer Risk at the MEIW**	2	**≥ 10/Million**	**Yes**
		Chronic HI at the MEIW	<0.1	**>1.0**	**Yes**
2027	**144**	**Cancer Risk at the MEIW**	4.8	**≥ 10/Million**	**Yes**
		Chronic HI at the MEIW	<0.1	**>1.0**	**Yes**
2028	**288**	**Cancer Risk at the MEIW**	9.7	**≥ 10/Million**	**Yes**
		Chronic HI at the MEIW	<0.1	**>1.0**	**Yes**
2029	**576**	**Cancer Risk at the MEIW**	19.3	**≥ 10/Million**	No
		Chronic HI at the MEIW	<0.1	**>1.0**	**Yes**
1496 Horsepower Water Pump Generator					
Year	**Hours**	**Value Type**	**DICE Screening Health Risk Outputs**	**Threshold**	**Below Threshold?**
2024	**50**	**Cancer Risk at the MEIW**	2.9	**≥ 10/Million**	**Yes**
		Chronic HI at the MEIW	<0.1	**>1.0**	**Yes**
2025	**50**	**Cancer Risk at the MEIW**	2.9	**≥ 10/Million**	**Yes**
		Chronic HI at the MEIW	<0.1	**>1.0**	**Yes**
2026	**50**	**Cancer Risk at the MEIW**	2.9	**≥ 10/Million**	**Yes**
		Chronic HI at the MEIW	<0.1	**>1.0**	**Yes**
2027	**50**	**Cancer Risk at the MEIW**	2.9	**≥ 10/Million**	**Yes**
		Chronic HI at the MEIW	<0.1	**>1.0**	**Yes**
2028	**50**	**Cancer Risk at the MEIW**	2.9	**≥ 10/Million**	**Yes**
		Chronic HI at the MEIW	<0.1	**>1.0**	**Yes**
2029	**50**	**Cancer Risk at the MEIW**	2.9	**≥ 10/Million**	**Yes**
		Chronic HI at the MEIW	<0.1	**>1.0**	**Yes**

MEIW = Maximally Exposed Individual Worker; HI = Hazard Index

F.7 Detailed Launch Activities Calculations

The below tables and formulas give a breakdown of how criteria air pollutants and greenhouse gas (GHG) emissions estimates were calculated for launch activities associated with the Proposed Action. Inputs and emissions factors for these calculations were gathered from Phantom Space's *Laguna Trajectory File* (Phantom Space, 2022) and *Daytona Trajectory File* (Phantom Space, 2022) Chapter 2.0 Description of the Proposed Action and Alternatives of this document, and from the *Environmental Assessment for SpaceX Falcon Launches at Kennedy Space Center and Cape Canaveral Air Force Station*, February 2020.

F.7.1 Criteria Air Pollutants

Table F-8 shows the emissions factors (lb emitted per burn second) for Rocket Propellant 1 and Liquid Oxygen (LOX and RP1). Note lead (Pb) is not emitted during any launches or static fires since lead does not exist in RP1 and LOX.

Table F-8: Emission Factors for Criteria Air Pollutants (lb emitted per sec propellant burned)

CO	NO_x	VOC	SO_x	$PM_{2.5}$	PM_{10}
0.000	2.313	0.000	0.000	0.000	0.000

Source – Environmental Assessment for SpaceX Falcon Launches at Kennedy Space Center and Cape Canaveral Air Force Station, February 2020

NOTE: Values reported as 0.000 are less than 0.00049, however, the actual values were still used in calculations.

Table F-9 shows the first step of calculations which finds the tons emitted per launch activity found using the inputs in Table F-8 and emissions factors in Table F-9. Table F-10 shows the total annual launch activity emissions in tons by activity type and annual total. To calculate these emissions estimates, we used the following process.

EmissionsPerLaunch = TimeBurned * EmissionsFactor * NumberOfEngines *PoundsToTonsRatio

EmissionsAnnual = EmissionsPerLaunch * Quantity

EmissionsPerLaunch = Emissions estimates in tons per launch activity

EmissionsAnnual = Emissions estimates in tons per year per launch activity

TimeBurned = The number of seconds fuel burned per activity (Daytona – 29, Laguna – 24)

EmissionsFactor = pounds pollutant emitted per second propellant burned (Table F-6)

NumberOfEngines = Number of engines per launch vehicle (Daytona – 9, Laguna – 3)

PoundsToTonsRatio = The ratio used to convert pounds to tons (0.0005)

Quantity = The quantity of launch activities per year

Table F-9: Criteria Air Emission Estimates by Launch Activity and Total Annual Criteria Air Emission Estimates

	Criteria Pollutants Emissions (ton/yr)					
Activity	CO	NOx	VOC	SOx	PM2.5	PM10
Daytona						
Single Launch	0.000	0.302	0.000	0.000	0.000	0.000
Single Static Fire	0.000	0.023	0.000	0.000	0.000	0.000
24 Launches and Static Fires	**0.000**	**7.799**	**0.000**	**0.000**	**0.000**	**0.000**
Laguna						
Single Launch	0.000	0.083	0.000	0.000	0.000	0.000
Single Static Fire	0.000	0.023	0.000	0.000	0.000	0.000
24 Launches and Static Fires	**0.000**	**2.554**	**0.000**	**0.000**	**0.000**	**0.000**

NOTE: Values reported as 0.000 are less than 0.00049, however, the actual values were still used in calculations.

F.7.2 Greenhouse Gas Emissions

For GHG emissions, the same sources are used for emissions factors and CO_2e values as for criteria pollutant estimates.

Inputs for GHG calculations are summarized in Table F-10 below and GHG Emission Tonnage by Launch Activity and Total Annual GHG Emissions are presented in Table F-11. Note that for GHG emissions, the amount of fuel burned considered for calculations is not just below 3,000 ft like for criteria pollutants, but instead is for the total fuel burned up to an elevation of approximately 100,000 ft.

Table F-10: Emission Factors for GHGs (Metric Tons emitted per event)

Type	Fuel	CO2e / event
Launch	RP1/LOX	387.100
Static Fire	RP1/LOX	73.714

NOTE: Values reported as 0.000 are less than 0.00049, however, the actual values were still used in calculations.

Launch emissions include fuel spent up to 100,000 ft MSL (approximately 105 seconds). Source: Environmental Assessment for SpaceX Falcon Launches at Kennedy Space Center and Cape Canaveral Air Force Station, February 2020 used to determine CO2e per launch or landing

Table F-11: GHG Emission Tonnage by Launch Activity and Total Annual GHG Emissions

Activity	Metric Tons Emitted CO_2
Daytona	
Single Launch	387.100
Single Static Fire	73.714
24 Launches	11,059.54
Laguna	
Single Launch	129.033
Single Static Fire	24.571
24 Launches	3,686.49

NOTE: Values reported as 0.000 are less than 0.00049, however, the actual values were still used in calculations. This is why you see 0.000 for some values in the Per Launch Activity section but values greater than 0.000 in the Total section.

F.8 Fugitive Emissions Calculations

Fugitive emissions were calculated for the Proposed Action. Fugitive emissions could be emitted during the loading of fuel (Jet A and RP1) from the vehicle they are delivered into their storage tank, and from the tank they are stored in into the launch vehicle. The process for calculating fugitive emissions is detailed in the U.S. EPA's *Guidelines for Calculating and Reporting Emissions from Bulk Loading Operations* (USEPA 2009). The process used is detailed below:

VOC = Q * L

VOC = Emissions of VOC (lbs)

Q = Throughput in 1,000 gallons loaded

L = Loading Loss Factor (lbs/1,000 Gallon Loaded) can be found in the Default Emission Factor tables or determined using information defined in US EPA AP-42

L = (12.46 * S * P *M) / T

S = Saturation Factor

P = True Vapor Pressure, psia

M = Vapor Molecular Weight, lb/lb-mole

T = Temperature of the Liquid being Loaded, °R (°F + 460)

The above formulas were used to calculate the below values for both static fires and launch events using the U.S. EPA's *AP-42* (USEPA 2015, 2019). Note that these were calculated separately from all other emissions associated with static fire and launch events but were included in total emissions for these activities (Table F-12).

Separate fugitive emissions estimates were calculated for each type of fuel used under the Proposed Action. For each type of fuel, the following inputs were used for Saturation Factor (S), True Vapor Pressure (P), Vapor Molecular Weight (M), and Temperature of the Liquid being Loaded(T).

1. For Jet A:
    a. **S** = 1.45 – USEPA (2008)
    b. **P** = 0.008 – Hatch Consulting (2021)
    c. **M** = 130 – Hatch Consulting (2021)
    d. **T** = 520 – Hatch Consulting (2021)
2. For RP 1:
    a. **S** = 1.45 – USEPA (2009)
    b. **P** = 0.01 – Aerojet Liquid Rocket Company (1974)
    c. **M** = 175 – North Western University (n.d.)
    d. **T** = 520 – Hatch Consulting (2021) Note that at the time of analysis this data was not available for RP1. This value comes from Jet A and is used as a surrogate since the 2 fuels are very similar in chemical composition.

Table F-12 below shows fugitive emissions associated with the year of maximum launch activates (2028).

Table F-12: Fugitive Emissions Estimates

	VOC (lb)
24 Daytona Launches + Static Fires	7.359
24 Laguna Launches + Static Fires	47.967
Total	**55.327**

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DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

1. General Information

- Action Location
Base: VANDENBERG AFB
State: California
County(s): Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Action Title: Phantom Space Corporation Daytona-E and Laguna-E Launch Operations at Space Launch Complex 5, Vandenberg Space Force Base, California

- Project Number/s (if applicable):

- Projected Action Start Date: 1 / 2024

- Action Purpose and Need:

- Action Description:

Space Launch Delta 30 (SLD 30), Vandenberg Space Force Base (VSFB or Base), California, prepared this Environmental Assessment (EA). This EA evaluates the potential environmental impacts associated with operating Phantom Space Corporation's (Phantom) Daytona-E and Laguna-E launch vehicles and the associated construction of a new launch facility at Space Launch Complex (SLC-5) on VSFB. Congress, under the U.S. Commercial Space Launch Act (CSLA), 51 United States Code (U.S.C.) Subtitle V, Chapter 509, Sections 50901-50923, provided the Department of Transportation (DOT) statutory direction to, in part, "protect the public health and safety, safety of property, and national security and foreign policy interests of the United States" while "strengthening and [expanding] that United States space transportation infrastructure, including the enhancement of United States launch sites and launch-site support facilities, and development of reentry sites, with Government, State, and private sector involvement, to support the full range of United States space-related activities." Within the DOT, the Secretary of Transportation's authority under the CSLA has been delegated to the Federal Aviation Administration (FAA) Office of Commercial Space Transportation. Per agreements between the Department of the Air Force (DAF) and the FAA, the DAF will act as the lead agency for preparing and coordinating the National Environmental Policy Act (NEPA) documentation for the Proposed action and the FAA will act as a cooperating agency to review the EA preparation.
This EA was prepared to enable the DAF, FAA, and the public to understand the potential environmental impacts of the proposed Daytona-E launch program. Because FAA regulations (14 Code of Federal Regulations [C.F.R.] parts 400–460) require an applicant to provide enough information for the FAA to analyze the potential environmental impacts associated with proposed launch activities, this EA has been prepared to comply with the requirements of the NEPA as amended (42 U.S.C. 4321 et seq.); the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 C.F.R. parts 1500–1508); the DAF's Environmental Impact Analysis Process (32 C.F.R. 989), and FAA Order 1050.1F, Environmental Impacts: Policies and Procedures.

- Point of Contact
Name: Phantom Space Corporation Daytona-E and Laguna-E Launch Operations at Space Launch Complex 5, Vandenberg Space Force Base, California
Title: Associate Environmental Scientist
Organization: ManTech
Email:
Phone Number:

- Activity List:

Activity Type		Activity Title
2.	Construction / Demolition	Phase Ia - 19 Day Equipment

3.	Construction / Demolition	Phase 1a - Vendor Trips
4.	Personnel	Worker Trips
5.	Construction / Demolition	Phase 1a - 15 day equipment
6.	Construction / Demolition	Phase 1a - 13 Day Equipment
7.	Construction / Demolition	Phase Ia - 10 day equipment
8.	Construction / Demolition	Phase Ia - 8 day equipment
9.	Construction / Demolition	Phase Ia - 5 day equipment
10.	Construction / Demolition	Phase Ia - 1 day equipment

Emission factors and air emission estimating methods come from the United States Air Force's Air Emissions Guide for Air Force Stationary Sources, Air Emissions Guide for Air Force Mobile Sources, and Air Emissions Guide for Air Force Transitory Sources.

2. Construction / Demolition

2.1 General Information & Timeline Assumptions

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase Ia - 19 Day Equipment

- Activity Description:

- Activity Start Date
Start Month: 1
Start Month: 2024

- Activity End Date
Indefinite: False
End Month: 1
End Month: 2024

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.016614
SO_x	0.000243
NO_x	0.108346
CO	0.081594
PM 10	0.004127

Pollutant	Total Emissions (TONs)
PM 2.5	0.004127
Pb	0.000000
NH_3	0.000000
CO_2e	23.9

2.1 Building Construction Phase

2.1.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2024

- Phase Duration

Number of Month: 0
Number of Days: 19

2.1.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 9000
Height of Building (ft): 12
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 7

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Dumpers/Tenders Composite	1	8
Rubber Tired Dozers Composite	1	8
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 0

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 0

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 0

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

2.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Dumpers/Tenders Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0091	0.0001	0.0581	0.0313	0.0021	0.0021	0.0008	7.6451
Rubber Tired Dozers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.1747	0.0024	1.1695	0.6834	0.0454	0.0454	0.0157	239.47
Tractors/Loaders/Backhoes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**

Emission Factors	0.0348	0.0007	0.1980	0.3589	0.0068	0.0068	0.0031	66.875

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.164	000.003	000.093	001.268	000.017	000.006		000.025	00285.560
LDGT	000.217	000.004	000.177	001.754	000.018	000.007		000.027	00356.560
HDGV	000.273	000.005	000.286	002.004	000.029	000.010		000.052	00545.059
LDDV	000.026	000.002	000.237	000.323	000.031	000.020		000.008	00225.935
LDDT	000.017	000.003	000.082	000.161	000.025	000.013		000.009	00309.267
HDDV	000.176	000.007	002.043	000.559	000.124	000.067		000.033	00760.601
MC	005.697	000.002	000.762	018.634	000.019	000.008		000.053	00210.432

2.1.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase

$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)

0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
VMT_{VT} = BA * BH * (0.38 / 1000) * HT

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

3. Construction / Demolition

3.1 General Information & Timeline Assumptions

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase 1a - Vendor Trips

- Activity Description:

- Activity Start Date
Start Month: 1
Start Month: 2024

- Activity End Date
Indefinite: False
End Month: 2
End Month: 2024

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.010771
SO_x	0.000236
NO_x	0.047926
CO	0.048960
PM 10	0.001478

Pollutant	Total Emissions (TONs)
PM 2.5	0.001478
Pb	0.000000
NH_3	0.000000
CO_2e	23.6

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

3.1 Building Construction Phase

3.1.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2024

- Phase Duration
Number of Month: 1
Number of Days: 15

3.1.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 9000
Height of Building (ft): 12
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 7

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Off-Highway Trucks Composite	1	4

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 0

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 0

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 80

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

3.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

Off-Highway Trucks Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.1188	0.0026	0.5286	0.5400	0.0163	0.0163	0.0107	260.33

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.164	000.003	000.093	001.268	000.017	000.006		000.025	00285.560
LDGT	000.217	000.004	000.177	001.754	000.018	000.007		000.027	00356.560
HDGV	000.273	000.005	000.286	002.004	000.029	000.010		000.052	00545.059
LDDV	000.026	000.002	000.237	000.323	000.031	000.020		000.008	00225.935
LDDT	000.017	000.003	000.082	000.161	000.025	000.013		000.009	00309.267
HDDV	000.176	000.007	002.043	000.559	000.124	000.067		000.033	00760.601
MC	005.697	000.002	000.762	018.634	000.019	000.008		000.053	00210.432

3.1.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase

$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

4. Personnel

4.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Worker Trips

- Activity Description:

- Activity Start Date
Start Month: 1
Start Year: 2024

- Activity End Date
Indefinite: No
End Month: 2
End Year: 2024

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.024140
SO_x	0.000288
NO_x	0.012553

Pollutant	Total Emissions (TONs)
PM 2.5	0.000534
Pb	0.000000
NH_3	0.002143

CO	0.151584
PM 10	0.001418

CO_2e	26.2

4.2 Personnel Assumptions

- Number of Personnel

Active Duty Personnel: 0
Civilian Personnel: 15
Support Contractor Personnel: 0
Air National Guard (ANG) Personnel: 0
Reserve Personnel: 0

- Default Settings Used: No

- Average Personnel Round Trip Commute (mile): 80

- Personnel Work Schedule

Active Duty Personnel: 5 Days Per Week
Civilian Personnel: 7 Days Per Week
Support Contractor Personnel: 5 Days Per Week
Air National Guard (ANG) Personnel: 4 Days Per Week
Reserve Personnel: 4 Days Per Month

4.3 Personnel On Road Vehicle Mixture

- On Road Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	37.55	60.32	0	0.03	0.2	0	1.9
GOVs	54.49	37.73	4.67	0	0	3.11	0

4.4 Personnel Emission Factor(s)

- On Road Vehicle Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.164	000.003	000.093	001.268	000.017	000.006		000.025	00285.560
LDGT	000.217	000.004	000.177	001.754	000.018	000.007		000.027	00356.560
HDGV	000.273	000.005	000.286	002.004	000.029	000.010		000.052	00545.059
LDDV	000.026	000.002	000.237	000.323	000.031	000.020		000.008	00225.935
LDDT	000.017	000.003	000.082	000.161	000.025	000.013		000.009	00309.267
HDDV	000.176	000.007	002.043	000.559	000.124	000.067		000.033	00760.601
MC	005.697	000.002	000.762	018.634	000.019	000.008		000.053	00210.432

4.5 Personnel Formula(s)

- Personnel Vehicle Miles Travel for Work Days per Year

$VMT_P = NP * WD * AC$

VMT_P: Personnel Vehicle Miles Travel (miles/year)
NP: Number of Personnel
WD: Work Days per Year
AC: Average Commute (miles)

- Total Vehicle Miles Travel per Year

$VMT_{Total} = VMT_{AD} + VMT_C + VMT_{SC} + VMT_{ANG} + VMT_{AFRC}$

VMT_{Total}: Total Vehicle Miles Travel (miles)
VMT_{AD}: Active Duty Personnel Vehicle Miles Travel (miles)
VMT_{C}: Civilian Personnel Vehicle Miles Travel (miles)
VMT_{SC}: Support Contractor Personnel Vehicle Miles Travel (miles)
VMT_{ANG}: Air National Guard Personnel Vehicle Miles Travel (miles)
VMT_{AFRC}: Reserve Personnel Vehicle Miles Travel (miles)

- Vehicle Emissions per Year
$V_{POL} = (VMT_{Total} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{Total}: Total Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Personnel On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

5. Construction / Demolition

5.1 General Information & Timeline Assumptions

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase 1a - 15 day equipment

- Activity Description:

- Activity Start Date
Start Month: 1
Start Month: 2024

- Activity End Date
Indefinite: False
End Month: 1
End Month: 2024

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.001818
SO_x	0.000036
NO_x	0.014784
CO	0.016044
PM 10	0.000546

Pollutant	Total Emissions (TONs)
PM 2.5	0.000546
Pb	0.000000
NH_3	0.000000
CO_2e	3.7

5.1 Building Construction Phase

5.1.1 Building Construction Phase Timeline Assumptions

- Phase Start Date

Start Month: 1
Start Quarter: 1
Start Year: 2024

- Phase Duration
Number of Month: 0
Number of Days: 15

5.1.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 9000
Height of Building (ft): 12
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 7

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Generator Sets Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 0

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 0

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 0

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

5.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Generator Sets Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0303	0.0006	0.2464	0.2674	0.0091	0.0091	0.0027	61.061

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e

LDGV	000.164	000.003	000.093	001.268	000.017	000.006		000.025	00285.560
LDGT	000.217	000.004	000.177	001.754	000.018	000.007		000.027	00356.560
HDGV	000.273	000.005	000.286	002.004	000.029	000.010		000.052	00545.059
LDDV	000.026	000.002	000.237	000.323	000.031	000.020		000.008	00225.935
LDDT	000.017	000.003	000.082	000.161	000.025	000.013		000.009	00309.267
HDDV	000.176	000.007	002.043	000.559	000.124	000.067		000.033	00760.601
MC	005.697	000.002	000.762	018.634	000.019	000.008		000.053	00210.432

5.1.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase
CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
VMT_{VE} = BA * BH * (0.42 / 1000) * HT

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
VMT_{WT} = WD * WT * 1.25 * NE

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
VMT_{VT} = BA * BH * (0.38 / 1000) * HT

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

6. Construction / Demolition

6.1 General Information & Timeline Assumptions

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase 1a - 13 Day Equipment

- Activity Description:

- Activity Start Date
Start Month: 1
Start Month: 2024

- Activity End Date
Indefinite: False
End Month: 1
End Month: 2024

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.012293
SO_x	0.000239
NO_x	0.069774
CO	0.090355
PM 10	0.002772

Pollutant	Total Emissions (TONs)
PM 2.5	0.002772
Pb	0.000000
NH_3	0.000000
CO_2e	22.7

6.1 Building Construction Phase

6.1.1 Building Construction Phase Timeline Assumptions

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2024

- Phase Duration
Number of Month: 0
Number of Days: 13

6.1.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 9000
Height of Building (ft): 102
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 7

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Cranes Composite	1	8
Graders Composite	1	8
Rubber Tired Loaders Composite	1	8
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 0

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 0

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 0

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

6.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Cranes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e

Emission Factors	0.0715	0.0013	0.4600	0.3758	0.0161	0.0161	0.0064	128.78
Graders Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0714	0.0014	0.3708	0.5706	0.0167	0.0167	0.0064	132.90
Rubber Tired Loaders Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0587	0.0012	0.3130	0.4323	0.0137	0.0137	0.0053	108.74
Tractors/Loaders/Backhoes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0348	0.0007	0.1980	0.3589	0.0068	0.0068	0.0031	66.875

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.164	000.003	000.093	001.268	000.017	000.006		000.025	00285.560
LDGT	000.217	000.004	000.177	001.754	000.018	000.007		000.027	00356.560
HDGV	000.273	000.005	000.286	002.004	000.029	000.010		000.052	00545.059
LDDV	000.026	000.002	000.237	000.323	000.031	000.020		000.008	00225.935
LDDT	000.017	000.003	000.082	000.161	000.025	000.013		000.009	00309.267
HDDV	000.176	000.007	002.043	000.559	000.124	000.067		000.033	00760.601
MC	005.697	000.002	000.762	018.634	000.019	000.008		000.053	00210.432

6.1.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase

$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)

WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

7. Construction / Demolition

7.1 General Information & Timeline Assumptions

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase Ia - 10 day equipment

- Activity Description:

- Activity Start Date
Start Month: 1
Start Month: 2024

- Activity End Date
Indefinite: False
End Month: 1
End Month: 2024

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.003468
SO_x	0.000060
NO_x	0.020884
CO	0.031096
PM 10	0.000908

Pollutant	Total Emissions (TONs)
PM 2.5	0.000908
Pb	0.000000
NH_3	0.000000
CO_2e	5.7

7.1 Building Construction Phase

7.1.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2024

- Phase Duration
Number of Month: 0
Number of Days: 10

7.1.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 9000
Height of Building (ft): 12
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 7

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Cement and Mortar Mixers Composite	1	8
Rollers Composite	1	8
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 0

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 0

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips

Average Vendor Round Trip Commute (mile): 0

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

7.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Cement and Mortar Mixers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0085	0.0001	0.0534	0.0413	0.0020	0.0020	0.0007	7.2673
Rollers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0434	0.0007	0.2707	0.3772	0.0139	0.0139	0.0039	67.130
Tractors/Loaders/Backhoes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0348	0.0007	0.1980	0.3589	0.0068	0.0068	0.0031	66.875

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.164	000.003	000.093	001.268	000.017	000.006		000.025	00285.560
LDGT	000.217	000.004	000.177	001.754	000.018	000.007		000.027	00356.560
HDGV	000.273	000.005	000.286	002.004	000.029	000.010		000.052	00545.059
LDDV	000.026	000.002	000.237	000.323	000.031	000.020		000.008	00225.935
LDDT	000.017	000.003	000.082	000.161	000.025	000.013		000.009	00309.267
HDDV	000.176	000.007	002.043	000.559	000.124	000.067		000.033	00760.601
MC	005.697	000.002	000.762	018.634	000.019	000.008		000.053	00210.432

7.1.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)

0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
VMT_{WT} = WD * WT * 1.25 * NE

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
VMT_{VT} = BA * BH * (0.38 / 1000) * HT

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

8. Construction / Demolition

8.1 General Information & Timeline Assumptions

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase Ia - 8 day equipment

- Activity Description:

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

- Activity Start Date
Start Month: 1
Start Month: 2024

- Activity End Date
Indefinite: False
End Month: 1
End Month: 2024

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.002781
SO_x	0.000058
NO_x	0.015091
CO	0.024682
PM 10	0.000602

Pollutant	Total Emissions (TONs)
PM 2.5	0.000602
Pb	0.000000
NH_3	0.000000
CO_2e	5.4

8.1 Building Construction Phase

8.1.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2024

- Phase Duration
Number of Month: 0
Number of Days: 8

8.1.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 9000
Height of Building (ft): 12
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 7

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Excavators Composite	1	8
Pumps Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 0

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 0

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 0

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

8.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Excavators Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0584	0.0013	0.2523	0.5090	0.0100	0.0100	0.0052	119.71
Pumps Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0285	0.0005	0.2193	0.2623	0.0088	0.0088	0.0025	49.670

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.164	000.003	000.093	001.268	000.017	000.006		000.025	00285.560
LDGT	000.217	000.004	000.177	001.754	000.018	000.007		000.027	00356.560
HDGV	000.273	000.005	000.286	002.004	000.029	000.010		000.052	00545.059
LDDV	000.026	000.002	000.237	000.323	000.031	000.020		000.008	00225.935
LDDT	000.017	000.003	000.082	000.161	000.025	000.013		000.009	00309.267
HDDV	000.176	000.007	002.043	000.559	000.124	000.067		000.033	00760.601
MC	005.697	000.002	000.762	018.634	000.019	000.008		000.053	00210.432

8.1.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase
$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

9. Construction / Demolition

9.1 General Information & Timeline Assumptions

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase Ia - 5 day equipment

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

- Activity Description:

- Activity Start Date
Start Month: 1
Start Month: 2024

- Activity End Date
Indefinite: False
End Month: 1
End Month: 2024

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.001528
SO_x	0.000016
NO_x	0.008270
CO	0.009546
PM 10	0.000486

Pollutant	Total Emissions (TONs)
PM 2.5	0.000486
Pb	0.000000
NH_3	0.000000
CO_2e	1.6

9.1 Building Construction Phase

9.1.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2024

- Phase Duration
Number of Month: 0
Number of Days: 5

9.1.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 9000
Height of Building (ft): 12
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 7

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Pavers Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 0

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 0

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 0

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

9.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Pavers Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0764	0.0008	0.4135	0.4773	0.0243	0.0243	0.0068	78.105

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.164	000.003	000.093	001.268	000.017	000.006		000.025	00285.560
LDGT	000.217	000.004	000.177	001.754	000.018	000.007		000.027	00356.560
HDGV	000.273	000.005	000.286	002.004	000.029	000.010		000.052	00545.059
LDDV	000.026	000.002	000.237	000.323	000.031	000.020		000.008	00225.935
LDDT	000.017	000.003	000.082	000.161	000.025	000.013		000.009	00309.267
HDDV	000.176	000.007	002.043	000.559	000.124	000.067		000.033	00760.601
MC	005.697	000.002	000.762	018.634	000.019	000.008		000.053	00210.432

9.1.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase
$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

10. Construction / Demolition

10.1 General Information & Timeline Assumptions

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase Ia - 1 day equipment

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

- Activity Description:

- Activity Start Date
Start Month: 1
Start Month: 2024

- Activity End Date
Indefinite: False
End Month: 1
End Month: 2024

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.000432
SO_x	0.000008
NO_x	0.002434
CO	0.003912
PM 10	0.000096

Pollutant	Total Emissions (TONs)
PM 2.5	0.000096
Pb	0.000000
NH_3	0.000000
CO_2e	0.8

10.1 Building Construction Phase

10.1.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2024

- Phase Duration
Number of Month: 0
Number of Days: 1

10.1.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 9000
Height of Building (ft): 12
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 7

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Crushing/Proc. Equipment Composite	1	8
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 0

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips

Average Worker Round Trip Commute (mile): 0

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips

Average Vendor Round Trip Commute (mile): 0

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

10.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Crushing/Proc. Equipment Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0731	0.0014	0.4104	0.6192	0.0172	0.0172	0.0065	132.47
Tractors/Loaders/Backhoes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0348	0.0007	0.1980	0.3589	0.0068	0.0068	0.0031	66.875

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.164	000.003	000.093	001.268	000.017	000.006		000.025	00285.560
LDGT	000.217	000.004	000.177	001.754	000.018	000.007		000.027	00356.560
HDGV	000.273	000.005	000.286	002.004	000.029	000.010		000.052	00545.059
LDDV	000.026	000.002	000.237	000.323	000.031	000.020		000.008	00225.935
LDDT	000.017	000.003	000.082	000.161	000.025	000.013		000.009	00309.267
HDDV	000.176	000.007	002.043	000.559	000.124	000.067		000.033	00760.601
MC	005.697	000.002	000.762	018.634	000.019	000.008		000.053	00210.432

10.1.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)

BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

1. General Information

- Action Location
Base: VANDENBERG AFB
State: California
County(s): Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Action Title: Phantom Space Corporation Daytona-E and Laguna-E Launch Operations at Space Launch Complex 5, Vandenberg Space Force Base, California

- Project Number/s (if applicable):

- Projected Action Start Date: 1 / 2024

- Action Purpose and Need:

- Action Description:

Space Launch Delta 30 (SLD 30), Vandenberg Space Force Base (VSFB or Base), California, prepared this Environmental Assessment (EA). This EA evaluates the potential environmental impacts associated with operating Phantom Space Corporation's (Phantom) Daytona-E and Laguna-E launch vehicles and the associated construction of a new launch facility at Space Launch Complex (SLC-5) on VSFB. Congress, under the U.S. Commercial Space Launch Act (CSLA), 51 United States Code (U.S.C.) Subtitle V, Chapter 509, Sections 50901-50923, provided the Department of Transportation (DOT) statutory direction to, in part, "protect the public health and safety, safety of property, and national security and foreign policy interests of the United States" while "strengthening and [expanding] that United States space transportation infrastructure, including the enhancement of United States launch sites and launch-site support facilities, and development of reentry sites, with Government, State, and private sector involvement, to support the full range of United States space-related activities." Within the DOT, the Secretary of Transportation's authority under the CSLA has been delegated to the Federal Aviation Administration (FAA) Office of Commercial Space Transportation. Per agreements between the Department of the Air Force (DAF) and the FAA, the DAF will act as the lead agency for preparing and coordinating the National Environmental Policy Act (NEPA) documentation for the Proposed action and the FAA will act as a cooperating agency to review the EA preparation.

This EA was prepared to enable the DAF, FAA, and the public to understand the potential environmental impacts of the proposed Daytona-E launch program. Because FAA regulations (14 Code of Federal Regulations [C.F.R.] parts 400–460) require an applicant to provide enough information for the FAA to analyze the potential environmental impacts associated with proposed launch activities, this EA has been prepared to comply with the requirements of the NEPA as amended (42 U.S.C. 4321 et seq.); the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 C.F.R. parts 1500–1508); the DAF's Environmental Impact Analysis Process (32 C.F.R. 989), and FAA Order 1050.1F, Environmental Impacts: Policies and Procedures.

- Point of Contact
Name: Phantom Space Corporation Daytona-E and Laguna-E Launch Operations at Space Launch Complex 5, Vandenberg Space Force Base, California
Title: Associate Environmental Scientist
Organization: ManTech
Email:
Phone Number:

- Activity List:

Activity Type		Activity Title
2.	Construction / Demolition	Phase Ib - 19 Day Equipment

3.	Construction / Demolition	Phase 1b - Vendor Trips
4.	Personnel	Worker Trips
5.	Construction / Demolition	Phase 1b - 15 day equipment
6.	Construction / Demolition	Phase 1b - 13 Day Equipment
7.	Construction / Demolition	Phase Ib - 10 day equipment
8.	Construction / Demolition	Phase Ib - 8 day equipment
9.	Construction / Demolition	Phase Ib - 1 day equipment

Emission factors and air emission estimating methods come from the United States Air Force's Air Emissions Guide for Air Force Stationary Sources, Air Emissions Guide for Air Force Mobile Sources, and Air Emissions Guide for Air Force Transitory Sources.

2. Construction / Demolition

2.1 General Information & Timeline Assumptions

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase Ib - 19 Day Equipment

- Activity Description:

- Activity Start Date
Start Month: 1
Start Month: 2025

- Activity End Date
Indefinite: False
End Month: 1
End Month: 2025

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.015937
SO_x	0.000243
NO_x	0.100791
CO	0.079944
PM 10	0.003777

Pollutant	Total Emissions (TONs)
PM 2.5	0.003777
Pb	0.000000
NH_3	0.000000
CO_2e	23.9

2.1 Building Construction Phase

2.1.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2025

- Phase Duration
Number of Month: 0

Number of Days: 19

2.1.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 9000
Height of Building (ft): 12
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 7

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Dumpers/Tenders Composite	1	8
Rubber Tired Dozers Composite	1	8
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 0

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 0

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 0

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

2.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Dumpers/Tenders Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0091	0.0001	0.0581	0.0313	0.0021	0.0021	0.0008	7.6451
Rubber Tired Dozers Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.1671	0.0024	1.0824	0.6620	0.0418	0.0418	0.0150	239.45
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0335	0.0007	0.1857	0.3586	0.0058	0.0058	0.0030	66.872

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.150	000.003	000.081	001.130	000.015	000.005		000.025	00262.959
LDGT	000.202	000.003	000.157	001.591	000.017	000.006		000.027	00335.286
HDGV	000.252	000.005	000.250	001.799	000.027	000.010		000.052	00504.034
LDDV	000.022	000.002	000.195	000.289	000.028	000.017		000.008	00205.036
LDDT	000.016	000.003	000.072	000.153	000.024	000.012		000.009	00294.832
HDDV	000.161	000.007	001.849	000.514	000.115	000.062		000.033	00713.557
MC	005.399	000.002	000.699	017.186	000.018	000.008		000.053	00193.309

2.1.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase

$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds

EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

3. Construction / Demolition

3.1 General Information & Timeline Assumptions

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase 1b - Vendor Trips

- Activity Description:

- Activity Start Date
Start Month: 1
Start Month: 2025

- Activity End Date
Indefinite: False
End Month: 2
End Month: 2025

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.010336
SO_x	0.000236
NO_x	0.043239
CO	0.048815
PM 10	0.001287

Pollutant	Total Emissions (TONs)
PM 2.5	0.001287
Pb	0.000000
NH_3	0.000000
CO_2e	23.6

3.1 Building Construction Phase

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

3.1.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2025

- Phase Duration
Number of Month: 1
Number of Days: 15

3.1.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 9000
Height of Building (ft): 12
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 7

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Off-Highway Trucks Composite	1	4

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 0

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 0

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 0

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

3.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Off-Highway Trucks Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e

Emission Factors	0.1140	0.0026	0.4769	0.5384	0.0142	0.0142	0.0102	260.32

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.150	000.003	000.081	001.130	000.015	000.005		000.025	00262.959
LDGT	000.202	000.003	000.157	001.591	000.017	000.006		000.027	00335.286
HDGV	000.252	000.005	000.250	001.799	000.027	000.010		000.052	00504.034
LDDV	000.022	000.002	000.195	000.289	000.028	000.017		000.008	00205.036
LDDT	000.016	000.003	000.072	000.153	000.024	000.012		000.009	00294.832
HDDV	000.161	000.007	001.849	000.514	000.115	000.062		000.033	00713.557
MC	005.399	000.002	000.699	017.186	000.018	000.008		000.053	00193.309

3.1.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase

$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)

0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

4. Personnel

4.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Worker Trips

- Activity Description:

- Activity Start Date
Start Month: 1
Start Year: 2025

- Activity End Date
Indefinite: No
End Month: 2
End Year: 2025

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.022537
SO_x	0.000239
NO_x	0.011124
CO	0.137323

Pollutant	Total Emissions (TONs)
PM 2.5	0.000456
Pb	0.000000
NH_3	0.002143
CO_2e	24.5

PM 10	0.001307			

4.2 Personnel Assumptions

- Number of Personnel
- **Active Duty Personnel:** 0
- **Civilian Personnel:** 15
- **Support Contractor Personnel:** 0
- **Air National Guard (ANG) Personnel:** 0
- **Reserve Personnel:** 0

- Default Settings Used: No

- Average Personnel Round Trip Commute (mile): 80

- Personnel Work Schedule
- **Active Duty Personnel:** 5 Days Per Week
- **Civilian Personnel:** 7 Days Per Week
- **Support Contractor Personnel:** 5 Days Per Week
- **Air National Guard (ANG) Personnel:** 4 Days Per Week
- **Reserve Personnel:** 4 Days Per Month

4.3 Personnel On Road Vehicle Mixture

- On Road Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	37.55	60.32	0	0.03	0.2	0	1.9
GOVs	54.49	37.73	4.67	0	0	3.11	0

4.4 Personnel Emission Factor(s)

- On Road Vehicle Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.150	000.003	000.081	001.130	000.015	000.005		000.025	00262.959
LDGT	000.202	000.003	000.157	001.591	000.017	000.006		000.027	00335.286
HDGV	000.252	000.005	000.250	001.799	000.027	000.010		000.052	00504.034
LDDV	000.022	000.002	000.195	000.289	000.028	000.017		000.008	00205.036
LDDT	000.016	000.003	000.072	000.153	000.024	000.012		000.009	00294.832
HDDV	000.161	000.007	001.849	000.514	000.115	000.062		000.033	00713.557
MC	005.399	000.002	000.699	017.186	000.018	000.008		000.053	00193.309

4.5 Personnel Formula(s)

- Personnel Vehicle Miles Travel for Work Days per Year

$VMT_P = NP * WD * AC$

VMT_P: Personnel Vehicle Miles Travel (miles/year)
NP: Number of Personnel
WD: Work Days per Year
AC: Average Commute (miles)

- Total Vehicle Miles Travel per Year

$VMT_{Total} = VMT_{AD} + VMT_C + VMT_{SC} + VMT_{ANG} + VMT_{AFRC}$

VMT_{Total}: Total Vehicle Miles Travel (miles)
VMT_{AD}: Active Duty Personnel Vehicle Miles Travel (miles)
VMT_{C}: Civilian Personnel Vehicle Miles Travel (miles)
VMT_{SC}: Support Contractor Personnel Vehicle Miles Travel (miles)
VMT_{ANG}: Air National Guard Personnel Vehicle Miles Travel (miles)
VMT_{AFRC}: Reserve Personnel Vehicle Miles Travel (miles)

- Vehicle Emissions per Year
$V_{POL} = (VMT_{Total} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{Total}: Total Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Personnel On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

5. Construction / Demolition

5.1 General Information & Timeline Assumptions

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase 1b - 15 day equipment

- Activity Description:

- Activity Start Date
Start Month: 1
Start Month: 2025

- Activity End Date
Indefinite: False
End Month: 1
End Month: 2025

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.001722
SO_x	0.000036
NO_x	0.013974
CO	0.015996
PM 10	0.000480

Pollutant	Total Emissions (TONs)
PM 2.5	0.000480
Pb	0.000000
NH_3	0.000000
CO_2e	3.7

5.1 Building Construction Phase

5.1.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 1

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Start Quarter: 1
Start Year: 2025

- Phase Duration
Number of Month: 0
Number of Days: 15

5.1.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 9000
Height of Building (ft): 12
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 7

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Generator Sets Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 0

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 0

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 0

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

5.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Generator Sets Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0287	0.0006	0.2329	0.2666	0.0080	0.0080	0.0025	61.057

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.150	000.003	000.081	001.130	000.015	000.005		000.025	00262.959

LDGT	000.202	000.003	000.157	001.591	000.017	000.006		000.027	00335.286
HDGV	000.252	000.005	000.250	001.799	000.027	000.010		000.052	00504.034
LDDV	000.022	000.002	000.195	000.289	000.028	000.017		000.008	00205.036
LDDT	000.016	000.003	000.072	000.153	000.024	000.012		000.009	00294.832
HDDV	000.161	000.007	001.849	000.514	000.115	000.062		000.033	00713.557
MC	005.399	000.002	000.699	017.186	000.018	000.008		000.053	00193.309

5.1.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase
$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
VMT_{VT} = BA * BH * (0.38 / 1000) * HT

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

6. Construction / Demolition

6.1 General Information & Timeline Assumptions

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase 1b - 13 Day Equipment

- Activity Description:

- Activity Start Date
Start Month: 1
Start Month: 2025

- Activity End Date
Indefinite: False
End Month: 1
End Month: 2025

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.011695
SO_x	0.000239
NO_x	0.063580
CO	0.090106
PM 10	0.002434

Pollutant	Total Emissions (TONs)
PM 2.5	0.002434
Pb	0.000000
NH_3	0.000000
CO_2e	22.7

6.1 Building Construction Phase

6.1.1 Building Construction Phase Timeline Assumptions

- Phase Start Date

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Start Month: 1
Start Quarter: 1
Start Year: 2025

- Phase Duration
Number of Month: 0
Number of Days: 13

6.1.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 9000
Height of Building (ft): 12
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 7

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Cranes Composite	1	8
Graders Composite	1	8
Rubber Tired Loaders Composite	1	8
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 0

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 0

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 0

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

6.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Cranes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0680	0.0013	0.4222	0.3737	0.0143	0.0143	0.0061	128.77

Graders Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0676	0.0014	0.3314	0.5695	0.0147	0.0147	0.0061	132.89
Rubber Tired Loaders Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0558	0.0012	0.2834	0.4310	0.0120	0.0120	0.0050	108.73
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0335	0.0007	0.1857	0.3586	0.0058	0.0058	0.0030	66.872

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.150	000.003	000.081	001.130	000.015	000.005		000.025	00262.959
LDGT	000.202	000.003	000.157	001.591	000.017	000.006		000.027	00335.286
HDGV	000.252	000.005	000.250	001.799	000.027	000.010		000.052	00504.034
LDDV	000.022	000.002	000.195	000.289	000.028	000.017		000.008	00205.036
LDDT	000.016	000.003	000.072	000.153	000.024	000.012		000.009	00294.832
HDDV	000.161	000.007	001.849	000.514	000.115	000.062		000.033	00713.557
MC	005.399	000.002	000.699	017.186	000.018	000.008		000.053	00193.309

6.1.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase

CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

VMT_{VE} = BA * BH * (0.42 / 1000) * HT

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase

VMT_{WT} = WD * WT * 1.25 * NE

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)

WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

7. Construction / Demolition

7.1 General Information & Timeline Assumptions

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase Ib - 10 day equipment

- Activity Description:

- Activity Start Date
Start Month: 1
Start Month: 2024

- Activity End Date
Indefinite: False
End Month: 1
End Month: 2025

- Activity Emissions:

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Pollutant	Total Emissions (TONs)
VOC	0.003316
SO_x	0.000060
NO_x	0.019560
CO	0.031044
PM 10	0.000800

Pollutant	Total Emissions (TONs)
PM 2.5	0.000800
Pb	0.000000
NH_3	0.000000
CO_2e	5.7

7.1 Building Construction Phase

7.1.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2025

- Phase Duration
Number of Month: 0
Number of Days: 10

7.1.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 9000
Height of Building (ft): 12
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 7

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Cement and Mortar Mixers Composite	1	8
Rollers Composite	1	8
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 0

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 0

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips

Average Vendor Round Trip Commute (mile): 0

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

7.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Cement and Mortar Mixers Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0085	0.0001	0.0533	0.0413	0.0020	0.0020	0.0007	7.2673
Rollers Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0409	0.0007	0.2500	0.3762	0.0122	0.0122	0.0036	67.123
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0335	0.0007	0.1857	0.3586	0.0058	0.0058	0.0030	66.872

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.150	000.003	000.081	001.130	000.015	000.005		000.025	00262.959
LDGT	000.202	000.003	000.157	001.591	000.017	000.006		000.027	00335.286
HDGV	000.252	000.005	000.250	001.799	000.027	000.010		000.052	00504.034
LDDV	000.022	000.002	000.195	000.289	000.028	000.017		000.008	00205.036
LDDT	000.016	000.003	000.072	000.153	000.024	000.012		000.009	00294.832
HDDV	000.161	000.007	001.849	000.514	000.115	000.062		000.033	00713.557
MC	005.399	000.002	000.699	017.186	000.018	000.008		000.053	00193.309

7.1.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds

EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
VMT_{WT} = WD * WT * 1.25 * NE

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
VMT_{VT} = BA * BH * (0.38 / 1000) * HT

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

8. Construction / Demolition

8.1 General Information & Timeline Assumptions

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase Ib - 8 day equipment

- Activity Description:

- Activity Start Date

Start Month: 1
Start Month: 2024

- Activity End Date
Indefinite: False
End Month: 1
End Month: 2025

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.002650
SO_x	0.000058
NO_x	0.013914
CO	0.024646
PM 10	0.000525

Pollutant	Total Emissions (TONs)
PM 2.5	0.000525
Pb	0.000000
NH_3	0.000000
CO_2e	5.4

8.1 Building Construction Phase

8.1.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2025

- Phase Duration
Number of Month: 0
Number of Days: 8

8.1.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 9000
Height of Building (ft): 12
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 7

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Excavators Composite	1	8
Pumps Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 0

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips

Average Worker Round Trip Commute (mile): 0

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips

Average Vendor Round Trip Commute (mile): 0

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

8.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Excavators Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0559	0.0013	0.2269	0.5086	0.0086	0.0086	0.0050	119.70
Pumps Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0269	0.0005	0.2079	0.2616	0.0078	0.0078	0.0024	49.667

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.150	000.003	000.081	001.130	000.015	000.005		000.025	00262.959
LDGT	000.202	000.003	000.157	001.591	000.017	000.006		000.027	00335.286
HDGV	000.252	000.005	000.250	001.799	000.027	000.010		000.052	00504.034
LDDV	000.022	000.002	000.195	000.289	000.028	000.017		000.008	00205.036
LDDT	000.016	000.003	000.072	000.153	000.024	000.012		000.009	00294.832
HDDV	000.161	000.007	001.849	000.514	000.115	000.062		000.033	00713.557
MC	005.399	000.002	000.699	017.186	000.018	000.008		000.053	00193.309

8.1.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

9. Construction / Demolition

9.1 General Information & Timeline Assumptions

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase Ib - 1 day equipment

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

- Activity Description:

- Activity Start Date
Start Month: 1
Start Month: 2024

- Activity End Date
Indefinite: False
End Month: 1
End Month: 2024

- Activity Emissions:

Pollutant	Total Emissions (TONs)	Pollutant	Total Emissions (TONs)
VOC	0.000432	PM 2.5	0.000096
SO_x	0.000008	Pb	0.000000
NO_x	0.002434	NH_3	0.000000
CO	0.003912	CO_2e	0.8
PM 10	0.000096		

9.1 Building Construction Phase

9.1.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2024

- Phase Duration
Number of Month: 0
Number of Days: 1

9.1.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 9000
Height of Building (ft): 12
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 7

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Crushing/Proc. Equipment Composite	1	8
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 0

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 0

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 0

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

9.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Crushing/Proc. Equipment Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0731	0.0014	0.4104	0.6192	0.0172	0.0172	0.0065	132.47
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0348	0.0007	0.1980	0.3589	0.0068	0.0068	0.0031	66.875

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.164	000.003	000.093	001.268	000.017	000.006		000.025	00285.560
LDGT	000.217	000.004	000.177	001.754	000.018	000.007		000.027	00356.560
HDGV	000.273	000.005	000.286	002.004	000.029	000.010		000.052	00545.059
LDDV	000.026	000.002	000.237	000.323	000.031	000.020		000.008	00225.935
LDDT	000.017	000.003	000.082	000.161	000.025	000.013		000.009	00309.267
HDDV	000.176	000.007	002.043	000.559	000.124	000.067		000.033	00760.601
MC	005.697	000.002	000.762	018.634	000.019	000.008		000.053	00210.432

9.1.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)

BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

1. General Information

- Action Location
Base: VANDENBERG AFB
State: California
County(s): Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Action Title: Phantom Space Corporation Daytona-E and Laguna-E Launch Operations at Space Launch Complex 5, Vandenberg Space Force Base, California

- Project Number/s (if applicable):

- Projected Action Start Date: 1 / 2027

- Action Purpose and Need:

- Action Description:
Space Launch Delta 30 (SLD 30), Vandenberg Space Force Base (VSFB or Base), California, prepared this Environmental Assessment (EA). This EA evaluates the potential environmental impacts associated with operating Phantom Space Corporation's (Phantom) Daytona-E and Laguna-E launch vehicles and the associated construction of a new launch facility at Space Launch Complex (SLC-5) on VSFB. Congress, under the U.S. Commercial Space Launch Act (CSLA), 51 United States Code (U.S.C.) Subtitle V, Chapter 509, Sections 50901-50923, provided the Department of Transportation (DOT) statutory direction to, in part, "protect the public health and safety, safety of property, and national security and foreign policy interests of the United States" while "strengthening and [expanding] that United States space transportation infrastructure, including the enhancement of United States launch sites and launch-site support facilities, and development of reentry sites, with Government, State, and private sector involvement, to support the full range of United States space-related activities." Within the DOT, the Secretary of Transportation's authority under the CSLA has been delegated to the Federal Aviation Administration (FAA) Office of Commercial Space Transportation. Per agreements between the Department of the Air Force (DAF) and the FAA, the DAF will act as the lead agency for preparing and coordinating the National Environmental Policy Act (NEPA) documentation for the Proposed action and the FAA will act as a cooperating agency to review the EA preparation.
This EA was prepared to enable the DAF, FAA, and the public to understand the potential environmental impacts of the proposed Daytona-E launch program. Because FAA regulations (14 Code of Federal Regulations [C.F.R.] parts 400–460) require an applicant to provide enough information for the FAA to analyze the potential environmental impacts associated with proposed launch activities, this EA has been prepared to comply with the requirements of the NEPA as amended (42 U.S.C. 4321 et seq.); the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 C.F.R. parts 1500–1508); the DAF's Environmental Impact Analysis Process (32 C.F.R. 989), and FAA Order 1050.1F, Environmental Impacts: Policies and Procedures.

- Point of Contact
Name: Lawrence F. Wolski
Title: Technical Project Manager
Organization: ManTech
Email: lawrence.wolski@mantech.com
Phone Number: 858-345-1951

- Activity List:

Activity Type		Activity Title
2.	Construction / Demolition	Phase II - 23 Day Equipment
3.	Construction / Demolition	Phase II - 20 Day Equipment

4.	Construction / Demolition	Phase II - 15 Day Equipment
5.	Construction / Demolition	Phase II -12 Day Equipment
6.	Construction / Demolition	Phase II - 10 Day Equipment
7.	Construction / Demolition	Phase II - 4 Day Equipment
8.	Construction / Demolition	Phase II - 1 Day Equipment
9.	Construction / Demolition	Phase II Vendor Trips
10.	Personnel	Phase II - Personnel trips

Emission factors and air emission estimating methods come from the United States Air Force's Air Emissions Guide for Air Force Stationary Sources, Air Emissions Guide for Air Force Mobile Sources, and Air Emissions Guide for Air Force Transitory Sources.

2. Construction / Demolition

2.1 General Information & Timeline Assumptions

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase II - 23 Day Equipment

- Activity Description:

- Activity Start Date
Start Month: 1
Start Month: 2027

- Activity End Date
Indefinite: False
End Month: 1
End Month: 2027

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.002640
SO_x	0.000055
NO_x	0.021427
CO	0.024527
PM 10	0.000736

Pollutant	Total Emissions (TONs)
PM 2.5	0.000736
Pb	0.000000
NH_3	0.000000
CO_2e	5.6

2.1 Building Construction Phase

2.1.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2027

- Phase Duration
Number of Month: 0

Number of Days: 23

2.1.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 1500
Height of Building (ft): 12
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 7

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Generator Sets Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 0

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 0

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 0

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

2.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Generator Sets Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0287	0.0006	0.2329	0.2666	0.0080	0.0080	0.0025	61.057

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.139	000.002	000.072	001.003	000.014	000.005		000.025	00241.071
LDGT	000.190	000.003	000.140	001.434	000.016	000.006		000.027	00314.132
HDGV	000.235	000.005	000.222	001.615	000.025	000.009		000.052	00465.357
LDDV	000.018	000.002	000.157	000.243	000.023	000.014		000.008	00183.680
LDDT	000.014	000.003	000.064	000.137	000.022	000.011		000.009	00278.098

HDDV	000.147	000.006	001.685	000.474	000.106	000.058		000.033	00666.113
MC	005.142	000.002	000.643	015.891	000.016	000.007		000.053	00177.342

2.1.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase
$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)

BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

3. Construction / Demolition

3.1 General Information & Timeline Assumptions

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase II - 20 Day Equipment

- Activity Description:

- Activity Start Date
Start Month: 1
Start Month: 2027

- Activity End Date
Indefinite: False
End Month: 1
End Month: 2027

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.000740
SO_x	0.000008
NO_x	0.004782
CO	0.002542
PM 10	0.000176

Pollutant	Total Emissions (TONs)
PM 2.5	0.000173
Pb	0.000000
NH_3	0.000003
CO_2e	0.7

3.1 Building Construction Phase

3.1.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2027

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- Phase Duration
Number of Month: 0
Number of Days: 20

3.1.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 1500
Height of Building (ft): 12
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 7

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Dumpers/Tenders Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 5

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 0

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 0

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

3.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Dumpers/Tenders Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0091	0.0001	0.0581	0.0313	0.0021	0.0021	0.0008	7.6451

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.139	000.002	000.072	001.003	000.014	000.005		000.025	00241.071
LDGT	000.190	000.003	000.140	001.434	000.016	000.006		000.027	00314.132
HDGV	000.235	000.005	000.222	001.615	000.025	000.009		000.052	00465.357
LDDV	000.018	000.002	000.157	000.243	000.023	000.014		000.008	00183.680

LDDT	000.014	000.003	000.064	000.137	000.022	000.011		000.009	00278.098
HDDV	000.147	000.006	001.685	000.474	000.106	000.058		000.033	00666.113
MC	005.142	000.002	000.643	015.891	000.016	000.007		000.053	00177.342

3.1.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase
$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

4. Construction / Demolition

4.1 General Information & Timeline Assumptions

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase II - 15 Day Equipment

- Activity Description:

- Activity Start Date
Start Month: 1
Start Month: 2027

- Activity End Date
Indefinite: False
End Month: 1
End Month: 2027

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.014082
SO_x	0.000228
NO_x	0.084828
CO	0.073890
PM 10	0.003390

Pollutant	Total Emissions (TONs)
PM 2.5	0.003390
Pb	0.000000
NH_3	0.000000
CO_2e	22.3

4.1 Building Construction Phase

4.1.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2027

- Phase Duration
Number of Month: 0
Number of Days: 15

4.1.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 1500
Height of Building (ft): 12
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 7

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Graders Composite	1	8
Rubber Tired Dozers Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 0

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 0

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 0

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

4.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Graders Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0676	0.0014	0.3314	0.5695	0.0147	0.0147	0.0061	132.89
Rubber Tired Dozers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.1671	0.0024	1.0824	0.6620	0.0418	0.0418	0.0150	239.45

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.139	000.002	000.072	001.003	000.014	000.005		000.025	00241.071
LDGT	000.190	000.003	000.140	001.434	000.016	000.006		000.027	00314.132
HDGV	000.235	000.005	000.222	001.615	000.025	000.009		000.052	00465.357
LDDV	000.018	000.002	000.157	000.243	000.023	000.014		000.008	00183.680
LDDT	000.014	000.003	000.064	000.137	000.022	000.011		000.009	00278.098
HDDV	000.147	000.006	001.685	000.474	000.106	000.058		000.033	00666.113
MC	005.142	000.002	000.643	015.891	000.016	000.007		000.053	00177.342

4.1.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase
$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)

2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

5. Construction / Demolition

5.1 General Information & Timeline Assumptions

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase II -12 Day Equipment

- Activity Description:

- Activity Start Date
Start Month: 1
Start Month: 2027

- Activity End Date
Indefinite: False
End Month: 1
End Month: 2027

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.003348
SO_x	0.000072
NO_x	0.017004
CO	0.025860
PM 10	0.000720

Pollutant	Total Emissions (TONs)
PM 2.5	0.000720
Pb	0.000000
NH_3	0.000000
CO_2e	6.5

5.1 Building Construction Phase

5.1.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2027

- Phase Duration
Number of Month: 0
Number of Days: 15

5.1.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 1500
Height of Building (ft): 12
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 7

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Rubber Tired Loaders Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 0

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 0

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 0

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

5.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Rubber Tired Loaders Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0558	0.0012	0.2834	0.4310	0.0120	0.0120	0.0050	108.73

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- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.139	000.002	000.072	001.003	000.014	000.005		000.025	00241.071
LDGT	000.190	000.003	000.140	001.434	000.016	000.006		000.027	00314.132
HDGV	000.235	000.005	000.222	001.615	000.025	000.009		000.052	00465.357
LDDV	000.018	000.002	000.157	000.243	000.023	000.014		000.008	00183.680
LDDT	000.014	000.003	000.064	000.137	000.022	000.011		000.009	00278.098
HDDV	000.147	000.006	001.685	000.474	000.106	000.058		000.033	00666.113
MC	005.142	000.002	000.643	015.891	000.016	000.007		000.053	00177.342

5.1.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase

$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)

VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

6. Construction / Demolition

6.1 General Information & Timeline Assumptions

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase II - 10 Day Equipment

- Activity Description:

- Activity Start Date
Start Month: 1
Start Month: 2027

- Activity End Date
Indefinite: False
End Month: 1
End Month: 2027

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.014652
SO_x	0.000256
NO_x	0.087676
CO	0.102676
PM 10	0.003360

Pollutant	Total Emissions (TONs)
PM 2.5	0.003360
Pb	0.000000
NH_3	0.000000
CO_2e	24.7

6.1 Building Construction Phase

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6.1.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2027

- Phase Duration
Number of Month: 0
Number of Days: 10

6.1.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 1500
Height of Building (ft): 12
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 7

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Cement and Mortar Mixers Composite	1	8
Excavators Composite	1	8
Pumps Composite	1	8
Rollers Composite	1	8
Rubber Tired Dozers Composite	1	8
Tractors/Loaders/Backhoes Composite	2	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 0

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 0

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 0

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

6.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Cement and Mortar Mixers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0085	0.0001	0.0533	0.0413	0.0020	0.0020	0.0007	7.2673
Excavators Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0559	0.0013	0.2269	0.5086	0.0086	0.0086	0.0050	119.70
Pumps Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0269	0.0005	0.2079	0.2616	0.0078	0.0078	0.0024	49.667
Rollers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0409	0.0007	0.2500	0.3762	0.0122	0.0122	0.0036	67.123
Rubber Tired Dozers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.1671	0.0024	1.0824	0.6620	0.0418	0.0418	0.0150	239.45
Tractors/Loaders/Backhoes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0335	0.0007	0.1857	0.3586	0.0058	0.0058	0.0030	66.872

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.139	000.002	000.072	001.003	000.014	000.005		000.025	00241.071
LDGT	000.190	000.003	000.140	001.434	000.016	000.006		000.027	00314.132
HDGV	000.235	000.005	000.222	001.615	000.025	000.009		000.052	00465.357
LDDV	000.018	000.002	000.157	000.243	000.023	000.014		000.008	00183.680
LDDT	000.014	000.003	000.064	000.137	000.022	000.011		000.009	00278.098
HDDV	000.147	000.006	001.685	000.474	000.106	000.058		000.033	00666.113
MC	005.142	000.002	000.643	015.891	000.016	000.007		000.053	00177.342

6.1.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase

CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

VMT_{VE} = BA * BH * (0.42 / 1000) * HT

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

7. Construction / Demolition

7.1 General Information & Timeline Assumptions

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase II - 4 Day Equipment

- Activity Description:

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

- Activity Start Date
Start Month: 1
Start Month: 2027

- Activity End Date
Indefinite: False
End Month: 1
End Month: 2027

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.001147
SO_x	0.000013
NO_x	0.006173
CO	0.007590
PM 10	0.000350

Pollutant	Total Emissions (TONs)
PM 2.5	0.000350
Pb	0.000000
NH_3	0.000000
CO_2e	1.2

7.1 Building Construction Phase

7.1.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2027

- Phase Duration
Number of Month: 0
Number of Days: 4

7.1.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 1500
Height of Building (ft): 12
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 5

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Pavers Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 0

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

- Worker Trips
Average Worker Round Trip Commute (mile): 0

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 0

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

7.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Pavers Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0717	0.0008	0.3858	0.4744	0.0219	0.0219	0.0064	78.094

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.139	000.002	000.072	001.003	000.014	000.005		000.025	00241.071
LDGT	000.190	000.003	000.140	001.434	000.016	000.006		000.027	00314.132
HDGV	000.235	000.005	000.222	001.615	000.025	000.009		000.052	00465.357
LDDV	000.018	000.002	000.157	000.243	000.023	000.014		000.008	00183.680
LDDT	000.014	000.003	000.064	000.137	000.022	000.011		000.009	00278.098
HDDV	000.147	000.006	001.685	000.474	000.106	000.058		000.033	00666.113
MC	005.142	000.002	000.643	015.891	000.016	000.007		000.053	00177.342

7.1.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase
$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

8. Construction / Demolition

8.1 General Information & Timeline Assumptions

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase II - 1 Day Equipment

- Activity Description:

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

- Activity Start Date
Start Month: 1
Start Month: 2027

- Activity End Date
Indefinite: False
End Month: 1
End Month: 2027

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.000411
SO_x	0.000008
NO_x	0.002248
CO	0.003909
PM 10	0.000081

Pollutant	Total Emissions (TONs)
PM 2.5	0.000081
Pb	0.000000
NH_3	0.000000
CO_2e	0.8

8.1 Building Construction Phase

8.1.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2027

- Phase Duration
Number of Month: 0
Number of Days: 1

8.1.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 1500
Height of Building (ft): 12
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 5

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Crushing/Proc. Equipment Composite	1	8
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 0

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC

POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 0

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 0

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

8.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Crushing/Proc. Equipment Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0692	0.0014	0.3762	0.6187	0.0145	0.0145	0.0062	132.46
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0335	0.0007	0.1857	0.3586	0.0058	0.0058	0.0030	66.872

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.139	000.002	000.072	001.003	000.014	000.005		000.025	00241.071
LDGT	000.190	000.003	000.140	001.434	000.016	000.006		000.027	00314.132
HDGV	000.235	000.005	000.222	001.615	000.025	000.009		000.052	00465.357
LDDV	000.018	000.002	000.157	000.243	000.023	000.014		000.008	00183.680
LDDT	000.014	000.003	000.064	000.137	000.022	000.011		000.009	00278.098
HDDV	000.147	000.006	001.685	000.474	000.106	000.058		000.033	00666.113
MC	005.142	000.002	000.643	015.891	000.016	000.007		000.053	00177.342

8.1.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase
$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)

(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

9. Construction / Demolition

9.1 General Information & Timeline Assumptions

- Activity Location
County: Santa Barbara

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase II Vendor Trips

- Activity Description:

- Activity Start Date
Start Month: 1
Start Month: 2027

- Activity End Date
Indefinite: False
End Month: 2
End Month: 2027

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.010336
SO_x	0.000236
NO_x	0.043239
CO	0.048815
PM 10	0.001287

Pollutant	Total Emissions (TONs)
PM 2.5	0.001287
Pb	0.000000
NH_3	0.000000
CO_2e	23.6

9.1 Building Construction Phase

9.1.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2027

- Phase Duration
Number of Month: 1
Number of Days: 15

9.1.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 1500
Height of Building (ft): 12
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 7

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Off-Highway Trucks Composite	1	4

- Vehicle Exhaust

Average Hauling Truck Round Trip Commute (mile): 0

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 0

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 0

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

9.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Off-Highway Trucks Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.1140	0.0026	0.4769	0.5384	0.0142	0.0142	0.0102	260.32

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.139	000.002	000.072	001.003	000.014	000.005		000.025	00241.071
LDGT	000.190	000.003	000.140	001.434	000.016	000.006		000.027	00314.132
HDGV	000.235	000.005	000.222	001.615	000.025	000.009		000.052	00465.357
LDDV	000.018	000.002	000.157	000.243	000.023	000.014		000.008	00183.680
LDDT	000.014	000.003	000.064	000.137	000.022	000.011		000.009	00278.098
HDDV	000.147	000.006	001.685	000.474	000.106	000.058		000.033	00666.113
MC	005.142	000.002	000.643	015.891	000.016	000.007		000.053	00177.342

9.1.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)

(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

10. Personnel

10.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase II - Personnel trips

- Activity Description:

- Activity Start Date
Start Month: 1
Start Year: 2027

- Activity End Date
Indefinite: No
End Month: 2
End Year: 2027

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.021232
SO_x	0.000209
NO_x	0.009943
CO	0.123916
PM 10	0.001225

Pollutant	Total Emissions (TONs)
PM 2.5	0.000454
Pb	0.000000
NH_3	0.002143
CO_2e	22.8

10.2 Personnel Assumptions

- Number of Personnel
Active Duty Personnel: 0
Civilian Personnel: 15
Support Contractor Personnel: 0
Air National Guard (ANG) Personnel: 0
Reserve Personnel: 0

- Default Settings Used: No

- Average Personnel Round Trip Commute (mile): 80

- Personnel Work Schedule
Active Duty Personnel: 5 Days Per Week
Civilian Personnel: 7 Days Per Week
Support Contractor Personnel: 5 Days Per Week
Air National Guard (ANG) Personnel: 4 Days Per Week
Reserve Personnel: 4 Days Per Month

10.3 Personnel On Road Vehicle Mixture

- On Road Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	37.55	60.32	0	0.03	0.2	0	1.9
GOVs	54.49	37.73	4.67	0	0	3.11	0

10.4 Personnel Emission Factor(s)

- On Road Vehicle Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.139	000.002	000.072	001.003	000.014	000.005		000.025	00241.071
LDGT	000.190	000.003	000.140	001.434	000.016	000.006		000.027	00314.132
HDGV	000.235	000.005	000.222	001.615	000.025	000.009		000.052	00465.357
LDDV	000.018	000.002	000.157	000.243	000.023	000.014		000.008	00183.680
LDDT	000.014	000.003	000.064	000.137	000.022	000.011		000.009	00278.098
HDDV	000.147	000.006	001.685	000.474	000.106	000.058		000.033	00666.113
MC	005.142	000.002	000.643	015.891	000.016	000.007		000.053	00177.342

10.5 Personnel Formula(s)

- Personnel Vehicle Miles Travel for Work Days per Year

$VMT_P = NP * WD * AC$

VMT_P: Personnel Vehicle Miles Travel (miles/year)
NP: Number of Personnel
WD: Work Days per Year
AC: Average Commute (miles)

- Total Vehicle Miles Travel per Year

$VMT_{Total} = VMT_{AD} + VMT_C + VMT_{SC} + VMT_{ANG} + VMT_{AFRC}$

VMT_{Total}: Total Vehicle Miles Travel (miles)
VMT_{AD}: Active Duty Personnel Vehicle Miles Travel (miles)
VMT_C: Civilian Personnel Vehicle Miles Travel (miles)
VMT_{SC}: Support Contractor Personnel Vehicle Miles Travel (miles)
VMT_{ANG}: Air National Guard Personnel Vehicle Miles Travel (miles)
VMT_{AFRC}: Reserve Personnel Vehicle Miles Travel (miles)

- Vehicle Emissions per Year

$V_{POL} = (VMT_{Total} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{Total}: Total Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Personnel On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

1. General Information

- Action Location
Base: VANDENBERG AFB
State: California
County(s): Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Action Title: Phantom Space Corporation Daytona-E and Laguna-E Launch Operations at Space Launch Complex 5, Vandenberg Space Force Base, California

- Project Number/s (if applicable):

- Projected Action Start Date: 1 / 2023

- Action Purpose and Need:

- Action Description:
The purpose of the Proposed Action is to provide next generation, affordable U.S. enterprise access to space through Phantom's efficient and reliable launch system. Phantom's mission is to provide low-cost access to satellite technology by mass manufacturing launch vehicles, satellites, and space propulsion systems. In addition, the Proposed Action supports VSFB's vision of becoming the "world''s most innovative space launch and landing team" and complies with the National Space Policy.
The need for the Proposed Action is to fulfill the requirements of commercial and governmental entities in the small satellite orbital and suborbital market. The satellite industry is changing and leading to an interest in small, responsive, efficient, and commercially focused launch vehicles that are low-cost solutions for government and commercial clients. Implementation of the Proposed Action will fulfill the FAA's responsibilities as authorized by Executive Order (EO) 12465, Commercial Expendable Launch Vehicle Activities, and the Commercial Space Launch Act for oversight of commercial space launch activities. The Proposed Action would also fulfill the U.S. expectation to reduce space transportation costs and ensure continued exploration, development, and the use of space more affordable.

- Point of Contact
Name: Ryan Wright-Zinniger
Title: Associate Environmental Scientist
Organization: ManTech International
Email:
Phone Number:

- Activity List:

Activity Type		Activity Title
2.	Emergency Generator	Site Ops Generator
3.	Emergency Generator	Hydrolic Power Units
4.	Emergency Generator	Water Pump

Emission factors and air emission estimating methods come from the United States Air Force's Air Emissions Guide for Air Force Stationary Sources, Air Emissions Guide for Air Force Mobile Sources, and Air Emissions Guide for Air Force Transitory Sources.

2. Emergency Generator

2.1 General Information & Timeline Assumptions

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Site Ops Generator

- Activity Description:

- Activity Start Date
Start Month: 1
Start Year: 2023

- Activity End Date
Indefinite: No
End Month: 12
End Year: 2023

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.014302
SO_x	0.000250
NO_x	0.517353
CO	0.137428
PM 10	0.016160

Pollutant	Total Emissions (TONs)
PM 2.5	0.016160
Pb	0.000000
NH_3	0.000000
CO_2e	26.6

2.2 Emergency Generator Assumptions

- Emergency Generator
Type of Fuel used in Emergency Generator: Diesel
Number of Emergency Generators: 1

- Default Settings Used: No

- Emergency Generators Consumption
Emergency Generator's Horsepower: 799
Average Operating Hours Per Year (hours): 50

2.3 Emergency Generator Emission Factor(s)

- Emergency Generators Emission Factor (lb/hp-hr)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
0.000716	0.0000125	0.0259	0.00688	0.000809	0.000809			1.33

2.4 Emergency Generator Formula(s)

- Emergency Generator Emissions per Year

AE_{POL}= (NGEN * HP * OT * EF_{POL}) / 2000

AE_{POL}: Activity Emissions (TONs per Year)
NGEN: Number of Emergency Generators
HP: Emergency Generator's Horsepower (hp)

OT: Average Operating Hours Per Year (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hp-hr)

3. Emergency Generator

3.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Hydrolic Power Units

- Activity Description:

- Activity Start Date
Start Month: 1
Start Year: 2023

- Activity End Date
Indefinite: No
End Month: 12
End Year: 2023

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.014648
SO_x	0.012338
NO_x	0.060375
CO	0.040320
PM 10	0.013178

Pollutant	Total Emissions (TONs)
PM 2.5	0.013178
Pb	0.000000
NH_3	0.000000
CO_2e	7.0

3.2 Emergency Generator Assumptions

- Emergency Generator
Type of Fuel used in Emergency Generator: Diesel
Number of Emergency Generators: 1

- Default Settings Used: No

- Emergency Generators Consumption
Emergency Generator's Horsepower: 210
Average Operating Hours Per Year (hours): 50

3.3 Emergency Generator Emission Factor(s)

- Emergency Generators Emission Factor (lb/hp-hr)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
0.00279	0.00235	0.0115	0.00768	0.00251	0.00251			1.33

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

3.4 Emergency Generator Formula(s)

- Emergency Generator Emissions per Year

AE_{POL}= (NGEN * HP * OT * EF_{POL}) / 2000

AE_{POL}: Activity Emissions (TONs per Year)
NGEN: Number of Emergency Generators
HP: Emergency Generator's Horsepower (hp)
OT: Average Operating Hours Per Year (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hp-hr)

4. Emergency Generator

4.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Water Pump

- Activity Description:

- Activity Start Date
Start Month: 1
Start Year: 2023

- Activity End Date
Indefinite: No
End Month: 12
End Year: 2023

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.026778
SO_x	0.000468
NO_x	0.968660
CO	0.257312
PM 10	0.030257

Pollutant	Total Emissions (TONs)
PM 2.5	0.030257
Pb	0.000000
NH_3	0.000000
CO_2e	49.7

4.2 Emergency Generator Assumptions

- Emergency Generator
Type of Fuel used in Emergency Generator: Diesel
Number of Emergency Generators: 1

- Default Settings Used: No

- Emergency Generators Consumption
Emergency Generator's Horsepower: 1496

Average Operating Hours Per Year (hours): 50

4.3 Emergency Generator Emission Factor(s)

- Emergency Generators Emission Factor (lb/hp-hr)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
0.000716	0.0000125	0.0259	0.00688	0.000809	0.000809			1.33

4.4 Emergency Generator Formula(s)

- Emergency Generator Emissions per Year

AE_{POL}= (NGEN * HP * OT * EF_{POL}) / 2000

AE_{POL}: Activity Emissions (TONs per Year)
NGEN: Number of Emergency Generators
HP: Emergency Generator's Horsepower (hp)
OT: Average Operating Hours Per Year (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hp-hr)

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

1. General Information

- Action Location
Base: VANDENBERG AFB
State: California
County(s): Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Action Title: Phantom Space Corporation Daytona-E and Laguna-E Launch Operations at Space Launch Complex 5, Vandenberg Space Force Base, California

- Project Number/s (if applicable):

- Projected Action Start Date: 5 / 2023

- Action Purpose and Need:

- Action Description:
Space Launch Delta 30 (SLD 30), Vandenberg Space Force Base (VSFB or Base), California, prepared this Environmental Assessment (EA). This EA evaluates the potential environmental impacts associated with operating Phantom Space Corporation's (Phantom) Daytona-E and Laguna-E launch vehicles and the associated construction of a new launch facility at Space Launch Complex (SLC-5) on VSFB. Congress, under the U.S. Commercial Space Launch Act (CSLA), 51 United States Code (U.S.C.) Subtitle V, Chapter 509, Sections 50901-50923, provided the Department of Transportation (DOT) statutory direction to, in part, "protect the public health and safety, safety of property, and national security and foreign policy interests of the United States" while "strengthening and [expanding] that United States space transportation infrastructure, including the enhancement of United States launch sites and launch-site support facilities, and development of reentry sites, with Government, State, and private sector involvement, to support the full range of United States space-related activities." Within the DOT, the Secretary of Transportation's authority under the CSLA has been delegated to the Federal Aviation Administration (FAA) Office of Commercial Space Transportation. Per agreements between the Department of the Air Force (DAF) and the FAA, the DAF will act as the lead agency for preparing and coordinating the National Environmental Policy Act (NEPA) documentation for the Proposed action and the FAA will act as a cooperating agency to review the EA preparation.
This EA was prepared to enable the DAF, FAA, and the public to understand the potential environmental impacts of the proposed Daytona-E launch program. Because FAA regulations (14 Code of Federal Regulations [C.F.R.] parts 400–460) require an applicant to provide enough information for the FAA to analyze the potential environmental impacts associated with proposed launch activities, this EA has been prepared to comply with the requirements of the NEPA as amended (42 U.S.C. 4321 et seq.); the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 C.F.R. parts 1500–1508); the DAF's Environmental Impact Analysis Process (32 C.F.R. 989), and FAA Order 1050.1F, Environmental Impacts: Policies and Procedures.

- Point of Contact
Name: Ryan Wright-Zinniger
Title: Associate Environmental Scientist
Organization: ManTech
Email:
Phone Number:

- Activity List:

Activity Type		Activity Title
2.	Construction / Demolition	Normal Operations - Commercial Truck Transport of Rocket
3.	Construction / Demolition	Normal Operations - All Other Equipment

4.	Emergency Generator	Generator - Env Control System
5.	Emergency Generator	Generator - Inert Gas Pump

Emission factors and air emission estimating methods come from the United States Air Force's Air Emissions Guide for Air Force Stationary Sources, Air Emissions Guide for Air Force Mobile Sources, and Air Emissions Guide for Air Force Transitory Sources.

2. Construction / Demolition

2.1 General Information & Timeline Assumptions

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Normal Operations - Commercial Truck Transport of Rocket

- Activity Description:

- Activity Start Date
Start Month: 10
Start Month: 2023

- Activity End Date
Indefinite: False
End Month: 10
End Month: 2023

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.001579
SO_x	0.000047
NO_x	0.012913
CO	0.007290
PM 10	0.000494

Pollutant	Total Emissions (TONs)
PM 2.5	0.000362
Pb	0.000000
NH_3	0.000039
CO_2e	4.9

2.1 Building Construction Phase

2.1.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 10
Start Quarter: 1
Start Year: 2023

- Phase Duration
Number of Month: 0
Number of Days: 3

2.1.2 Building Construction Phase Assumptions

- General Building Construction Information

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

Building Category: Office or Industrial
Area of Building (ft^2): 1500
Height of Building (ft): 12
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 5

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Off-Highway Trucks Composite	1	7

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 88.5

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 1

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 0

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

2.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Off-Highway Trucks Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.1243	0.0026	0.5880	0.5421	0.0188	0.0188	0.0112	260.35

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.114	000.003	000.084	000.992	000.047	000.020		000.023	00298.845
LDGT	000.288	000.004	000.178	001.871	000.048	000.021		000.024	00379.038
HDGV	000.600	000.011	001.339	008.875	000.183	000.078		000.045	01128.468
LDDV	000.026	000.003	000.125	000.281	000.060	000.032		000.008	00271.718
LDDT	000.094	000.003	000.533	000.594	000.112	000.082		000.008	00364.857
HDDV	000.194	000.014	004.796	001.133	000.211	000.117		000.028	01514.699
MC	004.452	000.002	001.252	023.791	000.019	000.009		000.054	00187.891

2.1.4 Building Construction Phase Formula(s)

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

- Construction Exhaust Emissions per Phase
$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

3. Construction / Demolition

3.1 General Information & Timeline Assumptions

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Normal Operations - All Other Equipment

- Activity Description:

- Activity Start Date
Start Month: 10
Start Month: 2023

- Activity End Date
Indefinite: False
End Month: 10
End Month: 2023

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.000834
SO_x	0.000018
NO_x	0.004405
CO	0.004816
PM 10	0.000159

Pollutant	Total Emissions (TONs)
PM 2.5	0.000148
Pb	0.000000
NH_3	0.000006
CO_2e	1.8

3.1 Building Construction Phase

3.1.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 10
Start Quarter: 1
Start Year: 2023

- Phase Duration
Number of Month: 0
Number of Days: 1

3.1.2 Building Construction Phase Assumptions

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

- General Building Construction Information

Building Category: Office or Industrial
Area of Building (ft^2): 1500
Height of Building (ft): 12
Number of Units: N/A

- Building Construction Default Settings

Default Settings Used: No
Average Day(s) worked per week: 5

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Cranes Composite	1	1
Forklifts Composite	1	5.5
Generator Sets Composite	1	0.5
Off-Highway Trucks Composite	1	8
Other Construction Equipment Composite	1	3
Pumps Composite	1	2
Tractors/Loaders/Backhoes Composite	1	4

- Vehicle Exhaust

Average Hauling Truck Round Trip Commute (mile): 5

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips

Average Worker Round Trip Commute (mile): 15

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips

Average Vendor Round Trip Commute (mile): 1

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

3.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Cranes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0754	0.0013	0.5027	0.3786	0.0181	0.0181	0.0068	128.79
Forklifts Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0258	0.0006	0.1108	0.2145	0.0034	0.0034	0.0023	54.454
Generator Sets Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e

Emission Factors	0.0320	0.0006	0.2612	0.2683	0.0103	0.0103	0.0028	61.065
Off-Highway Trucks Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.1243	0.0026	0.5880	0.5421	0.0188	0.0188	0.0112	260.35
Other Construction Equipment Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0483	0.0012	0.2497	0.3481	0.0091	0.0091	0.0043	122.61
Pumps Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0302	0.0005	0.2318	0.2631	0.0100	0.0100	0.0027	49.674
Tractors/Loaders/Backhoes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0364	0.0007	0.2127	0.3593	0.0080	0.0080	0.0032	66.879

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.114	000.003	000.084	000.992	000.047	000.020		000.023	00298.845
LDGT	000.288	000.004	000.178	001.871	000.048	000.021		000.024	00379.038
HDGV	000.600	000.011	001.339	008.875	000.183	000.078		000.045	01128.468
LDDV	000.026	000.003	000.125	000.281	000.060	000.032		000.008	00271.718
LDDT	000.094	000.003	000.533	000.594	000.112	000.082		000.008	00364.857
HDDV	000.194	000.014	004.796	001.133	000.211	000.117		000.028	01514.699
MC	004.452	000.002	001.252	023.791	000.019	000.009		000.054	00187.891

3.1.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase

VMT_{WT} = WD * WT * 1.25 * NE

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
VMT_{VT} = BA * BH * (0.38 / 1000) * HT

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

4. Emergency Generator

4.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Generator - Env Control System

- Activity Description:
Was added at the end of round 2.

- Activity Start Date
Start Month: 5
Start Year: 2023

- Activity End Date
Indefinite: No
End Month: 5
End Year: 2023

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.000177
SO_x	0.000149
NO_x	0.000728
CO	0.000486
PM 10	0.000159

Pollutant	Total Emissions (TONs)
PM 2.5	0.000159
Pb	0.000000
NH_3	0.000000
CO_2e	0.1

4.2 Emergency Generator Assumptions

- Emergency Generator
Type of Fuel used in Emergency Generator: Diesel
Number of Emergency Generators: 1

- Default Settings Used: No

- Emergency Generators Consumption
Emergency Generator's Horsepower: 380
Average Operating Hours Per Year (hours): 4

4.3 Emergency Generator Emission Factor(s)

- Emergency Generators Emission Factor (lb/hp-hr)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
0.00279	0.00235	0.0115	0.00768	0.00251	0.00251			1.33

4.4 Emergency Generator Formula(s)

- Emergency Generator Emissions per Year
AE_{POL}= (NGEN * HP * OT * EF_{POL}) / 2000

AE_{POL}: Activity Emissions (TONs per Year)
NGEN: Number of Emergency Generators
HP: Emergency Generator's Horsepower (hp)
OT: Average Operating Hours Per Year (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hp-hr)

5. Emergency Generator

5.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Generator - Inert Gas Pump

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

- Activity Description:

- Activity Start Date
Start Month: 5
Start Year: 2023

- Activity End Date
Indefinite: No
End Month: 5
End Year: 2023

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.000419
SO_x	0.000353
NO_x	0.001725
CO	0.001152
PM 10	0.000377

Pollutant	Total Emissions (TONs)
PM 2.5	0.000377
Pb	0.000000
NH_3	0.000000
CO_2e	0.2

5.2 Emergency Generator Assumptions

- Emergency Generator
Type of Fuel used in Emergency Generator: Diesel
Number of Emergency Generators: 1

- Default Settings Used: No

- Emergency Generators Consumption
Emergency Generator's Horsepower: 300
Average Operating Hours Per Year (hours): 12

5.3 Emergency Generator Emission Factor(s)

- Emergency Generators Emission Factor (lb/hp-hr)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
0.00279	0.00235	0.0115	0.00768	0.00251	0.00251			1.33

5.4 Emergency Generator Formula(s)

- Emergency Generator Emissions per Year

AE_{POL}= (NGEN * HP * OT * EF_{POL}) / 2000

AE_{POL}: Activity Emissions (TONs per Year)
NGEN: Number of Emergency Generators
HP: Emergency Generator's Horsepower (hp)
OT: Average Operating Hours Per Year (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hp-hr)

Phantom EA - Construction Phases

Santa Barbara-North of Santa Ynez County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
User Defined Industrial	1.00	User Defined Unit	0.00	0.00	0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	3.1	**Precipitation Freq (Days)**	37
Climate Zone	4			**Operational Year**	2027
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	702.44	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - SCE as power company

Land Use -

Construction Phase - 45 days estimated for all phases

Off-road Equipment - replicating ACAM inputs

Off-road Equipment - replicating ACAM inputs

Off-road Equipment - Replicating ACAM Inputs

Trips and VMT - Assumes Vendors and workers come from points close to or near in distance to Santa MAria. 40 miles one way, 80 miles R/T

Phantom EA - Construction Phases - Santa Barbara-North of Santa Ynez County, Annual

Table Name	Column Name	Default Value	New Value
tblConstDustMitigation	WaterUnpavedRoadVehicleSpeed	40	0
tblConstructionPhase	NumDays	0.00	45.00
tblConstructionPhase	NumDays	0.00	45.00
tblConstructionPhase	NumDays	0.00	45.00
tblOffRoadEquipment	HorsePower	97.00	101.00
tblOffRoadEquipment	HorsePower	97.00	110.00
tblOffRoadEquipment	HorsePower	97.00	101.00
tblOffRoadEquipment	HorsePower	97.00	110.00
tblOffRoadEquipment	HorsePower	97.00	110.00
tblOffRoadEquipment	HorsePower	97.00	101.00
tblOffRoadEquipment	HorsePower	9.00	405.00
tblOffRoadEquipment	HorsePower	9.00	405.00
tblOffRoadEquipment	HorsePower	81.00	405.00
tblOffRoadEquipment	HorsePower	85.00	25.00
tblOffRoadEquipment	HorsePower	85.00	25.00
tblOffRoadEquipment	HorsePower	85.00	25.00
tblOffRoadEquipment	HorsePower	16.00	300.00
tblOffRoadEquipment	HorsePower	16.00	300.00
tblOffRoadEquipment	HorsePower	16.00	300.00
tblOffRoadEquipment	HorsePower	158.00	110.00
tblOffRoadEquipment	HorsePower	158.00	110.00
tblOffRoadEquipment	HorsePower	158.00	110.00
tblOffRoadEquipment	HorsePower	84.00	80.00
tblOffRoadEquipment	HorsePower	84.00	80.00

tblOffRoadEquipment	HorsePower	84.00	80.00
tblOffRoadEquipment	HorsePower	187.00	145.00
tblOffRoadEquipment	HorsePower	187.00	145.00
tblOffRoadEquipment	HorsePower	187.00	145.00
tblOffRoadEquipment	HorsePower	130.00	71.00
tblOffRoadEquipment	HorsePower	130.00	71.00
tblOffRoadEquipment	HorsePower	84.00	150.00
tblOffRoadEquipment	HorsePower	80.00	125.00
tblOffRoadEquipment	HorsePower	80.00	125.00
tblOffRoadEquipment	HorsePower	80.00	130.00
tblOffRoadEquipment	HorsePower	247.00	150.00
tblOffRoadEquipment	HorsePower	247.00	74.00
tblOffRoadEquipment	HorsePower	247.00	150.00
tblOffRoadEquipment	HorsePower	247.00	74.00
tblOffRoadEquipment	HorsePower	247.00	130.00
tblOffRoadEquipment	HorsePower	247.00	74.00
tblOffRoadEquipment	HorsePower	203.00	130.00
tblOffRoadEquipment	HorsePower	203.00	130.00
tblOffRoadEquipment	HorsePower	203.00	130.00
tblOffRoadEquipment	HorsePower	65.00	84.00
tblOffRoadEquipment	HorsePower	65.00	84.00
tblOffRoadEquipment	HorsePower	65.00	84.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00

tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	UsageHours	8.00	2.20
tblOffRoadEquipment	UsageHours	8.00	1.80
tblOffRoadEquipment	UsageHours	8.00	2.20
tblOffRoadEquipment	UsageHours	8.00	1.80
tblOffRoadEquipment	UsageHours	8.00	1.80
tblOffRoadEquipment	UsageHours	8.00	1.80
tblProjectCharacteristics	OperationalYear	2018	2027
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblTripsAndVMT	HaulingTripLength	20.00	0.00
tblTripsAndVMT	HaulingTripLength	20.00	0.00
tblTripsAndVMT	HaulingTripLength	20.00	0.00
tblTripsAndVMT	VendorTripLength	6.40	40.00
tblTripsAndVMT	VendorTripLength	6.40	40.00
tblTripsAndVMT	VendorTripLength	6.40	40.00
tblTripsAndVMT	VendorTripNumber	0.00	2.00
tblTripsAndVMT	VendorTripNumber	0.00	2.00

tblTripsAndVMT	VendorTripNumber	0.00	2.00
tblTripsAndVMT	WorkerTripLength	8.30	40.00
tblTripsAndVMT	WorkerTripLength	8.30	40.00
tblTripsAndVMT	WorkerTripLength	8.30	40.00
tblTripsAndVMT	WorkerTripNumber	0.00	30.00
tblTripsAndVMT	WorkerTripNumber	0.00	30.00
tblTripsAndVMT	WorkerTripNumber	0.00	30.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2024	0.0225	0.1660	0.2325	4.8000e-004	0.0217	7.7100e-003	0.0294	5.8000e-003	7.1900e-003	0.0130	0.0000	43.4001	43.4001	6.8100e-003	0.0000	43.5704
2025	0.0202	0.1439	0.2232	4.7000e-004	0.0217	6.2500e-003	0.0280	5.8000e-003	5.8400e-003	0.0116	0.0000	42.2613	42.2613	6.5900e-003	0.0000	42.4260
2027	0.0206	0.1459	0.2363	5.0000e-004	0.0217	6.3500e-003	0.0281	5.8000e-003	5.9700e-003	0.0118	0.0000	45.0731	45.0731	6.3300e-003	0.0000	45.2313
Maximum	**0.0225**	**0.1660**	**0.2363**	**5.0000e-004**	**0.0217**	**7.7100e-003**	**0.0294**	**5.8000e-003**	**7.1900e-003**	**0.0130**	**0.0000**	**45.0731**	**45.0731**	**6.8100e-003**	**0.0000**	**45.2313**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2024	0.0225	0.1660	0.2325	4.8000e-004	0.0217	7.7100e-003	0.0294	5.8000e-003	7.1900e-003	0.0130	0.0000	43.4001	43.4001	6.8100e-003	0.0000	43.5703
2025	0.0202	0.1439	0.2232	4.7000e-004	0.0217	6.2500e-003	0.0280	5.8000e-003	5.8400e-003	0.0116	0.0000	42.2613	42.2613	6.5900e-003	0.0000	42.4259
2027	0.0206	0.1459	0.2363	5.0000e-004	0.0217	6.3500e-003	0.0281	5.8000e-003	5.9700e-003	0.0118	0.0000	45.0731	45.0731	6.3300e-003	0.0000	45.2313
Maximum	**0.0225**	**0.1660**	**0.2363**	**5.0000e-004**	**0.0217**	**7.7100e-003**	**0.0294**	**5.8000e-003**	**7.1900e-003**	**0.0130**	**0.0000**	**45.0731**	**45.0731**	**6.8100e-003**	**0.0000**	**45.2313**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
1	**1-1-2024**	**3-31-2024**	0.1832	0.1832
5	**1-1-2025**	**3-31-2025**	0.0785	0.0785
6	**4-1-2025**	**6-30-2025**	0.0854	0.0854
14	**4-1-2027**	**6-30-2027**	0.1523	0.1523
15	**7-1-2027**	**9-30-2027**	0.0131	0.0131
		Highest	0.1832	0.1832

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Total	**0.0000**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**2.0000e-005**	**2.0000e-005**	**0.0000**	**0.0000**	**2.0000e-005**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**2.0000e-005**	**2.0000e-005**	**0.0000**	**0.0000**	**2.0000e-005**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Phase Ia - Building Construction	Building Construction	1/1/2024	3/1/2024	5	45	
2	Phase Ib - Building Construction	Building Construction	3/2/2025	5/3/2025	5	45	
3	Phase II - Building Construction	Building Construction	5/4/2027	7/5/2027	5	45	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Phase Ia - Building Construction	Cement and Mortar Mixers	1	1.80	405	0.56
Phase Ia - Building Construction	Cranes	0	4.00	231	0.29
Phase Ia - Building Construction	Crushing/Proc. Equipment	1	0.20	25	0.78
Phase Ia - Building Construction	Dumpers/Tenders	1	3.30	300	0.38
Phase Ia - Building Construction	Excavators	1	1.30	110	0.38

Phase Ia - Building Construction	Forklifts	0	6.00	89	0.20
Phase Ia - Building Construction	Generator Sets	1	2.70	80	0.74
Phase Ia - Building Construction	Graders	1	2.20	145	0.41
Phase Ia - Building Construction	Pavers	1	0.90	71	0.42
Phase Ia - Building Construction	Pumps	1	1.30	84	0.74
Phase Ia - Building Construction	Rollers	1	1.80	125	0.38
Phase Ia - Building Construction	Rubber Tired Dozers	1	3.30	150	0.40
Phase Ia - Building Construction	Rubber Tired Dozers	1	0.20	74	0.40
Phase Ia - Building Construction	Rubber Tired Loaders	1	2.20	130	0.36
Phase Ia - Building Construction	Skid Steer Loaders	1	3.30	84	0.37
Phase Ia - Building Construction	Tractors/Loaders/Backhoes	1	2.20	101	0.37
Phase Ia - Building Construction	Tractors/Loaders/Backhoes	1	1.80	110	0.37
Phase Ib - Building Construction	Cement and Mortar Mixers	1	1.80	405	0.56
Phase Ib - Building Construction	Cranes	0	4.00	231	0.29
Phase Ib - Building Construction	Crushing/Proc. Equipment	1	0.20	25	0.78
Phase Ib - Building Construction	Dumpers/Tenders	1	3.30	300	0.38
Phase Ib - Building Construction	Excavators	1	1.30	110	0.38
Phase Ib - Building Construction	Forklifts	0	6.00	89	0.20
Phase Ib - Building Construction	Generator Sets	1	2.70	80	0.74
Phase Ib - Building Construction	Graders	1	2.20	145	0.41
Phase Ib - Building Construction	Pumps	1	1.30	84	0.74
Phase Ib - Building Construction	Rollers	1	1.80	125	0.38
Phase Ib - Building Construction	Rubber Tired Dozers	1	3.30	150	0.40
Phase Ib - Building Construction	Rubber Tired Dozers	1	0.20	74	0.40
Phase Ib - Building Construction	Rubber Tired Loaders	1	2.20	130	0.36

Phase Ib - Building Construction	Skid Steer Loaders	1	3.30	84	0.37
Phase Ib - Building Construction	Tractors/Loaders/Backhoes	1	2.20	101	0.37
Phase Ib - Building Construction	Tractors/Loaders/Backhoes	1	1.80	110	0.37
Phase II - Building Construction	Concrete/Industrial Saws	1	1.80	405	0.73
Phase II - Building Construction	Cranes	0	4.00	231	0.29
Phase II - Building Construction	Crushing/Proc. Equipment	1	0.20	25	0.78
Phase II - Building Construction	Dumpers/Tenders	1	3.60	300	0.38
Phase II - Building Construction	Excavators	1	1.80	110	0.38
Phase II - Building Construction	Forklifts	0	6.00	89	0.20
Phase II - Building Construction	Generator Sets	1	4.00	80	0.74
Phase II - Building Construction	Graders	1	2.70	145	0.41
Phase II - Building Construction	Pavers	1	0.60	71	0.42
Phase II - Building Construction	Pumps	1	1.80	150	0.74
Phase II - Building Construction	Rollers	1	1.80	130	0.38
Phase II - Building Construction	Rubber Tired Dozers	1	2.70	130	0.40
Phase II - Building Construction	Rubber Tired Dozers	1	0.20	74	0.40
Phase II - Building Construction	Rubber Tired Loaders	1	1.80	130	0.36
Phase II - Building Construction	Skid Steer Loaders	1	2.20	84	0.37
Phase II - Building Construction	Tractors/Loaders/Backhoes	1	1.80	110	0.37
Phase II - Building Construction	Tractors/Loaders/Backhoes	1	1.80	101	0.37

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Phase Ia - Building Construction	15	30.00	2.00	0.00	40.00	40.00	0.00	LD_Mix	HDT_Mix	HHDT

Phase Ib - Building Construction	14	30.00	2.00	0.00	40.00	40.00	0.00	LD_Mix	HDT_Mix	HHDT
Phase II - Building Construction	15	30.00	2.00	0.00	40.00	40.00	0.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Phase Ia - Building Construction - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0162	0.1511	0.1857	2.8000e-004		7.5800e-003	7.5800e-003		7.0700e-003	7.0700e-003	0.0000	24.4133	24.4133	6.1600e-003	0.0000	24.5673
Total	**0.0162**	**0.1511**	**0.1857**	**2.8000e-004**		**7.5800e-003**	**7.5800e-003**		**7.0700e-003**	**7.0700e-003**	**0.0000**	**24.4133**	**24.4133**	**6.1600e-003**	**0.0000**	**24.5673**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	3.8000e-004	0.0100	4.3400e-003	5.0000e-005	1.6300e-003	3.0000e-005	1.6600e-003	4.7000e-004	3.0000e-005	5.0000e-004	0.0000	5.2954	5.2954	3.5000e-004	0.0000	5.3040
Worker	5.9300e-003	4.8600e-003	0.0425	1.5000e-004	0.0201	1.0000e-004	0.0202	5.3300e-003	9.0000e-005	5.4200e-003	0.0000	13.6914	13.6914	3.0000e-004	0.0000	13.6990
Total	**6.3100e-003**	**0.0149**	**0.0468**	**2.0000e-004**	**0.0217**	**1.3000e-004**	**0.0218**	**5.8000e-003**	**1.2000e-004**	**5.9200e-003**	**0.0000**	**18.9868**	**18.9868**	**6.5000e-004**	**0.0000**	**19.0030**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0162	0.1511	0.1857	2.8000e-004		7.5800e-003	7.5800e-003		7.0700e-003	7.0700e-003	0.0000	24.4133	24.4133	6.1600e-003	0.0000	24.5673
Total	**0.0162**	**0.1511**	**0.1857**	**2.8000e-004**		**7.5800e-003**	**7.5800e-003**		**7.0700e-003**	**7.0700e-003**	**0.0000**	**24.4133**	**24.4133**	**6.1600e-003**	**0.0000**	**24.5673**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	3.8000e-004	0.0100	4.3400e-003	5.0000e-005	1.6300e-003	3.0000e-005	1.6600e-003	4.7000e-004	3.0000e-005	5.0000e-004	0.0000	5.2954	5.2954	3.5000e-004	0.0000	5.3040
Worker	5.9300e-003	4.8600e-003	0.0425	1.5000e-004	0.0201	1.0000e-004	0.0202	5.3300e-003	9.0000e-005	5.4200e-003	0.0000	13.6914	13.6914	3.0000e-004	0.0000	13.6990
Total	**6.3100e-003**	**0.0149**	**0.0468**	**2.0000e-004**	**0.0217**	**1.3000e-004**	**0.0218**	**5.8000e-003**	**1.2000e-004**	**5.9200e-003**	**0.0000**	**18.9868**	**18.9868**	**6.5000e-004**	**0.0000**	**19.0030**

3.3 Phase Ib - Building Construction - 2025

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0142	0.1299	0.1798	2.7000e-004		6.1200e-003	6.1200e-003		5.7200e-003	5.7200e-003	0.0000	23.8516	23.8516	5.9600e-003	0.0000	24.0006
Total	**0.0142**	**0.1299**	**0.1798**	**2.7000e-004**		**6.1200e-003**	**6.1200e-003**		**5.7200e-003**	**5.7200e-003**	**0.0000**	**23.8516**	**23.8516**	**5.9600e-003**	**0.0000**	**24.0006**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	3.7000e-004	9.6200e-003	4.2300e-003	5.0000e-005	1.6300e-003	3.0000e-005	1.6600e-003	4.7000e-004	3.0000e-005	5.0000e-004	0.0000	5.2654	5.2654	3.6000e-004	0.0000	5.2742
Worker	5.6200e-003	4.4000e-003	0.0392	1.5000e-004	0.0201	1.0000e-004	0.0202	5.3300e-003	9.0000e-005	5.4200e-003	0.0000	13.1443	13.1443	2.7000e-004	0.0000	13.1511
Total	**5.9900e-003**	**0.0140**	**0.0434**	**2.0000e-004**	**0.0217**	**1.3000e-004**	**0.0218**	**5.8000e-003**	**1.2000e-004**	**5.9200e-003**	**0.0000**	**18.4097**	**18.4097**	**6.3000e-004**	**0.0000**	**18.4254**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0142	0.1299	0.1798	2.7000e-004		6.1200e-003	6.1200e-003		5.7200e-003	5.7200e-003	0.0000	23.8516	23.8516	5.9600e-003	0.0000	24.0006
Total	**0.0142**	**0.1299**	**0.1798**	**2.7000e-004**		**6.1200e-003**	**6.1200e-003**		**5.7200e-003**	**5.7200e-003**	**0.0000**	**23.8516**	**23.8516**	**5.9600e-003**	**0.0000**	**24.0006**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	3.7000e-004	9.6200e-003	4.2300e-003	5.0000e-005	1.6300e-003	3.0000e-005	1.6600e-003	4.7000e-004	3.0000e-005	5.0000e-004	0.0000	5.2654	5.2654	3.6000e-004	0.0000	5.2742
Worker	5.6200e-003	4.4000e-003	0.0392	1.5000e-004	0.0201	1.0000e-004	0.0202	5.3300e-003	9.0000e-005	5.4200e-003	0.0000	13.1443	13.1443	2.7000e-004	0.0000	13.1511
Total	**5.9900e-003**	**0.0140**	**0.0434**	**2.0000e-004**	**0.0217**	**1.3000e-004**	**0.0218**	**5.8000e-003**	**1.2000e-004**	**5.9200e-003**	**0.0000**	**18.4097**	**18.4097**	**6.3000e-004**	**0.0000**	**18.4254**

3.4 Phase II - Building Construction - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0151	0.1333	0.1991	3.2000e-004		6.2400e-003	6.2400e-003		5.8600e-003	5.8600e-003	0.0000	27.7195	27.7195	5.7400e-003	0.0000	27.8630
Total	**0.0151**	**0.1333**	**0.1991**	**3.2000e-004**		**6.2400e-003**	**6.2400e-003**		**5.8600e-003**	**5.8600e-003**	**0.0000**	**27.7195**	**27.7195**	**5.7400e-003**	**0.0000**	**27.8630**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	3.5000e-004	8.9300e-003	4.0600e-003	5.0000e-005	1.6300e-003	2.0000e-005	1.6500e-003	4.7000e-004	2.0000e-005	4.9000e-004	0.0000	5.2108	5.2108	3.7000e-004	0.0000	5.2201
Worker	5.1000e-003	3.6400e-003	0.0331	1.3000e-004	0.0201	9.0000e-005	0.0202	5.3300e-003	8.0000e-005	5.4100e-003	0.0000	12.1428	12.1428	2.2000e-004	0.0000	12.1483
Total	**5.4500e-003**	**0.0126**	**0.0372**	**1.8000e-004**	**0.0217**	**1.1000e-004**	**0.0218**	**5.8000e-003**	**1.0000e-004**	**5.9000e-003**	**0.0000**	**17.3536**	**17.3536**	**5.9000e-004**	**0.0000**	**17.3683**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0151	0.1333	0.1991	3.2000e-004		6.2400e-003	6.2400e-003		5.8600e-003	5.8600e-003	0.0000	27.7195	27.7195	5.7400e-003	0.0000	27.8630
Total	**0.0151**	**0.1333**	**0.1991**	**3.2000e-004**		**6.2400e-003**	**6.2400e-003**		**5.8600e-003**	**5.8600e-003**	**0.0000**	**27.7195**	**27.7195**	**5.7400e-003**	**0.0000**	**27.8630**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	3.5000e-004	8.9300e-003	4.0600e-003	5.0000e-005	1.6300e-003	2.0000e-005	1.6500e-003	4.7000e-004	2.0000e-005	4.9000e-004	0.0000	5.2108	5.2108	3.7000e-004	0.0000	5.2201
Worker	5.1000e-003	3.6400e-003	0.0331	1.3000e-004	0.0201	9.0000e-005	0.0202	5.3300e-003	8.0000e-005	5.4100e-003	0.0000	12.1428	12.1428	2.2000e-004	0.0000	12.1483
Total	**5.4500e-003**	**0.0126**	**0.0372**	**1.8000e-004**	**0.0217**	**1.1000e-004**	**0.0218**	**5.8000e-003**	**1.0000e-004**	**5.9000e-003**	**0.0000**	**17.3536**	**17.3536**	**5.9000e-004**	**0.0000**	**17.3683**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
User Defined Industrial	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
User Defined Industrial	6.60	5.50	6.40	0.00	0.00	0.00	0	0	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
User Defined Industrial	0.581396	0.025754	0.208279	0.111920	0.015368	0.004658	0.017778	0.020794	0.002788	0.001868	0.006229	0.002427	0.000740

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
User Defined Industrial	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
User Defined Industrial	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use		Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	tons/yr	MT/yr			
User Defined Industrial	0		0.0000	0.0000	0.0000	0.0000
Total			**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use		Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	tons/yr	MT/yr			
User Defined Industrial	0		0.0000	0.0000	0.0000	0.0000
Total			**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Unmitigated	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005

Total	**0.0000**	**0.0000**	**1.0000e-005**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**2.0000e-005**	**2.0000e-005**	**0.0000**	**0.0000**	**2.0000e-005**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Total	**0.0000**	**0.0000**	**1.0000e-005**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**2.0000e-005**	**2.0000e-005**	**0.0000**	**0.0000**	**2.0000e-005**

7.0 Water Detail

7.1 Mitigation Measures Water

		Total CO2	CH4	N2O	CO2e
Category	tons/yr	MT/yr			
Mitigated		0.0000	0.0000	0.0000	0.0000
Unmitigated		0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use		Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr	MT/yr			
User Defined Industrial	0 / 0		0.0000	0.0000	0.0000	0.0000
Total			**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Indoor/Outdoor Use		Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr	MT/yr			
User Defined Industrial	0 / 0		0.0000	0.0000	0.0000	0.0000
Total			**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

		Total CO2	CH4	N2O	CO2e
	tons/yr	MT/yr			
Mitigated		0.0000	0.0000	0.0000	0.0000
Unmitigated		0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed		Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr	MT/yr			
User Defined Industrial	0		0.0000	0.0000	0.0000	0.0000
Total			**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed		Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr	MT/yr			
User Defined Industrial	0		0.0000	0.0000	0.0000	0.0000
Total			**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Phantom EA - Backup Generator Testing

Santa Barbara-North of Santa Ynez County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
User Defined Industrial	1.00	User Defined Unit	1.00	0.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	3.1	**Precipitation Freq (Days)**	37
Climate Zone	4			**Operational Year**	2023
Utility Company	Santa Barbara Clean Energy				
CO2 Intensity (lb/MWhr)	597.98	**CH4 Intensity (lb/MWhr)**	0.033	**N2O Intensity (lb/MWhr)**	0.004

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - All estimates provided by Phantom Space.

Construction Phase - All estimates provided by Phantom Space.

Off-road Equipment - All estimates provided by Phantom Space.

Off-road Equipment - All estimates provided by Phantom Space.

Off-road Equipment - All estimates provided by Phantom Space.

Off-road Equipment - All estimates provided by Phantom Space.

Table Name	Column Name	Default Value	New Value
tblAreaCoating	Area_EF_Parking	250	0
tblAreaMitigation	UseLowVOCPaintNonresidentialExteriorValue	250	0
tblAreaMitigation	UseLowVOCPaintNonresidentialInteriorValue	250	0

tblAreaMitigation	UseLowVOCPaintResidentialExteriorValue	100	0
tblAreaMitigation	UseLowVOCPaintResidentialInteriorValue	50	0
tblConstructionPhase	NumDays	1.00	5.00
tblConstructionPhase	NumDays	1.00	5.00
tblConstructionPhase	NumDays	1.00	5.00
tblFleetMix	HHD	6.1310e-003	0.00
tblFleetMix	LDA	0.49	0.00
tblFleetMix	LDT1	0.05	0.00
tblFleetMix	LDT2	0.21	0.00
tblFleetMix	LHD1	0.03	0.00
tblFleetMix	LHD2	7.1460e-003	0.00
tblFleetMix	MCY	0.03	0.00
tblFleetMix	MDV	0.15	0.00
tblFleetMix	MH	4.2720e-003	0.00
tblFleetMix	MHD	0.01	0.00
tblFleetMix	OBUS	9.6600e-004	0.00
tblFleetMix	SBUS	3.5230e-003	0.00
tblFleetMix	UBUS	5.9700e-004	0.00
tblLandUse	LotAcreage	0.00	1.00
tblOffRoadEquipment	HorsePower	84.00	597.00
tblOffRoadEquipment	HorsePower	84.00	210.00
tblOffRoadEquipment	HorsePower	84.00	1,850.00
tblOffRoadEquipment	LoadFactor	0.74	0.41
tblOffRoadEquipment	LoadFactor	0.74	0.41
tblOffRoadEquipment	LoadFactor	0.74	0.41
tblOffRoadEquipment	OffRoadEquipmentType	Graders	Generator Sets
tblOffRoadEquipment	OffRoadEquipmentType	Graders	Generator Sets
tblOffRoadEquipment	OffRoadEquipmentType	Graders	Generator Sets

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2022	8.4000e-004	7.1700e-003	4.9500e-003	3.0000e-005	5.0000e-005	2.0000e-004	2.5000e-004	1.0000e-005	2.0000e-004	2.2000e-004	0.0000	2.4829	2.4829	7.0000e-005	0.0000	2.4850
2023	0.0103	0.1448	0.0567	2.8000e-004	9.0000e-005	2.9200e-003	3.0200e-003	2.0000e-005	2.9200e-003	2.9500e-003	0.0000	28.5784	28.5784	8.2000e-004	0.0000	28.5996
Maximum	**0.0103**	**0.1448**	**0.0567**	**2.8000e-004**	**9.0000e-005**	**2.9200e-003**	**3.0200e-003**	**2.0000e-005**	**2.9200e-003**	**2.9500e-003**	**0.0000**	**28.5784**	**28.5784**	**8.2000e-004**	**0.0000**	**28.5996**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2022	8.4000e-004	7.1700e-003	4.9500e-003	3.0000e-005	5.0000e-005	2.0000e-004	2.5000e-004	1.0000e-005	2.0000e-004	2.2000e-004	0.0000	2.4829	2.4829	7.0000e-005	0.0000	2.4850
2023	0.0103	0.1448	0.0567	2.8000e-004	9.0000e-005	2.9200e-003	3.0200e-003	2.0000e-005	2.9200e-003	2.9500e-003	0.0000	28.5784	28.5784	8.2000e-004	0.0000	28.5996
Maximum	**0.0103**	**0.1448**	**0.0567**	**2.8000e-004**	**9.0000e-005**	**2.9200e-003**	**3.0200e-003**	**2.0000e-005**	**2.9200e-003**	**2.9500e-003**	**0.0000**	**28.5784**	**28.5784**	**8.2000e-004**	**0.0000**	**28.5996**

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
1	**7-1-2023**	**9-30-2023**	0.1551	0.1551
		Highest	0.1551	0.1551

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**2.0000e-005**	**2.0000e-005**	**0.0000**	**0.0000**	**2.0000e-005**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**2.0000e-005**	**2.0000e-005**	**0.0000**	**0.0000**	**2.0000e-005**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Generator - Hydrolic Power Units	Site Preparation	8/2/2022	8/8/2022	5	5	
2	Generator - Site Ops	Site Preparation	7/1/2023	7/7/2023	5	5	
3	Generator - Water Pump	Site Preparation	7/19/2023	7/25/2023	5	5	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Generator - Site Ops	Generator Sets	1	10.00	597	0.41
Generator - Hydrolic Power Units	Generator Sets	1	10.00	210	0.41
Generator - Water Pump	Generator Sets	1	10.00	1850	0.41

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Generator - Site Ops	1	3.00	0.00	0.00	8.30	6.40	20.00	LD_Mix	HDT_Mix	HHDT
Generator - Hydrolic Power Units	1	3.00	0.00	0.00	8.30	6.40	20.00	LD_Mix	HDT_Mix	HHDT
Generator - Water Pump	1	3.00	0.00	0.00	8.30	6.40	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Generator - Hydrolic Power Units - 2022

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	8.2000e-004	7.1600e-003	4.7900e-003	3.0000e-005		2.0000e-004	2.0000e-004		2.0000e-004	2.0000e-004	0.0000	2.4465	2.4465	6.0000e-005	0.0000	2.4481
Total	**8.2000e-004**	**7.1600e-003**	**4.7900e-003**	**3.0000e-005**	**0.0000**	**2.0000e-004**	**2.0000e-004**	**0.0000**	**2.0000e-004**	**2.0000e-004**	**0.0000**	**2.4465**	**2.4465**	**6.0000e-005**	**0.0000**	**2.4481**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.0000e-005	2.0000e-005	1.6000e-004	0.0000	5.0000e-005	0.0000	5.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0364	0.0364	0.0000	0.0000	0.0368
Total	**2.0000e-005**	**2.0000e-005**	**1.6000e-004**	**0.0000**	**5.0000e-005**	**0.0000**	**5.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0364**	**0.0364**	**0.0000**	**0.0000**	**0.0368**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	8.2000e-004	7.1600e-003	4.7900e-003	3.0000e-005		2.0000e-004	2.0000e-004		2.0000e-004	2.0000e-004	0.0000	2.4465	2.4465	6.0000e-005	0.0000	2.4481
Total	**8.2000e-004**	**7.1600e-003**	**4.7900e-003**	**3.0000e-005**	**0.0000**	**2.0000e-004**	**2.0000e-004**	**0.0000**	**2.0000e-004**	**2.0000e-004**	**0.0000**	**2.4465**	**2.4465**	**6.0000e-005**	**0.0000**	**2.4481**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.0000e-005	2.0000e-005	1.6000e-004	0.0000	5.0000e-005	0.0000	5.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0364	0.0364	0.0000	0.0000	0.0368
Total	**2.0000e-005**	**2.0000e-005**	**1.6000e-004**	**0.0000**	**5.0000e-005**	**0.0000**	**5.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0364**	**0.0364**	**0.0000**	**0.0000**	**0.0368**

3.3 Generator - Site Ops - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.1600e-003	0.0169	0.0133	7.0000e-005		5.0000e-004	5.0000e-004		5.0000e-004	5.0000e-004	0.0000	6.9551	6.9551	1.7000e-004	0.0000	6.9594
Total	**2.1600e-003**	**0.0169**	**0.0133**	**7.0000e-005**	**0.0000**	**5.0000e-004**	**5.0000e-004**	**0.0000**	**5.0000e-004**	**5.0000e-004**	**0.0000**	**6.9551**	**6.9551**	**1.7000e-004**	**0.0000**	**6.9594**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.0000e-005	1.0000e-005	1.5000e-004	0.0000	5.0000e-005	0.0000	5.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0353	0.0353	0.0000	0.0000	0.0357
Total	**2.0000e-005**	**1.0000e-005**	**1.5000e-004**	**0.0000**	**5.0000e-005**	**0.0000**	**5.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0353**	**0.0353**	**0.0000**	**0.0000**	**0.0357**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.1600e-003	0.0169	0.0133	7.0000e-005		5.0000e-004	5.0000e-004		5.0000e-004	5.0000e-004	0.0000	6.9551	6.9551	1.7000e-004	0.0000	6.9594
Total	**2.1600e-003**	**0.0169**	**0.0133**	**7.0000e-005**	**0.0000**	**5.0000e-004**	**5.0000e-004**	**0.0000**	**5.0000e-004**	**5.0000e-004**	**0.0000**	**6.9551**	**6.9551**	**1.7000e-004**	**0.0000**	**6.9594**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.0000e-005	1.0000e-005	1.5000e-004	0.0000	5.0000e-005	0.0000	5.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0353	0.0353	0.0000	0.0000	0.0357
Total	**2.0000e-005**	**1.0000e-005**	**1.5000e-004**	**0.0000**	**5.0000e-005**	**0.0000**	**5.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0353**	**0.0353**	**0.0000**	**0.0000**	**0.0357**

3.4 Generator - Water Pump - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	8.1100e-003	0.1278	0.0431	2.1000e-004		2.4200e-003	2.4200e-003		2.4200e-003	2.4200e-003	0.0000	21.5527	21.5527	6.4000e-004	0.0000	21.5689
Total	**8.1100e-003**	**0.1278**	**0.0431**	**2.1000e-004**	**0.0000**	**2.4200e-003**	**2.4200e-003**	**0.0000**	**2.4200e-003**	**2.4200e-003**	**0.0000**	**21.5527**	**21.5527**	**6.4000e-004**	**0.0000**	**21.5689**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.0000e-005	1.0000e-005	1.5000e-004	0.0000	5.0000e-005	0.0000	5.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0353	0.0353	0.0000	0.0000	0.0357
Total	**2.0000e-005**	**1.0000e-005**	**1.5000e-004**	**0.0000**	**5.0000e-005**	**0.0000**	**5.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0353**	**0.0353**	**0.0000**	**0.0000**	**0.0357**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	8.1100e-003	0.1278	0.0431	2.1000e-004		2.4200e-003	2.4200e-003		2.4200e-003	2.4200e-003	0.0000	21.5527	21.5527	6.4000e-004	0.0000	21.5688
Total	**8.1100e-003**	**0.1278**	**0.0431**	**2.1000e-004**	**0.0000**	**2.4200e-003**	**2.4200e-003**	**0.0000**	**2.4200e-003**	**2.4200e-003**	**0.0000**	**21.5527**	**21.5527**	**6.4000e-004**	**0.0000**	**21.5688**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.0000e-005	1.0000e-005	1.5000e-004	0.0000	5.0000e-005	0.0000	5.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0353	0.0353	0.0000	0.0000	0.0357
Total	**2.0000e-005**	**1.0000e-005**	**1.5000e-004**	**0.0000**	**5.0000e-005**	**0.0000**	**5.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0353**	**0.0353**	**0.0000**	**0.0000**	**0.0357**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
User Defined Industrial	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
User Defined Industrial	6.60	5.50	6.40	0.00	0.00	0.00	0	0	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH

User Defined Industrial	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
User Defined Industrial	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
User Defined Industrial	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use		Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	tons/yr	MT/yr			
User Defined Industrial	0		0.0000	0.0000	0.0000	0.0000
Total			**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use		Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	tons/yr	MT/yr			
User Defined Industrial	0		0.0000	0.0000	0.0000	0.0000
Total			**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Unmitigated	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005

6.2 Area by SubCategory

Unmitigated

SubCategory	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Total	**0.0000**	**0.0000**	**1.0000e-005**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**2.0000e-005**	**2.0000e-005**	**0.0000**	**0.0000**	**2.0000e-005**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Total	**0.0000**	**0.0000**	**1.0000e-005**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**2.0000e-005**	**2.0000e-005**	**0.0000**	**0.0000**	**2.0000e-005**

7.0 Water Detail

7.1 Mitigation Measures Water

		Total CO2	CH4	N2O	CO2e
Category	tons/yr	MT/yr			
Mitigated		0.0000	0.0000	0.0000	0.0000
Unmitigated		0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use		Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr	MT/yr			
User Defined Industrial	0 / 0		0.0000	0.0000	0.0000	0.0000
Total			**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Indoor/Outdoor Use		Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr	MT/yr			
User Defined Industrial	0 / 0		0.0000	0.0000	0.0000	0.0000
Total			**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

		Total CO2	CH4	N2O	CO2e
	tons/yr	MT/yr			
Mitigated		0.0000	0.0000	0.0000	0.0000
Unmitigated		0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed		Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr	MT/yr			
User Defined Industrial	0		0.0000	0.0000	0.0000	0.0000
Total			**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed		Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr	MT/yr			
User Defined Industrial	0		0.0000	0.0000	0.0000	0.0000
Total			**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

Phantom EA - Launch Operations

Santa Barbara-North of Santa Ynez County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
User Defined Industrial	1.00	User Defined Unit	1.00	0.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	3.1	**Precipitation Freq (Days)**	37
Climate Zone	4			**Operational Year**	2023
Utility Company	Santa Barbara Clean Energy				
CO2 Intensity (lb/MWhr)	597.98	**CH4 Intensity (lb/MWhr)**	0.033	**N2O Intensity (lb/MWhr)**	0.004

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - All estimates provided by Phantom Space.

Construction Phase - All estimates provided by Phantom Space.

Off-road Equipment - All estimates provided by Phantom Space.

Off-road Equipment - All equipment estimates provided by Phantom Space.

Off-road Equipment - All equipment estimates provided by Phantom Space.

Table Name	Column Name	Default Value	New Value
tblAreaCoating	Area_EF_Parking	250	0
tblAreaMitigation	UseLowVOCPaintNonresidentialExteriorValue	250	0
tblAreaMitigation	UseLowVOCPaintNonresidentialInteriorValue	250	0
tblAreaMitigation	UseLowVOCPaintResidentialExteriorValue	100	0

tblAreaMitigation	UseLowVOCPaintResidentialInteriorValue	50	0
tblConstructionPhase	NumDays	1.00	3.00
tblConstructionPhase	NumDays	1.00	2.00
tblFleetMix	HHD	6.1310e-003	0.00
tblFleetMix	LDA	0.49	0.00
tblFleetMix	LDT1	0.05	0.00
tblFleetMix	LDT2	0.21	0.00
tblFleetMix	LHD1	0.03	0.00
tblFleetMix	LHD2	7.1460e-003	0.00
tblFleetMix	MCY	0.03	0.00
tblFleetMix	MDV	0.15	0.00
tblFleetMix	MH	4.2720e-003	0.00
tblFleetMix	MHD	0.01	0.00
tblFleetMix	OBUS	9.6600e-004	0.00
tblFleetMix	SBUS	3.5230e-003	0.00
tblFleetMix	UBUS	5.9700e-004	0.00
tblLandUse	LotAcreage	0.00	1.00
tblOffRoadEquipment	HorsePower	84.00	280.00
tblOffRoadEquipment	HorsePower	84.00	300.00
tblOffRoadEquipment	HorsePower	97.00	74.00
tblOffRoadEquipment	HorsePower	89.00	250.00
tblOffRoadEquipment	HorsePower	402.00	300.00
tblOffRoadEquipment	HorsePower	402.00	300.00
tblOffRoadEquipment	HorsePower	88.00	505.00
tblOffRoadEquipment	LoadFactor	0.20	0.37
tblOffRoadEquipment	LoadFactor	0.38	0.41
tblOffRoadEquipment	LoadFactor	0.38	0.41
tblOffRoadEquipment	OffRoadEquipmentType		Generator Sets

tblOffRoadEquipment	OffRoadEquipmentType		Generator Sets
tblOffRoadEquipment	UsageHours	8.00	2.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2023	1.6000e-003	0.0117	0.0107	5.0000e-005	1.2000e-004	4.0000e-004	5.2000e-004	3.0000e-005	3.8000e-004	4.1000e-004	0.0000	4.3124	4.3124	7.8000e-004	0.0000	4.3327
Maximum	**1.6000e-003**	**0.0117**	**0.0107**	**5.0000e-005**	**1.2000e-004**	**4.0000e-004**	**5.2000e-004**	**3.0000e-005**	**3.8000e-004**	**4.1000e-004**	**0.0000**	**4.3124**	**4.3124**	**7.8000e-004**	**0.0000**	**4.3327**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2023	1.6000e-003	0.0117	0.0107	5.0000e-005	1.2000e-004	4.0000e-004	5.2000e-004	3.0000e-005	3.8000e-004	4.1000e-004	0.0000	4.3124	4.3124	7.8000e-004	0.0000	4.3327
Maximum	**1.6000e-003**	**0.0117**	**0.0107**	**5.0000e-005**	**1.2000e-004**	**4.0000e-004**	**5.2000e-004**	**3.0000e-005**	**3.8000e-004**	**4.1000e-004**	**0.0000**	**4.3124**	**4.3124**	**7.8000e-004**	**0.0000**	**4.3327**

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
		Highest		

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**2.0000e-005**	**2.0000e-005**	**0.0000**	**0.0000**	**2.0000e-005**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**2.0000e-005**	**2.0000e-005**	**0.0000**	**0.0000**	**2.0000e-005**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Rocket Delivery	Site Preparation	5/1/2023	5/3/2023	5	3	
2	Launch Operations	Site Preparation	5/4/2023	5/5/2023	5	2	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Launch Operations	Generator Sets	1	2.00	280	0.74
Rocket Delivery	Off-Highway Trucks	1	7.00	300	0.41
Launch Operations	Generator Sets	1	6.00	300	0.74
Launch Operations	Forklifts	1	2.80	250	0.37
Launch Operations	Off-Highway Trucks	1	4.00	300	0.41
Launch Operations	Other General Industrial Equipment	1	1.50	505	0.34
Launch Operations	Tractors/Loaders/Backhoes	1	2.00	74	0.37

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Rocket Delivery	1	3.00	0.00	0.00	8.30	6.40	20.00	LD_Mix	HDT_Mix	HHDT
Launch Operations	6	15.00	0.00	0.00	8.30	6.40	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Rocket Delivery - 2023

Unmitigated Construction On-Site

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	5.3000e-004	3.7700e-003	3.4800e-003	1.0000e-005		1.4000e-004	1.4000e-004		1.3000e-004	1.3000e-004	0.0000	1.2271	1.2271	4.0000e-004	0.0000	1.2370
Total	**5.3000e-004**	**3.7700e-003**	**3.4800e-003**	**1.0000e-005**	**0.0000**	**1.4000e-004**	**1.4000e-004**	**0.0000**	**1.3000e-004**	**1.3000e-004**	**0.0000**	**1.2271**	**1.2271**	**4.0000e-004**	**0.0000**	**1.2370**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.0000e-005	1.0000e-005	9.0000e-005	0.0000	3.0000e-005	0.0000	3.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0212	0.0212	0.0000	0.0000	0.0214
Total	**1.0000e-005**	**1.0000e-005**	**9.0000e-005**	**0.0000**	**3.0000e-005**	**0.0000**	**3.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0212**	**0.0212**	**0.0000**	**0.0000**	**0.0214**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	5.3000e-004	3.7700e-003	3.4800e-003	1.0000e-005		1.4000e-004	1.4000e-004		1.3000e-004	1.3000e-004	0.0000	1.2271	1.2271	4.0000e-004	0.0000	1.2370
Total	**5.3000e-004**	**3.7700e-003**	**3.4800e-003**	**1.0000e-005**	**0.0000**	**1.4000e-004**	**1.4000e-004**	**0.0000**	**1.3000e-004**	**1.3000e-004**	**0.0000**	**1.2271**	**1.2271**	**4.0000e-004**	**0.0000**	**1.2370**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.0000e-005	1.0000e-005	9.0000e-005	0.0000	3.0000e-005	0.0000	3.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0212	0.0212	0.0000	0.0000	0.0214
Total	**1.0000e-005**	**1.0000e-005**	**9.0000e-005**	**0.0000**	**3.0000e-005**	**0.0000**	**3.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0212**	**0.0212**	**0.0000**	**0.0000**	**0.0214**

3.3 Launch Operations - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.0200e-003	7.8400e-003	6.8800e-003	3.0000e-005		2.6000e-004	2.6000e-004		2.5000e-004	2.5000e-004	0.0000	2.9937	2.9937	3.8000e-004	0.0000	3.0030
Total	**1.0200e-003**	**7.8400e-003**	**6.8800e-003**	**3.0000e-005**	**0.0000**	**2.6000e-004**	**2.6000e-004**	**0.0000**	**2.5000e-004**	**2.5000e-004**	**0.0000**	**2.9937**	**2.9937**	**3.8000e-004**	**0.0000**	**3.0030**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.0000e-005	3.0000e-005	2.9000e-004	0.0000	9.0000e-005	0.0000	9.0000e-005	2.0000e-005	0.0000	3.0000e-005	0.0000	0.0705	0.0705	0.0000	0.0000	0.0713
Total	**4.0000e-005**	**3.0000e-005**	**2.9000e-004**	**0.0000**	**9.0000e-005**	**0.0000**	**9.0000e-005**	**2.0000e-005**	**0.0000**	**3.0000e-005**	**0.0000**	**0.0705**	**0.0705**	**0.0000**	**0.0000**	**0.0713**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.0200e-003	7.8400e-003	6.8800e-003	3.0000e-005		2.6000e-004	2.6000e-004		2.5000e-004	2.5000e-004	0.0000	2.9936	2.9936	3.8000e-004	0.0000	3.0030
Total	**1.0200e-003**	**7.8400e-003**	**6.8800e-003**	**3.0000e-005**	**0.0000**	**2.6000e-004**	**2.6000e-004**	**0.0000**	**2.5000e-004**	**2.5000e-004**	**0.0000**	**2.9936**	**2.9936**	**3.8000e-004**	**0.0000**	**3.0030**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.0000e-005	3.0000e-005	2.9000e-004	0.0000	9.0000e-005	0.0000	9.0000e-005	2.0000e-005	0.0000	3.0000e-005	0.0000	0.0705	0.0705	0.0000	0.0000	0.0713
Total	**4.0000e-005**	**3.0000e-005**	**2.9000e-004**	**0.0000**	**9.0000e-005**	**0.0000**	**9.0000e-005**	**2.0000e-005**	**0.0000**	**3.0000e-005**	**0.0000**	**0.0705**	**0.0705**	**0.0000**	**0.0000**	**0.0713**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
User Defined Industrial	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
User Defined Industrial	6.60	5.50	6.40	0.00	0.00	0.00	0	0	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH

User Defined Industrial	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
User Defined Industrial	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
User Defined Industrial	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use		Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	tons/yr	MT/yr			
User Defined Industrial	0		0.0000	0.0000	0.0000	0.0000
Total			**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use		Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	tons/yr	MT/yr			
User Defined Industrial	0		0.0000	0.0000	0.0000	0.0000
Total			**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Unmitigated	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Total	**0.0000**	**0.0000**	**1.0000e-005**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**2.0000e-005**	**2.0000e-005**	**0.0000**	**0.0000**	**2.0000e-005**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Total	**0.0000**	**0.0000**	**1.0000e-005**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**2.0000e-005**	**2.0000e-005**	**0.0000**	**0.0000**	**2.0000e-005**

7.0 Water Detail

7.1 Mitigation Measures Water

		Total CO2	CH4	N2O	CO2e
Category	tons/yr	MT/yr			
Mitigated		0.0000	0.0000	0.0000	0.0000
Unmitigated		0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use		Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr	MT/yr			
User Defined Industrial	0 / 0		0.0000	0.0000	0.0000	0.0000
Total			**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Indoor/Outdoor Use		Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr	MT/yr			
User Defined Industrial	0 / 0		0.0000	0.0000	0.0000	0.0000
Total			**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

		Total CO2	CH4	N2O	CO2e
	tons/yr	MT/yr			
Mitigated		0.0000	0.0000	0.0000	0.0000
Unmitigated		0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed		Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr	MT/yr			
User Defined Industrial	0		0.0000	0.0000	0.0000	0.0000
Total			**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed		Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr	MT/yr			
User Defined Industrial	0		0.0000	0.0000	0.0000	0.0000
Total			**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Appendix G

Sound – Background & Regulatory Requirements

G.1 Definition of Sound and Characteristics

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as air or water, and are sensed by the human ear. Noise is defined as unwanted or annoying sound that interferes with or disrupts normal human activities. Although continuous and extended exposure to high noise levels (e.g., through occupational exposure) can cause hearing loss, the principal human response to noise is annoyance. The response of different individuals to similar noise events is diverse and is influenced by the type of noise, perceived importance of the noise, its appropriateness in the setting, time of day, type of activity during which the noise occurs, and sensitivity of the individual.

The perception and evaluation of sound involves three basic physical characteristics:

- Intensity – the acoustic energy, which is expressed in terms of sound pressure, in decibels (dB)
- Frequency – the number of cycles per second the air vibrates, in Hertz (Hz)
- Duration – the length of time the sound can be detected

The primary human response to noise is annoyance, which is defined by the United States (U.S.) Environmental Protection Agency (EPA) as any negative subjective reaction on the part of an individual or group (U.S. Environmental Protection Agency 1974). . While aircraft are not the only sources of noise in an urban or suburban environment, they are readily identified by their noise output.

G.2 Noise Sensitive Areas and Sensitive Receptors

A noise sensitive area is an area where noise interferes with normal activities associated with its use. Normally, noise sensitive areas include residential, educational, health, and religious structures and sites; parks; recreational areas (including areas with wilderness characteristics); wildlife refuges; and cultural and historical sites. For example, in the context of noise from airplanes and helicopters, noise sensitive areas include such areas within the DNL 65 dB noise contour. Individual, isolated, residential structures may be considered compatible within the Day-Night Average Sound Level (DNL) 65 dB noise contour where the primary use of land is agricultural and adequate noise attenuation is provided (FAA Order 10501.F, Paragraph 11-5.b.(10)). Also, transient residential use such as motels may be considered compatible within the DNL 65 dB noise contour where adequate noise attenuation is provided. Users of designated recreational areas are considered sensitive receptors.

G.3 Sound Intensity and Weighting

The loudest sounds that can be detected comfortably by the human ear have intensities that are a trillion times higher than those of sounds that can barely be heard. Because of this vast range, it is unwieldy to use a linear scale to represent the intensity of sound. As a result, a logarithmic unit known as the decibel represents the intensity or amplitude of a sound, also referred to as the sound level. The dB scale simplifies the broad range of encountered sound pressures detected by the human ear and allows the measurement of sound to be more easily understood. A sound level of 0 dB is approximately the threshold of human hearing and is barely audible under extremely quiet listening conditions. Normal speech has a sound level of approximately 60 dB. Sound levels above 120 dB begin to be felt inside the human ear as discomfort. Sound levels between 130 and 140 dB are felt as pain (Berglund 1995).

All sounds have a spectral content, which means their magnitude or level changes with frequency, where frequency is measured in cycles per second or Hz. To mimic the human ear's non-linear sensitivity and perception of different frequencies of sound, the spectral content is weighted. For example, environmental noise measurements are usually on an "A-weighted" scale, which places less weight on very low and very high frequencies in order to replicate human hearing sensitivity. The general range of human hearing is from 20 to 20,000 cycles per second, or Hz; humans hear best in the range of 1,000–4,000 Hz. A-weighting is a frequency-dependent adjustment of sound level used to approximate the natural range and sensitivity of the human auditory system. **Error! Reference source not found.** provides a comparison of how the human ear perceives changes in loudness on the logarithmic scale.

Table G-1: Subjective Responses to Changes in A-Weighted Decibels

Change	Change in Perceived Loudness
3 dB	Barely perceptible
5 dB	Quite noticeable
10 dB	Dramatic – twice or half as loud
20 dB	Striking – fourfold change

Note: dB = decibel(s)

Error! Reference source not found. provides a chart of A-weighted sound levels from typical noise sources (Cowan 1994; Harris 1979). Some noise sources (e.g., air conditioner, vacuum cleaner) are continuous sounds that maintain a constant sound level for some period of time. Other sources are time-varying events and reach a maximum sound level during an event, such as a vehicle passing by. Sounds can also be part of the ambient environment (e.g., urban daytime, urban nighttime) and are described by averages taken over extended periods. A variety of noise metrics has been developed to describe noise, particularly aircraft noise, in different contexts and over different time periods.

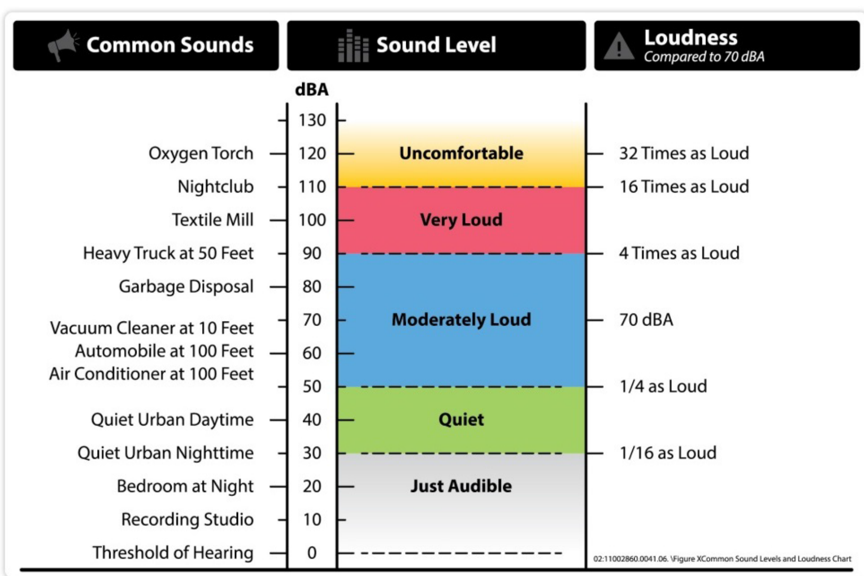

Figure G-1: A-Weighted Sound Levels from Typical Sources

G.4 Sound Metrics

A “metric” is a system for measuring or quantifying a particular characteristic of a subject. Since noise is a complex physical phenomenon, different noise metrics help to quantify the noise environment. The Day-Night Average Sound Level (DNL) metric is the energy-averaged sound level measured over a 24-hour period, with a 10 dB nighttime adjustment to account for heightened human sensitivity to noise when ambient sound levels are low, such as when sleep disturbance could occur. DNL does not represent a sound level heard at any given time but instead represents long-term exposure. Scientific studies have found good correlation between the percentages of groups of people highly annoyed and the level of their average noise exposure measured in DNL (U.S. Department of the Navy et al. 1978; U.S. Environmental Protection Agency 1999). As such, DNL has been determined to be a reliable measure of long-term community annoyance with noise and has become the standard noise metric used by the U.S. Department of Housing and Urban Development, Federal Aviation Administration (FAA), EPA, and Department of Defense (DoD) for assessing noise exposure.

DNL values are average quantities, mathematically representing the continuous sound level (L_{eq1H}) that would be present if all of the variations in sound level that occur over a 24-hour period were averaged to have the same total sound energy. The DNL metric quantifies the total sound energy received and is therefore a cumulative measure, but it does not provide specific information on the number of noise events or the individual sound levels that occur during the 24-hour day. The DNL metric also adds an additional 10 dB to nighttime (10:00 p.m. to 7:00 a.m., also known as “acoustic night”) sound levels to account for heightened human sensitivity to noise when ambient sound levels are low, such as when sleep disturbance could occur.

While DNL is the primary metric used to determine noise impacts, California has adopted the use of the Community Noise Equivalent Level (CNEL). While CNEL, like DNL, adds a ten times weighting (equivalent to a 10 dBA [A-weighted decibel] "penalty") to each operation between 10:00 p.m. and 7:00 a.m., CNEL also adds a three times weighting (equivalent to a 4.77 dBA penalty) for each operation during evening hours (7:00 p.m. to 10:00 p.m.).

Of note is that methods for quantifying noise depend on the potential impacts in question and on the type of noise. Another useful noise measurement in determining the effects of noise is the 1-hour average sound level, abbreviated L_{eq1H}. The L_{eq1H} can be thought of in terms of equivalent sound; that is, if a L_{eq1H} is 45.3 dB, this is what would be measured if a sound measurement device were placed in a sound field of 45.3 dB for 1 hour. The L_{eq1H} is usually A weighted unless specified otherwise (dBA). A weighting is a standard filter used in acoustics that approximates human hearing and in some cases is the most appropriate weighting filter when investigating the impacts of noise on wildlife as well as humans.

G.5 Sound Propagation

In an ideal setting in which sound propagates away from a point source without any outside influence (e.g., a barrier reflecting or attenuating the sound), sound energy radiates uniformly outward in all directions from the source in a pattern referred to as spherical spreading. As sound energy propagates away from the sound source, both the sound level and frequency change. For each doubling of distance from the source, the sound level attenuates (or drops off) at a rate of 6 dBA.

In a real-world setting, a number of factors can influence how sound propagates in the environment; the ideal case of spherical spreading is at best only an approximation of attenuation with distance. Wind has been shown to be the single most important meteorological factor within approximately 500 feet

(152 meters) of the sound source, while vertical air temperature gradients are more important in sound propagation over longer distances. Other atmospheric conditions such as air temperature, humidity, and turbulence also can have a major effect on received sound levels.

Whether natural or manmade, a large object or barrier in the path between a sound source and a receptor can attenuate sound levels substantially. The impact of this shielding depends on the size and material of the object as well as the frequency content of the sound source. Natural terrain, buildings, and walls can serve as noise barriers in which attenuation of 5–10 dB is often not noticeable.

G.6 Noise Control Act

The Noise Control Act (NCA) (42 United States Code 4901 et seq.) sought to limit the exposure and disturbance that individuals and communities experience from noise. It focuses on surface transportation and construction sources, particularly near airport environments. The NCA also specifies that performance standards for transportation equipment be established with the assistance of the U.S. Department of Transportation. Section 7 of the NCA regulates sonic booms and gave the FAA regulatory authority after consultation with the EPA. Furthermore, the 1987 Quiet Community amendment gave state and local authorities greater involvement in controlling noise.

G.7 Ambient Sound Guidance Documents

Ambient sound standards regulate ambient sound levels through time-averaged sound limits. Sound standards for land use compatibility established by DoD and civilian jurisdictions are expressed in terms of the DNL.

G.8 Federal Interagency Committee on Urban Noise Criteria

The federal government has established suggested land use compatibility criteria for different noise zones. However, land use compatibility with differing noise levels is regulated at the local level (Federal Interagency Committee on Urban Noise 1980). Residential areas and schools are considered compatible where the DNL is less than or equal to 65 dBA, and outdoor recreational activities are compatible with noise levels less than or equal to 70 dBA. Furthermore, parks are compatible with noise levels less than or equal to 75 dBA based on Land Use Guidelines.

G.9 U.S. Environmental Protection Agency Noise Standards

The level of environmental noise at which no measurable hearing loss would be expected to occur over a lifetime, as identified by the EPA, is a 24-hour exposure level of 70 dB (U.S. Environmental Protection Agency 1974).

G.10 Bibliography

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APPENDIX H: Species Observed During Field Surveys

Table E-1. Plant species observed during field surveys at the proposed construction area

Family	Scientific Name	Common Name	Wetland Indicator Status	General Status
Aizoaceae	*Conicosia pugioniformis*	narrow leaved iceplant	Upland	Non-native
Anacardiaceae	*Rhus integrifolia*	lemonade berry	Upland	Native
Anacardiaceae	*Toxicodendron diversilobum*	poison oak	Facultative Upland	Native
Apiaceae	*Conium maculatum*	poison hemlock	Facultative Wetland	Non-native
Apiaceae	*Foeniculum vulgare*	fennel	Upland	Non-native
Asphodelaceae	*Aloe maculata*	aloe	Upland	Non-native
Asteraceae	*Artemisia californica*	California sagebrush	Upland	Native
Asteraceae	*Artemisia douglasiana*	mugwort	Facultative	Native
Asteraceae	*Baccharis pilularis*	coyote brush	Upland	Native
Asteraceae	*Carduus pycnocephalus*	Italian thistle	Upland	Non-native
Asteraceae	*Centaurea melitensis*	tocalote	Upland	Non-native
Asteraceae	*Corethrogyne filaginifolia*	common sand aster	Upland	Native
Asteraceae	*Deinandra increscens ssp. increscens*	grassland tarweed	Upland	Native
Asteraceae	*Encelia californica*	bush sunflower	Upland	Native
Asteraceae	*Ericameria ericoides*	mock heather	Upland	Native
Asteraceae	*Erigeron canadensis*	Canada horseweed	Facultive Upland	Native
Asteraceae	*Eriophyllum staechadifolium*	coastal golden yarrow	Upland	Native
Asteraceae	*Helminthotheca echioides††*	bristly ox tongue	Facultative	Non-native
Asteraceae	*Heterotheca grandiflora*	telegraph weed	Upland	Native
Asteraceae	*Isocoma menziesii*	coastal goldenbush	Upland	Native
Asteraceae	*Leptosyne gigantea*	giant coreopsis	Upland	Native
Asteraceae	*Madia sativa*	coastal tarweed	Upland	Native
Asteraceae	*Pseudognaphalium californicum*	california everlasting	Upland	Native
Asteraceae	*Pseudognaphalium luteoalbum*	cudweed	Facultative	Non-native
Asteraceae	*Pseudognaphalium ramosissimum*	pink cudweed	Upland	Native
Asteraceae	*Silybum marianum*	milk thistle	Upland	Non-native
Asteraceae	*Sonchus asper*	prickly sow thistle	Facultative	Non-native
Asteraceae	*Venegasia carpesioides*	canyon sunflower	Upland	Native
Brassicaceae	*Brassica nigra*	black mustard	Upland	Non-native
Brassicaceae	*Hirschfeldia incana*	summer mustard	Upland	Non-native
Caprifoliaceae	*Lonicera hispidula*	pink honeysuckle	Upland	Native

Family	Scientific Name	Common Name	Wetland Indicator Status	General Status
Caprifoliaceae	*Sambucus nigra ssp. caerulea*	elderberry	Facultative Upland	Native
Caryophyllaceae	*Cardionema ramosissimum*	sand mat	Upland	Native
Chenopodiacea e	*Atriplex semibaccata*	australian saltbush	Facultative	Non-native
Convolvulaceae	*Calystegia macrostegia*	coast morning glory	Upland	Native
Crassulaceae	*Cotyledon orbiculata*	pig's ear	Upland	Non-native
Crassulaceae	*Dudleya caespitosa*	coast dudleya	Upland	Native
Crassulaceae	*Dudleya palmeri*	Palmer's dudleya	Upland	Native
Cupressaceae	*Hesperocyparis macrocarpa*	Monterey cypress	Upland	Non-native
Dipsacaceae	*Dipsacus sativus*	Fuller's teasel	Upland	Non-native
Ericaceae	*Arctostaphylos purissima*	La Purisima manzanita	Upland	Native, CNPS 1B.1
Euphorbiaceae	*Croton californicus*	California croton	Upland	Non-native
Fabaceae	*Acacia longifolia*	long-leafed acacia	Upland	Non-native
Fabaceae	*Acmispon glaber*	deerweed	Upland	Native
Fabaceae	*Lupinus chamissonis*	beach blue lupine	Upland	Native
Fabaceae	*Lupinus albifrons*	silver bush lupne	Upland	Native
Fabaceae	*Lupinus arboreus*	coastal bush lupine	Upland	Native
Fabaceae	*Melilotus indicus*	yellow sweet clover	Facultative Upland	Non-native
Fabaceae	*Vicia benghalensis*	purple vetch	Upland	Non-native
Fagaceae	*Quercus agrifolia*	coast live oak	Upland	Native
Grossulariaceae	*Ribes sanguineum*	flowering currant	Upland	Native
Iridaceae	*Sisyrinchium bellum*	western blue-eyed grass	Facultive Wetland	Native
Juncaceae	*Juncus patens*	spreading rush	Facultive Wetland	Native
Lamiaceae	*Marrubium vulgare*	white horehound	Facultive Upland	Non-native
Lamiaceae	*Salvia leucophylla*	purple sage	Upland	Native
Lamiaceae	*Salvia mellifera*	black sage	Upland	Native
Lamiaceae	*Stachys bullata*	California hedge nettle	Upland	Native
Myrsinaceae	*Lysimachia arvensis*	scarlet pimpernel	Facultative	Non-native
Myrtaceae	*Eucalyptus globulus*	blue gum	Upland	Non-native
Papaveraceae	*Eschscholzia california*	California poppy	Upland	Native
Phrymaceae	*Diplacus aurantiacus*	sticky mokeyflower	Upland	Native
Pinaceae	*Pinus radiata*	Monterey pine	Upland	Non-native
Plantaginaceae	*Plantago coronopus*	cutleaf plantain	Facultative	Non-native
Plantaginaceae	*Verbena lasiostachys*	western vervain	Facultive	Native
Poaceae	*Avena barbata*	slim oat	Upland	Non-native
Poaceae	*Avena fatua*	wild oats	Upland	Non-native

Family	Scientific Name	Common Name	Wetland Indicator Status	General Status
Poaceae	*Bromus diandrus*	ripgut brome	Upland	Non-native
Poaceae	*Bromus hordeaceus*	soft chess brome	Upland	Non-native
Poaceae	*Bromus madritensis*	red brome	Upland	Non-native
Poaceae	*Cortaderia jubata*	jubata grass	Facultative Upland	Non-native
Poaceae	*Ehrharta calycina*	veldt grass	Upland	Non-native
Poaceae	*Elymus condensatus*	giant wild rye	Upland	Native
Poaceae	*Elymus triticoides*	bearless wild rye	Upland	Native
Poaceae	*Phalaris aquatica*	harding grass	Facultive Upland	Non-native
Poaceae	*Stipa miliacea*	smilo grass	Upland	Non-native
Poaceae	*Stipa pulchra*	purple needlegrass	Upland	Native
Polygonaceae	*Eriogonum parvifolium*	seacliff buckwheat	Upland	Native
Polygonaceae	*Rumex crispus*	curly dock	Facultative	Non-native
Ranunculaceae	*Clematis ligusticifolia*	virgin's bower	Facultative	Native
Rhamnaceae	*Ceanothus cuneatus*	buck brush	Upland	Native, CNPS 4.2
Rhamnaceae	*Ceanthus thyrsiflorus*	blue blossom	Upland	Native
Rhamnaceae	*Frangula californica*	California coffeeberry	Upland	Native
Rhamnaceae	*Rhamnus crocea*	redberry	Upland	Native
Rosaceae	*Heteromeles arbutifolia*	toyon	Upland	Native
Rosaceae	*Rubus ursinus*	blackberry	Facultative	Native
Salicaceae	*Populus trichocarpa*	black cottonwood	Upland	Native
Salicaceae	*Salix lasiolepis*	arroyo willow	Facultative Wetland	Native
Scrophulariacea e	*Scrophularia californica*	california figwort	Facultative	Native
Solanaceae	*Solanum douglasii*	douglas nightshade	Facultive	Native
Solanaceae	*Solanum xanti*	nightshade	Upland	Native

Table E-2. Fish, amphibian, and reptile species recorded and potentially occurring in the proposed construction area and adjacent portions of Honda Creek and its estuary.

Species name	Common name	Status	Occurrence
Fish			
Eucyclogobius newberryi	Tidewater goby	Native	Historic
Amphibians			
Aneides lugubris	Arboreal salamander	Native	Documented
Batrachoseps nigriventris	Black-bellied slender salamander	Native	Documented
Batrachoseps wakei	Slender salamander	Native	Documented
Ensatina eschscholtzii	Ensatina	Native	Expected
Pseudacris hypochondriaca	Baja California chorus frog	Native	Documented
Rana draytonii	California red-legged frog	FT, SSC	Documented
Reptiles			
Aniella puchra	Northern legless lizard	SSC	Expected
Crotalus oreganus	Pacific rattlesnake	Native	Expected
Elgaria multicarinata	Southern alligator lizard	Native	Expected
Actinemys pallida	Southwestern pond turtle	Native	Documented
Lampropeltis getula	California kingsnake	Native	Expected
Masticophis lateralis	California whipsnake	Native	Expected
Plestiodon skiltonianus	Western skink	Native	Expected
Pituophis catenifer	Gopher snake	Native	Expected
Sceloporus occidentalis	Western fence lizard	Native	Documented
Thamnophis elegans	Western terrestrial gartersnake	Native	Expected
Thamnophis hammondii	Two-striped gartersnake	Native	Documented
Thamnophis sirtalis	Common gartersnake	Native	Expected

Table E-3. Bird species recorded and potentially occurring in the proposed construction area and adjacent portions of Honda Creek and its estuary.

Species name	Common name	Status	Occurrence
Birds			
Accipiter cooperii	Cooper's Hawk	Native	Breeding
Aeronautes saxatalis	White-throated Swift	Native	Foraging
Agelaius phoeniceus	Red-winged Blackbird	Native	Breeding
Aphelocoma californica	Western Scrub-Jay	Native	Breeding
Archilochus alexandri	Black-chinned Hummingbird	Native	Breeding

Species name	Common name	Status	Occurrence
Aquila chrysaetos	Golden Eagle	Native	Foraging
Baeolophus inornatus	Oak Titmouse	Native	Breeding
Bombycilla cedrorum	Cedar Waxwing	Native	Wintering
Bubo virginianus	Great Horned Owl	Native	Breeding
Buteo jamaicensis	Red-tailed Hawk	Native	Breeding
Callipepla californica	California Quail	Native	Breeding
Calypte anna	Anna's Hummingbird	Native	Breeding
Calypte costae	Costa's Hummingbird	Native	Breeding
Carduelis lawrencei	Lawrence's Goldfinch	BCC	Breeding
Carpodacus mexicanus	House Finch	Native	Breeding
Carpodacus purpureus	Purple Finch	Native	Breeding
Cathartes aura	Turkey Vulture	Native	Foraging
Catharus ustulatus	Swainson's Thrush	Native	Breeding
Catherpes mexicanus	Canyon Wren	Native	Breeding
Chamaea fasciata	Wrentit	Native	Breeding
Charadrius nivosus	Western snowy plover	FT, BCC, SSC	Foraging
Charadrius vociferus	Killdeer	Native	Breeding
Colaptes auratus	Northern Flicker	Native	Breeding
Contopus cooperi	Olive-sided Flycatcher	Native	Breeding
Contopus sordidulus	Western Wood-Pewee	Native	Breeding
Corvus brachyrhynchos	American Crow	Native	Breeding
Dendroica coronata	Yellow-rumped Warbler	Native	Wintering
Dendroica petechia	Yellow Warbler	Native	Breeding
Dendroica townsendi	Townsend's Warbler	Native	Wintering
Empidonax difficilis	Pacific-slope Flycatcher	Native	Breeding
Eremophila alpestris	Horned Lark	Native	Foraging
Euphagus cyanocephalus	Brewer's Blackbird	Native	Breeding
Falco peregrinus anatum	Peregrine Falcon	BCC, FP	Foraging
Falco sparverius	American Kestrel	Native	Breeding
Geococcyx californianus	Greater Roadrunner	Native	Foraging
Geothlypis trichas	Common Yellowthroat	Native	Breeding
Gymnogyps californianus	California Condor	FE, SE	Rare Fly Over
Haematopus bachmani	Black Oystercatcher	BCC	Fly Over

Species name	Common name	Status	Occurrence
Haliaeetus leucocephalus	Bald Eagle	BGEPA, FP	Fly Over
Icteria virens	Yellow-breasted Chat	SSC	Breeding
Icterus bullockii	Bullock's Oriole	Native	Breeding
Icterus cucullatus	Hooded Oriole	Native	Breeding
Junco hyemalis	Dark-eyed Junco	Native	Breeding
Lanius ludovicianus	Loggerhead Shrike	BCC	Breeding
Larus californicus	California Gull	Native	Wintering
Larus canus	Mew Gull	Native	Wintering
Larus delawarensis	Ring-billed Gull	Native	Wintering
Larus glaucescens	Glaucous-winged Gull	Native	Wintering
Larus heermanni	Heermann's Gull	Native	Wintering
Larus occidentalis	Western Gull	Native	Foraging
Limnodromus griseus	Short-billed Dowitcher	BCC	Wintering
Limosa fedoa	Marbled Godwit	BCC	Wintering
Melospiza melodia	Song Sparrow	Native	Breeding
Molothrus ater	Brown-headed Cowbird	Native	Breeding
Morus bassanus	Northern Gannet	Native	Fly Over
Myiarchus cinerascens	Ash-throated Flycatcher	Native	Breeding
Numenius americanus	Long-billed Curlew	BCC	Wintering
Numenius phaeopus	Whimbrel	BCC	Foraging
Passerina amoena	Lazuli Bunting	Native	Breeding
Passerina caerulea	Blue Grosbeak	Native	Breeding
Patagioenas fasciata	Band-tailed Pigeon	Native	Foraging
Phainopepla nitens	Phainopepla	Native	Breeding
Phalaenoptilus nuttallii	Common Poorwill	Native	Breeding
Pheucticus melanocephalus	Black-headed Grosbeak	Native	Breeding
Picoides nuttallii	Nuttall's Woodpecker	Native	Breeding
Picoides pubescens	Downy Woodpecker	Native	Breeding
Picoides villosus	Hairy Woodpecker	Native	Breeding
Pipilo crissalis	California Towhee	Native	Breeding
Pipilo maculatus	Spotted Towhee	Native	Breeding
Piranga ludoviciana	Western Tanager	Native	Breeding
Poecile rufescens	Chestnut-backed Chickadee	Native	Breeding

Species name	Common name	Status	Occurrence
Polioptila caerulea	Blue-gray Gnatcatcher	Native	Breeding
Psaltriparus minimus	Bushtit	Native	Breeding
Rynchops niger	Black Skimmer	BCC	Fly Over
Sayornis nigricans	Black Phoebe	Native	Breeding
Selasphorus sasin	Allen's Hummingbird	BCC	Breeding
Setophaga petechia	Yellow warbler	SSC	Breeding
Sialia mexicana	Western Bluebird	Native	Breeding
Spinus lawrencei	Lawrence's Goldfinch	Native	Breeding
Spinus psaltria	Lesser Goldfinch	Native	Breeding
Spinus tristis	American Goldfinch	Native	Breeding
Stelgidopteryx serripennis	Northern Rough-winged Swallow	Native	Fly Over
Streptopelia decaocto	Eurasian Collared-Dove	Non-native	Breeding
Sturnella neglecta	Western Meadowlark	Native	Breeding
Sturnus vulgaris	European Starling	Non-native	Breeding
Tachycineta thalassina	Violet-green Swallow	Native	Breeding
Thryomanes bewickii	Bewick's Wren	Native	Breeding
Toxostoma redivivum	California Thrasher	Native	Breeding
Tringa semipalmata	Willet	BCC	Wintering
Troglodytes aedon	House Wren	Native	Breeding
Turdus migratorius	American Robin	Native	Breeding
Tyrannus verticalis	Western Kingbird	Native	Breeding
Tyrannus vociferans	Cassin's Kingbird	Native	Breeding
Vermivora celata	Orange-crowned Warbler	Native	Breeding
Vireo gilvus	Warbling Vireo	Native	Breeding
Vireo huttoni	Hutton's Vireo	Native	Breeding
Wilsonia pusilla	Wilson's Warbler	Native	Breeding
Zenaida macroura	Mourning Dove	Native	Breeding
Zonotrichia leucophrys	White-crowned Sparrow	Native	Breeding

Table E-4. Mammal species recorded and potentially occurring in the proposed construction area and adjacent portions of Honda Creek and its estuary.

Species name	Common name	Status	Occurrence
Mammals			
Antrozous pallidus	Pallid bat	SSC	Documented

Species name	Common name	Status	Occurrence
Canis latrans	Coyote	Native	Documented
Corynorhinus townsendii	Townsend's big-eared bat	SSC	Documented
Eptesicus fuscus	Big brown bat	Native	Documented
Eumops perotis	Greater bonneted bat	Native	Documented
Lasionycteris noctivagans	silver-haired bat	Native	Documented
Lasiurus blossevillii	western red bat	Native	Documented
Lasiurus cinereus	Hoary bat	Native	Documented
Microtus californicus	California vole	Native	Expected
Mirounga angustirostris	Northern elephant seal	Native	Rare
Myotis californicus	California myotis	Native	Documented
Myotis yumanensis	Yuma myotis	Native	Documented
Neotoma fuscipes	Dusky-footed woodrat	Native	Expected
Odocoileus hemionus	Mule deer	Native	Documented
Parastrellus hesperus	Canyon bat	Native	Documented
Peromyscus californicus	California mouse	Native	Expected
Peromyscus maniculatus	Deer mouse	Native	Expected
Phoca vitulina	Harbor seal	Native	Rare
Sorex ornatus	Ornate shrew	Native	Expected
Sorex trowbridgii	Trowbridge's shrew	Native	Expected
Spermophilus beecheyi	California ground squirrel	Native	Documented
Sylvilagus bachmani	Brush rabbit	Native	Documented
Tadarida brasiliensis	Mexican free-tailed bat	Native	Documented
Thomomys bottae	Botta's pocket gopher	Native	Documented
Zalophus californianus	California sea lion	Native	Rare

Table E-5. Invertebrate species recorded and potentially occurring in the proposed construction area and adjacent portions of Honda Creek and its estuary.

Species name	Common name	Status	Occurrence
Snails			
Helminthoglypta phlyctaena	Zaca shoulderband	Native	Documented
Arachnids			
Araneus andrewsi	Andrew's orb weaver	Native	Documented
Callobius sp.	Tangled nest spider	Native	Documented
Cyclosa turbinata	Trash line orbweaver	Native	Documented

Species name	Common name	Status	Occurrence
Metepeira sp.	Labyrinth orbweaver	Native	Documented
Neoscona arabesca	Arabesque orbweaver	Native	Documented
Latrodectus hesperus	Western black widow	Native	Documented
Beetles			
Altica bimarginata	Flea beetle	Native	Documented
Aphodius sp.	Aphodiine dung beetle	Native	Documented
Athous sp.	Click beetle	Native	Documented
Cantharis sp.	Soldier beetle	Native	Documented
Dichelonys pusilla	Scarab beetle	Native	Documented
Euthysanius sp.	Click beetle	Native	Documented
Lebia sp.	Ground beetle	Native	Documented
Meloe strigulosus	Blister beetle	Native	Documented
Mordella sp.	Tumbling flower beetle	Native	Documented
Nicrophorus nigrita	Burying beetle	Native	Documented
Trirhabda sp.	Leaf beetle	Native	Documented
Flies			
Admontia sp.	Tachinid fly	Native	Documented
Bombobrachicoma sp.	Flesh fly	Native	Documented
Brachydeutera argentata	Shore fly	Native	Documented
Chaetoplagia sp.	Tachinid fly	Native	Documented
Coelopa vanduzeei	Kelp fly	Native	Documented
Copromyza sp.	Lesser dung fly	Native	Documented
Cyanus sp.	Blow fly	Native	Documented
Dasiops sp.	Lance fly	Native	Documented
Geron sp.	Bee fly	Native	Documented
Hesperodinera cinerea	Tachinid fly	Native	Documented
Leskiomima sp.	Tachinid fly	Native	Documented
Limonia sp.	Limoniid crane fly	Native	Documented
Microphthalma disjuncta	Tachinid fly	Native	Documented
Phaenicia sp.	Blow fly	Native	Documented
Sericomya chalcopyga	Syrphid fly	Native	Documented
Sylvicola sp.	Wood gnat	Native	Documented
Tephritis sp.	Picture-winged fly	Native	Documented

Species name	Common name	Status	Occurrence
Tipula sp.	Crane fly	Native	Documented
Villa sp.	Bee fly	Native	Documented
Xanthogramma sp.	Syrphid fly	Native	Documented
True Bugs			
Acizzia uncatoides	Acacia psyllid	Non-Native	Documented
Calophya californica	Lemonade berry psyllid	Native	Documented
Ctenarytaina eucalypti	Eucalyptus psyllid	Non-Native	Documented
Family Cicadellidae	Leafhopper	Native	Documented
Family Miridae	Plant bug	Native	Documented
Okanagana canescens	Whip cicada	Native	Documented
Okanagana sp.	Whip cicada	Native	Documented
Phytocoris sp.	Plant bug	Native	Documented
Ants, Bees, and Wasps			
Apis mellifera	European honeybee	Non-Native	Documented
Bombus crotchii	Crotch bumblebee	SSC	Expected
Bombus vosnesenskii	Yellow-faced bumble bee	Native	Documented
Chyphotes sp.	Chyphotid wasp	Native	Documented
Colletes sp.	Cellophane bee	Native	Documented
Family Braconidae	Braconid wasp	Native	Documented
Family Ichneumonidae	Ichneumonid wasp	Native	Documented
Family Mutillidae	Velvet ant	Native	Documented
Family Tiphiidae	Tiphiid wasp	Native	Documented
Formica moki	Field ant	Native	Documented
Hylaeus sp.	Masked bee	Native	Documented
Vespula pensylvanica	Yellow jacket	Native	Documented
Butterflies and Moths			
Apodemia mormo	Mormon metalmark	Native	Documented
Arachnis picta	Painted tiger moth	Native	Documented
Aseptis perfumosa	Noctuid moth	Native	Documented
Benjamin colorada	Noctuid moth	Native	Documented
Caradrina distincta	Noctuid moth	Native	Documented
Cheteoscelis faseularia	Geometrid moth	Native	Documented
Clostera apicalis ornata	Notodontid moth	Native	Documented

Species name	Common name	Status	Occurrence
Coenonmpha californica	Common ringlet	Native	Documented
Cupido amyntula	Western tailed blue	Native	Documented
Deilinea behrensaria	Geometrid moth	Native	Documented
Dichorda species	Geometrid moth	Native	Documented
Drepanulatrix quadraria	Geometrid moth	Native	Documented
Egira rubrica	Noctuid moth	Native	Documented
Elpiste marcescaria	Geometrid moth	Native	Documented
Eusarca falcata	Geometrid moth	Native	Documented
Eustroma semiatrata	Geometrid moth	Native	Documented
Euxoa nevada	Noctuid moth	Native	Documented
Euxoa obeliscoides	Noctuid moth	Native	Documented
Family Pterophoridae	Plume moth	Native	Documented
Furcula scolopendrina	Notodontid moth	Native	Documented
Glaucina species	Geometrid moth	Native	Documented
Heliothis zea	Noctuid moth	Native	Documented
Hydryomena quinquefasciata	Geometrid moth	Native	Documented
Hypena californica	Noctuid moth	Native	Documented
Lacinia leucogramma	Noctuid moth	Native	Documented
Lacinia strigicolus	Noctuid moth	Native	Documented
Lacinipolia cuneata	Noctuid moth	Native	Documented
Leucania oaxacana	Noctuid moth	Native	Documented
Nemoria darwiniata	Geometrid moth	Native	Documented
Neoterpes edwardstata	Geometrid moth	Native	Documented
Parabagrotis insularis	Noctuid moth	Native	Documented
Pero honestaria	Geometrid moth	Native	Documented
Pherne subpunctata	Geometrid moth	Native	Documented
Platea californica	Geometrid moth	Native	Documented
Platyperigea mona	Noctuid moth	Native	Documented
Polia delecta	Noctuid moth	Native	Documented
Protorthodes rufula	Noctuid moth	Native	Documented
Pseudorthodes communis	Noctuid moth	Native	Documented
Pseudorthodes irrorata	Noctuid moth	Native	Documented
Pseudorthodes puerilis	Noctuid moth	Native	Documented

Species name	Common name	Status	Occurrence
Scythris sp.	Flower moth	Native	Documented
Smerinthus cerisyi	Willow sphinx	Native	Documented
Tricholita chipeta	Noctuid moth	Native	Documented
Tricoplusia ni	Noctuid moth	Native	Documented
Ulolonche niveiguttata	Noctuid moth	Native	Documented
Xylomiges patalis	Noctuid moth	Native	Documented
Zale lunata	Noctuid moth	Native	Documented
Zenophleps lignicolorata	Geometrid moth	Native	Documented
Zosteropoda hirtipes	Noctuid moth	Native	Documented
Lacewings, Antlions, and Allies			
Family Coniopterygidae	Dusty wing	Native	Documented
Myrmeleon sp.	Ant lion	Native	Documented
Pseudomallada perfectus	Green lacewing	Native	Documented
Grasshoppers, Crickets, and Katydids			
Ammopelmatus sp.	Jerusalem cricket	Native	Documented
Conozoa texana	Cristate grasshopper	Native	Documented
Cnemotettix bifasciatus	Silk-spinning cricket	Native	Documented
Lactista gibbosus	Trailside grasshopper	Native	Documented
Melanoplus cinereus	Grayish sagebrush grasshopper	Native	Documented
Melanoplus devastator	Devastating grasshopper	Native	Documented
Psoloessa texana	Texas range spotted grasshopper	Native	Documented
Tessellania tessellata	Brown bushcricket	Non-native	Documented

Appendix I

Terrestrial Biological Resources

I.1 Description of Vegetation Resources

Vegetation alliances were classified and mapped following the *Manual of California Vegetation Second Edition* (Sawyer et al. 2009). Table I-1 includes species composition by vegetation alliance.

Table I-1: Vegetation Alliance Species Composition and Absolute Cover

Common Name	Alliance Name	Absolute Cover of Main Component Species*
Annual Grassland	*Avena* spp. - *Bromus* spp. Herbaceous Semi-Natural Alliance	20% *Medicago polymorpha* ; 10% *Plantago coronopus* ; 10% *Carpobrotus* sp.
Australian Wattle Patch	*Acacia* spp. - *Grevillea* spp. - *Leptospermum laevigatum* Shrubland Semi-natural Alliance	90-100% *Acacia longifolia*
Mixed Bush Lupine Scrub / Annual Grassland	mixed *Lupinus arboreus* Shrubland Alliance and *Avena* spp. - *Bromus* spp. Herbaceous Semi-Natural Alliance	70% *Lupinus arboreus* ; 20% *Carpobrotus* sp.; 10% *Ericameria ericoides* ; 10% *Ehrharta calycina*
Mixed Coyote Brush Scrub / Iceplant Mat	mixed *Baccharis pilularis* Alliance and *Mesembryanthemum* spp. - *Carpobrotus* spp. Herbaceous Semi-Natural Alliance	40% *Carpobrotus* sp.; 20% *Ehrharta calycina* ; 20% *Ericameria ericoides* ; 5% *Baccharis pilularis* ; 5% *Frangula californica*
Developed	Developed - Unvegetated	None
Iceplant Mat	*Mesembryanthemum* spp. - *Carpobrotus* spp. Herbaceous Semi-Natural Alliance	70-95% *Carpobrotus* sp.; 0-15% *Ehrharta calycina* ; 0-15% *Bromus* sp.; 0-1% *Acmispon glaber* ; 0-1% *Ericameria ericoides* ; 0-1%
Mixed Iceplant Mat / Annual Grassland	Mixed *Mesembryanthemum* spp. - *Carpobrotus* spp. Herbaceous Semi-Natural Alliance and *Avena* spp. - *Bromus* spp. Herbaceous Semi-Natural Alliance	50% *Bromus* sp.; 50% *Carpobrotus* sp.
Lemonade Berry Scrub	*Rhus integrifolia* Shrubland Alliance	30% *Rhus integrifolia* ; 0-45% *Salvia melifera* ; 0-30% *Toxicodendron*
Mixed Lemonade Berry Scrub / Veldt Grass	mixed *Rhus integrifolia* Shrubland Alliance and *Ehrharta calycina*	25% *Rhus integrifolia* ; 20% *Ehrharta calycina* ; 15% *Ericameria ericoides* ; 10% *Carpobrotus* sp.; 10% Salvia melifera
Monterey Cypress & Pine Stand	*Hesperocyparis macrocarpa* - *Pinus radiata* Forest & Woodland Semi-Natural Alliance	85% *Hesperocyparis macrocarpa* ; 0-75% *Carpobrotus* sp.
Mock Heather Scrub	*Lupinus chamissonis* - *Ericameria ericoides* alliance	30% *Ericameria ericoides* ; 30% *Carpobrotus* sp.; 20% *Ehrharta*
Needle Grass Grassland	*Nassella* spp. - *Melica* spp. Herbaceous Alliance	30% *Stipa pulchra* ; 25% *Bromus* sp.; 15% *Medicago polymorpha* ;
Poison Oak Scrub	*Toxicodendron diversilobum* Shrubland Alliance	40% *Artemisia californica* ; 20% *Toxicodendron diversilobum* ; 15%
Mixed Poison Oak Scrub / Iceplant Mat	mixed *Toxicodendron diversilobum* Shrubland Alliance and *Mesembryanthemum* spp. - *Carpobrotus* spp. Herbaceous Semi-Natural Alliance	50% *Carpobrotus* sp.; 30% *Ericameria ericoides* ; 20% *Toxicodendron diversilobum* ; 10% *Artemisia californica* ; 5% *Baccharis pilularis* ; 2% *Frangula californica*
Veldt Grass	*Ehrharta calycina* Undescribed Alliance	50-80% *Ehrharta calycina* ; 10-15% *Bromus* sp.; 7-25% *Carpobrotus*

*Species cover and composition varied by location; alliance assignments represent the best fit among described alliances (J. Sawyer et al 2009); cover of non-dominant species was ony noted where doing so helped clarify alliance assignments

I.2 Terrestrial Special Status Species Excluded from Potential Occurrence

Several species were excluded from potential occurrence because of the following: they do not occur at the site when project activities would occur; they do not breed within the Proposed Action Area and their special status affords them protection only during their breeding period; or they do not occur in a manner (rookeries or nesting colonies) that affords them special status protection. Species unlikely to be affected by SLC-5 construction, launch and static fire noise, and site maintenance, and not present within areas receiving at least 100 dB Lmax, were also not given further consideration. This includes special status plant species occurring outside of the construction area.

The California least tern (*Sternula antillarum browni*) nests at Purisima Point and adults and fledglings roost and forage at Santa Ynez River lagoon. The nesting colony is approximately 9.4 miles (mi) (15.1 kilometers [km]) north of SLC-5. The lagoon is approximately 6.0 mi (9.6 km) north of SLC-5. At these distances, terns would be outside areas where loud noises would occur and be far enough from the launch and static fire activities that no effect on nesting, foraging, or roosting terns is expected. Potential habitat for least Bell's vireo (*Vireo bellii pusillus*, federally endangered species/state endangered species) and southwestern willow flycatcher (*Empidonax traillii extimus*, federally endangered species/state endangered species) exists on VSFB. However, these species have not been documented within the area potentially impacted by a significant launch or static fire related noise. Historically occupied breeding habitat for the southwestern willow flycatcher along the Santa Ynez River on VSFB has been degraded and is unlikely to support breeding in the future (Seavy et al. 2012). As a result, these species are not carried forward in this EA. Bald eagles (*Haliaeetus leucocephalus*, Federal Bird Species of Conservation Concern, California Endangered Species, California Fully Protected Species) are occasionally seen throughout VSFB and may forage in coastal habitat nearby SLC-5. However, this species is rarely sighted and not anticipated to be affected by project activities.

I.3 Terrestrial Federally-listed Species Considered in the Environmental Assessment

I.3.1 Tidewater Goby (Federally Listed Endangered Species)

I.3.1.1 Status

The tidewater goby (TWG; *Eucyclogobius newberryi*) was listed as endangered on 7 March 1994 (59 Federal Register [FR] 5494). On 24 June 1999, the USFWS proposed to remove the populations occurring north of Orange County, California, from the endangered species list (64 FR 33816). In November 2002, the USFWS withdrew this proposed delisting rule and retained the TWG's listing as endangered throughout its range (67 FR 67803). The USFWS published a Recovery Plan for the TWG in 2005 (USFWS 2005). In January 2014, USFWS proposed to reclassify the TWG from endangered to threatened (79 FR 14340-14362). In addition, the USFWS is considering a proposed taxonomic split between northern and southern populations of this species, with an expectation to delist the northern population (including all individuals at VSFB). A decision on this proposal has not been made.

I.3.1.2 Life History

The TWG is a small, bottom-dwelling fish found in California's coastal estuaries, wetlands, lagoons, and lower reaches of coastal streams and rivers. It is an annual species, with individuals typically not living for more than a year. TWG population size is heavily influenced by environmental conditions. In years experiencing high rains, when lagoons are breached, TWG numbers fall as fish are washed out to sea. Individuals able to access refugia, such as that provided by vegetation in littoral marshes, are able to survive flood events. These surviving individuals breed after the lagoons close, allowing populations to rebound the following summer (Swift et al. 1989). Breeding may occur year-round (Swenson 1999) with peak spawning activity usually occurring during the spring and a second peak during the late summer (Swift et al. 1989).

The key threat to TWG is the degradation of coastal lagoons as a result of diversion of water (dewatering streams affects marsh habitat extent, and alters temperature and salinity within the marshes), pollution from agricultural and sewage effluents, siltation (often through sediment generated during cattle overgrazing and feral pig activity), and coastal development. In addition, introduced predatory fish (especially centrarchids and channel catfish [*Ictalurus punctatus*], crayfish [*Procambarus clarkii*], and mosquito fish [*Gambusia affinis*]) pose a direct threat to TWG populations through predation of eggs, larvae, and adults.

I.3.1.3 Occurrence within the Action Area

TWG have been reported in all the major drainages on VSFB, including Shuman Creek, San Antonio Creek, Santa Ynez River, Honda Creek, and Jalama Creek (Swift et al. 1997). TWG typically favor areas within the fresh-saltwater interface with salinities of less than 12 parts per thousand (Swift et al. 1989). However, this species will range into fresh water and has been recorded up to 7.5 mi (12 km) upstream from the ocean in the Santa Ynez River (Swift et al. 1997).

Suitable habitat for TWG is found in Honda Creek. TWG were first found in the Honda estuary lagoon in 1995 (Lafferty et al. 1999). The species was again documented in 2001; however, seine net surveys conducted in Honda Creek in 2008 indicated that TWG were no longer present (MSRS 2009). Seine net surveys were again conducted in Honda Creek in 2015 and 2016 with no TWG present (MSRS 2016, 2018). Despite being easily detectable in shallow water with a flashlight during night frog surveys, no TWG were observed during night CRLF surveys of the Honda Creek estuary for SpaceX launch monitoring activities in January 2022 (J. LaBonte, pers. obs.).

In 2013, the estuary lagoon dried and stayed dry through 2016 before rehydrating in the winter of 2016–2017 (MSRS 2018). Since 2017 the lagoon has been subject to drying during late summer months, making more than short-term occupancy by fish dependent on them being able to establish in areas east of Coast Road, but the narrowness and shallowness of the creek in this area makes this unlikely. Occurrence within the Proposed Action Area would be dependent on TWG recolonizing the lagoon if it fills and breaches in response to winter rains. Unless environmental conditions return to a consistently wetter regime conducive to perennial water in the Honda lagoon, any TWG occupancy is likely to be of short duration.

I.3.2 Unarmored Threespine Stickleback (Federally Listed Endangered Species)

I.3.2.1 Status

The unarmored threespine stickleback (UTS; *Gasterosteus aculeatus*) was listed as endangered in 1970 (35 FR 16047-16048). A Recovery Plan was issued in 1985 (USFWS 1985).

I.3.2.2 Life History

UTS are small fish (approximately 6 centimeters) that are short-lived (i.e., rarely surviving 2-3 years) (USFWS 1985). UTS reproduce throughout the year with highest recruitment noted from May to September (USFWS 1985). These fish are opportunistic feeders and primarily feed on invertebrates and aquatic insects (USFWS 1985). In San Antonio Creek, UTS coexist with other native and introduced species, many of which likely prey on UTS.

I.3.2.3 Occurrence within the Action Area

UTS was abundant throughout the Los Angeles basin, but was reported to be extirpated by 1942. As of 1985, UTS was generally restricted to the Santa Clara River drainage in Los Angeles County and the San Antonio Creek drainage in Santa Barbara County (USFWS 1985). On VSFB, UTS are found in San Antonio Creek from Barka Slough to the lagoon and found mostly in the creek channel rather than the lagoon (ManTech 2009, Swift 1999). UTSs were previously documented as being most concentrated near the El Rancho Road bridge (Swift 1999).

UTS were introduced into Honda Creek, south of SLC-5, in 1984 (MSRS 2009). Extensive aquatic surveys conducted in 2008, 2016, and 2017 did not detect any fish in the creek (MSRS 2009, 2016, 2018). Between 2008 and 2022, Honda Creek has gone through multiple cycles of drying and rehydration, which would preclude occupancy by and persistence of fish.

I.3.3 California Red-Legged Frog (Federally Listed Threatened Species)

I.3.3.1 Status

The United States Fish and Wildlife Service (UFSWS) listed the California red-legged frog (*Rana draytonii*; CRLF) as threatened on 23 May 1996 (61 Federal Register [FR] 25813-25833). In 2002, USFWS issued a Recovery Plan to stabilize and restore CRLF populations (USFWS 2002).

I.3.3.2 Life History

The CRLF is a member of the family Ranidae and is California's largest native frog. In order to breed, CRLF require water bodies with sufficient hydroperiods and compatible salinity levels to accommodate larval and egg development. Breeding typically takes place from November through April with most egg deposition occurring in March. Eggs require 7 to 28 days, depending on water temperature, to develop into tadpoles (Cook 1997). Tadpoles typically require 11 to 20 weeks to develop into terrestrial frogs (USFWS 2002), although some individuals may overwinter in the tadpole stage (Fellers et al. 2001).

Adult CRLF have been documented traveling distances of over 1 mile (1.6 km) during the wet season and spending considerable time in terrestrial riparian vegetation. Christopher (2018) found that 90 percent of the CRLF observations at Vandenberg Space Force Base within the dry season occurred within 197 ft (60 m) of riparian or other aquatic habitats. It is thought that riparian vegetation provides good foraging habitat, as well as good dispersal corridors, due to canopy cover and presence of adequate moisture (USFWS 2002).

Habitat loss and degradation, combined with over-exploitation and introduction of exotic predators, were important factors in the decline of CRLF in the early to mid-1900s. Continuing threats to CRLF include direct habitat loss due to stream alteration and loss of aquatic habitat and drought, and indirect effects of expanding urbanization, competition or predation from non-native species including the bullfrog (*Lithobates catesbeianus*), catfish (*Ictalurus* spp.), bass (*Micropterus* spp.), mosquitofish (*Gambusia affinis*), and crayfish (*Procambarus clarkii*). Chytrid fungus (*Batrachochytrium dendrobatidis*) is a waterborne fungus that can decimate amphibian populations and is considered a threat to CRLF populations.

I.3.3.3 Occurrence within the Action Area

CRLF have been documented in nearly all permanent streams and ponds on VSFB as well as most seasonally inundated wetland and riparian sites (Christopher 2002). CRLF have been consistently documented in Honda Creek, adjacent to SLC-5 (Christopher 2002; MSRS 2009, 2016, 2018, 2021) and during SpaceX launch monitoring activities in January 2022 (MSRS in prep.).

Suitable upland dispersal habitat exists throughout VSFB between the various riparian zones and ponds on Base, but as noted above, dispersal into these upland habitats is not likely to be as extensive as has been observed in more mesic parts of the range of this species. However, due to the proximity of CRLF aquatic habitat, upland habitat in the Proposed Action Area is likely to support CRLF. The SLC-5 site is within 450 ft (137 m) of occupied CRLF habitat within Honda Creek and portions of the Proposed Action Area encompassing Honda Canyon Road are within 50 ft (15 m) of Honda Creek and support areas of dense vegetation that could provide shelter for upland active CRLF, especially during periods of wet weather.

I.3.3.4 Literature Reviewed in Determining Effects of Noise on CRLF

There are no studies on the effects of noise on CRLF. Simmons et al. (2014) found that consistent morphological damage of hair cells in the hearing structures of American bullfrogs (*Lithobates catesbeianus*), which are within the same Family as the CRLF (Ranidae), were observed with exposure to sound levels greater than 150 dB L_{max} SEL. Even after such hearing damage, bullfrogs showed full functional recovery within 3 to 4 days, thus the hearing damage was temporary (Simmons et al. 2014).

Determining the amount of noise energy that would be perceived by CRLF is important to analyzing the potential effects that launch noise disturbances would have on this species. There are no CRLF-specific hearing curves (i.e., audiograms) or other data on this species' hearing sensitivity. However, there are published hearing curves for several species in the same family that are of similar size and have similar call frequency spectra. Fay (1988) presents hearing curves for the pool frog (*Pelophylax lessonae*, Family Ranidae), the marsh frog (*P. ridibunda*, Family Ranidae), and the edible frog (*P. esculentus*, Family Ranidae). We used these data to create a mean "Ranidae" hearing curve (Figure I-1). We then processed this mean curve following methods established in Southall et al. (2019) to produce a weighting function that would be appropriate for CRLF hearing sensitivity (Figure I-2). We measured the slopes beyond the lower and upper frequency cutoffs surrounding the range of best hearing (in dB/decade) to estimate the amount of weighting to be applied at each frequency (Figure I-2).

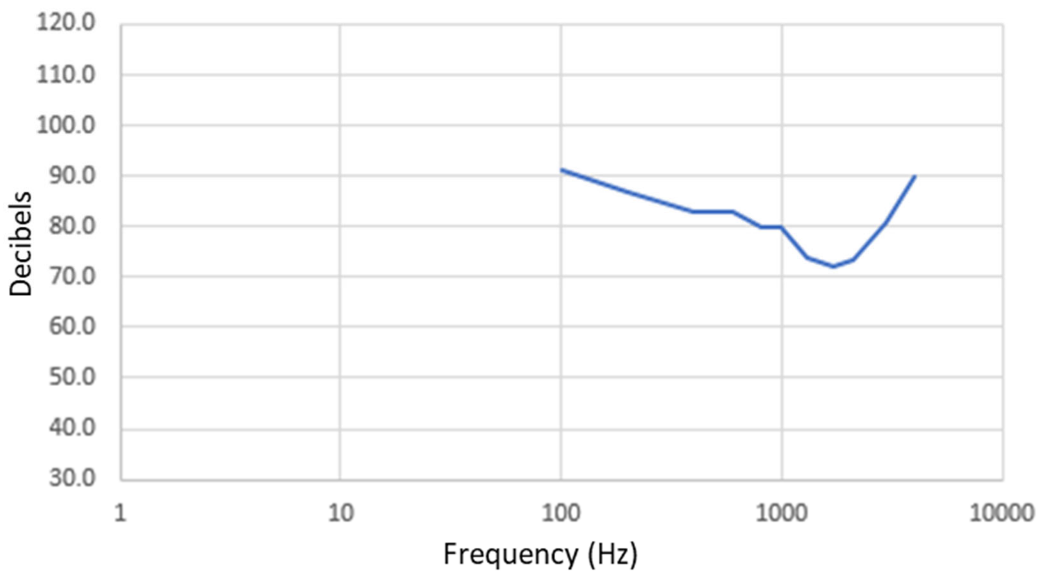

Figure I-1: Mean Ranidae hearing sensitivity curve

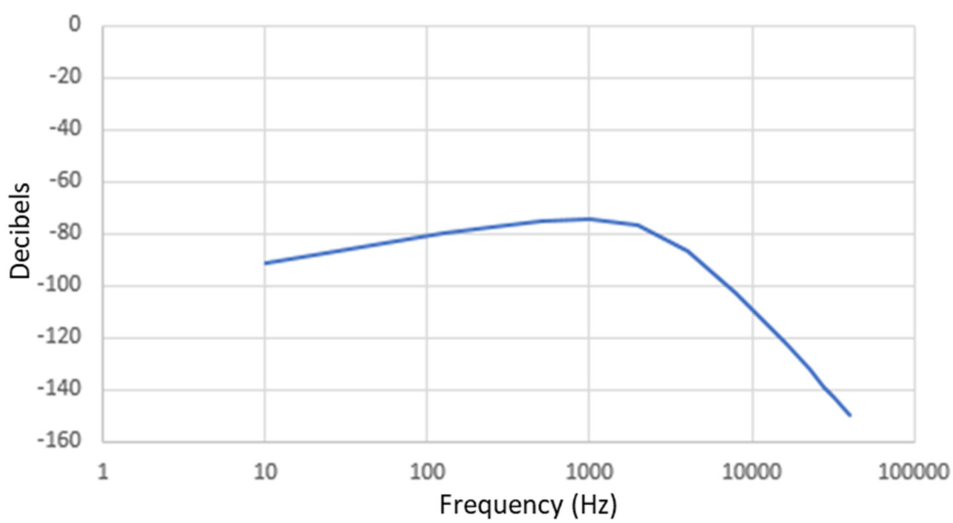

Figure I-2: Ranidae weighting function

We applied this weighting function to the time waveform recording of a recent launch at VSFB (Falcon 9 SARah-1). The unfiltered time waveform had a frequency spectra with an unweighted peak level of approximately 110 dB Lmax (Figure I-3). After applying the Ranidae weighting function, the peak level is approximately 22 dB Lmax (Figure I-3). In humans, 20 dBA is equivalent to whispering. Given the high falloff rates outside the range of best hearing, as well as a much higher hearing threshold, the perceived rocket engine noise in CRLF is very likely to be negligible. Lewis and Narins (1985) determined that white-lipped frogs (*Leptodactylus albilabris*) can detect seismic signals and use them in communication. This species is not closely related to CRLF; however, it may be reasonable to assume that any reaction to engine noise would be the result of physical vibrations of water or the ground caused by the low frequency portion of the noise energy in combination with visual disturbance, rather than the noise itself.

Figure I-3: Launch peak noise level comparison of unweighted (green) versus Ranidae-weighted (brown) decibels (note: time waveform recording from the Falcon 9 SARah-1 launch)

Rodrıguez-Prieto and Fernandez-Juricic (2005) examined the responses in the Iberian frog (*Rana iberica*) to repeated human disturbance and found that the resumption of normal behavior after three repeated human approaches occurred after less than four minutes. Sun and Narins (2005) examined the effects of airplane and motorcycle noise on anuran calling in a mixed-species assemblage, including the sapgreen stream frog (*Rana nigrovittata*). Sun and Narins found that frogs reduced calling rate during the stimulus but increased calling rate immediately after cessation of the stimuli, likely in response to the subsequent lull in ambient sound levels. Similarly, Kruger and Du Preez (2016) found that male Pickersgill's reed frog (*Hyperolius pickersgilli*) exposed to routine airplane overflights increased call rates immediately after the noise, but resumed their normal call-rest patterns within a few minutes of absence of plane noise.

Whether a result of physical vibrations caused by noise or overlap of some noise stimuli with various species hearing sensitivity range, there is a growing body of literature on the effects of anthropogenic noise disturbance on anurans. These studies have typically examined the impact of sustained vehicle noise associated with roads near breeding ponds and have generally shown negative effects on individual frog behavior and physiology which potentially have consequences for populations (see examples in Parris et al. 2009 and Tennessen et al. 2014). For instance, a variety of anurans have been shown to alter call signal structure in response to chronic exposure to traffic noise (Bee & Swanson 2007; Lengagne 2008; Cunnington & Fahrig 2010; Kaiser et al. 2011; Hanna et al. 2014) and airplane noise (Sun & Narins 2005, Kruger & Du Preez 2016). Researchers studying chronic exposure to sustained anthropogenic noise in anurans have also found higher levels of stress hormones, lowered immunity, and impacts to reproductive physiology and behavior, all of which may have negative consequences for populations. Tennessen et al. (2014) showed that prolonged exposure to traffic noise increased corticosterone and impaired mate attraction in wood frogs (*Lithobates sylvaticus*). Tennesen et al. (2018) also showed that populations of wood frogs in high traffic noise locations have undergone evolutionary adaptation to avoid physiological costs of the noise to fitness, suggesting that at least some species may be able to adapt to sustained noise. In an experiment where European tree frogs (*Hyla arborea*) were exposed to four hours of continuous recorded traffic noise nightly, Troïanowski et al. (2017) found increased stress hormone level that induced an immunosuppressive effect in the subjects. Similarly, White's treefrogs (*Litoria caerulea*) exposed to continuous, sustained noise (one week of recorded traffic noise) had higher levels of corticosterone and decreased sperm count and sperm viability (Kaiser et al. 2015). In chronic high-noise habitats adjacent to a busy highway (average 30,000 vehicles per day), the time and distance over which male Pacific chorus frogs (*Psuedacris regilla*) calls could be perceived for was significantly reduced, potentially having implications for the reproductive success of this species (Nelson et al. 2017). Japanese tree frogs (*Dryophytes japonicus*) exposed to persistent, low frequency noise caused by wind turbines had faster call rates, increased salivary concentrations of corticosterone, and lower innate immunity (Park & Do 2022). Eastern sedge frogs (*Litoria fallax*) tended to choose less attractive male calls significantly more often when experimentally exposed to background traffic noise, potentially having evolutionary and population level implications over the long term (Schou et al. 2021).

None of the preceding studies are directly comparable to the noise impacts of the Proposed Action, which is likely to be minimally perceptible in the hearing range of CRLF but presumed to cause vibrations that would be sensed, non-sustained (less than one minute duration), and comparatively infrequent (combined maximum of 96 noise events per year at full launch tempo versus the available literature, which examines sustained traffic noise and multiple daily airplane flights). Additionally, there are no thresholds in the literature that quantify what level of noise or frequency of disturbance would elicit stress hormone responses, impacts to breeding and reproduction, or negative population level effects. While these studies show effects on behavior and physiology that could have impacts on fitness and populations, none of them present direct evidence of population impacts so the long-term effects of chronic exposure to anthropogenic noise on populations is unknown for these species.

I.3.4 Marbled Murrelet (Federally Listed Threatened Species)

I.3.4.1 Status

The USFWS listed the marbled murrelet (MAMU; *Brachyramphus marmoratus*) as threatened on 1 October 1992 (57 FR 45328) and published a Recovery Plan for the species in 1997 (USFWS 1997). The USFWS completed a 5-year review of the species in 2009 (USFWS 2009).

I.3.4.2 Life History

The MAMU is a small seabird that breeds along the Pacific coast, foraging in nearshore marine waters on small fish and invertebrates, and flying inland to breed. The species requires nearshore marine habitats with abundant prey (fish and invertebrates). Among alcids, the species is unique because it uses old-growth coniferous forests and mature trees for nesting (USFWS 1997). MAMU are wing-pursuit divers. Although little has been known about the MAMU movement and home range, more information is becoming available. The first MAMU nest was not documented until 1974. Since then, the MAMU's home range has been observed as 655 square kilometers (km^2) for non-nesters and 240 km^2 for nesters within

California. In addition, at-sea resting areas have also been observed an average of 5.1 km from the mouths of drainages. MAMU spend nighttime hours resting in the ocean at these areas and commute to foraging areas during the day. Nests have been observed from sea level to 5,020 ft. (USFWS 2009). MAMU range from Alaska to California and may occur as far south as Baja California.

I.3.4.3 Occurrence within the Action Area

Using on-land observation sites, biologists have documented MAMU in nearshore waters from the Santa Maria River to VSFB (eBird 2021). Specifically, one individual was observed at an unreported distance offshore from an observation site located approximately 2.0 mi (3.2 km) from SLC-5 in 2011 (eBird 2021). Two separate sightings were also documented in 1995 offshore of Purisima Point (eBird 2021). As such, the species may occur within offshore portions of the Proposed Action Area subject to launch noise impacts less than 120 dB Lmax. MAMU has never been documented breeding on VSFB, nor is any old-growth coniferous forest present on VSFB or in the Proposed Action Area. Therefore, impacts to MAMU may occur if individuals are within the offshore ocean area encompassed by the 100 dB Lmax launch contour.

I.3.5 Western Snowy Plover (Federally Listed Threatened Species)

I.3.5.1 Status

The USFWS listed the Pacific coast population of the western snowy plover (*Charadrius nivosus nivosus*; SNPL) as federally threatened in March of 1993 (58 FR 12864–12874).

I.3.5.2 Life History

The SNPL is a small shorebird with pale tan back, white underparts, and dark patches on the sides of the neck reaching around to the top of the chest. The Pacific coast population of snowy plovers is limited to individuals that nest adjacent to tidal waters. The population’s range extends from Southern Washington to Baja California, Mexico.

I.3.5.3 Occurrence within the Action Area

VSFB provides important breeding and wintering habitat for SNPL, which includes all sandy beaches and adjacent coastal dunes from the rocky headlands at the north end of Minuteman Beach to the pocket beaches and dune areas adjacent to Purisima Point on north VSFB (approximately 7.7 mi [12.4 km]). Also included are all sandy beaches and adjacent coastal dunes from the rocky headlands at the north end of Wall Beach south to the rock cliffs at the south end of Surf Beach on South VSFB (approximately 4.8 mi [7.7 km]).

VSFB has consistently supported one of the largest populations of breeding SNPL along the west coast of the United States (Robinette et al. 2016). VSFB has performed annual monitoring of SNPL since 1993 (Robinette et al. 2021). In 2014, VSFB supported an estimated 11 percent of California's breeding population (USFWS 2014). The breeding population of SNPL on VSFB has been highly variable but relatively stable since 2007, with 235 adults and 472 nests initiated in 2021 (Robinette et al. 2021). The shoreline closer to SLC-5 is dominated by steep rocky cliffs and narrow beaches that are typically fully inundated at high tide, therefore no suitable nesting beaches for SNPL are present south of the southern end of Surf Beach. The nearest documented SNPL nest to the SLC-5 was on Surf Beach, approximately 3.5 mi (5.6 km) north of SLC-5.

The SNPL is also considered a permanent resident of Santa Rosa Island. A high count of 61 SNPL was documented during the 2016–2017 winter window survey of San Miguel Island (SMI), however, counts at SMI typically document very few to no individuals (USFWS 2017).

I.3.6 California Condor [Federally Listed Endangered Species]

I.3.6 California Condor

I.3.6.1 Status

The USFWS listed the California condor as endangered on 11 March 1967 (32 FR 4001) and completed a Recovery Plan for the species on 25 April 1996 (USFWS 1996). In 1982, there were only 23 California condors in existence. To prevent the condor from going extinct, all remaining condors were placed into a captive breeding program in 1987. The USFWS and its partners began releasing condors back into the wild in 1992. The nearest release site to the Proposed Action Area is Bitter Creek National Wildlife Refuge (USFWS 2017). Other release sites include the Ventana Wilderness, Big Sur Sanctuary, San Simeon Sanctuary, and Pinnacles National Park. Almost all condors released into Santa Barbara County have either died or were brought back into captivity, with the last nesting attempt occurring in 2001 (Lehman 2020).

I.3.6.2 Life History

Condors nest in rock formations (e.g., ledges and crevices) and less frequently in giant sequoia trees (*Sequoiadendron giganteum*). They normally lay a single egg between late January and early April. Both parents incubate the egg and share responsibilities for feeding the nestling after hatching. Condors require large remote areas and can range up to 150 mi (241 km) a day in search of food. Chicks usually take their first flight around 6 to 7 months from hatching. The cause of the California condor's decline is inconclusive, but experts believe that lead poisoning and hunting greatly contributed to their decline (USFWS 1996).

I.3.6.3 Occurrence within the Action Area

The California condor's current range is not within the Proposed Action Area. However, in March 2017, the USSF learned that telemetry data from USFWS showed there was a California condor ranging within VSFB. This condor was SB 760 (“VooDoo”), an immature, non-reproductive female (USFWS, personal communication, 27 March 2017). SB 760 hatched in captivity on 22 May 2014. She was released at the Ventana Wilderness on 9 November 2016 (Ventana Wildlife Society 2017). SB 760 departed the VSFB area on or about 22 April 2017 and several months later, was found deceased, in northern San Luis Obispo County. VSFB natural resource managers maintain routine communications with the USFWS and Ventana Wildlife Society for launch monitoring requirements and condors have not been present since. However, given the wide-ranging nature of this species, individuals may occur on Base in the future.

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Appendix J

Marine Species

J.1 Regulatory Setting

All marine mammals in the U.S. are protected under the Marine Mammal Protection Act (MMPA), and some species receive additional protection under the ESA. The MMPA defines a marine mammal "stock" as "…a group of marine mammals of the same species or smaller taxon in a common spatial arrangement that, interbreed when mature" (16 United States Code section 1362; for further details, see Oleson et al. (2013). As provided by NMFS guidance, "…for purposes of management under the MMPA a stock is recognized as being a management unit that identifies a demographically independent biological population" (NMFS 2016).

The Endangered Species Act (ESA) provides for listing species, subspecies, or Distinct Population Segments (DPSs) of species, all of which are referred to as "species" under the ESA. In short, a DPS is a portion of a species' or subspecies' population that is both discrete from the remainder of the population and significant in relation to the entire species, with the DPS then defined geographically instead of biologically. If a population meets the criteria to be identified as a DPS, it is eligible for listing under the ESA as a separate species (NMFS 2016). Among these species most marine mammal stocks are managed by NMFS; the southern sea otter is managed by the United States Fish and Wildlife Service (USFWS).

J.2 Southern Sea Otter (Federally Listed Threatened Species)

J.2.1 Status

The USFWS listed the Southern sea otter as federally threatened on 14 January 1977 (42 Federal Register [FR] 2965) and published a Recovery Plan in 2003 (USFWS 2003). The USWFS completed a 5-year review of the species in 2015 (USFWS 2015).

J.2.2 Life History

The Southern sea otter is the smallest species of marine mammal in North America. It inhabits the nearshore marine environments of California from San Mateo County to Santa Barbara County with a small geographically isolated population around San Nicolas Island. On occasion, Southern sea otters have been observed beyond these limits and have been documented as far south as Baja, Mexico (USFWS 2015).

This species breeds and gives birth year round and pups are dependent on maternal care for 120–280 days (average 166 days; Riedman & Estes 1990). Sea otters are opportunistic foragers known to eat mostly abalones, sea urchins, crabs, and clams. They play a key ecological role in kelp bed communities by controlling sea urchin grazing.

J.3 Steller Sea Lion

Steller sea lions (*Eumetopias jubatus*) range along the north Pacific from northern Japan to California (Perrin et al. 2009), with centers of abundance and distribution in the Gulf of Alaska and Aleutian Islands (Muto et al. 2020). There have also been reports of Steller sea lions in waters off Mexico as far south as the various islands off the port of Manzanillo in Colima, Mexico (Gallo-Reynoso et al. 2020). The Eastern U.S. stock (or DPS) of Steller sea lion is defined as the population occurring east of 144°W longitude, and it is not listed as threatened or endangered under the ESA (NOAA Fisheries 2016; Muto et al. 2020). The locations and distribution of the Eastern population's breeding sites along the U.S. Pacific coast have shifted northward, with fewer breeding sites in Southern California and more sites established in Washington and Southeast Alaska (Pitcher et al. 2007; Wiles 2015).

San Miguel Island and Santa Rosa Island were, in the past, the southernmost rookeries and haulouts for the Steller sea lions, but their range contracted northward in the 20th century, and now Año Nuevo Island off Central California is currently the southernmost rookery. Steller sea lions pups were known to be born at San Miguel Island up until 1981 (Pitcher et al. 2007; NOAA Fisheries 2008; Muto et al. 2020), and so, as the population continues to increase, it is anticipated that the Steller sea lions may re-establish a breeding colony on San Miguel Island in the future. In the Channel Islands and vicinity and despite the species' general absence from the area, a consistent but small number of Steller sea lions (one to two individuals at a time) have been sighted in recent years. Approximately one to two adult and subadult male Steller sea lions have been seen hauled out at San Miguel Island each year during the fall and winter over the last decade, and adult and subadult males have occasionally been seen on rocks north of Northwest Point at San Miguel Island during the part of the summer in the past few years (Delong 2019). Aerial surveys for pinnipeds in the Channel Islands from 2011 to 2015 encountered a single Steller sea lion at San Nicolas Island in 2013 (Lowry et al. 2017). A lone adult female gave birth to and reared a pup on San Miguel Island in the summer of 2017 (Delong 2019).

Based on a 2017 survey, the Eastern U.S. stock has increased at a rate of approximately 4.25 percent per year over the last 40 years (Muto et al. 2020), but it remains uncertain how many and what trend there will be for Steller sea lions that are occasionally present in small numbers off Central and Southern California.

J.4 Northern Elephant Seal

The northern elephant seal (*Mirounga angustirostris*) is not listed under the ESA. There are two distinct populations of northern elephant seals: one that breeds in the Baja Peninsula, Mexico; and a population that breeds in California (Garcia-Aguilar et al. 2018). NOAA Fisheries considers northern elephant seals in the ROI to be from the California Breeding stock, although elephant seals from the Baja Peninsula, Mexico, frequently migrate through the ROI (Aurioles-Gamboa & Camacho-Rios 2007; Carretta et al. 2020). Northern elephant seals spend little time nearshore and migrate four times a year as they travel to and from breeding/pupping and molting areas, spending more than 80 percent of their annual cycle at sea (Robinson et al. 2012; Lowry et al. 2014; Lowry et al. 2017; Carretta et al. 2020). Peak abundance in California is during the January–February breeding season and during molting season from April to July (Lowry et al. 2014; Lowry et al. 2017). As presented in the 2019 Stock Assessment Report (Carretta et al. 2020), the population in California continues to increase Lowry et al. (2014).

J.5 Harbor Seal

The harbor seal (*Phoca vitulina*) is not listed under the ESA and those present in the ROI have been assigned to the California stock of harbor seals (Carretta et al. 2020).

Harbor seals are generally not present in the deep waters of the open ocean, are rarely found more than 20 km from shore, and frequently occupy bays, estuaries, and inlets (Baird 2001; Harvey & Goley 2011; Jefferson et al. 2014). Data from 180 radio tagged harbor seals in California indicated most remained within 10 km of the location where they were captured and tagged (Harvey & Goley 2011).

Harbor seals generally haul out in greatest numbers at low tides and during the afternoon, when it is usually warmest. The period from late May to early June corresponds with the peak molt season when the maximum number of harbor seals are onshore (Lowry et al. 2017). The most recent (2012) statewide survey of California harbor seal rookeries has indicated that in the Channel Islands the count has been stable or trending as a slight increase since 1995 (Carretta et al. 2020).

J.6 California Sea Lion

The California sea lion (*Zalophus californianus*) is not listed under the ESA, and the population has been designated as the United States (U.S.) stock by National Oceanic and Atmospheric Association (NOAA) Fisheries. Typically, during the summer, California sea lions congregate near rookery islands and specific open-water areas. The primary rookeries off the coast of the United States are on San Nicolas, San Miguel, Santa Barbara, and San Clemente Islands (Le Boeuf & Bonnell 1980; Lowry et al. 1992; Carretta et al. 2000; Lowry & Forney 2005; Lowry et al. 2017). Haulout sites are also found on Richardson Rock, Santa Catalina Island, Santa Cruz Island, and Santa Rosa Island in the Southern California Bight (Le Boeuf 2002; Lowry et al. 2017).

In the nonbreeding season, beginning in late summer, adult and subadult males migrate northward along the coast of California to Washington and return south the following spring (Lowry & Forney 2005; Laake 2017). Females and juveniles also disperse somewhat but tend to stay in the Southern California area, although north and west of the Channel Islands (Melin & DeLong 2000; Lowry & Forney 2005; Thomas et al. 2010). Tagging results showed that lactating females foraging along the coast would travel as far north as Monterey Bay and offshore to the 1,000 meter isobath (Melin & DeLong 2000; Melin et al. 2008; Henkel & Harvey 2008; Kuhn & Costa 2014; McHuron et al. 2017). There is a general distribution shift northwest in fall and southeast during winter and spring, probably in response to changes in prey availability (DeLong et al. 2017a; DeLong et al. 2017b; Lowry et al. 2017). California sea lions are usually found in waters over the continental shelf and slope; they are also known to occupy locations far offshore in deep, oceanic waters, such as Guadalupe Island and Alijos Rocks off the Baja Peninsula, Mexico (Zavala-Gonzalez & Mellink 2000; Jefferson et al. 2008; Melin et al. 2008; Urrutia & Dziendzielewski 2012). California sea lions are the most frequently sighted pinnipeds offshore of Southern California during the spring, and peak abundance is during the May through August breeding season (Green et al. 1992; Keiper et al. 2005; Lowry et al. 2017). Overall, the California sea lion population is abundant and has been generally increasing (Jefferson et al. 2008; Carretta et al. 2010; Lowry et al. 2017; Carretta et al. 2020). Using count and resighting data gathered between 1975 and 2015, NOAA Fisheries researchers showed that California sea lion population growth was above the maximum net productivity level and within the range of the optimal sustainable population (Laake et al. 2018).

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Appendix K

Water Resources

K.1 Surface Water

K.1.1 Regulatory Setting

The Clean Water Act (CWA) establishes the structure for regulating discharges of pollutants in waters of the United States. The CWA mandates the National Pollutant Discharge Elimination System (NPDES) program, which requires a permit for the discharge of any pollutant to waters of the United States from point and non-point sources. Point sources include wastewater from any discernible confined and discrete conveyances from which pollutants are or may be discharged. Non-point sources include stormwater runoff from industrial, municipal, and construction sites. The CWA and implementing United States Environmental Protection Agency (EPA) regulations provide the authority and framework for state regulations. In California, the State Water Resources Control Board (SWRCB) administers the NPDES program through the California Porter-Cologne Water Quality Control Act/California Water Code (CWC). The SWRCB and the Regional Water Quality Control Board (RWQCB) administers the NPDES Program for industrial activities, municipalities, and construction activities through General Permits, although certain discharges are authorized and certain discharges require individual permits.

The CWC provides a framework for establishing beneficial uses of water resources and the development of local water quality objectives to protect these beneficial uses. The Central Coast Water Quality Control Plan (Basin Plan) assigns beneficial uses to water bodies and provides local water quality objectives to protect these beneficial uses. The California Ocean Plan provides water quality objectives to protect ocean water quality.

K.1.2 Honda Creek and San Antonio Creek Watersheds

The Honda Creek watershed consists almost entirely of undeveloped riparian, scrublands, and woodlands with Coast Road and the Union Pacific Railroad crossing it near its mouth at the Pacific Ocean. Honda Creek is a perennial waterway that may occasionally run dry in the summer during low-precipitation years. Rate of flow is seasonal with higher flows during the rainy season from November to May and lower flow during the rest of the year when precipitation is infrequent. Summer flow is derived from several springs along both sides of the canyon that occasionally cease during particularly dry periods. Mean rainfall for the region, measured at Surf from 1927 through 2021, is 11.2 inches (28.4 cm; County of Santa Barbara Public Works 2022).

Water quality sampling in 2007 in Honda Creek registered exceedances for chlorophyll a, pH, dissolved solids, and turbidity (Tetra Tech, Inc. 2008). Honda Creek provides municipal and domestic supply, agricultural supply, groundwater recharge, freshwater replenishment, water contact recreation, noncontact water recreation, wildlife habitat, warm freshwater habitat, cold freshwater habitat, migration of aquatic organisms, spawning, reproduction, and early development habitat, rare, threatened, or endangered species habitat, and commercial and sport fishing (Central Coast RWQCB 2019).

The San Antonio Creek watershed consists of mostly undeveloped riparian, scrublands, rangelands, and agricultural fields. Flow in San Antonio Creek is seasonal because of generally very little precipitation from June to November. Higher discharges generally occur during the rainy season, from November to May.

K.2 Groundwater

K.2.1 Regulatory Setting

The Sustainable Groundwater Management Act of 2014 (SGMA), and its subsequent enactment in January 2015 mandate that all California groundwater basins designated as high- or medium-priority by the California Department of Water Resources, be managed under a Groundwater Sustainability Plan (GSP; Section 10720.7 CWC). GSPs are currently being formed for the medium-priority Santa Ynez and San Antonio groundwater basins by their associated groundwater sustainability agencies (GSAs). VSFB is a federal institution that is exempt from mandatory SGMA compliance yet has expressed intent to collaborate and assist with pertinent GSAs in their GSP formations per CWC Section 10720.3.

K.2.2 Basins, Subbasins, and Supply

VSFB includes parts of two major groundwater basins, and at least two subbasins. Most of the northern third of the base is within the San Antonio Creek Basin, while most of the southern two thirds of the base is within the Santa Ynez River Basin and associated Lompoc Terrace and Cañada Honda Subbasins (U.S. Space Force 2021). The Proposed Action is within the Cañada Honda Subbasin. Its associated subbasin is also thus predominantly on VSFB property.

The Cañada Honda Subbasin is not used for drinking water for VSFB. The VSFB water supply primarily comes from the State Water Project (80 to 90 percent) in non-drought years. During drought periods, groundwater supply is primarily provided by the San Antonio Groundwater Basin (U.S. Air Force 1998).

In 1963, the Point Arguello Naval Missile Facility installed and monitored test wells to analyze groundwater across south VSFB, some of which were in Honda Creek (Evenson and Miller 1963). These test wells indicated that Honda Canyon's underlying alluvium is a heterogeneous mixture of silt, sand, gravel, and clay approximately 50 ft to 80 ft (15 m to 24 m) thick, and the coarser water-bearing strata are in the lower third of the section. The study concluded that owing to the heterogeneity of the material, the deposits would not yield much water to wells, and the quality of the water would be poor because of high chloride levels and dissolved solids.

Groundwater in the San Antonio Creek Valley occurs in most of the unconsolidated deposits (deposits through which water flows easily) that have filled the San Antonio Trough (a notch cut through the consolidated Tertiary rocks by San Antonio Creek). The water-bearing deposits in San Antonio Creek include alluvium, Orcutt Sand, the Paso Robles Formation, and Careaga Sand. Groundwater in the area moves from the hills surrounding the San Antonio Creek Valley toward the center of the valley, and from there west to the Pacific Ocean. At Barka Slough groundwater rises to the surface, creating a freshwater marsh, and flows westward into San Antonio Creek as surface flow.

The current water source for VSFB is four water wells located within the San Antonio Creek Basin. There is an existing connection between State water and the VSFB water supply system. Due to the recent California rain events, especially in the watersheds in the central and northern parts of California, VSFB will likely return to State water as its primary drinking water supply in 2023.. The San Antonio Creek Basin is considered in this EA due to water extraction requirements to support SLC-5 operations.

K.3 Waters of the United States and Wetlands

K.3.1 Regulatory Setting

Waters of the United States (WOTUS) encompass the jurisdictional limits of the authority of the U.S. Army Corps of Engineers (USACE) and include perennial and intermittent streams and their tributaries that have defined bed and banks, have an ordinary high-water mark (OHWM), or are below the high-tide-line (HTL). The OHWM is a line on the shore established by the fluctuations of ordinary water flows, while the HTL is equivalent to the highest predicted high tide for the calendar year. In addition to these waters, WOTUS also include adjacent jurisdictional wetlands, defined in the 2020 Navigable Waters Protection Rule (NWPR): "waters of the United States" are wetlands with a direct surface connection to a non-wetland WOTUS (FR 33 Part 328; 40 CFR 110, 112, 116, 117, 120, 122, 230, 232, 300, 302, and 401).

K.4 Waters of the State and Wetlands

K.4.1 Regulatory Setting

In addition to federal protections afforded by the federal CWA and NWPR, aquatic resources are protected in California through regulation of activities within inland streams, wetlands, and riparian zones. The RWQCB and the California Department of Fish and Wildlife both hold jurisdiction over all wetland and non-wetland WOTUS under USACE jurisdiction, along with additional features such as riparian zones, ground water, and a broader scope of isolated and ephemerally present surface and ground waters. The California Water Code gives the State broad authority to regulate Waters of the State (WOTS) which are defined as surface water or groundwater, including saline waters. The local RWQCB administers the Porter-Cologne Water Quality Control Act (PCWQCA) and determines the exact definition of WOTS within its region.

The State of California also regulates water resources under Sections 1600 to 1603 of the Fish and Game Code. Waters of the state include ephemeral, intermittent, and perennial watercourses. Jurisdiction is extended to the limit of riparian zones that are located contiguous to the water resource and that function as part of the watercourse system. Section 2785(e) of the Fish and Game Code of California defines "riparian zones" as lands which contain habitat which grows close to and which depends on soil moisture from a nearby freshwater source. Waters of the state include all wetland WOTUS, as well as wetlands that meet the state's own definition. State wetlands include isolated wetlands with no surface connection to a traditionally navigable water, as well as wetlands that are unvegetated, so long as they have hydric soils and wetland hydrology. Waters of the state also include all non-wetland WOTUS, and some ephemeral streams that do not qualify as WOTUS may qualify as WOTS if they have indicators of an OHWM, for instance.

K.5 Septic Systems

K.5.1 Regulatory Setting

In California, the SWRCB regulates Onsite Wastewater Treatment Systems (OWTS; i.e. septic systems). The SWRCB adopted OWTS Policy for the Siting, Design, Operation and Maintenance of Onsite Wastewater Treatment Systems in June 2012 (SWRCB 2012). This Policy established a statewide tiered approach to regulate and manage OWTS. In addition to establishing minimum standards for new and replacement OWTS, the policy also allows local agencies to develop customized programs called Local Agency Management Programs (LAMP). The Santa Barbara County LAMP became effective in January 2016 (Santa Barbara County Public Health Department 2015).Santa Barbara Environmental Health and Safety declined to include VSFB in its LAMP. Therefore, the SWRCB OWTS Policy is the guiding document for VSFB septic systems.

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Appendix L

Cultural Resources Background

L.1 Cultural Setting

The prehistory of California's central coast spans the entire Holocene and may extend back to late Pleistocene times. Excavations on Vandenberg Space Force Base (VSFB) reveal occupations dating to the Pleistocene/Holocene transition, around 11,000 years ago (Lebow et al. 2014, 2015). Occupations during the earliest part of the Holocene (9,000 to 10,000 years) have been identified at several sites on the base (Glassow 1996; Glassow et al. 1990; Lebow et al. 2001; Lebow et al. 2006; Lebow et al. 2007; Stevens 2011). These early occupants are thought to have lived in small groups that had a relatively egalitarian social organization and a forager-type land-use strategy (Erlandson 1994; Glassow 1996; Greenwood 1972; Moratto 1984). Human population density remained low throughout the early and middle Holocene (Lebow et al. 2007). Cultural complexity appears to have increased around 3,000–2,500 years ago (King 1981, 1990). At VSFB, that interval also marks the beginning of increasing human population densities and appears to mark the shift from a foraging to a collecting land-use strategy (Lebow et al. 2006; Lebow et al. 2007). Population densities reached their peak around 600–800 years ago, corresponding to the full emergence of Chumash cultural complexity (Arnold 1992).

People living in the VSFB area prior to historic contact are grouped with the Purisimeño Chumash (Greenwood 1978; King 1984; Landberg 1965), one of several linguistically related members of the Chumash culture. In the Santa Barbara Channel area, the Chumash people lived in large, densely populated villages and had a culture that "was as elaborate as that of any hunter-gatherer society on earth" (Moratto 1984). Relatively little is known about the Chumash in the VSFB region. Explorers noted that villages were smaller and lacked the formal structure found in the channel area (Greenwood 1978). About five ethnohistoric villages are identified by King (1984) on VSFB, along with another five villages in the general vicinity. Diseases introduced by early Euroamerican explorers, beginning with the maritime voyages of Cabrillo in A.D. 1542–1543, substantially impacted Chumash populations more than 200 years before Spanish occupation began (Erlandson and Bartoy 1995, 1996; Preston 1996). Drastic changes to Chumash lifeways resulted from the Spanish occupation that began with the Portolá expedition in A.D. 1769.

L.2 History

VSFB history is divided into the Mission, Rancho, Anglo-Mexican, Americanization, Regional Culture, and Suburban periods. The Mission Period began with the early Spanish explorers and continued until 1820. Mission La Purísima encompassed the VSFB area. Farming and ranching were the primary economic activities at the Mission. The Rancho Period began in 1820 and continued until 1845. Following secularization in 1834, the Alta California government granted former mission lands to Mexican citizens as ranchos. Cattle ranching was the primary economic activity during this period. The Bear Flag Revolt and the Mexican War marked the beginning of the Anglo-Mexican Period (1845–1880). Cattle ranching continued to flourish during the early part of this period, but severe droughts during the 1860s decimated cattle herds. The combination of drought and change in government from Mexico to the United States caused substantial changes in land ownership. Sheep ranching and grain farming replaced the old rancho system. Increased population densities characterize the Americanization Period (1880–1915). Beginning in the late 1890s, the railroad provided a more efficient means of shipping and receiving goods and supplies, which in turn increased economic activity. Ranching and farming continued during the early part of the period of Regional Culture (1915–1945), until property was condemned for Camp Cooke. The Suburban Period (1945–1965) began with the end of World War II. In 1956, the army transferred 64,000 ac. (259 km^2) of North Camp Cooke to the U.S. Air Force, and it was renamed the Cooke Air Force Base. In 1958 the base had its first missile launch, the Thor, and was renamed VSFB (Palmer 1999). The first Intercontinental Ballistic Missile launched from VSFB was the Atlas, on 9 September 1959 (Smallwood and Loetzerich 2020).

L.3 Archaeological Sites and Isolated Artifacts

L.3.1 CA-SBA-538

When first recorded in 1950, Lathrop described CA-SBA-538 as a sand blowout with artifacts on the surface, including a core scraper, cobble scraper, and a blade fragment. Spanne updated the site record in 1970 and noted that the site was destroyed during the construction of the Scout Launch Facility. A subsequent survey report (Glassow et al. 1976) describes the site as "situated on the northern rim of Honda Canyon where the Scout Launch Facility now exists. The site, recorded in the 1950s, was apparently destroyed by construction of that facility" (Glassow et al. 1976). These studies concluded that the site likely no longer exists because of prior construction work and erosion and, as such, it was determined ineligible for the NRHP (SHPO-CON-17/USAF110418A).

L.3.2 CA-SBA-670

Encompassing approximately 82,300 square meters, CA-SBA-670 was recorded during an early base-wide survey and classified as a seasonal village or intermittently occupied habitation site (Spanne and Glassow 1974). It lies at the junction of three roads and consequently has been the subject of numerous archaeological studies associated with infrastructure development. It was first tested in 1974 in conjunction with the Space Transportation System (STS) (Glassow et al. 1976), an effort that found dense concentrations of marine shell, vertebrate faunal remains, lithic debitage, flaked stone tools, and fire-altered rock. Following that effort, the site was determined eligible for the NRHP in 1979 (E.0.11593; SHPO-CON-338). Since that time, multiple testing and data recovery excavations have been conducted at the site (Glassow 1981, 1990, 1996); Spanne (1980); (Stone and Glassow 1980); Schilz (1985); (Ferraro et al. 1988; Moore et al. 1988); (Environmental Solutions 1990); Lebow (2001); (Lebow et al. 2003); (Enright and Lebow 2011).

L.3.3 CA-SBA-2230

CA-SBA-2230 was originally recorded in 1988 as a low-density scatter of flaked stone and ground stone east of Surf Road. The site was re-recorded and tested during a survey for the SLC-4 Power System Upgrade Project (Schmidt and Bergin 1990). A SHPO concurrence letter dated 20 June 2011 (SHPO-CON-17/USAF110418A) indicates that the site was determined ineligible for the NRHP as it appears to contain only sparse, disturbed, and homogenous archaeological remains with limited data potentials. Bienenfeld et al. (2019) conducted additional testing at CA-SBA-2230, which included the excavation of 18 shovel test pits extending to a maximum of 100 cm below surface in most locations. No cultural material was encountered. A subsequent SHPO concurrence letter (SHPO-CON-351/USAF_2019_0510_001 dated 12 June 2019), affirms the initial determination of site ineligibility.

L.3.4 CA-SBA-2934

CA-SBA-2934 was recorded in 1994 by H. Calicher during a base-wide pedestrian survey as a sparse lithic scatter with five flakes and a tabular fragment. No additional studies were conducted at CA-SBA-2934, and the site has not been previously evaluated for NRHP eligibility.

L.3.5 Isolated Artifacts

Three previously recorded isolated artifacts and one newly discovered isolated artifact are present within or immediately adjacent to the ADI. VAFB-ISO-258 is a previously recorded black and tan banded Monterey chert secondary flake. VAFB-ISO-259 is a previously recorded slightly triangular battered sedimentary cobble. VAFB-ISO-700 is a previously recorded core. VAFB-ISO-1049 is an approximately 3.0 by 1.5-cm biface thinning flake made of light-colored chert with orange and white inclusions, found during fieldwork for the Proposed Action.

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APPENDIX M
Evacuation and Closure Agreement – U.S. Air Force & Santa Barbara County

Negotiated Agreement Under Authority of
Section 2304 (a) (10) of Title 10 U.S.C.

DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT, CORPS OF ENGINEERS
P.O. BOX 532711
LOS ANGELES, CALIFORNIA 90053-2325

Agreement No. DACA09-3-98-0008
Vandenberg Air Force Base, CA.
Tract No. 422

THIS AGREEMENT, made and entered into as of 1 April by and between the STATE OF CALIFORNIA, whose interest in the real property, hereinafter described as that of owners in fee simple as their separate property for themselves, their heirs, executors, administrators, successors, and assigns, hereinafter referred to as the "Grantor" and the UNITED STATES OF AMERICA, hereinafter referred to as the "Government,"

WITNESSETH THAT:

WHEREAS, the Government is maintaining and operating a Missile Testing Base at Vandenberg Air Force Base, California, and has determined that it is necessary to implement range safety procedures at said Air Force Base in order to provide for safety to persons on the land adjoining, or adjacent to said base;

NOW THEREFORE, the parties hereto, for consideration hereinafter set forth, covenant and agree as follows:

a. That Grantor and the Occupant hereby grant to the Government the following rights:

(1) The right to require the Grantor, the Occupant, their families, employees, lessees and any other person or persons occupying or using said land by permission or knowledge of the Grantor, the Occupant, vacate said land for intermittent periods, which shall not exceed twelve (12) consecutive hours for each period, provided the Government shall give to said Grantor, the Occupant, and other authorized persons, no less than twenty four (24) hours prior notice of the necessity to vacate said land.

(2) The right of the Wing Commander, 30 Space Wing ~~Commanding General of the First Strategic Aerospace Division~~, Vandenberg Air Force Base, California, or his duly authorized representative, to notify the Grantor, the Occupant, and such other persons as the Grantor may designate, of the dates said land will be vacated, and the duration of each period that said land is to remain unoccupied by the Grantor, the Occupant, and their families, employees, lessees, and other person or persons occupying or using said land by permission or knowledge of the owners, except that their livestock may remain on the land during each vacation period.

(3) The right to enter upon and pass through said land to give notice of evacuation, and to assure that all human beings have vacated said land.

(4) The right to require the Grantor, the Occupant, their heirs, executors, administrators, successors and assigns to give the Government three (3) months notice in writing, of any intention to enter into any contract or agreement for either residential, commercial or industrial subdivision of all or any part of said land, to be addressed to the District Engineer, U.S. Army Engineer District, Los Angeles, ATTN: CESPL-RE-C, P.O. Box 532711, Los Angeles, California 90053-2325.

b. That the term of this agreement shall be **1 APRIL 1998** to **31 MARCH 1999**, provided that unless and until the Government shall give notice of termination in accordance with provision (d) hereof, this agreement shall remain in force thereafter from year to year for the payment of rentals; and provided further this agreement shall in no event extend beyond **31 MARCH 2003**.

c. That the monetary consideration to be paid by the Government to the Grantor shall be at the following rate:

(1) To the Grantor the sum of NINE HUNDRED AND NO/100 DOLLARS ($900.00) per annum or pro rata amount for fractional period of use thereof.

Payment shall be made at the end of each fiscal year by the DFAS-SB/ARF, 1111 EAST MILL STREET, SAN BERNADINO, CALIFORNIA 92408-1621.

d. That the Government may terminate this agreement at any time by giving ninety (90) days notice in writing, to the Grantor. No payment shall accrue after the effective date of termination.

e. That any notice under the terms of this agreement shall be in writing, signed by the duly authorized representative of the party giving such notice, and if by the Government, it shall be addressed to the State, and if notice is given by the State, or the Occupant, it shall be addressed to the Commander, U.S. Army Engineer District, Los Angeles, ATTN: CESPL-RE-C, P.O. Box 532711, Los Angeles, California 90053-2325.

f. That nothing contained herein shall be construed to be a waiver or release of the Government from any liability for loss or damages to buildings, improvements, growing crops, livestock, or other personal property located on the land, which loss or damage may be caused by activities or negligence of the Government, its employees, or its agent. Written notice of any such loss or damage to any such buildings, improvements, growing crops, livestock or other personal property shall be given to the Government within fifteen (15) days after knowledge of such loss, and shall be directed to the Government as stated in provision (e) hereof.

g. That the land covered by the agreement is identified as Tract No. 422, Vandenberg Air Force Base, California, and is more particularly described as follows:

That certain parcel of land described as Lots 2 and 3 of Section 2, Township 9, Range 36 West, and Lots 1 and 2 of Section 35, Township 10 North, Range 36 West, San Bernardino Meridian, in the County of Santa Barbara, State of California, according to the official plat thereof.

h. That the Grantor hereby warrants that no person or selling agency has been employed or retained to solicit or secure this agreement, upon an agreement or understanding for a commission, percentage, brokerage,or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the Grantor for the purpose of securing business. For breach or violation of this warranty, the Government shall have the right to annul this agreement without liability, or in its discretion, to deduct from the consideration the full amount of such commission, percentage, brokerage, or contingent fee.

i. That no member of, or delegate to Congress, or Resident Commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom, but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

j. This agreement superceeds all previous agreements which hereby become null and void.

IN WITNESS WHEREOF, the parties hereto have hereunto subscribed their names as of the date first above written.

STATE OF CALIFORNIA

STEVE ~~TRENOR~~ TREANOR
District Superintendent,
Channel Coast District,
Department of Parks and Recreation
1933 Cliff Drive, Suite 27
Santa Barbara, California 93109

THE UNITED STATES OF AMERICA

BY: ________, Col, USAF
DEPARTMENT OF THE AIR FORCE

GILBERT T. PERRY JR., Colonel, USAF
Deputy Civil Engineer

(To be filled out by someone other than the person signing the agreement)

CERTIFICATE OF AUTHORITY

I, (Enter Name) RICHARD ROZZELLE certify that I
(Name of person certifying)
am the (Enter Title) DISTRICT SUPERINTENDENT of
(Title of person certifying)
STATE OF CALIFORNIA, named as GRANTOR IN AGREEMENT NO. DACA-09-6-98-0009 and that RICHARD ROZZELLE who signed on behalf of the
(Name of person signing license)
GRANTOR, was known to me and was DIST. SUPERINTENDENT ~~of~~ said ORGANIZATION
(Title of person signing license)
That said AGREEMENT was duly signed for and in behalf of said STATE OF CALIFORNIA by authority of its Governing body, and within the scope of its corporate powers.

DATE: 3/26/09 SIGNATURE: [signature]
(Person certifying)

WITNESS;

(To be filled out by someone other than the person signing the agreement)

Negotiated Agreement Under Authority of
Section 2304 (a) (10) of Title 10 U.S.C.

DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT, CORPS OF ENGINEERS
P.O. BOX 532711
LOS ANGELES, CALIFORNIA 90053-2325

Agreement No. DACA09-3-98-0009
Vandenberg Air Force Base, CA.
Tract No. 423

THIS AGREEMENT, made and entered into as of 1 April by and between the STATE OF CALIFORNIA, whose interest in the real property, hereinafter described as that of owners in fee simple as their separate property for themselves, their heirs, executors, administrators, successors, and assigns, hereinafter referred to as the "Grantor" and the UNITED STATES OF AMERICA, hereinafter referred to as the "Government,"

WITNESSETH THAT:

WHEREAS, the Government is maintaining and operating a Missile Testing Base at Vandenberg Air Force Base, California, and has determined that it is necessary to implement range safety procedures at said Air Force Base in order to provide for safety to persons on the land adjoining, or adjacent to said base;

NOW THEREFORE, the parties hereto, for consideration hereinafter set forth, covenant and agree as follows:

a. That Grantor and the Occupant hereby grant to the Government the following rights:

(1) The right to require the Grantor, the Occupant, their families, employees, lessees and any other person or persons occupying or using said land by permission or knowledge of the Grantor, the Occupant, vacate said land for intermittent periods, which shall not exceed twelve (12) consecutive hours for each period, provided the Government shall give to said Grantor, the Occupant, and other authorized persons, no less than twenty four (24) hours prior notice of the necessity to vacate said land.

(2) The right of the ~~Commanding General of the First Strategic Aerospace Division~~ Wing Commander, 30 Space Wing GT, Vandenberg Air Force Base, California, or his duly authorized representative, to notify the Grantor, the Occupant, and such other persons as the Grantor may designate, of the dates said land will be vacated, and the duration of each period that said land is to remain unoccupied by the Grantor, the Occupant, and their families, employees, lessees, and other person or persons occupying or using said land by permission or knowledge of the owners, except that their livestock may remain on the land during each vacation period.

(3) The right to enter upon and pass through said land to give notice of evacuation, and to assure that all human beings have vacated said land.

(4) The right to require the Grantor, the Occupant, their heirs, executors, administrators, successors and assigns to give the Government three (3) months notice in writing, of any intention to enter into any contract or agreement for either residential, commercial or industrial subdivision of all or any part of said land, to be addresed to the District Engineer, U.S. Army Engineer District, Los Angeles, ATTN: CESPL-RE-C, P.O. Box 532711, Los Angeles, California 90053-2325.

b. That the term of this agreement shall be **1 APRIL 1998** to **31 MARCH 1999**, provided that unless and until the Government shall give notice of termination in accordance with provision (d) hereof, this agreement shall remain in force thereafter from year to year for the payment of rentals; and provided further this agreement shall in no event extend beyond **31 MARCH 2003**.

c. That the monetary consideration to be paid by the Government to the Grantor shall be at the following rate:

(1) To the Grantor the sum of SIX HUNDRED AND NO/100 DOLLARS ($600.00) per annum or pro rata amount for fractional period of use thereof.

Payment shall be made at the end of each fiscal year by the the DFAS-SB/ARF, 1111 EAST MILL STREET, SAN BERNADINO, CALIFORNIA 92408-1621.

d. That the Government may terminate this agreement at any time by giving ninety (90) days notice in writing, to the Grantor. No payment shall accrue after the effective date of termination.

e. That any notice under the terms of this agreement shall be in writing, signed by the duly authorized representative of the party giving such notice, and if by the Government, it shall be addressed to the State, and if given by the State or the Occupant, it shall be addressed to the Commander, U.S. Army Engineer District, Los Angeles, ATTN: CESPL-RE-C, P.O. Box 532711, Los Angeles, California 90053-2325.

f. That nothing contained herein shall be construed to be a waiver or release of the Government from any liability for loss or damages to buildings, improvements, growing crops, livestock, or other personal property located on the land, which loss or damage may be caused by activities or negligence of the Government, its employees, or its agent. Written notice of any such loss or damage to any such buildings, improvements, growing crops, livestock or other personal property shall be given to the Government within fifteen (15) days after knowledge of such loss, and shall be directed to the Government as stated in provision (e) hereof.

g. That the land covered by the agreement is identified as Tract No. 423, Vandenberg Air Force Base, California, and is more particularly described as follows:

That certain parcel of land described as Lots 4, 5 and 6 of Section 3A, Township 10, Range 36 West San Bernadino Meridian, in the County of Santa Barbara, State of California, according to the official plat thereof.

h. That the Grantor hereby warrants that no person or selling agency has been employed or retained to solicit or secure this agreement, upon an agreement or understanding for a commission, percentage, brokerage,or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the Grantor for the purpose of securing business. For breach or violation of this warranty, the Government shall have the right to annul this agreement without liability, or in its discretion, to deduct from the consideration the full amount of such commission, percentage, brokerage, or contingent fee.

i That no member of, or delegate to Congress, or Resident Commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom, but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

j. This agreement superceeds all previous agreements which hereby become null and void.

IN WITNESS WHEREOF, the parties hereto have hereunto subscribed their names as of the date first above written.

STATE OF CALIFORNIA

STEVE ~~TRENOR~~ TREADOR
District Superintendent,
Channel Coast District,
Department of Parks and Recreation
1933 Cliff Drive, Suite 27
Santa Barbara, California 93109

THE UNITED STATES OF AMERICA

, COL, USAF
DEPARTMENT OF THE AIR FORCE

GILBERT T. PERRY JR., Colonel, USAF
Deputy Civil Engineer

EVACUATION AGREEMENT NO. SPCVAN-1-93-0006

SUPPLEMENTAL AGREEMENT NO. 3

THIS SUPPLEMENTAL AGREEMENT entered into this 13th day of JAN, 2009, by and between the County of Santa Barbara, State of California ("County") and Secretary of the Air Force ("Government" or "Air Force"). The Government and the County may be referred to jointly as the "Parties," and each separately may be referred to as a "Party."

RECITALS:

A. On 1 December 1992, the Parties entered into an evacuation agreement for the evacuation of County properties Jalama Beach Park, Ocean Beach Park and Point Sal Road in case of certain government operations for purposes of military necessity, security and public safety.

B. On 05 November 1997, the Parties agreed to extend the Agreement for one additional year through 01 December 1998 and to automatically renew the Agreement for a total additional term of five years from December 1, 1997 and added Surf Station Parking Lot to the Agreement.

C. On 13 May 2003, the Parties agreed to extend the agreement for five years though 30 November 2007.

AGREEMENT:

1. The Agreement is hereby modified in the following particulars, but no others:

   a. Paragraph III. 13, page 5 of the Agreement is rescinded and replaced with paragraph 1.b, below, of this Supplement No. 3.

   b. The term of the Agreement was extended for one additional year through 30 November 2008 and will automatically renew annually on 1 December 2008 and on each subsequent 1 December of the following three years for a total additional term of five years from 1 December 2007, unless otherwise amended or terminated pursuant to paragraph 1.b. of this Supplement Agreement No. 3. The Agreement may be modified, amended, revised, or discharged by either Party upon providing advanced written notice to the other Party. Such advanced notice must be provided at least 120 days in advance of the requested modification, amendment, revision, or discharge. Any notice under the terms of this Agreement shall be in writing, signed by a duly authorized representative of the party giving such notice. If notice is given to the County, it shall be addressed to the

County of Santa Barbara, General Services Department, Office of Real Estate Services, 1105 Santa Barbara Street, Santa Barbara, California 93101. If notice is given to the Government, it shall be addressed to the Installation Commander as follows: "30 SW/CC, Vandenberg AFB, California 93437" and a duplicate shall also be mailed and addressed to "30 CES/CECBR, 1172 Iceland Avenue, Bldg 11432, Vandenberg AFB, California, 93437.

2. All other terms and conditions of the Agreement shall be and remain the same, unless otherwise made void by operation of law.

3. This Supplemental Agreement shall be effective immediately.

Project:	Evacuation Agreement SPCVAN-1-93-0006 Vandenberg Air Force Base, CA
Tract No.:	Jalama, Ocean, Surf, Pt Sal Rd
Folio:	003375

IN WITNESS WHEREOF, Government and County have executed this Supplemental Agreement No. 3 to Evacuation Agreement SPCVAN-1-93-0006, by the respective authorized officers as set forth below to be effective as of the date executed by Government.

"COUNTY"
COUNTY OF SANTA BARBARA

By: ________________
Salud Carbajal,Chair,
Board of Supervisors
County of Santa Barbara

Date: 11/18/08

ATTEST
MICHAEL F. BROWN
CLERK OF THE BOARD

By: ________________
Deputy

APPROVED AS TO FORM:
DENNIS MARSHALL
COUNTY COUNSEL

By: ________________

APPROVED AS TO FORM
ROBERT W.GEIS, CPA
AUDITOR-CONTROLLER

By: ________________

APPROVED:

____
Ronn Carlentine,
Real Property Manager

APPROVED:

____
Ray Aromatorio, ARM, AIC
Risk Program Administrator

APPROVED:

____
Daniel Hernandez
Parks Director

APPROVED:

____
Scott McGolpin
Director of Public Works

IN WITNESS WHEREOF, I have set my hand by authority of the Secretary of the Air Force as of the day and year first written above.

DEPARTMENT OF THE AIR FORCE

By: David J. Buck

DAVID J. BUCK
Colonel, USAF
Commander, 30th Space Wing

No. SPCVAN-1-93-0006

EVACUATION AGREEMENT

I. THE PURPOSE

This AGREEMENT by and between the UNITED STATES OF AMERICA (hereinafter "GOVERNMENT") and the COUNTY OF SANTA BARBARA, STATE OF CALIFORNIA (hereinafter "COUNTY") is made and entered as of 15th Dec 1992.

The GOVERNMENT is maintaining and operating a military installation and conducting government operations including, but not limited to missile testing, at Vandenberg Air Force Base, California. Because of these activities and government interests, GOVERNMENT has determined that military necessity, security, and public safety dictate that the GOVERNMENT must exercise certain controls over the real property herein described. This control shall include the right to evacuate the property and prohibit the use or occupation of said property hy COUNTY employees, agents and business invitees, and members of the general public as permitted hereunder.

II. COUNTY INTEREST AFFECTED

The COUNTY'S interest in Jalama Beach Park is that of fee owner. Jalama Beach Park is in the vicinity of Vandenberg Air Force Base, California. The real property identified as Jalama Beach Park is legally described on Exhibit "A" and the area concerned is outlined in red on Exhibit "B," both of which are attached hereto and incorporated herein by reference.

The COUNTY ' S interest in Ocean Beach County Park is that of fee owner. Ocean Beach County Park is in the vicinity of Vandenberg Air Force Base, California. The real property identified as Ocean Beach County Park is known as Assessor's Parcel Number 95-041-01, designated tract 601. Said parcel of real property is legally described on Exhibit "C" and the area concerned is outlined in red on Exhibit "D," both of which are attached hereto and incorporated herein by reference.

The COUNTY ' S interest in Point Sal Road is that COUNTY has a certain road and road rights of way known as the Point Sal Road. Portions of Point Sal Road lie within Vandenberg Air Force Base, California and the remainder is in the vicinity of Vandenberg Air Force Base, California. The real property identified as the Point Sal is identified as Assessor's Parcel Number 095-020-02, and the Point Sal Road area concerned is more fully described on Exhibit "E" attached hereto and incorporated herein by reference.

III. RIGHTS AND RESPONSIBILITIES

IN CONSIDERATION OF THE MUTUAL PROMISES CONTAINED HEREIN, THE PARTIES HEREIN MUTUALLY AGREE AS FOLLOWS:

1. The GOVERNMENT has the following rights and responsibilities :

a. The right to evacuate and close Jalama Beach park and Ocean Beach County Park during government operations for intermittent periods as required by said operations. The right to evacuate will apply to all occupants and users. The term "all" specifically includes, but is not limited to all COUNTY employees, their families and guests, concessionaires and members of the public. The Term "government operations" as used herein shall be defined as those non-commercial launch-related operations of government which tend to endanger the health and safety of persons present in the area of Jalama Beach Park or Point Sal Road or Ocean Beach Park.

During any period of closure which extends between the hours of 9:00 P.M. and 7:00 A.M., Government shall, and at its own expense, supply temporary substitute quarters either on or off base at the Government's option for resident Park employees who are displaced from their homes. At the present time there are four park rangers and their families who will be affected by this provision. County shall notify Government of the number of persons who will be displaced by government operations within 24 hours following advance written notification of closure.

b. The right to evacuate and close Jalama Road, with the exception of allowing access to the owners (or the agents of the owners) of adjacent privately owned land requiring access to their property for residential, ranching or agricultural purposes via Jalama Road, during intermittent periods as required.

c. The right to evacuate and close those portions of Point Sal Road lying within the military reservation either intermittently or completely for short periods of time (not to exceed 48 consecutive hours), because of the government operations at military facilities near said road right-of-way. During operations the GOVERNMENT shall have exclusive use and control of that portion of Point Sal Road and road rights-of-way between a point where the said road intersects the easterly boundary of the military reservation of the Vandenberg Air Force Base (1.75 miles west of Lompoc-Casmalia Road) and the easterly edge of the said Point Sal Road at its intersection with the Point Sal Beach State Park Road.

d. The right to regulate and control traffic, including the right to close the road entirely to use by the public or use by any persons other than those authorized by the GOVERNMENT, for short periods of time (not to exceed 48 consecutive hours) prior to and during missile launches on that portion of Point Sal Road between a point where the said road intersects the Point Sal Beach State Park Road and the northerly boundary of the military reservation of the Vandenberg Air Force Base.

e. The right of the Installation Commander of Vandenberg Air Force Base, California or the Installation Commander's duly authorized representative to notify any occupants of the real property and such other persons as the occupants may designate, of the dates said land will be vacated and the duration of each period that said land is to remain unoccupied. This includes the right to enter upon or pass through said land to give notice of evacuation and to assure that all human beings have evacuated said land. Livestock may remain on the land during the evacuation period. The particular requirements of the advance notice shall be contained in supplements to this AGREEMENT. Said notice shall be given not less than seventy-two (72) hours in advance of any closure or evacuation undertaken pursuant to this agreement.

f. The right and responsibility to post and remove signs at the following locations for the purpose of giving notice of advance park and road closure dates. The particular requirements of the advance notice shall be contained in supplements to this agreement. The signs may be posted:

(1) At the entrance of Jalama Beach Park,

(2) At the junction of Jalama Road and California State Highway Number 1,

(3) At the entrance to Ocean Beach County Park,

(4) At the junction of Ocean Avenue (formerly "Highway 246") and Ocean Park Road.

g. The right to construct and operate temporary barricades across the following roads to control access to areas evacuated:

(1) On Jalama Road near the intersection of California State Highway Number 1 and said Jalama Road.

(2) On Ocean Avenue near the intersection of Ocean Park Road and Ocean Avenue.

h. The right to require the COUNTY or any successor in interest to give to the GOVERNMENT six (6) months notice, in writing, of any intention to enter into any contract or agreement for residential, commercial or industrial subdivision of all or any part of said land addressed herein that is presently owned by the COUNTY.

2. The COUNTY has the following rights and responsibilities:

a. To advise Government, in writing, to the Installation Commander or the Commander's duly authorized representative, of the name and address of the Director of County Parks and of any changes of the same during this agreement.

b. The right to authorize the attendance of a County Deputy Sheriff on site to assist in the evacuation of human beings from Jalama Beach Park, Ocean Beach County Park and the County road rights-of-way.

3. The GOVERNMENT will be solely responsible for the negligent and wrongful acts of GOVERNMENT'S agents or employees as such liability is established and specified under the Federal Tort Claims Act, Title 28, United States Code, as amended, and under other laws which may apply as determined by appropriate federal authority.

4. The COUNTY will be solely responsible for the negligent and wrongful acts of COUNTY'S agents or employees as such liability is established and specified under the law of the State of California or other applicable laws.

5. Nothing contained herein shall be construed to be a waiver or release of the GOVERNMENT from any liability for loss or damage to buildings, improvements, growing crops, livestock, other personal property, or other public rights, located on the land, which loss or damage may be caused by the activities or negligence of the GOVERNMENT, its agents or its employees. Written notice of any such loss or damage to any such buildings, improvements, growing crops, livestock or other personal property shall be given to the GOVERNMENT within ninety (90) days after the party discovers or reasonably should have discovered the existence of the act that resulted in the claimed loss, and shall be directed to the GOVERNMENT as required of written notices herein.

6. No government official, nor any member of their families dependent upon the government official for support, shall receive any personal economic benefit, of any kind from this AGREEMENT. However, if this AGREEMENT happens to benefit a corporation so that in general, the shareholders of the corporation receive an economic benefit because of their status of being a shareholder, and if a government official is a shareholder and receives such benefit, the prohibition against personal economic benefit is not violated.

7. GOVERNMENT is not aware of any government official receiving a personal economic benefit, gift or gratuity (in the form of entertainment, gifts, gratuities or otherwise). However, if GOVERNMENT later discovers that such benefits were offered or given to any officer or employee of the GOVERNMENT with a view toward securing an agreement or securing favorable treatment from the GOVERNMENT, then the Secretary of the Air Force or his duly authorized representative shall make such findings as are in issue and may terminate this agreement. These findings and termination may be reviewed in any federal court of competent jurisdiction.

8. In the event this AGREEMENT is terminated as provided in paragraph 7 above, the GOVERNMENT shall be entitled to take all legal remedies against the COUNTY and such other persons as may be responsible for violations of the above prohibitions. These remedies expressly include appropriate penalties as well as any and all damages to which GOVERNMENT may be entitled by law.

9. The rights and remedies of the parties provided herein shall not be exclusive and are in addition to any other rights and remedies provided by law.

10. All terms and conditions of this AGREEMENT relating to expenditures of money by the GOVERNMENT are subject to and contingent upon the availability of and adequate appropriations of funds. This section is included in this AGREEMENT for the purpose of meeting the requirements of the Anti-Deficiency Act, 31 United States Code, Section 1341. All terms and conditions of this AGREEMENT relating to expenditures of money by the COUNTY are likewise subject to and contingent upon the availability of and adequate appropriations of funds.

11. This AGREEMENT does not create any additional cause of action which does not otherwise exist under the law. This AGREEMENT does not grant jurisdiction not already in existence under applicable law. This AGREEMENT does not constitute a waiver of federal supremacy or sovereign immunity as such principles of law exist and are applicable.

12. The GOVERNMENT shall permit the installation and maintenance by the County of water tanks and pipelines drawing water from GOVERNMENT lands in an amount sufficient to supply the water needs of the County Park located at Jalama Beach. The specific quantity and source of the water supply is fully set forth as a special purpose water and pipeline agreement in a separate Memorandum of Agreement. Nothing contained herein obligates the GOVERNMENT to provide an alternative water supply should the spring which is the existing source under the pipeline agreement become insufficient.

The following are currently approved public access areas on Vandenberg Air Force Base:

a. One & one-half miles north of Jalama Beach; beach access only.

b. Three & one-half miles south and one & one-half miles north of Ocean Park Beach; beach access only.

c. Beginning from the one & one-half mile mark north of Ocean Beach Park to the five mile mark (three & one-half miles total) is designated permit fishing only; access is granted by permit only through the Solvang Gate, Highway 246, with a specified route through the base.

The parties shall continue to negotiate in good faith to open additional areas of coastline for public use to include coordination with all other federal, and State and local agencies.

13. This agreement shall automatically renew annually on 1 December 1992 and 1 December of the following four years for a term of 5 years. This agreement may be terminated by GOVERNMENT by written notice to COUNTY of cessation of mission requirement. This agreement may be terminated by County by written notice to government 90 days in advance of 1 December of each year beginning in 1992. If such notice is given, this agreement will terminate on 1 December of that year. Any notice under the terms of this AGREEMENT shall be in writing, signed by a duly authorized representative of the party giving such notice. If notice is given to the COUNTY, it shall be addressed to the County of Santa Barbara, Public

Works Department, Real Property Division, 123 East Anapamu Street, Santa Barbara, California 93101. If notice is given to the GOVERNMENT, it shall be addressed to the Installations Commander as follows: "30th SPW/CC, Vandenberg AFB, California 93437-5000."

THE DULY AUTHORIZED GOVERNMENT REPRESENTATIVE SIGNED THIS AGREEMENT THIS 11th DAY OF December, 1992.

THE UNITED STATES OF AMERICA

BY Sebastian F. Coglitore

SEBASTIAN F. COGLITORE, Brig Gen, USAF
Commander, 30th Space Wing
Vandenberg Air Force Base, California 93437-5000

THE DULY AUTHORIZED COUNTY REPRESENTATIVE SIGNED THIS AGREEMENT THIS 15th DAY OF December, 1992.

THE COUNTY OF SANTA BARBARA, STATE OF CALIFORNIA

BY W.B. Wallace

Chairman, Board of Supervisors

ATTEST: ZANDRA CHOLMONDELEY
CLERK OF THE BOARD

BY [signature]
Deputy Clerk

APPROVED AS TO FORM:
DAVID NAWI, COUNTY COUNSEL

BY [signature]

APPROVED AS TO FORM:
CHARLES A. MITCHELL, RISK MANAGER

BY [signature]

APPROVED AS TO FORM:
ROBERT GEIS, AUDITOR-CONTROLLER

BY [signature]

IT IS HEREBY ORDERED AND RESOLVED, that the Deeds from the following grantors, bearing the dates set forth herein, be and the same are hereby accepted for the uses and purposes therein mentioned, subject to the conditions therein contained:

GRANTOR	DATE OF DEED
Hubbard S. Russell	January 7, 1943
Adolf Kirschenmann and Bertha Kirschenmann	June 7, 1943
Chester Wylie	April 6, 1943
William J. Wylie	May 15, 1943
Chester K. Wylie	May 15, 1943
Martha H. Carlson	March 27, 1943

BE IT FURTHER ORDERED AND RESOLVED that the Clerk of this Board cause said Deeds to be recorded in the office of the Recorder of the County of Santa Barbara.

The foregoing Resolution was passed and adopted by the Board of Supervisors of the County of Santa Barbara, State of California, this 14th day of June, 1943, by the following vote, to wit:

Ayes: Clifford W. Bradbury, Paul E. Stewart,
J. Monroe Rutherford, Ronald M. Adam and
T. A. Twitchell.

Nays: None

Absent: None

J. MONROE RUTHERFORD
Chairman, Board of Supervisors

Attest: J. E. LEWIS
Clerk (SEAL)

State of California,)
) ss.
County of Santa Barbara,)

I, J. E. LEWIS, County Clerk and ex-officio Clerk of the Board of Supervisors in and for the County of Santa Barbara, do hereby certify that the foregoing is a true and correct copy of the original Resolution No. 4655, in the Matter of Acceptance of Deeds Conveying Rights of Way for Public Road Purposes in the Fifth Road District, and the endorsement's thereon, now remaining on file and of record in this office.

WITNESS my hand and the seal of said Board this 14th day of June A. D. 1943

(SEAL OF BOARD OF SUPERVISORS) J. E. LEWIS, Clerk,
By Bernell Warren, Deputy Clerk

RECORDED AT THE REQUEST OF County Clerk, Jun. 16, 1943, A. D. at 30 Min. past 8 o'clock A. M.
File No. 4623 YRIS COVARRUBIAS, County Recorder
Compared by:- Y COVARRUBIAS By [signature] Deputy Recorder

RICHFIELD OIL CORPORATION, ET AL. (DMA/md 4/12/43 ORIGINAL L & L 504
TO (DEED
COUNTY OF SANTA BARBARA (

THIS INDENTURE, dated the 28th day of May, 1943, by and between RICHFIELD OIL CORPORATION, a corporation, party of the First Part, hereinafter referred to as "Richfield," and the COUNTY OF SANTA BARBARA, a body politic and corporate, created and existing under and by virtue of the laws of the State of California, party of the Second Part, hereinafter referred to as the "County,"

Jalama Beach Park
Exhibit A & B

Exhibit A

W I T N E S S E T H:

That Richfield, in consideration of the sum of One Dollar ($1.00) lawful money of the United States of America, to it in hand paid, the receipt of which is hereby acknowledged, does by these presents grant, bargain, sell, convey and confirm unto the County for all of the uses and purposes of a county park, subject to the conditions, exceptions and reservations herein expressed, all that certain piece or parcel of land situate in the County of Santa Barbara, State of California, more particularly described as follows:

Beginning at the NW corner of Tract No. 20 as same is shown on Map of Subdivision of Concepcion Ranch on Sheet No. 6 of 8 Sheets in Book 9, Page 6, of Maps and Surveys, Santa Barbara County Recorder's Office, said NW corner being at the mouth of Jalama Creek;

thence, along the northerly boundary of said Tract No. 20, N 88° 25' E 1207.3 feet to a point on the center line of the Southern Pacific Railroad at the Southern Pacific Engineer's Station 12855+00 as same station is described in the deed recorded in Book 63, Page 617 of Deeds in the County Recorder's Office of Santa Barbara County;

thence, southerly along said center line of said Southern Pacific Railroad to Southern Pacific Railroad Engineer's Station 12865+25.0 of Southern Pacific Railroad;

thence, N 80° 54' W 275.0 feet to a point;

thence, N 9° 06' E 75.0 feet to a point;

thence, N 80° 54' W 275.0 feet to a point;

thence, S 3° 30' E 450.0 feet to a point;

thence, S 21° 24' W 252.0 feet to a point on the westerly boundary of above mentioned Tract No. 20, said point being S 24° 49' E 1644.6 feet from the NW corner of said Tract No. 20;

thence, N 24° 49' W along the west boundary of said Tract No. 20, 1644.6 feet to the point of beginning;

EXCEPTING THEREFROM portions of those parcels of said Tract No. 20 deeded to the Southern Pacific Railroad lying within the boundaries herein described, said parcels being designated as Numbers 1 and 3 as recorded in Book of Deeds 63, Page 617, in the County Recorder's Office of the County of Santa Barbara.

EXCEPTING THEREFROM all of the minerals, oil, gas, petroleum, nap_tha and other hydrocarbon substances in, on or under the above described real property, or recoverable thereon or therefrom, together with the right to prospect for, extract, produce and remove said substances from said real property; provided, however, that said minerals, oil, gas, petroleum, nap_tha and other hydrocarbon substances may be prospected for, extracted, produced and removed only by means of wells, tunnels, or excavations drilled, bored or dug into, through or under said real property from the surface of land other than said real property, or by wells, tunnels or excavations drilled wholly upon land other than said real property so as to drain said substances from under said real property, in a manner which will not utilize the surface.

AND FURTHER EXCEPTING all springs of water on said land and the water therein and produced thereby, provided, however, that the County shall be entitled to use for public park purposes so much of the water from said springs as said springs may produce in excess of any amounts which Richfield may use or desire to use; the right to use and consume such additional water as may be developed by the County hereafter on the land hereby conveyed in excess of the needs of the County for public park purposes, but without duty or obligation on the County to develop any such additional water; the right to one-fourth (¼) of all the water and flow of the spring known as "Las Animas Spring," referred to in that certain

Exhibit A

EXHIBIT A

agreement dated July 8, 1898, between F. W. Murphy, et al., and The Commercial Land Company, et al., recorded in Book 68 at Page 269, Deed Records, Santa Barbara County, California.

AND FURTHER EXCEPTING the right to use the surface of said land for all lawful purposes, including grazing, and to receive and accept rent for such use, during the period ending

(1) when the County elects to occupy said land for public park purposes and erects the fence hereinafter referred to; or

(2) upon the termination of an existing lease executed by Richfield, as lessor, and F. Elizabeth Bixby, as lessee, whichever occurs last.

THIS GRANT IS MADE UPON THE EXPRESS CONDITION that said land shall be used for public park purposes only, commencing not later than one (1) year after the complete cessation of hostilities between the United States and all belligerents with whom the United States is now, or may in the course of the present conflict become, at war, and if not so used for any continuous period of three (3) months thereafter, said land shall revert to Richfield, its successors or assigns, who thereupon shall have the right to re-enter and take and hold possession of said land and exclude all persons therefrom.

AND UPON THE FURTHER EXPRESS CONDITION that the County shall immediately upon termination of said grazing lease and/or before occupying said land for park purposes, erect and thereafter maintain a stockproof fence equipped with no fewer than two (2) gates or cattle guards that permit the use and exercise of the easement expressed and reserved in paragraph numbered 2 of the reservations hereinafter set forth, around all the exterior boundaries of said land except those portions of said boundaries which are common to said land and the Pacific Ocean and except where the natural configuration of the surface is such that live stock cannot pass across the boundary between said land and adjacent land.

AND UPON THE FURTHER EXPRESS CONDITION that in the event the county, at any time after the acceptance of this grant, should prohibit, by zoning ordinance or otherwise, the exploration for, drilling for, or production of minerals, oil, gas, petroleum, naphtha or other hydrocarbon substances upon all or any part of Tract No. 20, as same is shown on map of Subdivision of Concepcion Ranch on Sheet No. 6 of 8 Sheets in Book 9, Page 6 of Maps and Surveys, Santa Barbara County Recorder's Office, then said land shall revert to Richfield, its successors or assigns, who thereupon shall have the right to re-enter and take and hold possession of said land and exclude all persons therefrom.

Each of the conditions hereinabove stated as conditions upon which the above described land is granted is hereby declared to be a condition and not a personal covenant.

THERE IS RESERVED to Richfield, its successors and assigns, the following:

1. The right and right of way to construct, reconstruct, renew, repair, change the size of, maintain, operate, remove and abandon pipes and pipe lines for the transportation of petroleum, oil, gas and other hydrocarbons and the products and derivatives thereof, air and water in, over, along and across said land, together with telegraph, telephone and electric power lines necessary or convenient to the operations of Richfield or its successors or assigns.

2. An easement to ride, drive, herd, haul and otherwise transport or convey horses, cattle, sheep, swine and other live stock through, over, upon and across said land by all reasonable routes, which easement shall be appurtenant to and for the benefit of the following described land:

All of Tracts Numbers 4, 15 and 16; also portions of Tracts Numbers 17, 19 and 20 as shown upon the map entitled "Map of The Subdivision of Concepcion Ranch, in 8 sheets, being a portion of the Rancho El Cojo, owned by Del Norte Land Co. in the County of Santa Barbara,

Exhibit A

Official Record 571

State of California, surveyed by Frank F. Flournoy, County Surveyor," and recorded December 7, 1914, in Book 9, at Pages 1 to 8 inclusive, of Maps and Surveys, in the office of the County Recorder of said County; said portions of Tracts Numbers 17 and 19 being those portions thereof lying Southerly and Westerly of the following described line:

Beginning at the most Northerly corner of said Tract No. 16; thence Northwesterly in a direct line to a point on the Northwesterly line of said Tract No. 17, distant thereon 1640 feet Southwesterly from the most Northerly corner thereof; thence Northwesterly in a direct line to a point on the Northerly line of said Tract No. 19, distant thereon 1550 feet Easterly from the most Northerly corner of said Tract No. 19, which corner is also the most Easterly corner of said Tract No. 20; and further, said portion of Tract No. 20, being all of said Tract 20 excepting therefrom that portion thereof being herein described as being conveyed to Santa Barbara County for park purposes.

EXCEPTING from all of said Tracts above mentioned, any portions thereof conveyed to Southern Pacific Railroad Company by deed dated July 19, 1898, and recorded in Book 63 at Page 617 of Deeds; and by deed dated June 30, 1910, and recorded in Book 128 at Page 126 of Deeds; and by deed dated February 6, 1918, and recorded in Book 167 at Page 133 of Deeds, all records of said Santa Barbara County.

3. The right to protect the springs hereinbefore excepted from this grant and to keep and have the same protected by all reasonable means from contamination or pollution; and the right to install, construct, maintain and remove pipe lines, pumps, tanks and other facilities for producing, storing and transporting water and to connect said facilities to and to take and consume water from all pipes and tanks which may be installed, operated or maintained by or for the County to the extent that the same may be necessary to the full exercise by Richfield, its successors or assigns, of the rights herein reserved.

4. The right of ingress and egress to, from, upon and across said land by all reasonable routes.

SUBJECT TO:

1. Any unpaid taxes, assessments, charges or liens due or delinquent upon the date hereof.

2. All valid, existing leases, conditions, restrictions, reservations, rights of way and easements.

IN WITNESS WHEREOF, Richfield has caused this indenture to be executed by its officers thereunto duly authorized, and its corporate seal to be affixed.

(CORPORATE SEAL OF RICHFIELD)
(OIL CORPORATION)

RICHFIELD OIL CORPORATION

By Frank A. Morgan
Frank A. Morgan Vice President

By Cleve B. Bonner
Cleve B. Bonner Secretary

APPROVED FOR EXECUTION
TERMS C. E. R. R.D.M.
FORM G.G.
DESCRIPTION C. J. F.

STATE OF CALIFORNIA } ss.
COUNTY OF LOS ANGELES }

On this 4th day of June, 1943, before me CHAS. A. ROOT a Notary Public in and for the said County and State, personally appeared FRANK A. MORGAN, known to me to be the Vice President, and CLEVE B. BONNER, known to me to be the Secretary of RICHFIELD OIL CORPORATION, the corporation that executed the within instrument, known to me to be the persons who executed the within instrument on behalf of the corporation herein named, and acknowledged

EXHIBIT A

to me that such corporation executed the same.

In Witness Whereof, I have hereunto set my hand and affixed my official seal the day and year in this certificate first above written.

CHAS. A. ROOT
NOTARY PUBLIC in and for the County of Los Angeles, State of California.
(NOTARIAL SEAL)
My Commission Expires Mar. 29, 1944.

C O N S E N T

June 2, 1943

For and in consideration of the sum of One Dollar ($1.00) to her in hand paid, the receipt whereof is hereby acknowledged, F. ELIZABETH BIXBY JANEWAY, formerly F. Elizabeth Bixby, holding a grazing lease covering the premises described in the annexed grant, does hereby approve of, join in and consent to said grant.

F. ELIZABETH BIXBY JANEWAY
F. Elizabeth Bixby Janeway

Executed in the presence of:

Arden T. Jensen
Subscribing Witness

STATE OF CALIFORNIA)
) ss
COUNTY OF Santa Barbara)

On this 2nd day of June, 1943, before me, Arden T. Jenson, a Notary Public in and for the said County and State, residing therein, duly commissioned and sworn, personally appeared F. ELIZABETH BIXBY JANEWAY, known to me to be the person whose name is subscribed to the within instrument, and acknowledged to me that she executed the same.

In Witness Whereof, I have hereunto set my hand and affixed my official seal in the County and State aforesaid the day and year in this certificate first above written.

ARDEN T. JENSEN
(NOTARIAL SEAL)
Notary Public in and for said County and State.
My Commission Expires 10/21/46.

RESOLUTION OF THE BOARD OF SUPERVISORS OF THE
COUNTY OF SANTA BARBARA, STATE OF CALIFORNIA

RESOLUTION NO. 4631

IN THE MATTER OF ACCEPTANCE OF DEED FROM RICHFIELD OIL CORPORATION TO
THE COUNTY OF SANTA BARBARA

WHEREAS, on May 26, 1943, the Richfield Oil Corporation executed a deed in favor of the County of Santa Barbara, which deed was acknowledged on the 4th day of June, 1943, which deed described the following property:

Beginning at the NW corner of Tract No. 20 as same is shown on Map of Subdivision of Concepcion Ranch on Sheet No. 6 of 8 Sheets in Book 9, Page 6, of Maps and Surveys, Santa Barbara County Recorder's Office, said NW corner being at the mouth of Jalama Creek;

thence, along the northerly boundary of said Tract No. 20, N 88° 25' E 1207.3 feet to a point on the center line of the Southern Pacific Railroad at the Southern Pacific Engineer's Station 12855+00 as same station is described in the deed recorded in Book 63, Page 617 of Deeds in the County Recorder's Office of Santa Barbara County;

thence, southerly along said center line of said Southern Pacific Railroad to Southern Pacific Railroad Engineer's Station 12865+25.0 of Southern Pacific Railroad;

Official Record 571

thence, N 80° 54' W 275.0 feet to a point;

thence, N 9° 06' E 75.0 feet to a point;

thence, N 80° 54' W 275.0 feet to a point;

thence, S 3° 30' E 450.0 feet to a point;

thence, S 21° 24' W 252.0 feet to a point on the westerly boundary of above mentioned Tract No. 20, said point being S 24° 49' E 1644.6 feet from the NW corner of said Tract No. 20;

thence, N 24° 49' W along the west boundary of said Tract No. 20, 1644.6 feet to the point of beginning;

EXCEPTING THEREFROM portions of those parcels of said Tract No. 20 deeded to the Southern Pacific Railroad lying within the boundaries herein described, said parcels being designated as Numbers 1 and 3 as recorded in Book of Deeds 63, Page 617, in the County Recorder's Office of the County of Santa Barbara.

WHEREAS, it appears to be for the best interests of the County of Santa Barbara that said deed be accepted, and

WHEREAS, it appears that it is legal and proper for the Board of Supervisors of the County of Santa Barbara to accept such deed,

NOW, THEREFORE, BE IT RESOLVED that the aforesaid deed be and the same is hereby accepted by the County of Santa Barbara; and

BE IT FURTHER RESOLVED that J. E. Lewis, the clerk of the Board of Supervisors of the County of Santa Barbara, be and he is hereby authorized to record said deed.

Passed and adopted by the Board of Supervisors of the County of Santa Barbara, State of California, this 14th day of June, 1943, by the following vote:

Ayes: Clifford W. Bradbury, Paul E. Stewart, J. Monroe Rutherford, Ronald M. Adam and T. A. Twitchell.

Nays: None

Absent: None

J. MONROE RUTHERFORD
Chairman, Board of Supervisors

Attest:

J. E. LEWIS (SEAL)
Clerk.

State of California, }
County of Santa Barbara, } ss.

I, J. E. LEWIS, County Clerk and ex-officio Clerk of the Board of Supervisors in and for the County of Santa Barbara, do hereby certify that the foregoing is a true and correct copy of the original Resolution No. 4631, in the Matter of Acceptance of Deed from Richfield Oil Corporation to the County of Santa Barbara, and the endorsements thereon, now remaining on file and of record in this office.

WITNESS my hand and the seal of said Board this 14th day of June A. D. 1943

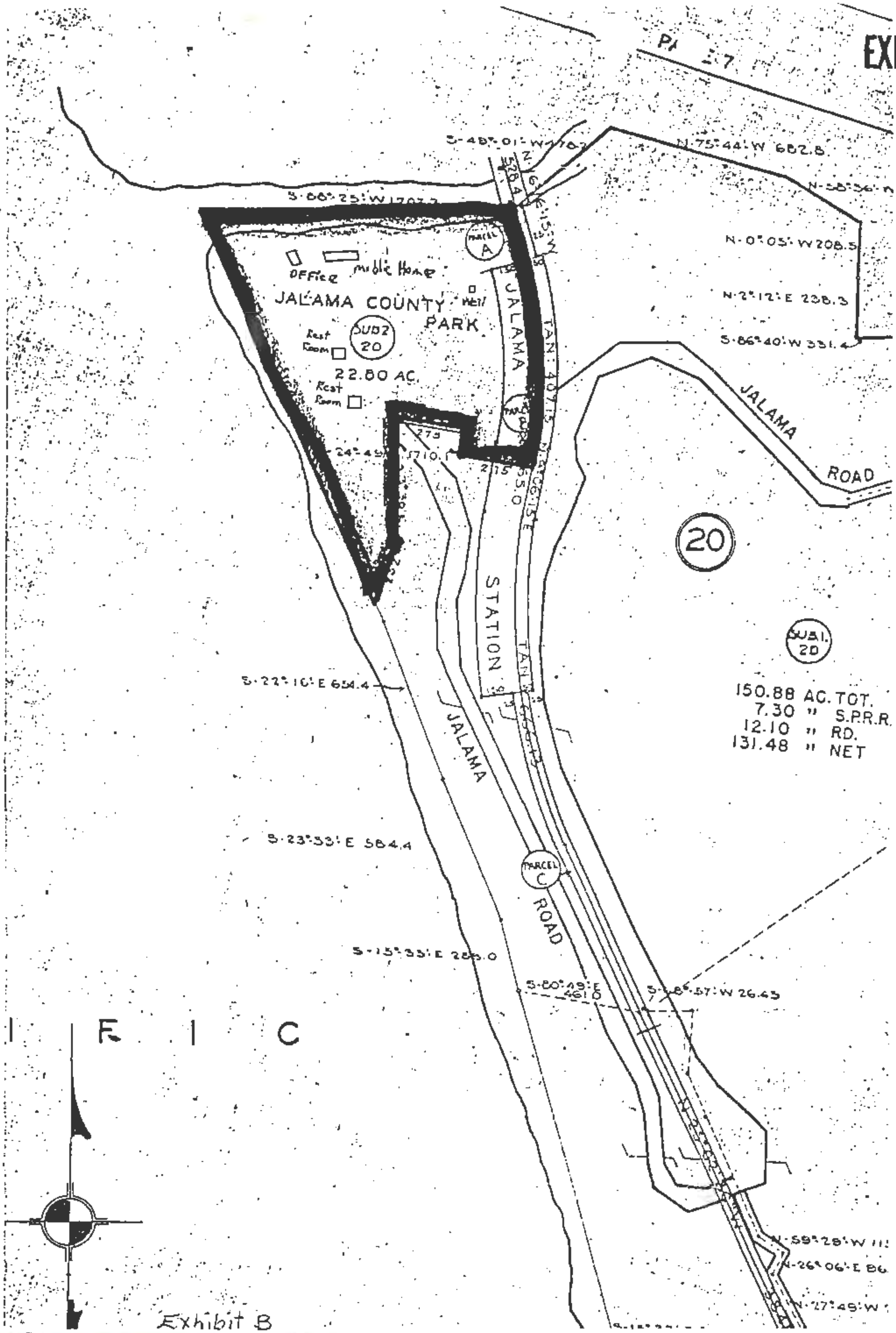
(SEAL OF BOARD OF SUPERVISORS) J. E. LEWIS, Clerk,
By Bernell Warren, Deputy Clerk

RECORDED AT REQUEST OF County Clerk, Jun. 16, 1943, at 30 Min. past 8 o'clock A. M.

File No. 4629 E. J. Hon. TRIS COVARRUBIAS, County Recorder
Compared by:- E. Covarrubias By [signature] Deputy Recorder

Exhibit A

EXHIBIT B



Jalama Beach Park

of the Ranchos Lompoc and Mission Viejo.

Together with all and singular the tenements, hereditaments and appurtenances thereunto belonging or in anywise appertaining, and the reversion and reversions, remainder and remainders, rents, issues and profits thereof.

To have and to hold all and singular the said premises, together with the appurtenances, unto the said party of the second part, and to its successors and assigns forever.

IN WITNESS WHEREOF the said parties of the first part have hereunto set their hands and seals, the day and year first above written.

J.C. Maretti
Anita Maretti
Joseph C. Maretti

State of California }
County of Santa Barbara } ss

On this 30th day of December, in the year nineteen hundred and thirteen, A.D., before me Stephen V.Campodonico, a Notary Public in and for the said county of Santa Barbara, state of California, residing therein, duly commissioned and sworn, personally appeared J.C.Maretti and Anita Maretti, personally known to me to be the persons whose names are subscribed to the within instrument, and acknowledged to me that they executed the same.

IN WITNESS WHEREOF I have hereunto set my hand and affixed my official seal, the day and year in this certificate first above written.

Stephen V.Campodonico, Notary Public in and for Santa Barbara county, state of California.

(Notarial Seal)
My commission expires Oct. 9th, 1916.

State of California }
County of Santa Barbara } ss

On this 7th day of January, in the year one thousand nine hundred and fourteen A.D., before me Fred E. Schauer, Notary Public in and for said county of Santa Barbara, state of California, residing therein, duly commissioned and sworn, personally appeared Joseph C. Maretti, personally known to me to be the person whose name is subscribed to the within instrument, and acknowledged to me that he executed the same.

IN WITNESS WHEREOF I have hereunto set my hand and affixed my official seal, the day and year in this certificate first above written.

Fred E. Schauer, Notary Public in and for Santa Barbara county, state of California

(Notarial Seal)

RECORDED AT REQUEST of County Auditor at 30 min. past 9 o'clock A.M. Jan 7, 1914.

Mark Bradley
County Recorder

Exhibit C & D Deed Beach Park

Exhibit 1

EXHIBIT C

Witnesseth:- That the said parties of the first part, for and in consideration of the sum of seven thousand dollars, lawful money of the United States of America, to them in hand paid by the said party of the second part, the receipt whereof is hereby acknowledged, have granted, bargained and sold, conveyed and confirmed and by these presents do grant, bargain and sell, convey and confirm unto the said party of the second part, and to its successors and assigns forever, all that certain lot, piece or parcel of land situate, lying and being in the county of Santa Barbara, state of California, and bounded and particularly described as follows, to wit:-

Commencing at a point in the center of the Southern Pacific Railroad bridge and in the center of the Santa Ynez River where said river empties into the Pacific Ocean, from which the southerly end of bridge in center of tract (steel structure) bears S. 26° 49' W. 274.2 feet; said point being Engineer's Station L 11876+93.7 of said Southern Pacific Railroad; thence 1st at right angles with the center line of said railroad N. 63° 11' W. 100 feet; thence 2nd, S. 26° 49' W. parallel with said center line of Railroad, 1000 feet; thence 4th at right angles, S. 63° 11' E., 100 feet to center of said Railroad; thence 5th, N. 26° 49' E., along the center line of said Railroad 302.2 feet; thence 6th, S. 23° 25' W. leaving the main line of said Southern Pacific Railroad and along the center line of the branch road to Lompoc, 80.5 feet to center of tract and northerly side of steel switch board; thence 7th, on an angle to the left 2° 59', 220 feet to a point in the center of track; thence 8th, 2° 39' to the left, 100 feet to the center of track; thence 9th, 9° 09' to the left, 100 feet to the center of track;; thence 10th, 9° 52' to the left, 100 feet to the center of track; thence 11th 9° 41' to the left, 100 feet to the center of track; thence 12th, 10° 12' to the left, 100 feet to the center of track; thence 13th, 10° 15' to the left, 100 feet to the center of track; thence 14th, 9° 25' to the left, 100 feet to the center of track; thence 15th, 11° 04' to the left, 100 feet to the center of track; thence 16th, 9° 11' to the left, 100 feet to the center of track; thence 17th, 10° 06' to the left, 100 feet to the center of track; thence 18th 6° 24' to the left, 100 feet to the center of track; thence 19th, 2° 03' to the left, 100 feet thence 20th, 1° 11' to the left along the tangent to the "Y" curves of said branch road, 1131 feet; thence 21st at right angles S. 9° 15' W., 50 feet to the southerly side of said railroad; thence 22nd, at right angles along the southerly side of said Railroad track, S. 80° 45' E., 80 feet to a point from which a 2" pipe with brass cap bears S. 9° 15' W., 2 feet; thence 23rd at right angles N. 9° 15' E., 150 feet to a 2" pipe with brass cap; thence 24th, at right angles, N. 80° 45' W. parallel with the northerly line of said branch railroad to Lompoc and 50 feet therefrom 675.0 feet to another 2" pipe with brass cap; thence 25th, at right angles N. 9° 15' E., at 1063.6 feet passing through a 2" pipe with brass cap about 20 feet southerly from the southerly side of Santa Ynez River, at 1463.0 feet to center of said river; thence 26th, N. 78° 11' W., 969.3 feet to the point of commencement, which leaving out the Southern Pacific right of way, contains 40 acres, as more fully shown on map entitled "Map of Survey made by F.F.Flournoy of Lompoc Ocean Park near Surf, Santa Barbara Co., Cal., containing 40 acres, owned by the County of Santa Barbara, June, 1913. Scale one inch-100 feet." which map was filed in the office of the County Recorder of said County of Santa Barbara on the 13th day of June, 1913, and pasted in book 7 of maps and surveys at page 26, Santa Barbara County Records, said land being a part of Farm Lot No. 96 of the Subdivisions

Exhibit C&D Ocean Beach Park

Exhibit 1

EXHIBIT D

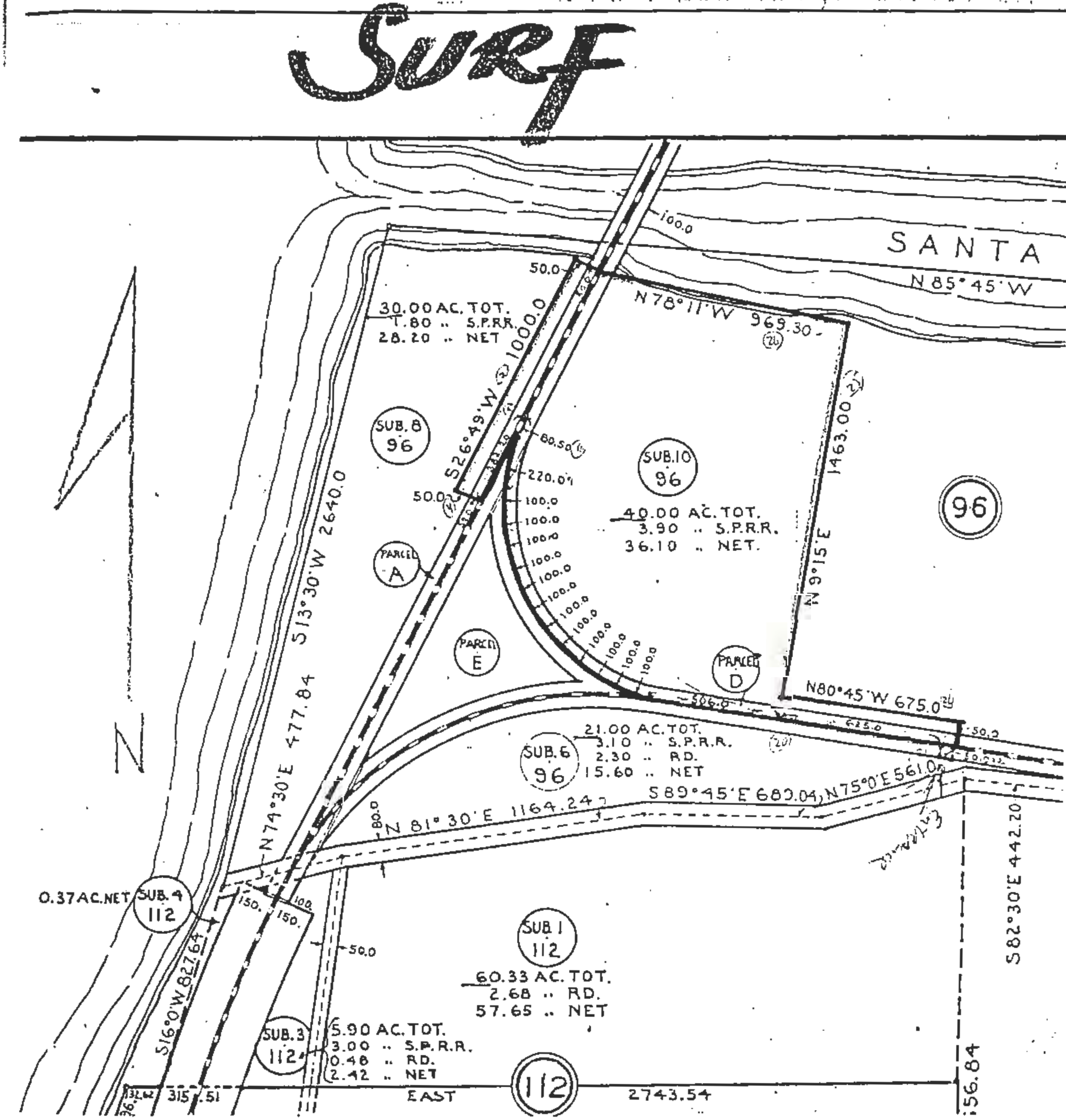
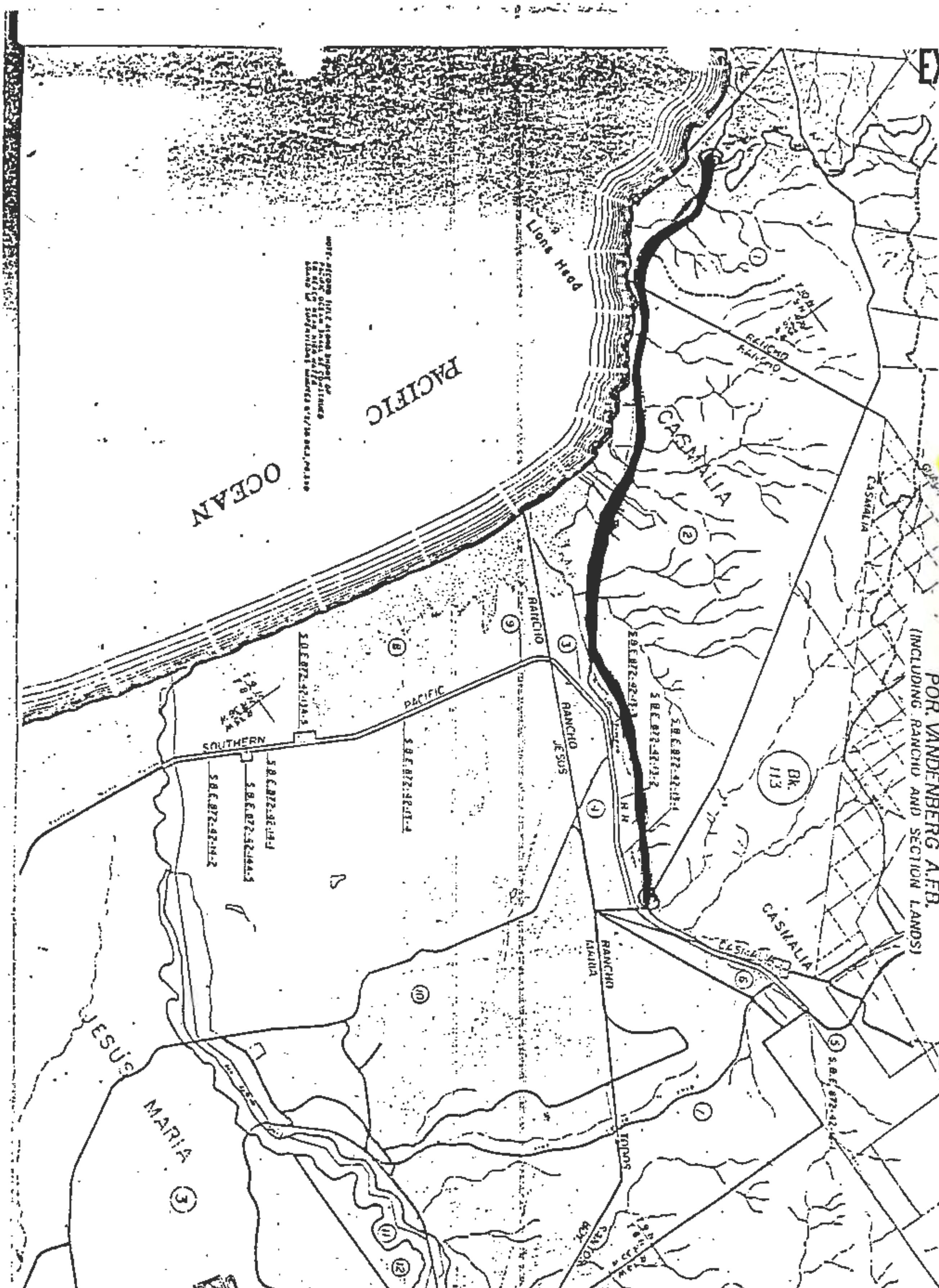


Exhibit 2

Ocean Bch Park

EXHIBIT E



Pt Sal Exhibit E

Pt Sal FOR INFORMATION ONLY.

Expired 7 Feb 1990

A G R E E M E N T

LA-2503

THIS AGREEMENT IS MADE between the

COUNTY OF SANTA BARBARA, California,
hereinafter called "COUNTY"

and the

UNITED STATES OF AMERICA
hereinafter called
"UNITED STATES"

as follows:

WHEREAS, the United States has activated the Vandenberg Air Force Base in Santa Barbara County and has constructed missile installations on said base;

and

WHEREAS, the County has a certain road and road rights of way known as the Point Sal Road, portions of which lie within the military reservation of the Vandenberg Air Force Base;

and

WHEREAS, it is necessary that portions of said Point Sal Road lying within the military reservation be closed to travel by the public, either permanently or intermittently, because of the operation of the military facilities near said road right-of-way in order to protect the public health and safety and also because of military necessity and for security reasons;

and

WHEREAS, because of the compelling military necessity, the United States must acquire control of said portions of Point Sal Road; and

WHEREAS, the parties hereto desire to avoid a condemnation action to condemn said road.

NOW, THEREFORE, in consideration of the foregoing premises, the parties hereto promise, covenant and agree as follows:

1. The County agrees that during the term of this agreement, the United States shall have exclusive use and control of that portion of Point Sal Road and road rights-of-way between a point where the said road intersects the easterly boundary of the military reservation of the Vandenberg Air Force Base (1.7[illegible] miles west of Lompoc-Casmalia Road) and the easterly edge of the said Point Sal Road at its intersection with the Point Sal Beach State Park Road.

2. The County agrees that during the term of this agreement the United States shall have the right to regulate and control traffic including the right to close the road entirely to use by the public or use by any persons other than those authorized by the United States, for short periods of time prior to and during missile firings, on that portion of Point Sal Road between a point where the said road intersects the Point Sal Beach State Park Road and the northerly boundary of the military reservation of the Vandenberg Air Force Base.

3. The United States shall have the right of construct, reconstruct, maintain, realign, relocate and use said portions of Point Sal Road described in Paragraph 1 of this agreement.

4. Provided that adequate appropriations are available, the United States shall have the obligation to maintain for vehicular use and in a safe condition said portion of Point Sal Road described in Paragraph 2 of this agreement.

5. The term of this agreement shall be five (5) years commencing February 8, 1980, with an option in the United States to renew the agreement for an additional five (5) years. Said option may be exercised by delivery or mailing of notice of exercising said option to:

Board of Supervisors
County of Santa Barbara
105 East Anapamu Street
Santa Barbara, California 93101

Attn: HOWARD C. MENZEL
Clerk of the Board

on or before thirty (30) days prior to the expiration of the term hereof.

LA-2503

COUNTY OF SANTA BARBARA

Dated: 9-4-79 By: [signature]
Chairman, Board of Supervisors

ATTEST:

County Clerk

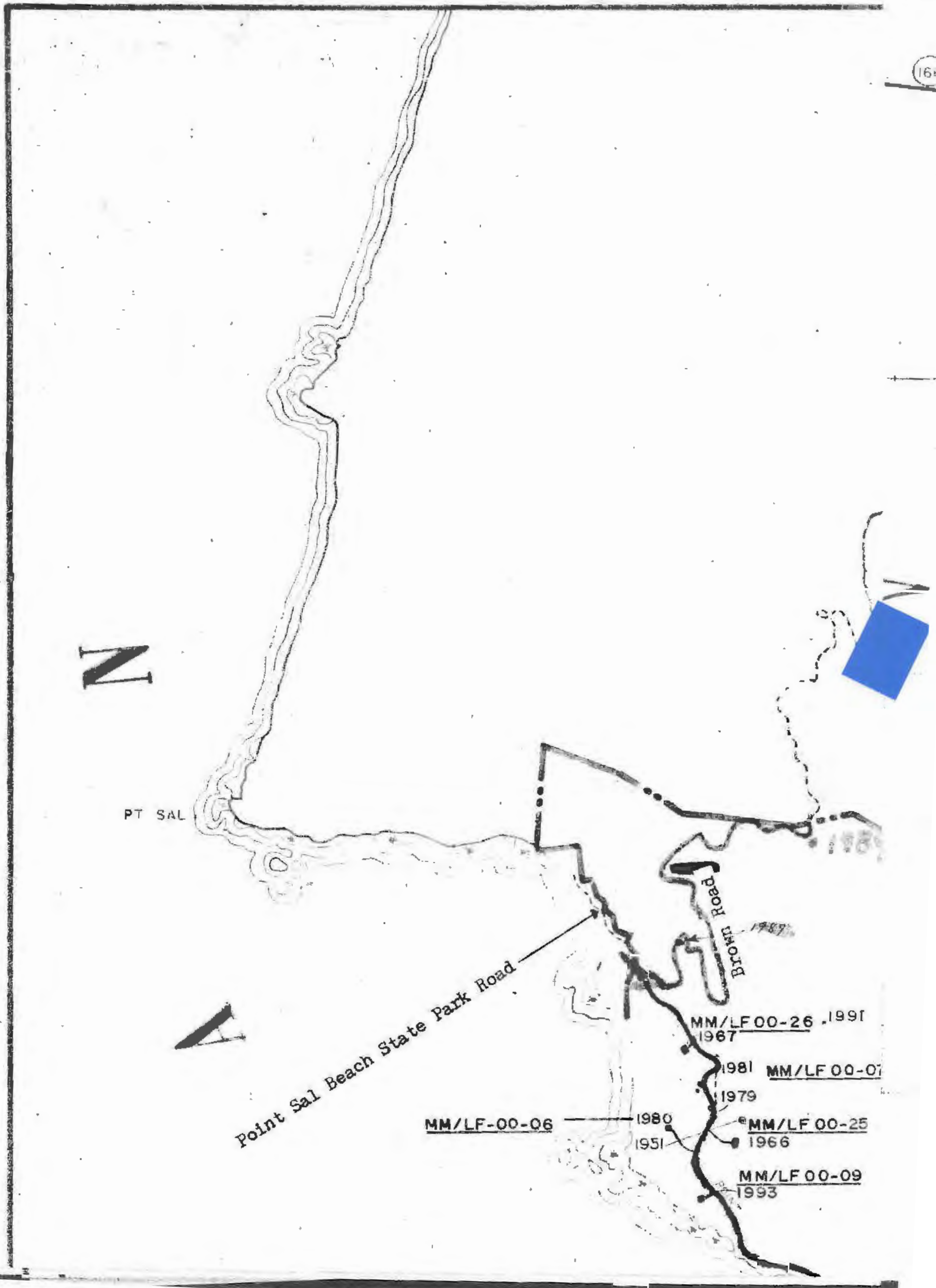
By: [signature]
Deputy County Clerk

UNITED STATES OF AMERICA

Dated: 79 AUG 23 By: [signature]
DOUGLAS E. GLASS
Chief, Real Estate Division
U.S. Army Engineer District, Los Angeles

APPROVED AS TO FORM:
GEORGE P. KADING
COUNTY COUNSEL

By: [signature]
Assistant Co. Counsel



PT SAL
Point Sal Beach State Park Road
Brown Road
MM/LF 00-26
1991
1967
1981
MM/LF 00-07
1979
MM/LF-00-06
1980
MM/LF 00-25
1951
1966
MM/LF 00-09
1993

No. SPCVAN-1-93-0006

SUPPLEMENTAL EVACUATION AGREEMENT NO. 1
(Extended Term)

THIS SUPPLEMENTAL AGREEMENT NO. 1, entered into by and between the UNITED STATES OF AMERICA, hereinafter referred to as the GOVERNMENT, and the COUNTY OF SANTA BARBARA, STATE OF CALIFORNIA, hereinafter referred to as the COUNTY, WITNESSETH:

WHEREAS, there exists an evacuation agreement between the parties for the evacuation of County properties Jalama Beach Park, Ocean Beach Park, and Point Sal Road in case of certain government operations for purposes of military necessity, security, and public safety; and

WHEREAS, the agreement dated 1 December 1992, having been automatically renewed annually since that date, expires 1 December 1997; and

WHEREAS, the parties desire to extend the agreement for an additional five years with certain modifications and with the addition of the Surf Train Station Parking Lot.

NOW THEREFORE, in consideration of these premises, the parties hereto do mutually agree that the evacuation agreement be extended and modified in the following particulars:

1. That the agreement be extended one year through 1 December 1998 and shall automatically renew annually on 1 December 1998 and on each subsequent 1 December of the following three years for a total additional term of five years from 1 December 1997.

2. That Part III., paragraph 1., subparagraph a., be modified such that the term "government operations" be defined to include commercial launch-related operations as well as non-commercial launch operations, the government having public safety responsibility for all launch related operations, whether commercial or non-commercial.

3. That the Surf Train Station Parking Lot, owned jointly by the County and the City of Lompoc in fee and located in the vicinity of Ocean Beach County Park, the Parking Lot legally described in Exhibit "F", and outlined in red on Exhibit "G", both of which are attached hereto and incorporated by reference, shall be added to this evacuation agreement in like measure as other County properties named above.

4. That in all other respects the evacuation agreement terms conditions remain in full force and effect.

THE DULY AUTHORIZED GOVERNMENT REPRESENTATIVE SIGNED THIS AGREEMENT THIS 5th DAY OF November, 1997.

THE UNITED STATES OF AMERICA

C. Robert Kehler

C. ROBERT KEHLER
Colonel, USAF
Commander

THE DULY AUTHORIZED COUNTY GOVERNMENT REPRESENTATIVE SIGNED THIS AGREEMENT THIS 2nd DAY OF December, 1997.

THE COUNTY OF SANTA BARBARA, STATE OF CALIFORNIA

Thomas B. Urbanske

Chairman, Board of Supervisors

APPROVED AS TO FORM:

STEPHEN SHANE STARK
COUNTY COUNSEL

By: M Ledbetter
DEPUTY

ATTEST: MICHAEL F. BROWN
CLERK OF THE BOARD

By Joanna Bisbee
Deputy Clerk

APPROVED AS TO FORM:
CHARLES A. MITCHELL, RISK MANAGER

By

APPROVED AS TO FORM:
ROBERT GEIS, AUDITOR-CONTROLLER

By Jol Sall CPA

EXHIBIT "F"

Being a portion of the most easterly parcel of land, I.K. Fisher to Southern Pacific Railroad Company Recorded Febuary 27, 1901 in Book 76, at Page 327, of Deeds, County of Santa Barbara, State of California, more particularly described as follows:

Commencing at a T-bar and cap stamped CL (centerline) Sta. 2+44.53, Pt. Arguello, as shown on Sheet 2 of 6, Santa Barbara County Road Map, Route 149, on file at the Santa Barbara County Surveyors Office; Thence northerly along said centerline North 0° 23' 03" East, 38.28 feet to a point which bears South 9° 13' 02" East 1191.81 feet from a U.S.C. and G.S. Survey Monument stamped "Surf 2"; Thence continuing northerly along said centerline, North 0° 23' 03" East 819.46 feet to the beginning of a curve, said point bears South 28° 49' 04" East 407.44 feet from said U.S.C. and G.S. monument; Thence curving to the right with a radius of 1200.00 feet, through an angle of 7° 53' 04", for a distance of 165.13 feet to a point on said curve; Thence radial to the centerline of Route 149, (now called Ocean Avenue), North 81° 43' 53" West 234.41 feet to a point on a curve in the easterly line of said parcel, and the **POINT OF BEGINNING;**

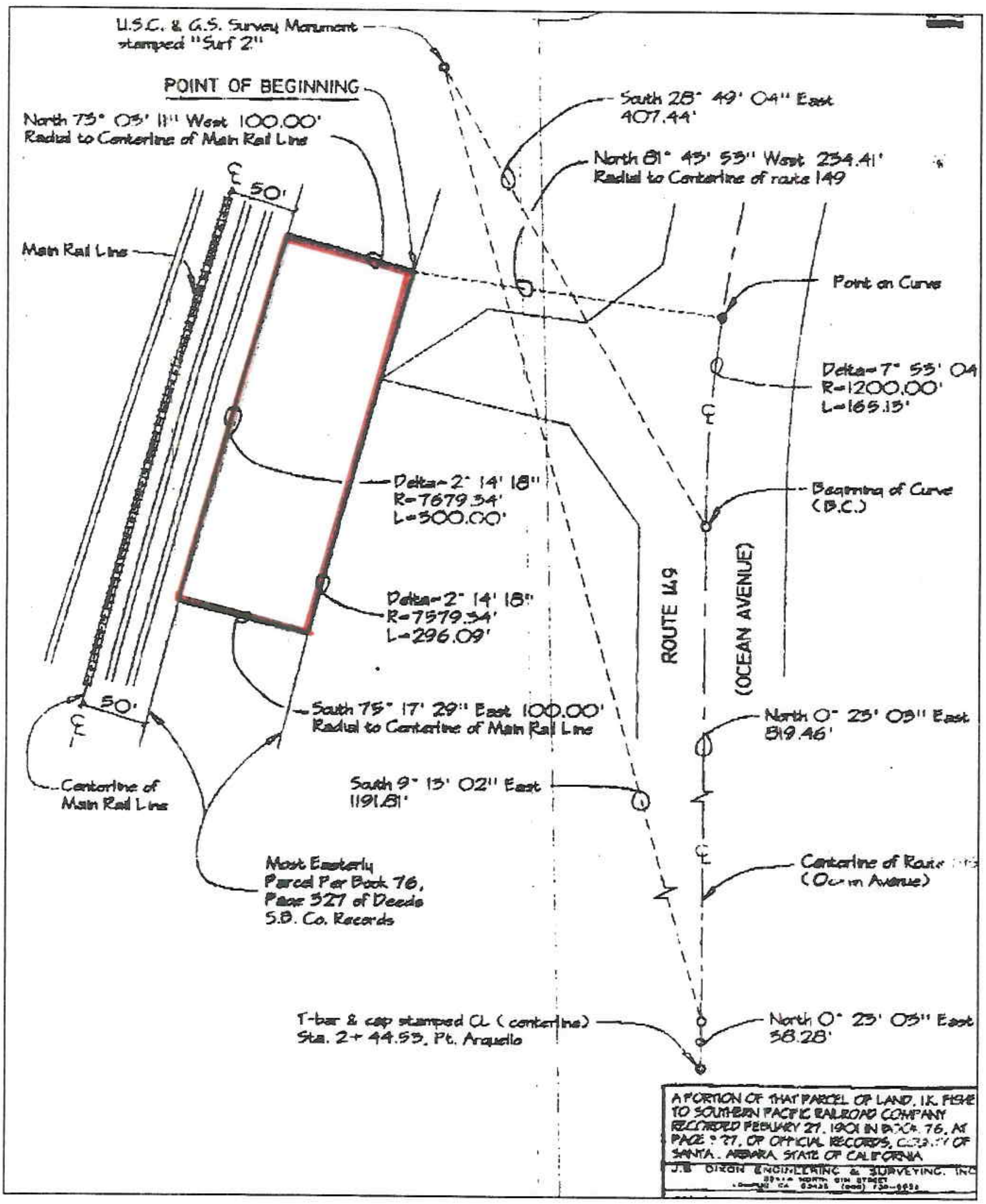
Thence 1; Radial to the centerline of the main rail line, North 73° 03' 11" West, 100.00 feet to a point on a curve in the westerly line of said Parcel, said point being 50.00 feet easterly of the centerline of the main rail line;

Thence 2; southerly along said westerly line, and curving to the left with a radius of 7679.34 feet, through an angle of 2° 14' 18", for a distance of 300.00 feet;

Thence 3; Radial to the centerline of the main rail line, South 75° 17' 29" East, 100.00 to a point on a curve in the easterly line of said parcel;

Thence 4; northerly along the easterly line of said parcel and curving to the right, with a radius of 7579.34 feet, through an angle of 2° 14' 18", for a distance of 296.09 feet, to the Point of Beginning, and containing 29804.67 square feet of land

EXHIBIT "G"


U.S.C. & G.S. Survey Monument stamped "Surf 2"
POINT OF BEGINNING
North 73° 03' 11" West 100.00' Radial to Centerline of Main Rail Line
South 28° 49' 04" East 407.44'
North 81° 43' 53" West 234.41' Radial to Centerline of route 149
50'
Main Rail Line
Point on Curve
Delta=7° 53' 04 R=1200.00' L=165.13'
Delta=2° 14' 18" R=7679.34' L=300.00'
Beginning of Curve (B.C.)
Delta=2° 14' 18" R=7579.34' L=296.09'
ROUTE 149
(OCEAN AVENUE)
50'
South 75° 17' 29" East 100.00' Radial to Centerline of Main Rail Line
North 0° 23' 03" East 519.46'
Centerline of Main Rail Line
South 9° 13' 02" East 1191.81'
Most Easterly Parcel Per Book 76, Page 327 of Deeds S.B. Co. Records
Centerline of Route
T-bar & cap stamped CL (centerline) Sta. 2+44.53, Pt. Arguello
North 0° 23' 03" East 38.28'
A PORTION OF THAT PARCEL OF LAND, I.K. FISHE TO SOUTHERN PACIFIC RAILROAD COMPANY RECORDED FEBRUARY 27, 1901 IN BOOK 76, AT PAGE 327, OF OFFICIAL RECORDS, COUNTY OF SANTA BARBARA STATE OF CALIFORNIA
J.B. DIXON ENGINEERING & SURVEYING, INC

EVACUATION AGREEMENT NO. SPCVAN-1-93-0006

SUPPLEMENTAL AGREEMENT NO. 2

THIS SUPPLEMENTAL AGREEMENT entered into this 13th day of May, 2003, by and between the County Of Santa Barbara, State of California ("County") and Secretary of the Air Force ("Government" or "Air Force"). The Government and the County may be referred to jointly as the "Parties," and each separately may be referred to as a "Party."

RECITALS:

A. On 1 December 1992, the Parties entered into an evacuation agreement for the evacuation of County properties Jalama Beach Park, Ocean Beach Park and Point Sal Road in case of certain government operations for purposes of military necessity, security and public safety.

B. On 05 November 1997, the parties agreed to extend the agreement for one additional year through 01 December 1998 and to automatically renew the agreement for a total additional term of five years from December 1, 1997 and added Surf Station Parking Lot to the agreement.

AGREEMENT:

1. This PERMIT is hereby modified in the following particulars, but no others:

   a. The term of the PERMIT is extended for five (5) years beginning 01 December 2002 through 30 November 2007.

2. All other terms and conditions of the PERMIT shall be and remain the same.

3. This Supplemental Agreement shall be effective immediately.

Project: Evacuation Agreement
No. SPCVAN-1-93-0006:
Supplemental Agreement No. 2
Jalama Beach Park; (WC2044)
Ocean Beach Park; (WC1165)
Point Sal Road; (WC3223)
Surf Train Station Parking Lot,
WC3775)

IN WITNESS WHEREOF, County and Government have executed this Supplemental Agreement No. 2 to Evacuation Agreement No. SPCVAN-1-93-0006, by the respective authorized officers as set forth below to be effective as of the date executed by the Government.

"COUNTY"
COUNTY OF SANTA BARBARA

By: Naomi Schwartz
Chair, Board of Supervisors

Date: 2/11/03

ATTEST:
MICHAEL F. BROWN
CLERK OF THE BOARD

By: ____________________
Deputy

APPROVED:

By: Terri Maus-Nisich
Terri Maus-Nisich, Parks Director

APPROVED AS TO FORM:
STEPHEN SHANE STARK
COUNTY COUNSEL

By: ____________________

APPROVED AS TO FORM:
ROBERT W. GEIS, CPA
AUDITOR-CONTROLLER

By: ____________________

APPROVED:

By: ____________________
John Forner
Supervising Risk Analyst

APPROVED:

By: ____________________
Ronn Carlentine, SR/WA
Real Property Supervisor

IN WITNESS WHEREOF, I have set my hand by authority of the Secretary of the Air Force as of the day and year first written above.

DEPARTMENT OF THE AIR FORCE

By: ______________________________
Robert M. Worley II
Colonel, USAF
Commander, 30th Space Wing

SUPPLEMENTAL AGREEMENT NO. 3
to
EVACUATION AGREEMENT NO. DACA-09-3-98-0008
Between
THE STATE OF CALIFORNIA
and
THE UNITED STATES OF AMERICA

WITNESSETH:

WHEREAS, The State of California granted to United States of America an evacuation agreement commencing 01 April 1998 and ending 31 March 2003 for an evacuation agreement between the parties for the evacuation of Tract 422 in order to provide for the safety of persons on land in the proximity of Vandenberg Air Force Base in connection with launch operation activities, and

WHEREAS, Supplemental Agreement No. 1 executed on 21 April 2003 to extend the term for a period of years ending 31 March 2009, and

WHEREAS, Supplemental Agreement No. 2 executed on 01 April 2009 to extend the term for a period of years ending 31 March 2014, and

WHEREAS, The parties would like to now extend the agreement for an additional one year with four one year periods.

NOW, THEREFORE, in consideration of these premises, the parties hereto do mutually agree that the evacuation agreement be extended and modified in the following particulars:

1. That the evacuation agreement be extended one year from 01 April 2014 through 31 March 2015 and each option, subject to the availability of funds, shall automatically renew annually on each subsequent 01 April of the following four years for a total additional term of five years to 31 March 2019

All other terms and conditions of the aforesaid evacuation agreement are hereby ratified and, except as modified by this Supplemental Agreement, shall remain in full force and effect.

SUPPLEMENTAL AGREEMENT NO. 3
to
EVACUATION AGREEMENT NO. DACA-09-3-98-0008

THIS SUPPLEMENTAL AGREEMENT is also executed by The Government under the authority of the Secretary of the Air Force this 20 day of Oct, 2017.

UNITED STATES OF AMERICA

MICHAEL S. HOUGH, Colonel, USAF
Commander, 30th Space Wing

SUPPLEMENTAL AGREEMENT NO. 3
to
EVACUATION AGREEMENT NO. DACA-09-3-98-0008

IN WITNESS WHEREOF, I have hereunto set my hand by authority of the State of California this 29th day of August, 2017.

STATE OF CALIFORNIA

DRodriguez

DANITA RODRIGUEZ, Superintendent
Channel Coast District
California State Parks
California Department of Parks and Recreation
1933 Cliff Drive, Suite 27
Santa Barbara, CA 93109

SUPPLEMENTAL AGREEMENT NO. 3
to
EVACUATION AGREEMENT NO. DACA-09-3-98-0009
Between
THE STATE OF CALIFORNIA
and
THE UNITED STATES OF AMERICA

WITNESSETH:

WHEREAS, The State of California granted to United States of America an evacuation agreement commencing 01 April 1998 and ending 31 March 2003 for an evacuation agreement between the parties for the evacuation of Tract 432 in order to provide for the safety of persons on land in the proximity of Vandenberg Air Force Base in connection with launch operation activities, and

WHEREAS, Supplemental Agreement No. 1 executed on 21 April 2003 to extend the term for a period of years ending 31 March 2009, and

WHEREAS, Supplemental Agreement No. 2 executed on 01 April 2009 to extend the term for a period of years ending 31 March 2014, and

WHEREAS, The parties would like to now extend the agreement for an additional one year with four one year periods.

NOW, THEREFORE, in consideration of these premises, the parties hereto do mutually agree that the evacuation agreement be extended and modified in the following particulars:

1. That the evacuation agreement be extended one year from 01 April 2014 through 31 March 2015 and each option, subject to the availability of funds, shall automatically renew annually on each subsequent 01 April of the following four years for a total additional term of five years to 31 March 2019

All other terms and conditions of the aforesaid evacuation agreement are hereby ratified and, except as modified by this Supplemental Agreement, shall remain in full force and effect.

SUPPLEMENTAL AGREEMENT NO. 3
to
EVACUATION AGREEMENT NO. DACA-09-3-98-0009

IN WITNESS WHEREOF, I have hereunto set my hand by authority of the State of California this 29th day of August, 2017.

STATE OF CALIFORNIA

DRodriguez

DANITA RODRIGUEZ, Superintendent
Channel Coast District
California State Parks
California Department of Parks and Recreation
1933 Cliff Drive, Suite 27
Santa Barbara, CA 93109

SUPPLEMENTAL AGREEMENT NO. 3
to
EVACUATION AGREEMENT NO. DACA-09-3-98-0009

THIS SUPPLEMENTAL AGREEMENT is also executed by The Government under the authority of the Secretary of the Air Force this 20 day of Oct, 2017.

UNITED STATES OF AMERICA

MICHAEL S. HOUGH, Colonel, USAF
Commander, 30th Space Wing

SUPPLEMENTAL AGREEMENT NO. 4

THIS SUPPLEMENTAL AGREEMENT entered into this____day of **__________, 2020,** by and between THE County of Santa Barbara, State of California ("County") and Secretary of the Air Force ("Government" or "Air Force") The Government and the County may be referred to jointly as the "Parties," and each separately may be referred to as a "Party."

RECITALS

A. On 1 December 1992, the Parties entered into an evacuation agreement for the evacuation of County properties Jalama Beach Park, Ocean Beach Park, Surf Station Parking and Brown/Point Sal Road in case of certain government operations for purposes of military necessity, security and public safety.

B. On 05 November 1997, the Parties agreed to extend the Agreement for one additional year through 01 December 1998 and to automatically renew the Agreement for a total additional term of five years from December 1, 1997 and added Surf Station Parking Lot to the Agreement.

C. On 13 May 2003, the Parties agreed to extend the agreement for five years through 30 November 2007.

D. On 18 November 2008 the Parties agreed to extend the agreement for an additional total term of five years through 30 November 2012.

AGREEMENT

1. The Agreement is hereby modified in the following particulars, but no others:

    a. The term of the Permit is extended for an additional twenty (20) years, beginning 1 December 2012 to and including 30 November 2032.

2. All other terms and conditions of the agreement shall be and remain the same.

3. This Supplemental Agreement shall be effective immediately.

IN WITNESS WHEREOF, I have set my hand by authority of the Secretary of the Air Force as of the day and year first written above.

DEPARTMENT OF THE AIR FORCE

BY: ______________________________________

ROBERT E. MORIARTY, P.E
Director
Installations Directorate
Air Force Civil Engineer Center

IN WITNESS WHEREOF, Government and County have executed this Supplemental Agreement No. 4 to Evacuation Agreement SPCVAN-1-93-0006, by the respective authorized officers as set forth below to be effective as of the date executed by Government.

COUNTY:

COUNTY OF SANTA BARBARA

By:______________________________
Gregg Hart, Chair
Board of Supervisors

Dated:______________________________

ATTEST:
MONA MIYASATO
CLERK OF THE BOARD

By:______________________________
Deputy Clerk

APPROVED AS TO FORM:
MICHAEL C GHIZZONI
COUNTY COUNSEL

By:______________________________
Scott Greenwood
Deputy County Counse

APPROVED AS TO ACCOUNTING FORM:
BETSY M. SCHAFFER, CPA
AUDITOR-CONTROLLER

By:______________________________
Deputy

APPROVED:

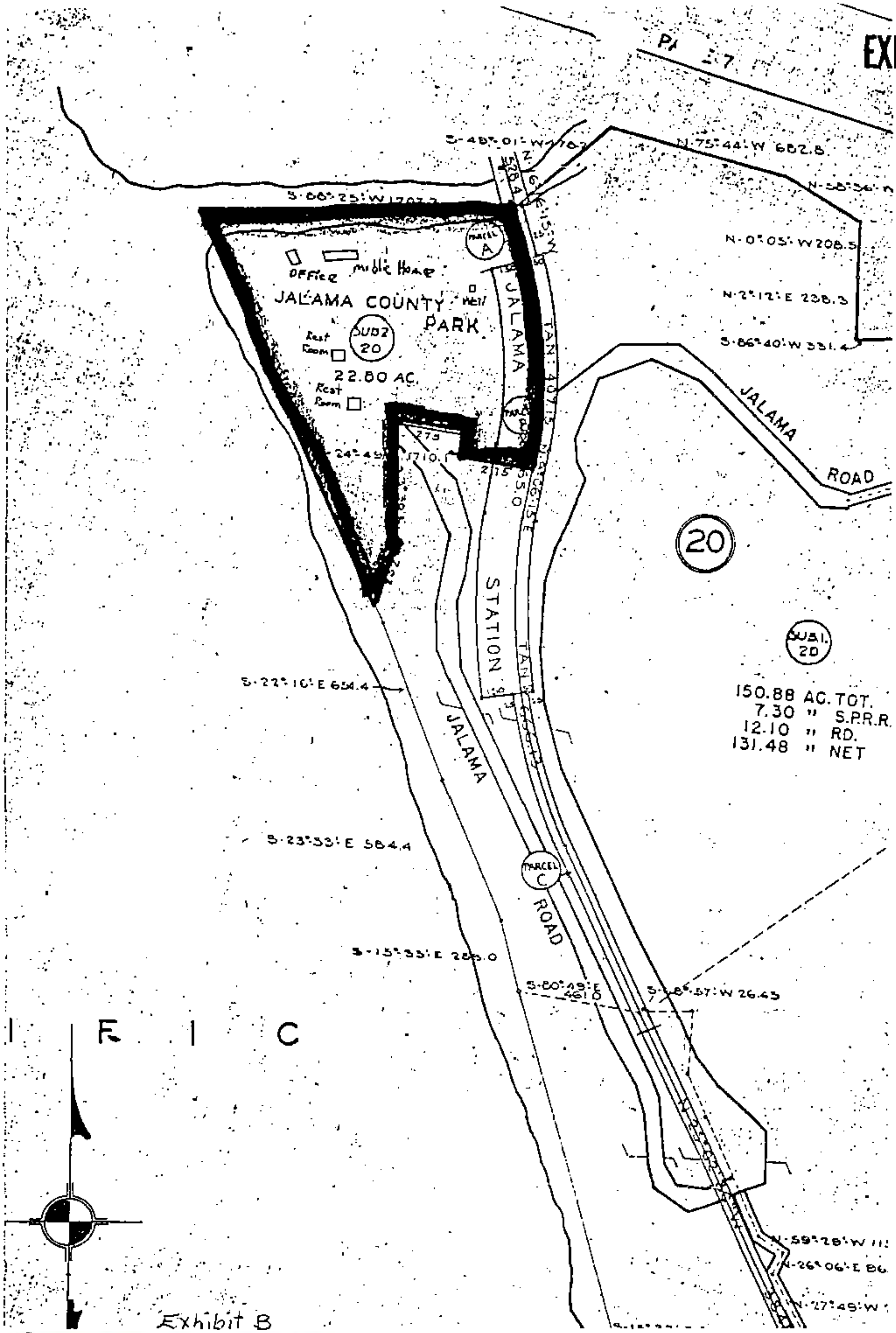
By:______________________________
Carlo Achdjian
Real Property Manager

APPROVED:

By:______________________________
Ray Aromatorio, ARM, AIC
Risk Manager


1967 1981
2002 1999
1990
1976 1974
1986 1886 1978
1970 2001
1937
1930 1926
1894 2007 1987 23235 23225
1900 1899 23229 23205
1887 1895 1905 23101 23100
1819 1865 1847 22010
1833 1836
1797 1788 1800 1350 21308 22114
1793 1805 21330 22409 22405
1762 21150 21155 21200 22396 22398
1670 1682 20224 21204
1628 1619 1768 14300 16170 31033
1611 1032 1740 12000 11237 11777 31036
1053 11439
1595 1735 8173 9320 15032
1555 1559 8310 8500
3000 5500
1546 6816 11488
6846 6842
1280
990 1230
980 960
984 861
945 852
907 874 831 836
799 753
763 761 639 660
731 770 760 638 644
738 707
621
701 622 467
466 444
561 490 475 441 425
525 542 431
510
398 521 185 420
392 502 500 175
375 178
331 330
75 64
302 304 70
308
65
51
40
Approx. location of Jalama Beach Park
Approx. location of Jalama Beach Park
Jalama Beach

EXHIBIT B



Jalama Beach Park


Approx. location of Ocean Beach Park
Approx. location of Surf Station Parking Lot
Approx. location of Ocean Beach Park
Surf/Ocean Beach
Surf Station
Approx. location of Surf Station Parking Lot

EXHIBIT D

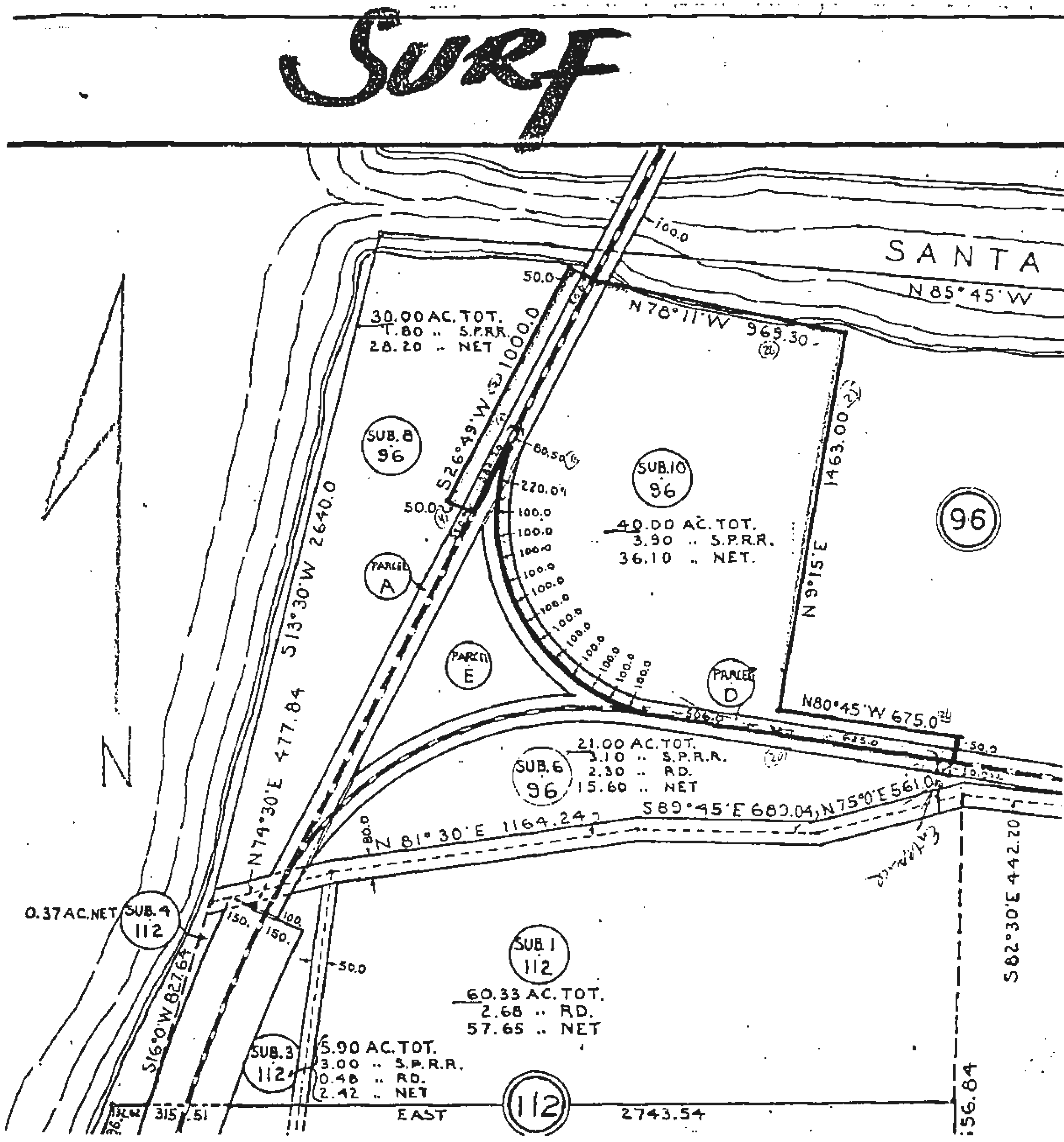


Exhibit 2

Ocean Bch Park

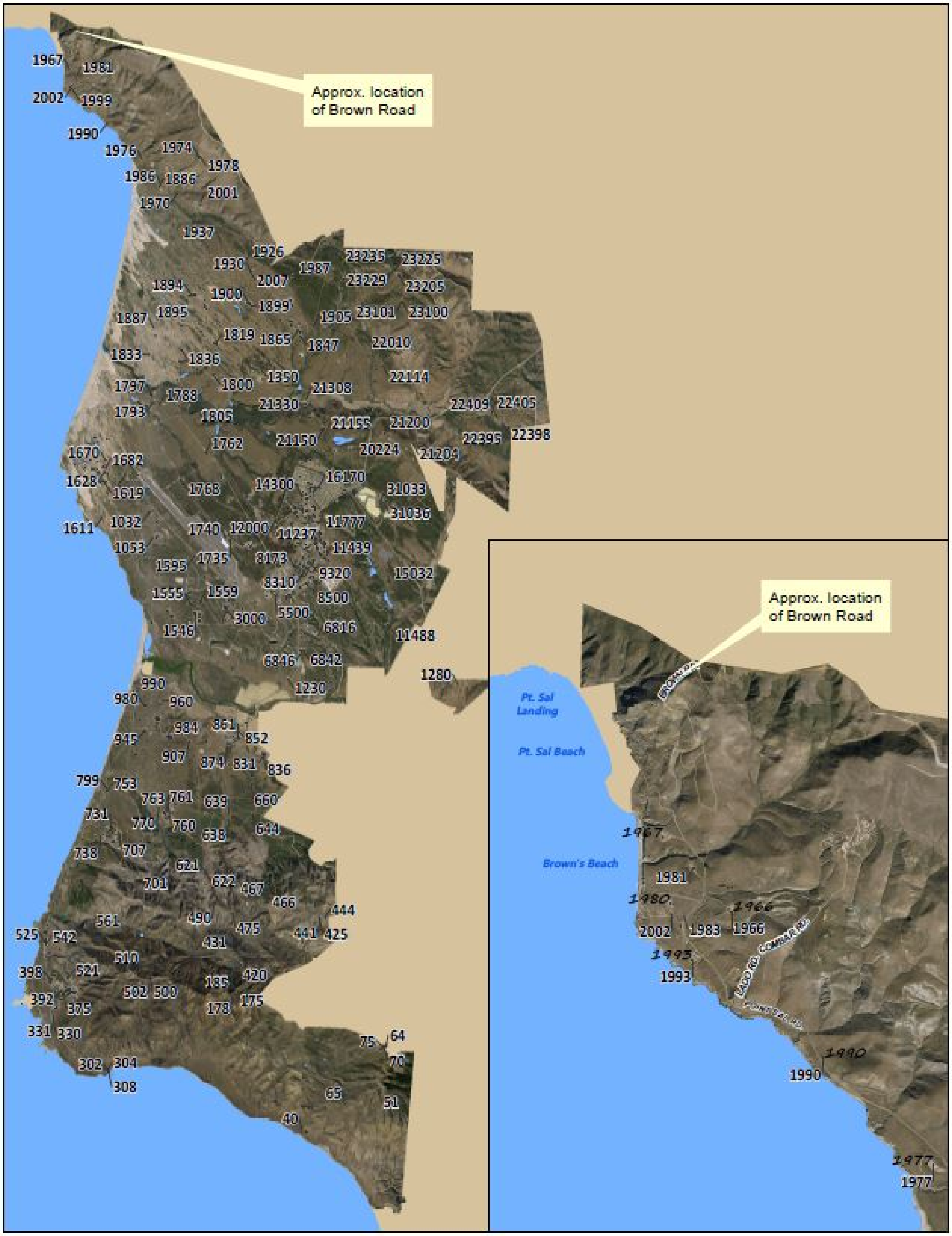
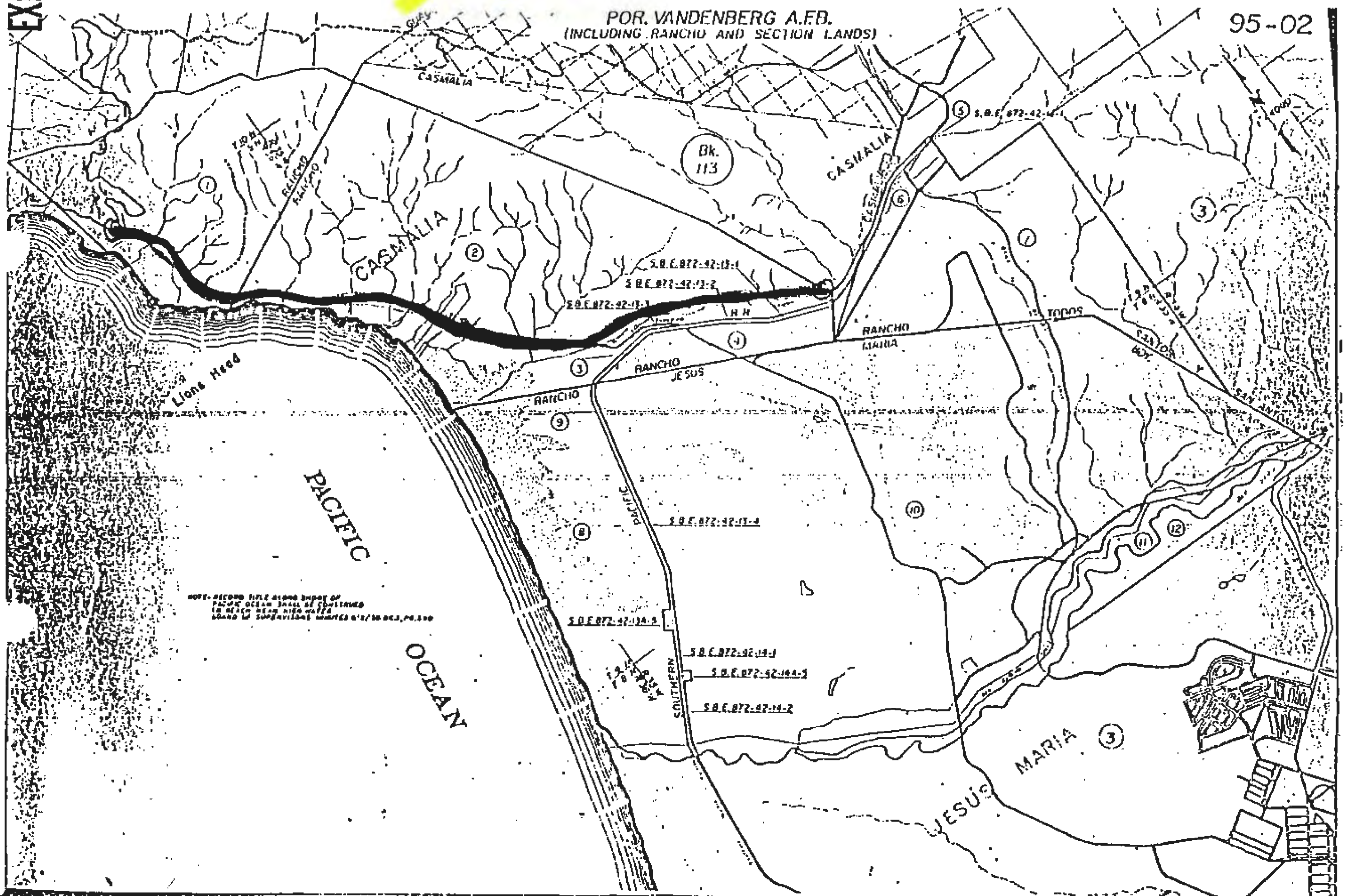

Approx. location of Brown Road
Approx. location of Brown Road
Pt. Sal Landing
Pt. Sal Beach
Brown's Beach

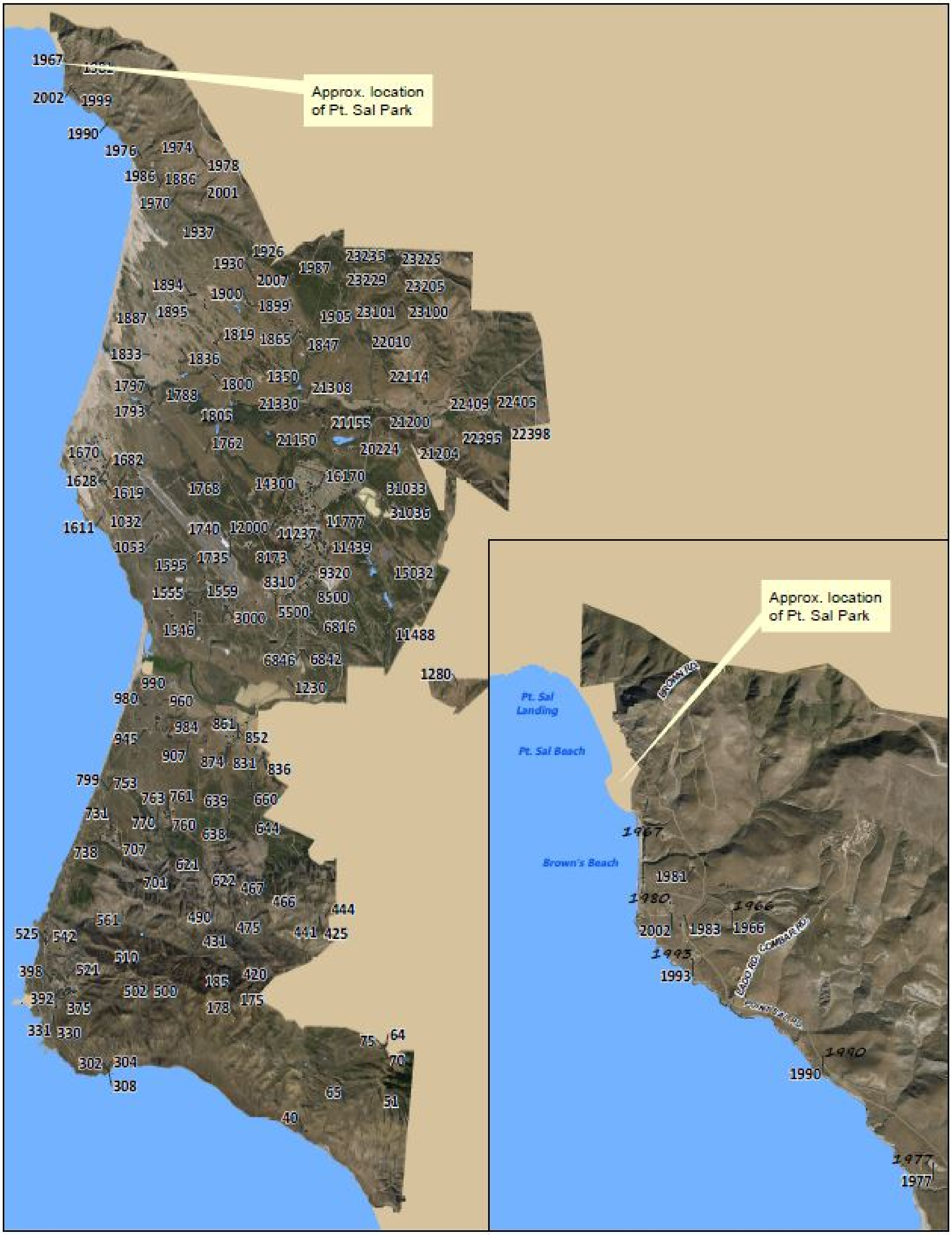
EXHIBIT E

Pt Sal Exhibit E

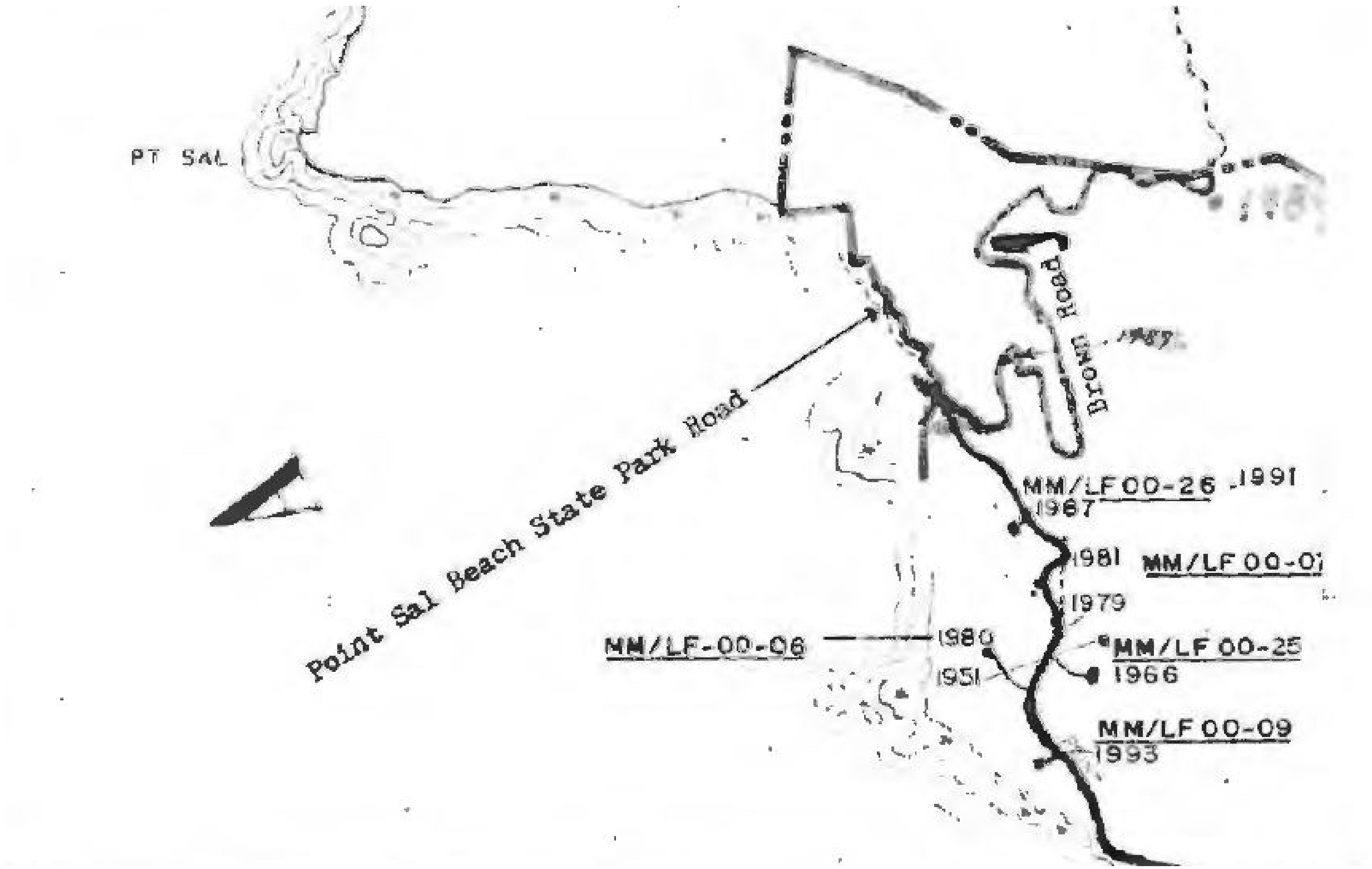


FOR INFORMATION ONLY

Pt Sal


Approx. location of Pt. Sal Park
1967
2002 1999
1990
1976 1974
1978
1986 1886
2001
1970
1937
1926
1930
1987
23233 23225
2007
23229 23205
1894 1900
1899
1887 1895
1905 23101 23100
1819 1865
1847 22010
1833
1836
1350
22114
1797 1800
21308
1788
21330
22409 22405
1793
1805
21155 21200
22395 22398
1762 21150
20224
21204
1670 1682
1628
14300
16170
1619
1768
31033
31036
1611 1032
1740 12000
11237
11777
1053
11439
1595 1735
8173
9320
15032
8310
1555 1559
8500
3000
5500
6816
1546
11488
6846 6842
1280
1230
990
980 960
984 861
852
945
907
874 831
836
799 753
763 761 639
660
731
770 760
638
644
738 707
621
701
622 467
466
444
561
490
475
441 425
525 542
431
510
398 521
185 420
392 502 500
375
178 175
331 330
75 64
70
302 304
308
65
51
40
Approx. location of Pt. Sal Park
Pt. Sal Landing
Pt. Sal Beach
Brown's Beach
1967
1981
1980
1966
2002 1983 1966
1993
1993
POINT SAL RD
1990
1990
1977
1977

Brown Road on North Base
To
Point Sal State Beach



Appendix N
Hazardous Materials Background

N.1 Defense Environmental Restoration Program

The Defense Environmental Restoration Program (ERP) is comprised of three programs: the Installation Restoration Program (IRP), Military Munitions Response Program (MMRP), and building demolition and debris removal (AFI 32-7020).

An analysis of MMRP and IRP sites, including IRP AOCs and AOIs, within the Proposed Action area was performed. Four IRP sites (AOC-188B, AOC-188C, AOC-188D, and AOI-183) are located within the Space Launch Complex (SLC)-5 Right of Entry area, and four IRP sites (AOC-188A, including AOI-065 and AOI-71, and LF-7) are located in Honda Canyon. The former three Honda Canyon sites are located on the north bank, above the creek bed. LF-7, a former landfill site, is within Honda Canyon and overlaps the creek bed. The sites are described below, along with their closure history.

N.1.1 IRP Sites Within the SLC-5 Right of Entry

N.1.1.1 AOC-188B

AOC-188B consists of facilities 579, 580, 582, and 583 and is located within SLC-5 at the end of Delphy Road. Facility 579 was the Scout winch shelter, which was used to slide Facility 580 in place for launches. Facility 580 was a Scout missile launch facility. It was a movable shelter (set on rails) that was pulled away prior to a launch. Investigations in 2007 identified hazardous materials storage and use, wastewater treatment/discharge, polychlorinated biphenyls (PCBs), unexploded ordnance, and lead-based paint at Facility 580. Facility 582 consisted of offices, bathrooms, a lunch area, and a hydrogen peroxide pumping system for the launch pad. Facility 583 housed the air conditioning plant for the former launch complex at SLC-5 under the Scout launch program. In March 2007, leaking transformer and electrical lines were removed, leaving only a concrete pad in place. In 2015, AOC-188B was closed under the VSFB IRP AOC Program.

N.1.1.2 AOC-188C

AOC-188C encompasses Facility 584 and is located south of Delphy Road. Facility 584 was a maintenance and fabrication shop supporting launch operations at SLC-5. The building stored launch support equipment and had a machine shop with welders, drill presses, and lathes. Investigations completed in 2007 identified storage of pesticides at the facility and two non-PCB-containing transformers. SLC-5 shop maintenance and testing facilities frequently used oil, hydraulic fluid, Freon 113, methyl ethyl ketone, paint, hydrofluoric acid, and dichlorofluoromethane. Excavation at this site of 320 cubic yards of impacted soil occurred, and the VSFB IRP AOC Program determined that unrestricted closure of AOC-188C was warranted. The VSFB IRP AOC Program closed AOC-188B in 2015.

N.1.1.3 AOC-188D

AOC-188D encompasses Facilities 589 and 590 located within SLC-5 on the south side of Delphy Road. Facility 589 was used for housing Scout missile launch control equipment. The Scout missile launcher was staged in the parking lot above the building. Several potential contaminant sources have been identified at this facility during investigations completed in 2007, including a septic system, hazardous materials storage, transformers, and rocket launches. Facility 590 supplied emergency electrical power for Facility 589. ASTs have been removed at the site, along with the generator and associated equipment.

Investigations completed in 2007 found no evidence of significant contaminant impact and was recommended for unrestricted closure. In 2015, AOC-188D was closed under the VSFB IRP AOC Program.

N.1.1.4 AOI-183

AOI-183 is located at the end of Ladd Road, and is associated with pole-mounted transformers to supply power to the SLC-5 launch complex supporting the Scout launch program. Subsequent investigations completed in 2011 showed that polyaromatic hydrocarbons (PAHs) were below the ambient PAH TEQ as calculated by California Department of Toxic Substances Control for southern California. Accordingly, AOI-183 was closed under the VSFB IRP AOC Program.

N.1.2 IRP Sites in Honda Canyon

N.1.2.1 AOC-188A

AOC-188A is comprised of decommissioned Buildings 560 and 561, both of which were associated with SLC-5 activities and located on Honda Canyon Road adjacent to Canada Honda Creek. Constructed in 1964, Facility 560 formerly stored UDMH. Facility 561 was a red fuming nitric acid/hydrogen peroxide drum storage building. Investigations completed in 2007 showed no evidence of hydrazine impact from former drum storage operations. Metals concentrations, though often greater than their background levels, were determined to result from bedrock composition, and therefore naturally occurring. Both AOI-065 and AOI-071 are associated with Facility 561. In 2015, AOC-188A, AOI-065, and AOI-071 were closed under the VSFB IRP AOC Program.

N.1.2.2 LF-7

LF-7 was a former landfill site closed in 1995. The landfill was approximately 5 to 10 acres in size and was used throughout the 1950s for disposal of residential sanitary trash generated by local ranches. Investigations completed in 1995 determined that there was no potential for contamination or hazardous leachate formation.

APPENDIX O
United States Space Force, Space Launch Delta 30 and United States Coast Guard Memorandum of Agreement

MEMORANDUM OF AGREEMENT

BETWEEN THE

U.S. SPACE FORCE, SPACE LAUNCH DELTA 30

AND

U.S. COAST GUARD DISTRICT ELEVEN

FOR

SPACE VEHICLE AND MISSILE LAUNCH SUPPORT

APPROVED FOR SPACE LAUNCH DELTA 30:

STEVENS.THOMAS.E.1230451784 Digitally signed by STEVENS.THOMAS.E.1230451784 Date: 2022.12.08 16:46:59 -08'00'

THOMAS E. STEVENS
NH-04, DAF, USSF
Executive Director, SLD 30

Date: 8 Dec 22

APPROVED FOR U.S. COAST GUARD DISTRICT ELEVEN:

Andrew Sugimoto

ANDREW M. SUGIMOTO
Rear Admiral, USCG
Commander, Eleventh CG District

Date: 19 Sept 2022

1. PURPOSE:

This Memorandum of Agreement (MOA) between the Space Launch Delta 30 (SLD 30) and the U.S. Coast Guard (USCG) District Eleven, contains the provisions, procedures for implementing USCG liaison, patrol, and maritime warning assistance in support of space vehicle and missile launches on the Western Launch and Test Range (WR). The USCG District Eleven support mission to aid in mitigating risk on the high seas for marine traffic within the SLD 30 identified launch hazard areas. USCG support also includes broadcast notice to mariners (BNM), local notice to mariners (LNM), and limited access areas (LAA) authority under Captain of the Port. This MOA does not alter the jurisdiction or responsibilities of any agency. The MOA is intended only to improve the internal management of existing responsibilities within each agency and enhance interagency coordination and communication. Neither this MOA, nor any actions to implement it, shall be construed to create any right or benefit, substantive or procedural, legally enforceable by any party or person. The Parties retain discretion to deviate from the provisions of the MOA after prior notification to the other Party.

2. AUTHORITY:

The USCG's authority to enter into this Agreement can be found in the following sources: 14 U.S.C. § 504(a), 14 CFR § 431.75, 14 CFR § 450.147, 14 CFR § 417.111 and USCG Commandant Instruction 5216.18.

3. PARTIES:

The SLD 30 is responsible for the safe conduct of launch and test operations from the WR. The Launch Risk Analysis Section within the SLD 30 Launch Safety Office (SLD 30/SEL) is responsible for determining the launch hazard areas for each launch from the WR. The 2nd Range Operations Squadron (2 ROPS) conducts air and sea surveillance of these launch hazard areas for each launch from the WR. The 2 ROPS Area Surveillance Officer (ASO) is responsible for the conduct of surveillance operations within the identified launch hazard area and for reporting the location of any seaborne vessels to the SLD 30/SEL Surveillance Control Officer (SCO) and Sea Surveillance Officer (SSO). The SCO and SSO are responsible for determining the launch risk to seaborne vessels and providing vessel redirect instructions, as required, to the ASO in order to minimize the hazards to the general public and remain within established risk criteria (individual and collective).

USCG District Eleven (D11) represents the U.S. Government on matters of maritime control. They are also the interface for all USCG/USCG Auxiliary launch support for safety and security operations within the USCG District Eleven area of responsibility.

4. POINTS OF CONTACT (POC):

a. The SLD 30 Points of Contact are the 2 ROPS/DON Flight Chief, 805-606-4761 or 805-606-0002, 1602 California Blvd STE 248, Vandenberg SFB, CA 93437 and SLD 30/SE 805-605-7168.

b. The USCG POC is the District Waterways Management Office (dpw), U.S. Coast Guard District Eleven, (510) 437-5984, Coast Guard Island, Bldg. 50-2, Alameda, CA 94501-5100.

5. RESPONSIBILITIES:

Space Launch Delta 30 agrees to the following:

a. Contingency Plans: SLD 30 will provide, or ensure commercial entities provide current copies of the following plans to the Coast Guard:

(1) Ship Hazard Areas as defined through RCC-321 section 3.4 to match 14 CFR 450.135 and 14 CFR 417.111(i) requirements:

(a) A Ship Hazard Area accounting for the impact area of l debris fragments in a catastrophic failure event;

(2) Mishap Investigation Plan as prepared IAW 14 CFR 450.173(d) and 14 CFR 417.111 (h) including the following provision:

(a) Immediate notification to the National Response Center (800) 424-8802 and Coast Guard Pacific Area / District Eleven Command Center (510) 437-3701 in the event of a launch site accident over or adjacent to navigable waters.

b. Response Plans: SLD 30 will provide, or ensure commercial entities provide current copies of the following plan to Coast Guard District Eleven, Sector LA/LB, and Sector San Diego:

(1) Response Plan as prepared IAW 14 CFR 450.173(c) and 14 CFR 417.111 (h) including the following provision:

(a) The plan should include procedures to ensure the consequences of a launch accident, launch incident, reentry accident, reentry incident, or other mishap occurring in the conduct of a reusable launch vehicle mission are contained and minimized so that it does not affect a navigable waterway. The plan should include response measures for impacts that cannot be avoided, including procedures to mitigate hazards to public health and safety, and the contamination of waterways.

c. Scheduling and Notification Activities:

(1) SLD 30 will provide D11 an annual launch schedule forecast for the fiscal year by 30 September each year.

(2) (L-30 days) SLD 30 will submit launch information to D11 to request a LNM article via D11-SMB-D11-LNM@uscg.mil with a goal of at least 30 days prior to scheduled launch. It is understood that with the emerging commercial launch industry, some launch programs may provide flight trajectory updates to accommodate late breaking launch

vehicle performance reviews requiring revisions to hazardous areas or provide launch trajectory data within 30 days because of a high frequency of launch.

SLD 30 shall provide all updates as received from launch developers due to modification or changes.

Launch information should include the following:

(a) Operation Number;
(b) Vehicle type and launch description;
(c) Primary and secondary launch date and time in local and GMT;
(d) Launch Hazard Areas, perimeter coordinates in degrees, minutes, and seconds to three decimal places, if applicable;
(e) Launch/Re-entry risk evaluation, type of debris, pollution risk, safety POC's;
(f) Perimeter coordinates shall be minimized to 4 coordinate positions per area box to limit maritime confusion and charting requirements.

(3) At L-20 days or as soon as SLD30 receives the launch inf ormation, BNM request is sent: D11SPACE@uscg.mil

(4) (L-72 hours) SLD 30 shall contact the following:

(a) D11 to confirm launch information for the LNM and Local Sector BNM, NAVTEX, and SMIB notifications are scheduled and distributed.

(b) National Geospatial-Intelligence Agency (NGA) to request Navigation Area XII warning notifications for launch activities occurring over water from 150 nautical miles offshore to deep-ocean. Launch information should be sent to navsafety@nga.mil and/or (571) 557-5455.

(c) Launch information shall be sent to D11SPACE@uscg.mil and RCCAlameda1@uscg.mil.

Coast Guard District Eleven agrees to the following:

a. Scheduling and Notification Activities:

(1) Review annual forecast of scheduled launches and provisions of this agreement each year;

(2) (L-90 days) Review scheduled launch operations, coordinate waterways risk, and make determination if LAA is recommended;

(3) (L-15 days) Publish launch information in the Local Notice to Mariners;

(4) (L-72 hours) Coordinate Local Broadcast Notice to Mariners (BNM) and NAVTEX prior to launch with respective operational USCG Sector;

(5) (L-day) Confirm local Safety Marine Information Broadcast (SMIB) via VHF-FM is scheduled to be distributed 3 hours before and during launch;

(6) Fulfill any other statutory responsibility pertaining to USCG jurisdiction and authorities;

(7) Coast Guard may communicate directly with the various providers launching out of Vandenberg in support of meeting its statutory obligations to the maritime community.

6. EFFECTIVE DATE AND TERMINATION:

This MOA becomes effective upon signature by an authorized agent from each organization. It may be terminated at any time by mutual agreement or by one party upon giving the other 180 days written notice.

7. MODIFICATIONS AND REVIEW:

This MOA may be modified by mutual agreement at any time. It will be reviewed triennially to determine whether it should be continued as is, modified, or terminated.

8. OTHER FEDERAL AGENCIES:

This MOA does not bind any federal agency, other than the Parties, nor waive required compliance with any law or regulation.

9. FINANCIAL DETAILS:

This MOA does not authorize the expenditure or reimbursement of any funds, nor does it obligate the partners to expend appropriations or enter into any contract or other obligation. All obligations of the partners under this MOA shall be subject to the availability of funds and resources for such purposes. No provision in this MOA will be interpreted to require obligation or payment of funds in violation of the Anti-Deficiency Act, Section 1341 of Title 31, United States Code.

10. OTHER PROVISIONS:

Nothing in this MOA is intended to conflict with current laws or regulations or the directives of the PARTIES. If a term of this MOA is inconsistent with such authority, then that term shall be invalid, but the remaining terms and conditions of this MOA shall remain in full force and effect.

Distribution:

SLD 30 SW/FM, JA, SE
SLD 30 MSG/CC (CES, CONS, FSS/MOF, SFS, Det 1)
SLD 30/CV (RANS, SCS, WS, 2 SLS)
HQ AFSPC(A4/A7 USSF SPOC SpOC/S3/6RA, AFSOC/A3OU, HAF/A3, AF/A3T /A3)
USCG District Eleven (DXO, DRMC, DRE, DL, DM, and DMF)
USCG Sector Los Angeles/Long Beach
USCG Sector San Diego

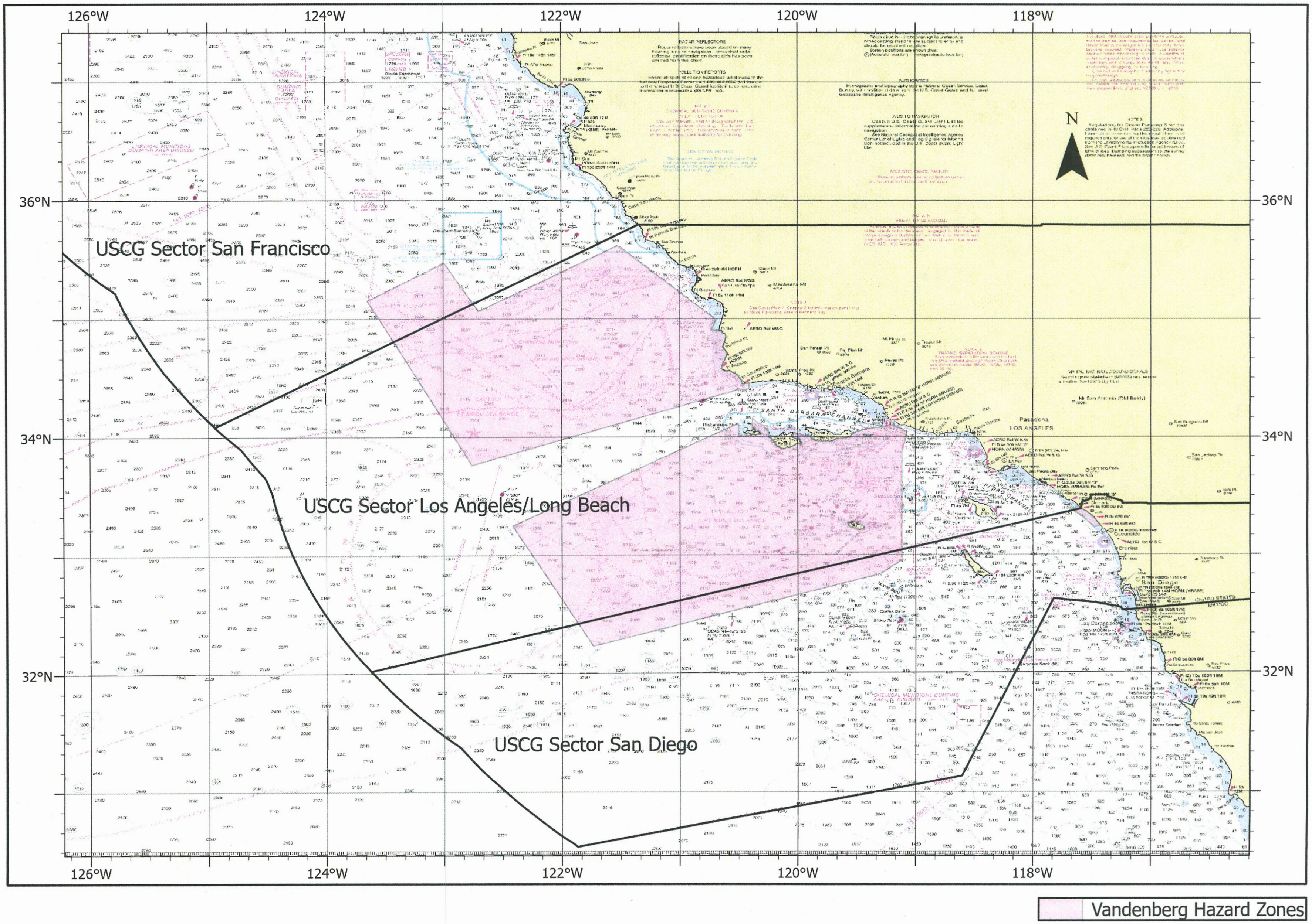
Appendix A – Specific Points of Contact

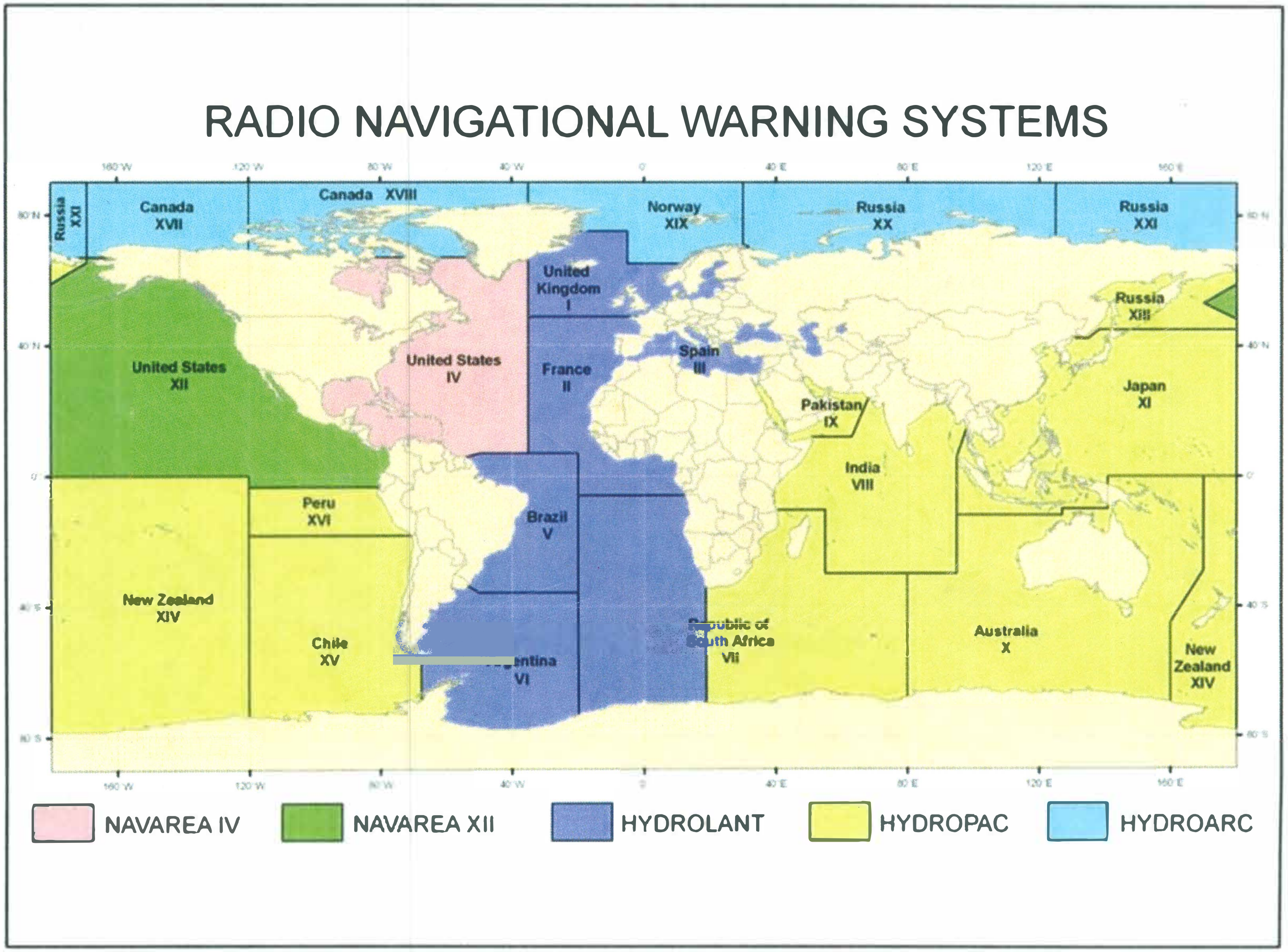
OFFICE	NUMBER	RESPONSIBILITY
Coast Guard District Eleven Waterways Management D11-DG-D11-Waterways@uscg.mil	510-437-2968	Chief, Waterways Management
Coast Guard District Eleven Marine Transportation System Officer D11-DG-D11-Waterways@uscg.mil	510-437-5984	Space Liaison Officer
Space Launch Delta 30 2ROPSDOSMailbox@us.af.mil	805-605-8011	Operations
Coast Guard District Eleven LNM Editor D11-SMB-D11-LNM@uscg.mil	510-437-2929	Publication of Local Notice to Mariners
Coast Guard Sector LA-LB Command Center D11-SMB-SECTORLALB-SCC@uscg.mil	310-521-3801	Emergency contact number for all Search and Rescue in COTP zone
Coast Guard Sector San Diego Command Center jhoc@uscg.mil	619-278-7033	Emergency contact number for all Search and Rescue in COTP zone
Coast Guard District Eleven Command Center RCCAlameda1@uscg.mil	510-437-3701	Emergency contact number for all Search and Rescue in D11

Appendix B – List of Acronyms

2ROPS 2nd Range Operations Squadron
ASO Area Surveillance Officer
BNM broadcast notice to mariners
CFR Code of Federal Regulations
COTP Captain of the Port
D11 Coast Guard District Eleven
DPW District Waterways Management Office
IAW In accordance with
LA/LB Los Angeles/Long Beach
LAA limited access areas
LNM local notice to mariners
MOA Memorandum of Agreement
NAVTEX Navigational Telex
POC Point of contact
SLD Space Launch Delta
SMIB Safety Marine Information Broadcast
SSO Sea Surveillance Officer
USCG United States Coast Guard
USSF Unites States Space Force
WR Western Launch and Test Range

Appendix C – Vandenberg Hazard Zones




RADIO NAVIGATIONAL WARNING SYSTEMS
Russia XXI
Canada XVII
Canada XVIII
Norway XIX
Russia XX
Russia XXI
United Kingdom I
Russia XIII
United States XII
United States IV
France II
Spain III
Japan XI
Pakistan IX
India VIII
Peru XVI
Brazil V
New Zealand XIV
Chile XV
VI
Republic of South Africa VII
Australia X
New Zealand XIV
NAVAREA IV
NAVAREA XII
HYDROLANT
HYDROPAC
HYDROARC

3.3.3 Aircraft Hazard Volumes for Planned Debris Releases

The range must confirm that Notices to Airmen are issued that encompass the volume and duration necessary to protect aircraft from debris capable of causing an aircraft accident due to all planned events.[22]

NOTE	Federal law[23] defines an aircraft accident as "an occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight and all such persons have disembarked, and in which any person suffers death or serious injury, or in which the aircraft receives substantial damage." As described in the glossary, federal law also defines death, serious injury, and substantial damage for the purposes of accident reporting.

3.3.4 Mishap Response

The range must coordinate with the FAA to ensure timely notification[24] of any expected air traffic hazard associated with range activities. In the event of a mishap, the range must immediately inform the FAA of the volume and duration of airspace where an aircraft hazard is predicted.

3.4 Ship Protection[25]

The term "ship" includes boats and watercraft of all sizes.

3.4.1 Non-Mission Ship Criteria

a. Ship Warning Areas. Notices to Mariners (NOTMARs) shall be issued to warn non-mission ships of regions defined by one of the following approaches:[26]

(1) where the probability of debris capable of causing a casualty impacting on or near a vessel exceeds 10E−6 (1E−5), accounting for all relevant hazards; or

(2) the union of the areas where the individual probability of casualty for any person onboard exceeds the criteria in a of Subsection 3.2.1, the collective casualty expectation for an individual ship would exceed the criterion in b of Subsection 3.2.1, and the catastrophic risk for an individual ship would exceed the provisional criteria outlined in Section 3.8.

In some situations, warnings may be optional when expected ship traffic in the affected area is low and adequate observation will be performed.

b. Non-Mission Ship Risk Criteria. People on observed non-mission ships shall be included[27] in the determination of compliance with collective risk criteria in b of

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[22] Planned debris releases include intercept debris, jettison stages, nozzle covers, fairings, inter-stage hardware, etc.
[23] 49 C.F. R. 830.2. 1 October 2011.
[24] This may be accomplished through preflight analyses and coordination as described in Chapter 4 of the supplement.
[25] Chapter 4 of the supplement provides important guidelines on the proper implementation of ship protection measures.
[26] The warning area may be expanded to provide additional mitigation so that risk criteria (3.2.1) are met, as discussed in Chapter 4 of the supplement.
[27] Mission risk shall include all members of the GP on land, on ships, and on aircraft.

Subsection 3.2.1 and provisional catastrophic criteria in c of Subsection 3.2.1. Observation to locate non-mission ships is an acceptable method to ensure compliance, provided that suitable observation techniques are used to include the region(s):

(1) where the individual probability of casualty exceeds the criteria in a of Subsection 3.2.1; and

(2) where the collective casualty expectation or provisional catastrophic risk criteria (b or c of Subsection 3.2.1, respectively) would be exceeded given a conservative estimate of typical ship traffic.

3.4.2 Mission-Essential Ship Criteria

a. Mission-Essential Ship Hazard Areas. Mission-essential ships will be restricted from hazard areas defined by either:

(1) the region where the probability of debris capable of causing a casualty impacting on or near a vessel exceeds 100E−6 (1E−4), accounting for all relevant hazards; or

(2) The union of the areas where the individual probability of casualty for an exposed person onboard exceeds the criteria in a of Subsection 3.2.2, the collective risk criteria in b of Subsection 3.2.2, or the catastrophic risk criteria in c of Subsection 3.2.2.

b. Mission-Essential Ship Risk Criteria. Ship-board MEP shall be included in the assessment of compliance with the collective risk criteria in b of Subsection 3.2.2 and catastrophic risk criteria in c of Subsection 3.2.2.

3.4.3 Ship Hazard Areas for Debris Releases

The range must confirm that NOTMARs are issued for each planned debris release event that encompasses the areas and durations necessary to satisfy the risks as described in a of Subsection 3.4.1 or contain, with 99% probability of containment, all resulting debris impacts capable of causing a casualty.[28]

3.4.4 Mishap Response

The range must coordinate with the United States Coast Guard or other appropriate authorities to ensure timely notification of any ship traffic hazard associated with range activities. In the event of a mishap, the range must promptly inform the appropriate authority(s) of the area and duration of navigable waters where a ship hazard is predicted.

3.5 Infrastructure Protection

3.5.1 Mission-Essential Infrastructure Criteria

Mission-essential infrastructure (such as radar equipment) is treated separately as critical assets.

[28] This 99% probability of containment region corresponds to a 3-sigma dispersion region for a single impact if the impact uncertainty can be characterized by a bivariate normal impact probability distribution.

Appendix P
Airspace

P.1 Introduction

Airspace management considers how airspace is designated, used, and administered to best accommodate the individual and common needs of military, commercial, and general aviation. The FAA considers multiple and sometimes competing demands for airspace in relation to airport operations, federal airways, jet routes, military flight training activities, commercial space operations, and other special needs to determine how the National Airspace System (NAS) can be best structured to address all user requirements.

The FAA designs and manages the NAS based on the Code of Federal Regulations (CFR) (14 CFR Part 71). The FAA has designated four types of airspace above the United States: controlled airspace, Special Use Airspace (SUA), other airspace, and uncontrolled airspace.

- **Controlled airspace** is a generic term that covers the different classifications of airspace and defined dimensions within which air traffic control service is provided in accordance with the airspace classification. Controlled airspace consists of five classes: A, B, C, D, and E (Figure P-1).

- **Class A** airspace is generally the airspace from 18,000 feet mean sea level (MSL) up to and including flight level 600, including the airspace overlying the waters within 12 nautical miles of the coast of the 48 contiguous states and Alaska. Unless otherwise authorized, all operation in Class A airspace is conducted under instrument flight rules (IFR).

- **Class B** airspace is generally airspace from the surface to 10,000 feet MSL surrounding the nation's busiest airports in terms of airport operations or passenger enplanements.

- **Class C** airspace is generally airspace from the surface to 4,000 feet above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower, are serviced by a radar approach control, and have a certain number of IFR operations or passenger enplanements.

- **Class D** airspace is generally airspace from the surface to 2,500 feet above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower.

- **Class E** airspace is the controlled airspace not classified as Class A, B, C, or D airspace. A large amount of the airspace over the United States is designated as Class E airspace.

- **SUA** is the designation for airspace in which certain activities must be confined, or where limitations may be imposed on aircraft operations that are not part of those activities. The FAA has designated SUA areas that are listed in FAA Order 7400.10C and 7400.2N. SUA usually consists of prohibited areas, restricted areas, warning areas, military operation areas, alert areas, and controlled firing areas. Most SUA areas have specific hours of operations, and users must remain clear of or obtain permission from the using agency or the controlling agency before flight through the defined areas.

- **Other airspace areas** is a general term referring to the majority of the remaining airspace. Examples include local airport advisory areas, military training routes, temporary flight restriction (TFR) areas, parachute jump aircraft operations areas, published visual flight rules routes, terminal radar service areas, and national security areas.

- **Uncontrolled airspace or Class G airspace** is the portion of the airspace that has not been designated as Class A, B, C, D, or E. Class G airspace extends from the surface to the base of the overlying Class E airspace.

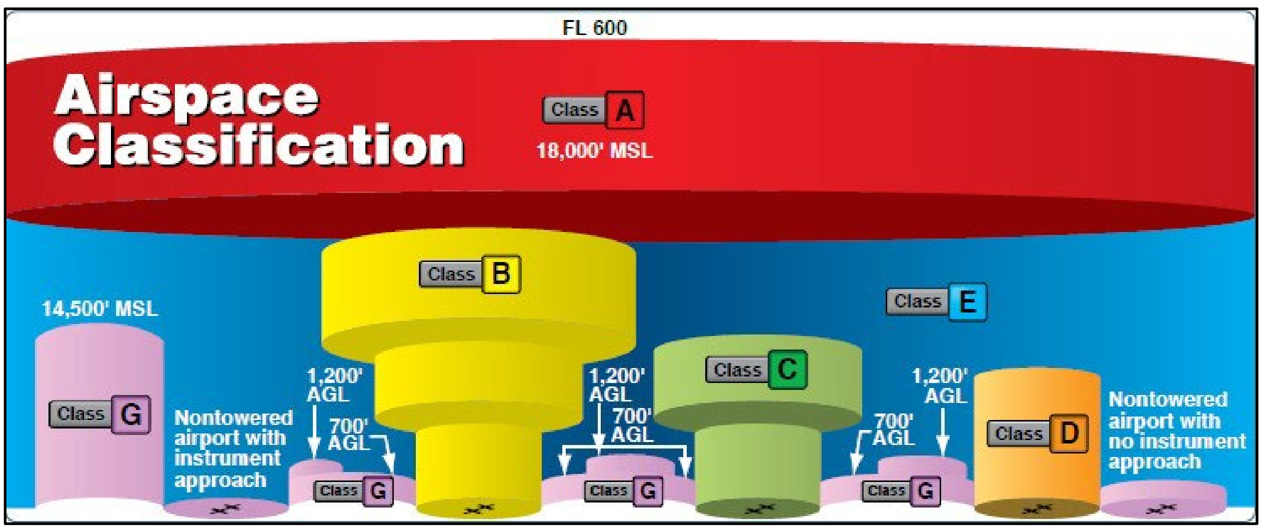

Figure P-1: Airspace Profile

P.2 Study Area

The airspace study area includes the airspace above Vandenberg Space Force Base (VSFB), the airspace surrounding the launch trajectory, and the airspace associated with any hazard areas that must be protected to ensure public safety. All launch trajectories would be over the Pacific Ocean. The study area's airspace is controlled primarily by the Los Angeles Air Route Traffic Control Center (ARTCC), and for northern trajectories, both Los Angeles and Oakland Centers.

Additionally, for missions involving reentry of the launch vehicle's second stage, the study area includes a downrange airspace hazard area (e.g., south Pacific Ocean or Indian Ocean). These airspaces could be controlled by the FAA, such as Los Angeles ARTCC, or another air navigation service provider.

P.3. Existing Conditions

The study area consists of airspace made up of SUA (Warning Areas and Restricted Areas) as well as an Altitude Reservation (ALTRV) area (Figure P-2). The SLD 30 is the using agency for the Warning Areas and Restricted Areas when these areas are activated by a Notice to Air Missions (NOTAM). The Los Angeles ARTCC controls the airspace around the Warning Areas, Restricted Areas, and the ALTRV. An ARTCC does not allow any air traffic they are controlling to enter these areas when active. The study area contains published aviation routes (Figures P-3 and P-4). The specific routes that would be impacted are identified prior to each launch and vary by mission.

Range Special Use Airspace and Published Aviation Routes

Table P-1: Restricted Areas, Warning Areas, and Altitude Reservation Area (Reference Figure P-2)

Designation	Altitude	Active Time
R-2517	Unlimited	Continuous
R-2534A	500 feet above the surface to unlimited	Intermittent by NOTAM at least 4 hours in advance
R-2534B	500 feet above the surface to unlimited	Intermittent by NOTAM at least 4 hours in advance
R-2535A	Surface to 100,000 feet MSL	0600-2200 local time Monday-Friday; other times by NOTAM at least 24 hours in advance
R-2535B	Surface to 100,000 feet MSL	0600-2200 local time Monday-Friday; other times by NOTAM at least 24 hours in advance
W-537	Surface to unlimited	Intermittent by NOTAM
W-289N	Surface to FL240	Intermittent by NOTAM
W-289	Surface to unlimited	Intermittent by NOTAM
W-412	Surface to 3,000 feet MSL	Intermittent by NOTAM
W-532	Surface to unlimited	Intermittent by NOTAM
ALTRAV (Southern Trajectory)	Surface to unlimited	Intermittent by NOTAM

Note: FL = Flight level,: MSL = Mean Sea Level; NOTAM = Notice to Air Missions

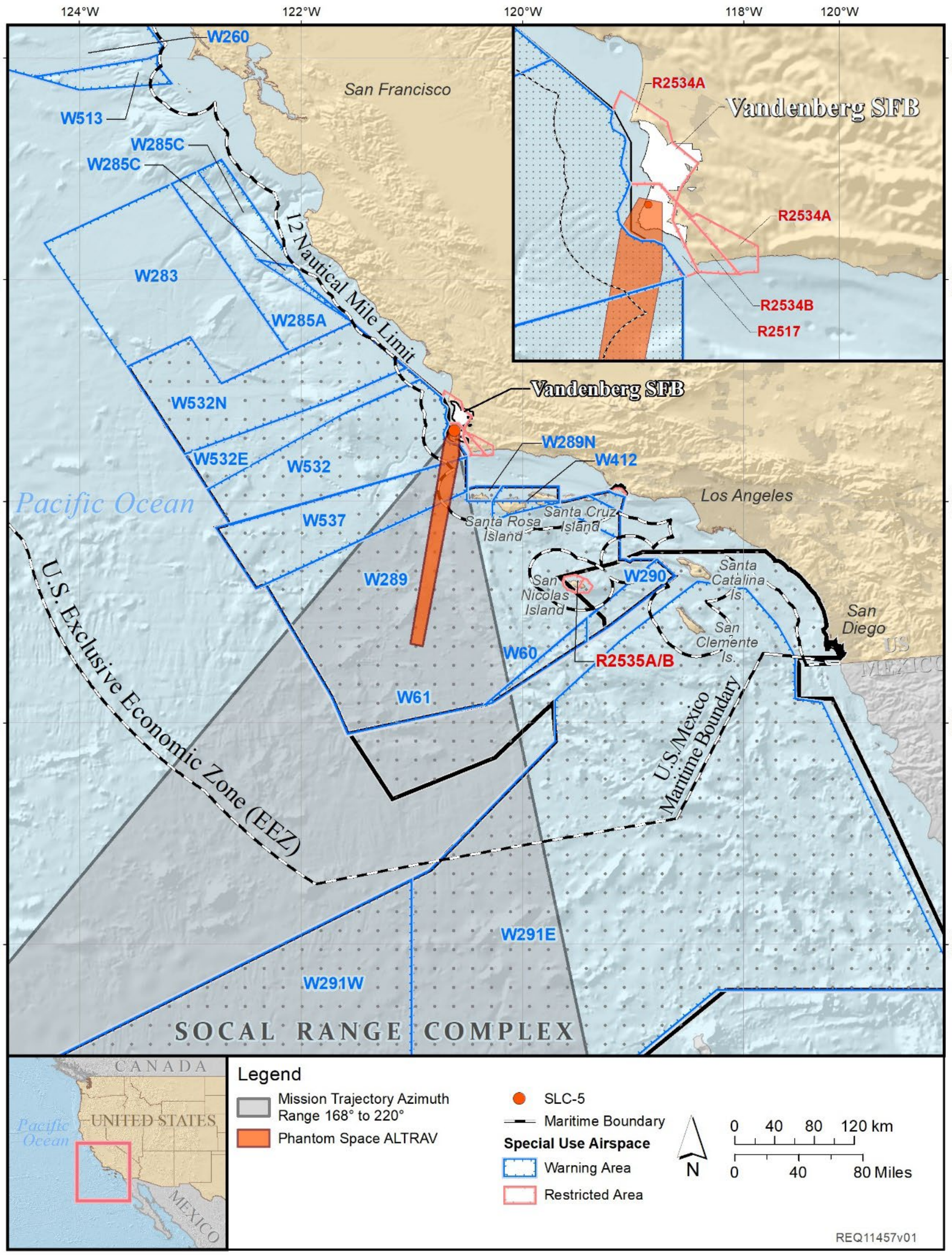

Figure P-2: Restricted Areas, Warning Areas, and Altitude Reservation Area

Figure P-3: Published Aviation Routes (Enroute High Altitude, Panel H-4)

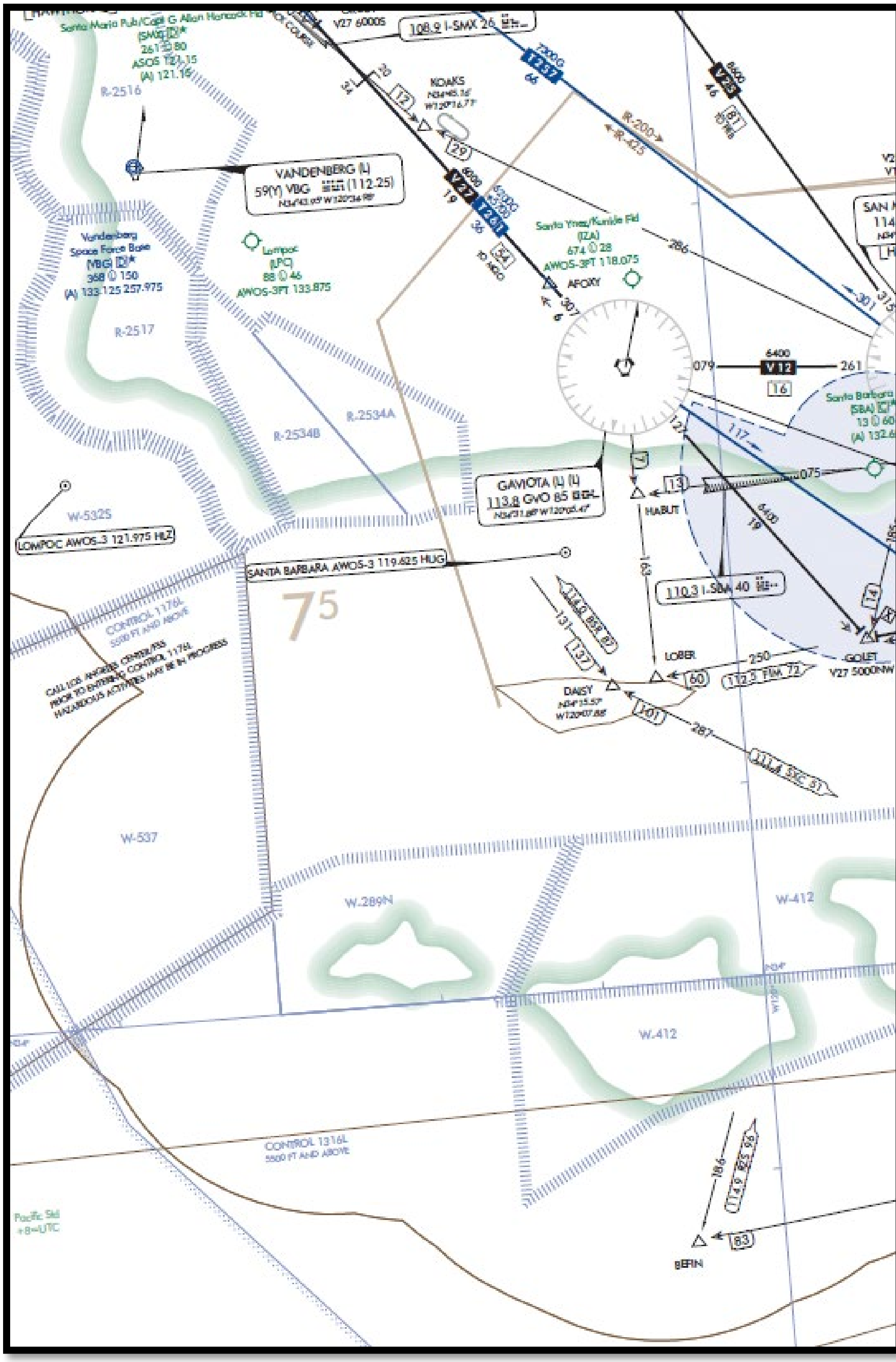

Figure P-4: Published Aviation Routes (Enroute Low Altitude, Panel L-4)

Oakland Air Route Traffic Control Center (ZOA), Los Angeles Air Route Traffic Control Center (ZLA), Santa Barbara Terminal Radar Approach Control Facility (SBA), Air Traffic Control System Command Center (ATCSCC), 30th Space Wing (30 SW)

LETTER OF AGREEMENT

EFFECTIVE: 07 APR 2020

SUBJECT: Vandenberg Space Vehicle Launch/Reentry Communications and Coordination

1. PURPOSE: This agreement establishes communication, coordination between the Federal Aviation Administration (FAA), and the 30th Space Wing (30 SW) for launch and/or reentry operations in to or through the national airspace system in accordance with 14 CFR Part 400-1199, AFI 13-201, and FAA JO 7610.4. Procedures defined in this Letter of Agreement (LOA) are part of and supplemental to all Air Force Safety requirements and agreements and are not intended to circumvent the terms or conditions of a space operator license.

2. CANCELLATION: The agreement between Western Space and Missile Center and FAA Oakland Air Route Traffic Control Center, subject "Interagency Coordination for Western Space and Missile Center Operations", is cancelled with the implementation of this agreement.

3. DISTRIBUTION: This agreement is distributed to the signatories, FAA office of Commercial Space and the Western Service Area.

4. RESPONSIBILITIES:

a. All signatories must ensure personnel operating within the scope of this agreement are knowledgeable of, understand, and comply with the provisions of this agreement.

b. 30 SW will notify ATCSCC, ZLA and ZOA of mission status at 3 hours and at 60 minutes prior to launch/deorbit burn. SBA must be notified according to this timeline when operational.

c. 30 SW will notify ATCSCC, ZLA ZOA and SBA, of any freezes or changes to launch times, or deorbit burn prior to T -30 minutes.

d. All signatories and the contracting space operator will communicate on the mission hotline, hosted by ATCSCC, no less than Target Launch Time T-30 minutes or Deorbit Burn -30 minutes. The hotline will remain active at least until the vehicle has entered earth orbit, returned to earth, completed the mission, or the mission is cancelled. The 30 SW will notify the participants to the hotline of any changes to hotline start times.

e. Deviations from responsibilities or procedures, established in this agreement must be effected only after prior coordination is accomplished, and responsibilities are clearly defined in each case.

Oakland Air Route Traffic Control Center (ZOA), Los Angeles Air Route Traffic Control Center (ZLA), Santa Barbara Terminal Radar Approach Control Facility (SBA), Air Traffic Control System Command Center (ATCSCC), 30th Space Wing (30 SW)

5. PROCEDURES:

a. 30th Space Wing must:

(1) Email the Altitude Reservation (ALTRV) request (per FAA Directives) to Central Altitude Reservation Function (CARF), no less than 12 days prior to a scheduled space operation (with cc. addresses, ZOA, ZLA, Fleet Area Control and Surveillance Facility (FACSFAC), ATCSCC Space Operations, Pacific Military Altitude Reservation Function (PACMARF), and others as appropriate.

(a) Include an operation name/number.

(b) Scheduled Primary and Backup dates/times of commencement and completion in Coordinated Universal Time (UTC).

(c) The altitudes requested.

(d) When aircraft hazard areas are contained in more than one area, the areas will be identified by name(s)/number(s)/letters.

(e) Request non-published airspace described by at least four fixes based on latitude and longitude (Degrees, Minutes).

(f) When the hazard areas fall in several Flight Information Regions (FIR), the portion CARF is responsible for will be indicated in a separate paragraph. In the event the hazard area falls within a FIR (ex. Auckland) which has an LOA with CARF, they will be included as an addressee in the message, and an additional paragraph indicating EUCARFs portion of the hazard area will be included in the message.

(2) Provide ZOA, ZLA, SBA and ATCSCC Space Ops a copy of the "Launch Airspace Safety Sheet" & "FOUO -11 Safety Sheet", at least 12 days prior to the planned launch.

(3) 30 minutes prior to launch (L-30)/or deorbit burn start (DB-30), participate on the ATC real-time hotline. Be prepared to communicate the following information:

(a) Launch status, delays or other information affecting the launch/reentry/fly-back time.

(b) Countdown status, delays or other information affecting the liftoff/deorbit burn ignition time.

(c) Verbal confirmation of critical mission events, including "Lift off" declaration.

(d) Vehicle health until the vehicle has entered earth orbit, returned to earth, touched down or otherwise completed the mission.

(4) For any unplanned events, particularly those which could produce debris, immediately advise via mission hotline which areas are affected, which are not, provide last known position and vector (if available), and provide the airspace opening times of the hazard areas if they differ from times included in the Launch Airspace Safety Sheet.

(5) Notify CARF of mission completion, cancellation, and/or the time per the Hazard Safety Sheet when the ALTRV(s) and/or Backup ALTRV(s) are no longer necessary. When CARF is closed, notify the ATCSCC National Operations Manager (NOM) 540-359-3100. Verbal notification on the hotline is preferred; however, verbal notification must be followed in writing, to include all identified areas of the ALTRV.

b. ZOA and ZLA must:

(1) Collaborate and formulate the airspace management plan and intended Notice to Airmen (NOTAMs) with ATCSCC Space Ops in advance of the space operation in accordance with JO 7400.2.

(2) Notify local facilities and other appropriate affected agencies of the proposed space operation and the pre-planned airspace mitigation strategies as required.

(3) Issue and distribute required local NOTAMs, as appropriate or required.

NOTE – *Local NOTAMs may be issued based on CARF ALTRV approval request and may need to be modified based on revisions from CARF.*

(4) Cancel local NOTAMs when the mission is complete, cancelled, or the airspace is no longer required.

c. ATCSCC must:

(1) Share appropriate mission data including the operational impact analysis and collaborate with ATC facilities to develop the airspace management plan.

(2) Publish requested traffic management initiatives, not issued by NOTAMs, via Command Center Advisories, when necessary.

(3) Activate and host the mission hotline, no less than 30 minutes prior to the scheduled target launch time or reentry deorbit burn.

NOTE - *Activation of the hotline could occur more than 30 minutes prior to mission, if so requested by 30SW/or Space Operator designee. Supporting air traffic facilities will not be required to be on the call until 30 minutes prior to launch time or deorbit burn.*

(4) Coordinate any additional safety or hazard mitigations relevant to the launch or reentry vehicle as needed.

Oakland Air Route Traffic Control Center (ZOA), Los Angeles Air Route Traffic Control Center (ZLA), Santa Barbara Terminal Radar Approach Control Facility (SBA), Air Traffic Control System Command Center (ATCSCC), 30th Space Wing (30 SW)

d. CARF must:

(1) Upon receipt of an ALTRV, coordinate the request in accordance with current FAA Orders.

(2) Coordinate ALTRVs with foreign countries in which CARF has written agreements, for missions which depart from the U.S.

(3) Approve ALTRVs at all altitudes for the space operation. Airspace requests that lie wholly within activated SUA will not be included in the ALTRV approval.

(4) Issue the approved ALTRV to 30SW, and applicable air traffic facilities, no less than three business days prior the proposed operation.

(5) Process updates and changes per FAA Orders.

(6) Issue CARF NOTAMs for the approved ALTRV airspace.

(7) Cancel ALTRV NOTAMS upon notification from the Project Officer, Range Scheduling Representative, or designee.

6. ATTACHMENT: Contact Information

JEFF B HUBERT
Digitally signed by JEFF B HUBERT
Date: 2020.02.13 14:21:41 -08'00'

Jeff B. Hubert
Air Traffic Manager
Oakland ARTCC

LISA MARIE JONES
Digitally signed by LISA MARIE JONES
Date: 2020.02.18 17:04:02 -08'00'

Lisa Jones
Air Traffic Manager
Los Angeles ARTCC

Oakland Air Route Traffic Control Center (ZOA), Los Angeles Air Route Traffic Control Center (ZLA), Santa Barbara Terminal Radar Approach Control Facility (SBA), Air Traffic Control System Command Center (ATCSCC), 30th Space Wing (30 SW)

CARRIE L DRAPER Digitally signed by CARRIE L DRAPER Date: 2020.02.19 10:01:37 -08'00'

Carrie Draper
Air Traffic Manager
Santa Barbara ATC/TRACON

JENNIFER A ROSS Digitally signed by JENNIFER A ROSS Date: 2020.03.03 08:59:06 -05'00'

Jennifer Ross
Acting Air Traffic Manager
Air Traffic Control System Command Center

MASTALIR.ANTHONY.J.1101714930 Digitally signed by MASTALIR.ANTHONY.J.1101714930 Date: 2020.04.07 14:10:45 -07'00'

Anthony J. Mastalir
Col., USAF
Commander, 30 SW

MARK G KUCK Digitally signed by MARK G KUCK Date: 2020.02.19 10:29:43 -08'00'

Mark Kuck
FAA Air Traffic Representative
Western Service Center

Oakland Air Route Traffic Control Center (ZOA), Los Angeles Air Route Traffic Control Center (ZLA), Santa Barbara Terminal Radar Approach Control Facility (SBA), Air Traffic Control System Command Center (ATCSCC), 30th Space Wing (30 SW)

Attachment

Contact Information

Name/Office/Function	Email	Phone
Oakland Center Operations Manager Oakland Center MOS	 9-AWP-ZOA-MOS@faa.gov	510 745-3331 510 745-3334
Los Angeles Center MOS Los Angeles Center Traffic Management Los Angeles Center Operations Manager	9-AWP-ZLA-MOS@faa.gov 9-AWP-ZLA-TMU@faa.gov	661-265-8249 661-575-2066 661 265-8205
Santa Barbara TRACON (SBA) SBA Airspace Spec.	AJT-SBA-ATM@faa.gov AJT-SBA-OS@faa.gov	805 681-0166 Recorded Line 805 681-0116 805 681-0534 ask for Airspace
30 Space Wing/2ROPS Airspace/Offshore Mgmt 30 SW Scheduling Office	2ROPS.DON@us.af.mil 2ROPS.DOS@us.af.mil	805-606-0002 805-606-8825
ATCSCC Space Operations Central Altitude Reservation Function (CARF) Challenger Space Operations Room Launch/Reentry Hotline National Operations Manager (NOM) (after hours, weekends and holidays)	9-AWA-AJR-Space.Ops@faa.gov 7-AWA-CARF@faa.gov	 540-422-4212 540-422-4053 540-359-3200, 2456# 540-359-3100 540-422-4100

APPENDIX Q
Notice of Availability for Public Review, Proof of Publication, and Proof of Delivery/Publication

Distribution Instructions: Please distribute NEPA documents, including the corresponding notice of availability (NOA), to the following points of contact (POCs) as indicated below. Send NOA only when indicated and ensure a hyperlink to the Draft EA is included in the NOA and in your email correspondence (as applicable). Please cc the SLD 30 NEPA POC on any email correspondence/notifications. Distribute hard copies to the libraries via personal delivery and obtain signed receipt. Please inform SLD 30 NEPA POC of any "return to sender" issues, change of preference for document type/delivery, or any individuals that would like to be removed from this list or need information updated.

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Attn: Chris Mobley
113 Harbor Way, Suite 150
Santa Barbara, CA 93l09
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NOAA - National Marine Fisheries Service
Southwest Regional Office
Attn: For Distribution
501 West Ocean Blvd
Long Beach, CA 90802-4213
NOA Only

National Park Service
Channel Islands National Park
Attn: Superintendent
1901 Spinnaker Drive
Ventura, CA 93001
NOA Only

U.S. Army Corps of Engineers
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Federal Aviation Administration (FAA)
Office of Commercial Space Transportation
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Washington, DC 20591
Email: Stacey.zee@faa.gov
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U.S. Coast Guard

U.S. Department of Transportation
Federal Aviation Administration (FAA)
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Washington, DC 20591
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U.S. Environmental Protection Agency, Region 9
Environmental Review Branch
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U.S. Fish and Wildlife Service
Ventura Fish and Wildlife Office
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State

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Central Coast Regional Water Quality Control Board - Central Coast Ambient Monitoring Program (CCAMP)
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California Environmental Protection Agency
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1001 I Street
P.O. Box 2815
Sacramento, CA 95812-2815
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California Office of Historic Preservation
Attn: Julianne Polanco
State Historic Preservation Officer
1725 23rd Street, Suite 100
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Office of the Governor
Office of Planning and Research
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1400 10th Street
Sacramento CA 95814
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260 N. San Antonio Road, Suite A
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Santa Ynez Band of Chumash Indians
Elders Council
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City of Lompoc
Economic & Community Development
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Libraries

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40 East Anapamu Street
Santa Barbara, CA 93101-2000
Hardcopy

Lompoc Public Library
501 East North Avenue
Lompoc, CA 93436
Hardcopy

Santa Maria Public Library
421 S. McClelland Street
Santa Maria, CA 93454
Hardcopy

Vandenberg Space Force Base Library
100 Community Loop, Building 10343A
Vandenberg SFB, CA 93437
Hardcopy

Requesting Entities

California Native Plant Society
Channel Islands Chapter
P.O. Box 6
Ojai, CA 93024-006
Email: cnpschannelislands@gmail.com
Electronic Copy

California Trout
Attn: Russell Marlow
290 Maple Court #140
Ventura, CA 93003
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Environmental Defense Center
Attn: Brian Trautwein
906 Garden Street
Santa Barbara, CA 93101
Email:
BTrautwein@EnvironmentalDefenseCenter.org
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La Purisima Audubon Society
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