Final

Environmental Impact Statement for Authorizing Changes to the Falcon Launch Program at Vandenberg Space Force Base, California

October 2025

Unique Identification Number: EISX–007–57–USF–1728547807

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for Authorizing Changes to the Falcon Launch Program

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PRIVACY ADVISORY

The Draft Environmental Impact Statement (EIS) was provided for public comment in accordance with the National Environmental Policy Act (NEPA), as amended by Public Law 118-5, the Fiscal Responsibility Act of 2023 (42 United States Code Section 4321 et seq.), and with the Department of Defense (DOD) NEPA Implementing Procedures.

The NEPA provides an opportunity for public input on Department of the Air Force (DAF) decision-making, allows the public to offer input on alternative ways for the DAF to accomplish what it is proposing, and solicits comments on the DAF's analysis of environmental effects.

Public input allows the DAF to make better, informed decisions. Letters or other written or verbal comments provided were published in the EIS. Providing personal information was voluntary. Private addresses were compiled to develop a stakeholders inventory. However, only the names of the individuals making comments and specific comments were disclosed. Personal information, home addresses, telephone phone numbers, and email addresses were not published in the EIS.

Compliance with Section 508 of the Rehabilitation Act

The digital version of this EIS and its project website are compliant with Section 508 of the Rehabilitation Act of 1973 because assistive technology (e.g., "screen readers") can be used to help the disabled to understand these electronic media. Due to the nature of graphics, figures, tables, and images occurring in the document, accessibility may be limited to a descriptive title for each item.

DEPARTMENT OF THE AIR FORCE
WASHINGTON DC

OFFICE OF THE ASSISTANT SECRETARY

October 10, 2025

MEMORANDUM FOR WHOM IT MAY CONCERN

FROM: SAF/IE
1665 Air Force Pentagon
Washington, DC 20330-1665

SUBJECT: Environmental Impact Statement for Authorizing Changes to the Falcon Launch Program at Vandenberg Space Force Base Certification of Page Limits and Deadline

This memorandum pertains to the Vandenberg Space Force Base (VSFB) Falcon Launch Program Environmental Impact Statement (EIS) (attached). In accordance with the National Environmental Policy Act (NEPA), 42 U.S.C. § 4321, et seq., the Department of the Air Force (DAF) has considered the factors mandated by NEPA in the preparation of this EIS.

I certify that the analysis within the EIS has been tailored to comply with page limits and deadlines. The EIS represents DAF's good-faith effort to prioritize and document the most important considerations required by NEPA within the congressionally mandated page limits and timeline. This prioritization reflects DAF's expert judgment. Considerations addressed briefly or unaddressed were, in DAF's judgment, to be comparatively unimportant or frivolous. The resulting EIS represents DAF's good-faith effort to fulfill NEPA's requirements within the Congressional timeline and such effort is substantially complete.

The analysis contained within the EIS is, in DAF's judgment, adequate to inform and reasonably explain the DAF's final decision regarding the proposed action for the VSFB Falcon Launch Program.

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MICHAEL E. SAUNDERS, P.E., SES, DAF
Acting Assistant Secretary of the Air Force
(Energy, Installations & Environment)

COVER SHEET

Responsible Lead Agency: Department of the Air Force

Cooperating Agencies: Federal Aviation Administration, U.S. Coast Guard

Title: Authorizing Changes to the Falcon Launch Program at Vandenberg Space Force Base, California

Inquiries: Information regarding the Environmental Impact Statement (EIS) is available on the website at www.VSFBFalconLaunchEIS.com. Questions can also be directed to ATTN: VSFB Falcon Launch EIS, c/o ManTech International Corporation, 420 Stevens Avenue, Suite 100, Solana Beach, CA 92075. For other inquiries, please contact Ms. Hilary Rummel, National Environmental Policy Act Project Manager, at info@VSFBFalconLaunchEIS.com or VSFB Public Affairs office by phone at 1–805–606–3595.

Designation: Final EIS

Abstract: The Department of the Air Force (DAF) has prepared this Final EIS in accordance with the National Environmental Policy Act, as amended by the Fiscal Responsibility Act of 2023 (Public Law 118-5; FRA); the DOD's NEPA Implementing Procedures; the DAF Policy for Implementation of NEPA (7 July 2025); Executive Order 14154 (*Unleashing American Energy*), and FAA Order 1050.1F (*Environmental Impacts: Policy and Procedures*). Under the Proposed Action, the DAF would authorize an increase in the annual Falcon launch cadence at Vandenberg Space Force Base (VSFB) through launch and landing operations at Space Launch Complex (SLC) 4 and SLC-6. The Proposed Action includes the DAF authorization of the modification of SLC-6 for Falcon 9 and Falcon Heavy launch vehicles to support future U.S. Government and commercial launch service needs. Modifications would include constructing commodity storage tanks, a vehicle erector, water tower(s), ground supporting equipment, a transport road with rail system from an existing horizontal integration facility (HIF) to the launch pad, and two new landing pads adjacent to SLC-6. The DAF would also authorize an increase in Falcon 9 launches from SLC-4. No modification of SLC-4 is proposed. The overall launch cadence for Falcon 9 and Falcon Heavy at both SLCs, combined, would be up to 100 launches per year. Falcon Heavy, which has not launched from VSFB in the past, would launch a maximum of five times per year from SLC-6.

This Final EIS evaluates the potential environmental impacts associated with the Proposed Action, Alternative 1 (the same activities described under the Proposed Action, but construction of a new hangar at SLC-6 instead of utilizing the existing HIF), and the No Action Alternative to the following resource areas: air quality, noise, biological resources, water resources, cultural resources, coastal resources, Department of Transportation Act section 4(f) resources, utilities, socioeconomics, transportation, human health and safety, hazardous materials and waste management, solid waste management, geology and soils, land use and aesthetics, light emissions, and visual resources/character, farmlands, natural resources, and wild and scenic rivers.

Public Review: A 45-day public review period of the Draft EIS took place starting 23 May 2025 and ending 7 July 2025. Three in-person public hearings were held on 10 June 2025, 11 June 2025, and 12 June 2025. A virtual hearing was conducted on 18 June 2025.

EIS Identification Number: EISX–007–57–USF–1728547807

SUMMARY

S.1 Introduction

This Final Environmental Impact Statement (EIS) has been prepared in accordance with the National Environmental Policy Act to analyze the potential environmental consequences associated with the following: (1) the Department of the Air Force (DAF)'s authorization of the redevelopment of Space Launch Complex (SLC)-6, an existing SLC on south Vandenberg Space Force Base (VSFB), to support Falcon 9 and Falcon Heavy operations, including launch and landing at VSFB; (2) DAF's authorization of an increase in Falcon 9 launches, landings, and static fire tests at VSFB and the addition of Falcon Heavy launches, landings, and static fire tests at VSFB; and (3) the Federal Aviation Administration's (FAA's) licensing Space Exploration Technologies Corporation's (SpaceX's) Falcon operations at VSFB and approval of related airspace closures. Redevelopment of SLC-6 would include constructing commodity storage tanks, a vehicle erector, water tower(s), ground supporting equipment, a transport road with rail system from an existing horizontal integration facility (HIF) to the launch pad, and two new landing pads adjacent to SLC-6. The DAF is the lead agency for the Proposed Action and is responsible for the scope and content of this EIS in accordance with (IAW) the Memorandum of Understanding between FAA and DAF. The FAA and United States (U.S.) Coast Guard (USCG) are cooperating agencies. The FAA is a cooperating agency because the scope of the Proposed Action includes the FAA's issuance of licenses along with potential license renewals and modifications for SpaceX operations analyzed in this EIS. In addition, the FAA must approve related airspace closures for launch operations. The USCG is a cooperating agency because of its role in maritime safety and regulatory authority over waters subject to jurisdiction of the U.S., pursuant to the Ports and Waterways Safety Act, 46 United States Code (USC) Section 700.

S.1.1 Purpose and Need

The purpose of the Proposed Action is to increase the space launch mission capability of the U.S. Department of Defense (DOD), the National Aeronautics and Space Administration, and other federal and commercial customers, and to enhance the resilience and capacity of the nation's space launch infrastructure, while promoting a robust and competitive national space industry. As directed by U.S. policy (10 USC Section 2273, "Policy regarding assured access to space: national security payloads"; see also Executive Order 14335, *Enabling Competition in the Commercial Space Industry* (Aug. 13, 2025)), the U.S. seeks to provide greater launch and landing capabilities and infrastructure to support national security objectives, including deploying satellites and other space assets that enable intelligence, reconnaissance, and global security operations. The U.S. aims to promote a hybrid space architecture that diversifies access to space, reduces dependency on singular systems, and ensures rapid reconstitution capabilities.

The Proposed Action is needed to meet current and near-term U.S. Government space launch requirements from the Western Range, specifically for medium and heavy-lift launches to polar and other orbits less reliably available elsewhere, without compromising current launch capabilities. The Proposed Action is also needed to expand launch capacity by returning heavy-lift launch capability to the Western Range and to fulfill (in part) 10 USC Section 2276(a), "Commercial space launch cooperation."

S.2 Proposed Action and Alternatives

S.2.1 Proposed Action

The Proposed Action is for the DAF to authorize an increase in the annual Falcon launch cadence at VSFB through launch and landing operations at SLC-4 and SLC-6, including construction and demolition (C&D) activities at SLC-6 for Falcon 9 and Falcon Heavy launch vehicles to support future U.S. Government and commercial launch service needs. The DAF would also authorize an increase in Falcon 9 launches from SLC-4. No modification of SLC-4 is proposed. The overall launch cadence for Falcon 9 and Falcon Heavy at both SLCs, combined, would increase from 50 to up to 100 launches per year. The Falcon Heavy, which has not launched from VSFB in the past, would launch and land up to five times per year from and at SLC-6. Under the Proposed Action, the DAF would authorize SpaceX to modify the existing HIF near SLC-6 to support launch operations at SLC-6, construct a road with rails between the launch pad and the HIF to move launch vehicles to the pad, and construct two new landing zones adjacent

to SLC-6 to support landing of first stage Falcon boosters launching from SLC-6. In addition, Space Launch Delta 30 would need to approve the Program on the range, including modifications to the Program. These modifications encompass changes to planning, construction, operations, and vehicle configurations.

The FAA's federal action is to issue or modify a vehicle operator license to authorize SpaceX commercial launches and landings at VSFB, described above. The FAA's federal action also includes the issuance of temporary airspace closures.

S.2.2 Alternative 1

Under Alternative 1, the DAF would implement the Proposed Action as described above, but rather than modifying the existing HIF, DAF would authorize SpaceX to construct a new approximately 62,000 square foot hangar north of the launch pad at SLC-6 to support Falcon 9 and Falcon Heavy integration and processing. A road with rails would be constructed between the launch pad and the hangar to transport launch vehicles to the pad. All other aspects of the Proposed Action would be identical.

S.2.3 No Action Alternative

Under the No Action Alternative, the DAF would not authorize any Falcon 9 or Falcon Heavy launches or landing operations at, or modifications to, SLC-6, nor would the DAF authorize additional Falcon 9 launches from SLC-4. The FAA would not modify or issue a vehicle operator license for Falcon operations at SLC-6 or an increase in Falcon 9 launches at SLC-4. Falcon 9 launches and landings would continue at SLC-4 as currently authorized. The No Action Alternative is the environmentally preferable alternative.

S.3 Affected Environment and Environmental Consequences

The Final EIS evaluates the potential effects of the Proposed Action, Alternative 1, and the No Action Alternative on the following resources: air quality, noise, biological resources, water resources, cultural resources, coastal resources, Department of Transportation Section 4(f) resources, utilities, socioeconomics, transportation, human health and safety, hazardous materials and waste management, solid waste management, and geology and soils. A summary of the findings for each of the resources is presented below.

S.3.1 Proposed Action

S.3.1.1 Air Quality: The Proposed Action would occur within three counties in California: Santa Barbara, Ventura, and Los Angeles. Construction would take place in Santa Barbara County, while operations would occur within all three counties. It was determined that the portion of Los Angeles County where the action would occur encompasses five nonattainment areas and two maintenance areas. It was also determined that the portion of Ventura County where the action would occur encompasses two nonattainment areas. Therefore, the air quality impact assessment is summarized separately for each county to ensure that each nonattainment or maintenance area is evaluated separately. Construction under the Proposed Action would result in the temporary addition of pollutants to the local airshed in Santa Barbara County. Implementation of the Proposed Action would generate air pollutant emissions from entrained dust, off-road equipment, vehicle emissions, architectural coatings, and asphalt pavement application. Entrained dust results from the exposure of earth surfaces to wind from the direct disturbance and movement of soil. Operations, which would increase under the Proposed Action with increased launch and landing cadence, would generate criteria pollutant and hazardous air pollutants emissions from mobile sources, including vehicle trips from passenger vehicles and heavy-duty trucks, marine vessels, booster launches and landings, launch vehicle processing, and off-road equipment used for maintenance. The net annual emissions of the Proposed Action within Santa Barbara, Los Angeles, and Ventura Counties would not exceed the DAF insignificance thresholds nor would they exceed the General Conformity Rule *de minimis* values. Therefore, annual net emissions are at levels so insignificant that they would not cause or contribute to an exceedance of one or more National Ambient Air Quality Standards.

S.3.1.2 Noise: C&D activities would temporarily increase noise levels at SLC-6. These activities are far removed from any human sensitive receptors. Sound levels decay with increasing distance. Noise from the C&D activities would be entirely limited to within the VSFB boundary, with the exception of explosives which would be used to aid in the removal of one existing structure. This would

result in a short impulsive sound, similar to those experienced during first stage landing events at SLC-4. Therefore, C&D activities at SLC-6 would not have a significant impact on the acoustic environment.

Launch and landing operations create engine noise and sonic booms. Noise levels would not exceed the Occupational Safety and Health Administration's (OSHA) thresholds for daily noise exposure limits. Residents within the area surrounding VSFB would likely hear launch engine noise and sonic booms during return landings at VSFB. Noise-induced structural vibration during launches and landings caused by rocket engine noise and sonic booms may cause annoyance to building occupants in and around Lompoc, CA. In southeastern Santa Barbara, Ventura, and northwestern Los Angeles Counties, residents would likely hear occasional sonic booms, which would vary in impact location and levels depending on mission trajectories and weather conditions, and may cause annoyance because of induced secondary vibrations, or "rattle" of objects within buildings.

Falcon 9 and Falcon Heavy launches and landings at SLC-4 and SLC-6 have the potential to cause damage to some structures depending on the overpressure levels the structures are exposed to as well as the construction quality and condition of the structures. Damage associated with noise and vibrations may occur to lightweight or brittle structural elements in poor condition, such as windows and plaster that are pre-cracked, prestressed, older and weakened, or poorly mounted; however, damage to windows and plaster in good condition and structural damage to buildings is not expected. Launches typically generate sonic booms over water which are not expected to damage structures. Booms in some areas may rarely exceed 4 pounds per square foot (psf). Damage to structures is unlikely below 2 psf, and more likely at 4 psf and above. Overall, while 4 psf sonic booms are more likely to cause damage compared to 2 psf, the extent of damage still depends on other factors, including the construction quality and maintenance of the structures.

A Community Noise Equivalent Level (CNEL) exceeding 65 A-weighted decibels (dBA; A-weighting is an adjustment applied to sound measurement to reflect how a noise is perceived by the human ear) is generally considered unacceptable for a residential neighborhood and is used to define the area of potentially significant noise impacts on communities. CNEL was estimated for projected launch, landing, and static fire test operations at SLC-4 and SLC-6. These estimates were made for each operation type (i.e., Falcon 9 launches, landings, and static fire tests at SLC-4 and SLC-6 and Falcon Heavy launches, landings, and static fire tests at SLC-6) and the results indicated that none of the operation types alone are expected to cause adverse community noise exposure using the CNEL 65 dBA. Additionally, when CNEL was assessed for the proposed maximum cadence which includes all combinations of these operation types assuming an almost equal distribution between night and day activities, noise exposure was still estimated to be less than CNEL 65 dBA in populated areas east of the VSFB property line. The CNEL 65 dBA contour is located entirely within the VSFB property and does not include residential land use. Therefore, the Proposed Action would not result in significant impacts related to noise and noise-compatible land use.

The C-weighted Day-Night Average Sound Level (CDNL) is similar to CNEL but computed with C-weighting, which has more emphasis placed on low frequencies below 1,000 hertz (Hz). This metric is used as a cumulative measure of noise events having lower frequency content and higher levels (e.g., sonic booms, large caliber weapons, and blast noise events). The cumulative sonic boom levels were estimated for the projected annual Falcon 9 and Falcon Heavy landing operations at SLC-4 and SLC-6. Conservatively estimating that all operations occurred at night, the maximum CDNL was estimated at 58.0 dBC. Since the FAA uses CDNL 60 dBC as the significance threshold for determining land use compatibility, the cumulative sonic boom levels from Falcon 9 and Falcon Heavy landing operations would be below the threshold for acceptable land use.

S.3.1.3 Terrestrial Biological Resources: Vegetation present within the construction area would be removed, resulting in a relatively small loss of native vegetation. Wildlife present within the C&D areas would also be at risk of injury and noise exposure from C&D activities. However, the DAF would implement environmental protection measures (EPMs) to minimize the risk of injury to any wildlife species. Rocket engine noise and sonic booms during launch and landing operations are the primary potential impact on sensitive species. The DAF completed formal consultation with the U.S. Fish and Wildlife Service (USFWS) under Section 7 of the Endangered Species Act (ESA) for 16 species listed as threatened or endangered. The USFWS issued a Final Biological Opinion (BO) on 21 August 2025. The Terms and Conditions and Reasonable and Prudent Measures identified during the Section

7 consultation with the USFWS and the resultant BO would be implemented. These measures would decrease the potential for long-term habitat and species loss, as well as adverse effects on reproductive success, mortality rate, or ability to sustain minimum population levels, such that there would be no significant impact.

S.3.1.4 Marine Biological Resources: The Proposed Action may also have impacts on marine species, including ESA-listed fish, turtles, cetaceans, and pinnipeds, as well as marine mammals protected under the Marine Mammal Protection Act (MMPA). The DAF conducted informal Section 7 consultation with National Marine Fisheries Service (NMFS), which concurred potential impacts may affect, but not likely to adversely affect ESA-listed species and issued a Letter of Concurrence on 17 April 2024. Pinnipeds at haulouts along the mainland coastline at VSFB, southeastern Santa Barbara, Ventura, northwestern Los Angeles Counties, and on the northern Channel Islands (NCI) would be disrupted by noise and visual disturbance associated with Falcon launches and landings up to 100 times per year under the Proposed Action. Through decades of monitoring and collaboration with NMFS, there are no substantial behavioral disruptions or anything more than temporary affects to the number of pinnipeds hauled out on VSFB and the Northern Channel Islands. Under the MMPA, NMFS issued a Final Rule for taking marine mammals incidental to VSFB launches. The Letter of Authorization (LOA) allows launch programs to unintentionally take small numbers of marine mammals by "Level B Harassment" (i.e., behavioral disruption) during launches. The Proposed Action would not result in exceedance of take thresholds as identified in the LOA. The DAF is required to comply with the LOA listed conditions and address NMFS concerns regarding marine mammals.

S.3.1.5 Water Resources: Potential impacts associated with C&D activities and operations on surface water, ground water, and jurisdictional wetlands were evaluated for the Proposed Action. EPMs would ensure that adequate sediment and erosion control best management practices (BMPs) are implemented to minimize or prevent any loss of surface soils. In compliance with Section 402 of the Clean Water Act (CWA), SpaceX would also obtain coverage under the National Pollutant Discharge Elimination System Construction General Permit and prepare and implement a Storm Water Pollution Prevention Plan (SWPPP). Wastewater discharges would continue to follow the conditions of the Regional Water Quality Control Board letter for Enrollment in the General Waiver of Waste Discharge Requirements. Water use to support the increased launch cadence would not have detectable impacts on the San Antonio Creek basin. Therefore, the Proposed Action would not have a significant impact on surface water or groundwater resources.

Under the Proposed Action, impacts on flow within the north drainage during construction could be avoided by completing any modifications to the drainage during the dry season and restoring drainage function prior to the onset of winter rains. Approximately 0.02 acres (ac) of the north drainage would be affected, which is currently impermeable concrete v-ditches and culverts. Since any disturbance would be temporary and the site has little ecological value, impacts on the north drainage would not be significant.

Approximately 0.01 ac of the south drainage, which is currently riprap line, would be temporarily disturbed. Impacts on the south drainage could be avoided by boring under the drainage, suspending the pipeline over the drainage, or completing construction during the dry season and restoring drainage function prior to the onset of winter rains. Because any disturbance would be temporary and it has little ecological value, impacts on the south drainage would not be significant.

A seep that occurs south of N Road would be filled in to construct the proposed landing zones and related infrastructure. Siting alternatives that avoid wetland impacts are not feasible and would not meet the purpose of and need for the Proposed Action. With the implementation of BMPs, no significant impacts on wetlands are anticipated.

S.3.1.6 Cultural Resources: The DAF considered the Proposed Action's potential impacts on prehistoric and historic sites, structures, artifacts, and any other physical or traditional evidence of human activity considered relevant to a particular culture or community for scientific, traditional, religious, or other reasons. Cultural resources include archaeological resources, historic architectural resources, and Native American sacred sites and traditional cultural properties. The only historic building located on VSFB that is not associated with launch complexes or supporting infrastructure is the former USCG Lifeboat Rescue Station. The centerpiece of the Colonial Revival style complex is the wood-frame three-story Administrative Barracks built in 1936. The building, which sports a substantial number of single-pane glass windows, has been subjected to many years of launches and boost-back

landings at SLC-4 as well as launches conducted at nearby SLC-6 with no reported or observed effect. Accordingly, there would be no effect on any National Register of Historic Places eligible resources in the built environment at VSFB from launch noise.

Built environment and archaeological resources could be subject to sonic booms of up to 4 and 5 psf. Specifically, the 2 psf and greater sonic boom impacts on the NCI which may reach as much as 5 psf over a very narrow portion of land on the NCI. However, a large portion of the NCI would be exposed to an overpressure no more than of 2–3 psf. Sonic booms are dependent on launch trajectory, inclination, and atmospheric conditions. The Proposed Action is not expected to result in a repeated alignment of the sonic boom overpressure footprint within specific areas and the duration of the overpressure effects are estimated to last less than one second per sonic boom. Previous studies, experimental analysis and observations of archaeological sites located on VSFB have provided good evidence that archaeological sites consisting of only surface artifacts or buried archaeological material do not have the potential to be affected by rocket engine noise exceeding 120 dB and sonic booms exceeding 2 psf. The DAF engaged with the California State Historic Preservation Office (SHPO) and Santa Ynez Band of Chumash Indians (SYBCI) over potentially affected historic properties. The SHPO concurred with the DAF's finding of no historic properties affected on 16 October 2024 and 6 February 2025. The SYBCI responded on 21 January 2025 that the Tribe had concerns the Proposed Action would affect a perceived traditional cultural landscape and therefore requested a site visit. The Installation Tribal Liaison Officer responded on 21 January 2025, requesting the Tribe schedule a site visit. As of certification of the Final EIS, the Tribe had not scheduled a site visit or identified any perceived potential effects. The Proposed Action would have no significant impact on cultural resources.

S.3.1.7 Coastal Resources: Because the Proposed Action is a Federal agency activity with the potential to affect coastal uses or resources, the DAF completed a Consistency Determination (CD) under the Coastal Zone Management Act (CZMA). VSFB property is statutorily excluded from the coastal zone. Downrange landings would occur outside of state waters, and would not occur within intertidal areas, salt marshes, estuaries, or coral reefs. The Proposed Action does not include any coastal construction nor seafloor disturbing activities. However, some effects from launch and landing (e.g., noise, public access restrictions) would occur within the California Coastal Zone. In addition, increased impervious surfaces could increase stormwater runoff; however, post-construction BMPs and stormwater management would minimize any potential effect. Based on the DAF's review of the CZMA and California's approved Coastal Management Program, the DAF determined that the Proposed Action is consistent to the maximum extent practicable with the enforceable policies of the California coastal management program. On 13 June 2025, the DAF submitted its CD to the California Coastal Commission (CCC). The CCC voted to object to the DAF's CD on 14 August 2025 and issued a letter of objection to the CD on 26 August 2025. Under the CZMA and its implementing regulations, the DAF may proceed with the Proposed Action over a CCC objection if it finds the Proposed Action is fully consistent with the enforceable policies of California's approved Coastal Management Program. See 15 CFR Section 930.43(d)(1)-(2).

S.3.1.8 Department of Transportation Section 4(f) Resources: Because there would be no physical use of any 4(f) properties, only constructive use is being determined. Constructive use occurs when the impacts of a project on a Section 4(f) resource are so severe that the activities, features, or attributes that qualify the property for protection under Section 4(f) are substantially impaired. Impacts on Jalama Beach County Park would result from occasional, temporary evacuation of the public during launch/landing events. Surf Beach and County of Santa Barbara Ocean Beach Park would only be closed up to 12 times per year. While some impacts on Jalama Beach County Park are unavoidable due to mission requirements, evacuations would not be issued for more than 12 launches. Given the formal evacuation agreement in place and the temporary nature of the closure, implementation of the Proposed Action would not substantially diminish the protected activities, features, or attributes of any Section 4(f) resources and therefore would not result in substantial impairment of the properties. There is no reasonable potential for launch-related noise to impair the majority of the Section 4(f) resources within the region of influence because a quiet setting is not part of the significant attributes or features qualifying these properties for protection under Section 4(f). Although launch trajectories overfly the Channel Islands National Park, impacts would not be significant to the point of impairing the activities, features, or attributes that qualify the Channel Island National Park for protection under Section 4(f).

S.3.1.9 Utilities: Impacts associated with utilities are related to changes in the supply (also referred to as capacity) or demand for a particular resource. As long as the capacity of a particular utility is higher than the demand for that resource, no impact occurs.

However, if the demand exceeds the capacity or if the demand is increased beyond the resource's projected rate of increase, an impact would occur, and the significance of the impact is determined based on the degree to which the capacity is strained. The DAF determined that existing infrastructure and utility capacity are adequate to support increased launch cadence and associated increased requirements for electricity and septic systems. The Proposed Action would not have a detectable effect on water supplies.

S.3.1.10 Socioeconomics: Launching and landing operations under the Proposed Action would result in moderate but positive economic benefits from increased demand in the existing workforce, higher revenues, and increased per capita income. SpaceX would continue to use its existing workforce for launching and landing activities. Ongoing commercial space activities at VSFB would continue to be an important economic generator for the local region and nearby counties. Recreational and commercial vessels transit and operate offshore of VSFB and may be affected by short-term warning areas during launches and landings, but these temporary closures of these areas for security and safety do not limit commercial or recreational fishing vessel access to or use of adjacent areas. Areas would be closed for the duration of the activity and reopened at the completion of the activity. The Proposed Action would not significantly affect the demand for local housing and the need for social services and support facilities.

S.3.1.11 Transportation: Given the low traffic volumes projected from increased operations, existing capacity of roadways at and near VSFB that would be affected by C&D activities on VSFB and nearby, and the relatively small and temporary increase in daily vehicle traffic that the Proposed Action would generate, no adverse effects on capacity would occur to transportation resources in the area. Increased oversized load transport is not expected to have a significant impact on operations on south VSFB, as these transports would utilize Coast Gate rather than Solvang Gate, which is the only point of access for routine traffic on south VSFB, and existing daily traffic volumes on south VSFB are low. Some oversized or commercial trucks may require additional inspection at the Lompoc Gate on north VSFB prior to transiting to south VSFB but this is not expected to have a significant impact on the operational level of service of VSFB roads. Trains that would pass through a launch vehicle flight path from VSFB would be temporarily stopped at safety hold points during launches to reduce potential risk to people and property. However, launch windows are typically instantaneous or several minutes; during longer launch delays VSFB communicates with railroad points of contact to allow trains to move through the affected area, thereby minimizing potential impacts on train schedules.

S.3.1.12 Human Health and Safety: An impact on Human Health and Safety would be considered significant if it were to create a potential public health hazard or to involve the improper use, production, or disposal of materials that pose a hazard to people in the affected area. An impact would also be considered significant if project activities were to pose a serious risk of fire, especially wildland fires, or were to involve potential obstruction of emergency response or evacuation routes in and around the project area. While adhering to these safety measures and procedures and EPMs, there would not be significant impacts on human health and safety as a result of the Proposed Action due to launch and landing operations. Modifications to SLC-6 would expose construction workers to hazards associated with C&D activities, including explosives. Contractors would be required to develop a site-specific safety plan that would address these potential hazards. Daily safety briefings would be conducted and workers would be expected to comply with federal OSHA and Air Force Occupational and Environmental Safety regulations. SpaceX would coordinate with VSFB staff to ensure DAF policies are incorporated into the site safety plan. SpaceX and its contractor(s) would be responsible for industrial hygiene and ground safety during SLC-6 construction and modification operations. While complying with industrial and ground safety procedures and EPMs, there would be no significant impacts on Human Health and Safety from the construction activities at SLC-6 under the Proposed Action.

S.3.1.13 Hazardous Materials and Waste Management: Compliance with all pertinent federal, state, and local laws and regulations, and applicable DAF and Space Launch Delta 30 plans, would govern all actions (i.e., C&D activities and launch and landing operations) associated with implementing the Proposed Action and would minimize the potential for significant impacts. Launch support operations would use a small amount of products containing hazardous materials, including petroleum, oil, and lubricants (POLs), paints, solvents, oils, lubricants, acids, batteries, and chemicals. SpaceX would also generate a small number of waste tires each year through "roll-on-roll-off" operations and other pad support equipment during routine launch support. Payload processing would generate a small amount of empty containers, spent solvents, waste oil, spill cleanup materials (if used), and lead-

acid batteries. Loading and unloading operations would take place over appropriately designed and sized containment basins, with spill prevention and emergency response procedures in place. Proper handling practices of liquid fuels would adhere to applicable federal regulations for liquid fuels and limit the risk of hazardous material releases due to leaking storage tanks, tanker trucks, delivery lines, or other infrastructure.

The relatively small amounts of hazardous materials needed and the waste generated by the Proposed Action would have little to no impact on waste processing capacity. EPMs would be implemented during implementation of the Proposed Action to avoid and reduce potential effects due to hazardous materials. Therefore, the Proposed Action would not have a significant impact due to using and generating hazardous materials and hazardous wastes.

S.3.1.14 Solid Waste Management: Solid waste generated during demolition would primarily include concrete, asphalt, and metal, much of which is recyclable. Construction wastes would include packing materials, scrap materials, and miscellaneous waste generated by onsite construction workers. Contractors would be responsible for the disposal or recycling of all waste generated during the scope of the C&D activities. During launch operations and facilities maintenance, solid waste would be disposed of routinely. Solid waste would be collected in on-site refuse containers and transported to the Santa Maria Transfer Station for waste disposal, diversion, and recycling. During C&D at SLC-6, sewage would be collected in temporary on-site portable toilets subject to spill-prevention EPMs and serviced by a commercial contractor. Before implementing the Proposed Action, the contractor would prepare a hazardous material Spill Prevention and Response Plan. Compliance with all applicable federal, state, local laws, and regulations, applicable DAF plans and policies, and EPMs, would govern all aspects of the Proposed Action, and would avoid or minimize potential impacts related to solid waste or pollution prevention. Therefore, the Proposed Action would not have a significant impact on solid waste management.

S.3.1.15 Geology and Soils: The Proposed Action would increase the extent of impervious areas at SLC-6 and the adjacent proposed Landing Zones. Activities with the potential to impact geology and soils would largely be associated with the removal of existing structures and construction of new structures. However, this area is largely previously disturbed from past construction activities and proposed soil disturbance is anticipated to be shallow. Coverage under the Construction General Permit is required and the DAF would prepare a SWPPP in accordance with this permit. The SWPPP would include erosion control measures. BMPs would also be implemented during ground-disturbing activities, and the EPMs would be implemented. Project construction and demolition would be designed to comply with seismic design standards. Implementation of Proposed Action would have no bearing on liquefaction. Thus, potential hazards due to liquefaction are not anticipated. As a result, no long-term or significant impacts on geological or soil resources from the Proposed Action are anticipated.

S.3.2 Alternative 1

Operations under Alternative 1 would be the same as the Proposed Action and would generate the same types and levels of impacts on all resources. The only differences between Alternative 1 and the Proposed Action is the construction of a new hangar, which would have minimal differences in terms of impacts on vegetation communities and water resources as a result of different construction footprints. Therefore, Alternative 1 would not result in significant impacts on any resource category.

S.3.3 No Action Alternative

Under the No Action Alternative, modifications of SLC-6 and increased Falcon launch cadence on VSFB would not occur, resulting in no new impacts on any resource categories. The FAA would not license Falcon operations at SLC-6 or an increase in Falcon 9 launches at SLC-4.

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APPENDICES

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ACRONYMS AND ABBREVIATIONS

2 ROPS/DON	2nd Range Operations Squadron
30 CES/CEIEA	SLD 30 Installation Management Flight, Environmental Conservation
ac	acre(s)
ACAM	Air Conformity Applicability Model
ac-ft	acre-feet
AFCEC	Air Force Civil Engineer Center
AFI	Air Force Instruction
AFOSH	Air Force Occupational Safety and Health
AHA	Aircraft Hazard Area
AOC	Area of Concern
AOI	Area of Interest
APE	Area of Potential Effects
AQMP	Air Quality Management Plan
ASA	Archeological Study Area
AST	Above Ground Storage Tank
BCC	Federal Bird Species of Conservation Concern
BGEPA	Bald and Golden Eagle Protection Act
bgs	Below Ground Surface
Blue Ridge	Blue Ridge Research and Consulting, LLC
BMP	Best Management Practice
BO	Biological Opinion
BP	Before Present
CAA	Clean Air Act
CalEEMod	California Emissions Estimator Model
Caltrans	California Department of Transportation
CCC	California Coastal Commission
CCR	California Code of Regulations
CCSFS	Cape Canaveral Space Force Station
CCMP	California Coastal Management Program
CCZ	California Coastal Zone
CD	Consistency Determination
C&D	construction and demolition
CDFW	California Department of Fish and Wildlife
CDNL	C-weighted DNL Average Noise Level
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CHNMS	Chumash Heritage National Marine Sanctuary
CINMS	Channel Islands National Marine Sanctuary
CNEL	Community Noise Equivalent Level
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_{2e}	Carbon Dioxide Equivalent
CRLF	California Red-Legged Frog
CRSA	Cultural Resources Study Area
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DAF	Department of the Air Force
DAFMAN	Department of the Air Force Manual
dB	decibels
dBA	A-weighted decibels
dBC	C-weighted decibels
DNL	Day-Night Average Sound Level
DOD	Department of Defense
DODI	Department of Defense Instruction
DOT	Department of Transportation
DPS	Distinct Population Segment
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMS	Environmental Management System
EO	Executive Order
EPM	Environmental Protection Measure
ERP	Environmental Restoration Program
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FAA	Federal Aviation Administration
FE	Federally Endangered
FICAN	Federal Interagency Committee on Aviation Noise
FONSI	Finding of No Significant Impact
FR	Federal Register
FRA	Fiscal Responsibility Act
FT	Federally Threatened
ft	foot/feet
ft^2	square feet
FWHA	Federal Highway Administration
FUT	Fixed Umbilical Tower
GAO	Government Accountability Office
GCR	General Conformity Rule
GHG	Greenhouse Gas
HAP	Hazardous Air Pollutants
HIF	Horizontal Integration Facility
HMMP	Hazardous Materials Management Process
HWMP	Hazardous Waste Management Plan
Hwy	Highway
Hz	hertz
IAW	In Accordance With
INRMP	Integrated Natural Resources Management Plan
IRP	Installation Restoration Program
ISWMP	Integrated Solid Waste Management Plan
ITLO	Installation Tribal Liaison Officer
km	kilometer(s)
KSC	Kennedy Space Center

kW-hr	kilowatt-hour
L_{Amax}	A-weighted maximum sound pressure level
L_{max}	unweighted maximum sound pressure level
L_{eq}	Equivalent Sound Level
L_{peak}	Highest Instantaneous Sound Level
lb(s)	pound(s)
LC	Launch Complex
LF	Launch Facility
LOA	Letter of Authorization
LOC	Letter of Concurrence
LOX	liquid oxygen
MAT	Mobile Assembly Shelter
mi	mile(s)
MBTA	Migratory Bird Treaty Act
MMPA	Marine Mammal Protection Act
MMRP	Military Munitions Response Program
MOU	Memorandum of Understanding
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSRS	ManTech SRS Technologies, Inc.
MST	Mobile Service Tower
N_2O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standards
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NCI	Northern Channel Islands
ND	Negative Determination
NEPA	National Environmental Policy Act
NH_3	Ammonia
NHPA	National Historic Preservation Act
nm	nautical mile(s)
NMFS	National Marine Fisheries Service
NMSA	National Marine Sanctuaries Act
NO_x	Nitrogen Oxides
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NOTAM	Notice to Airmen
NOTMAR	Notice to Mariners
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
O_3	Ozone
OSHA	Occupational Safety and Health Administration
P	Proposed for Listing Under the ESA
P2	Pollution Prevention
PA	percent awakenings
Pb	Lead
PHS	Pacific Harbor Seal
$PM_{2.5}$	Particulate Matter Less Than 2.5 microns (fine particulate matter)
PM_{10}	Particulate Matter Less Than 10 microns
POC	Point of Contact
POLs	Petroleum, Oil, and Lubricants
psf	pound(s) per square foot
RCRA	Resource Conservation and Recovery Act
RGF	Regional Growth Forecast
RHNA	Regional Housing Needs Allocation
ROI	Region of Influence
RORO	Roll-on-Roll-off
RP-1	Rocket Propellent
RWQCB	Regional Water Quality Control Board
SBCAG	Santa Barbara County Association of Governments
SBCAPCD	Santa Barbara County Air Pollution Control District
SCAB	South Coast Air Basin
SCAQMD	South Coast Air Quality Management District
SCCAB	South-Central Coast Air Basin
SE	State Endangered Species
SEA	Supplemental Environmental Assessment
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SLC	Space Launch Complex
SLD 30	Space Launch Delta 30
SLD 30/SEL	Space Launch Delta 30, Launch Safety
SMI	San Miguel Island
SO_X	Sulfur Oxides
SpaceX	Space Exploration Technologies Corporation
SPMT	Self-Propelled Modular Transporter
SR	State Route
SSC	California Species of Special Concern
ST	State Threatened Species
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
SYBCI	Santa Ynez Band of Chumash Indians
TBD	To Be Determined
TP	Test Pad
tpy	tons per year
UFC	Unified Facilities Criteria
ULA	United Launch Alliance
UPRR	Union Pacific Railroad
U.S.	United States
USC	United States Code
USCG	U.S. Coast Guard
USEPA	U.S. Environmental Protection Agency

USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USSF	U.S. Space Force
UST	Underground Storage Tank
UXO	Unexploded Ordnance
VCAPCD	Ventura County Air Pollution Control District
VSFB	Vandenberg Space Force Base
VSMR	Vandenberg State Marine Reserve
VOC	Volatile Organic Compound
WOTUS	Waters of the United States

1 PURPOSE OF AND NEED FOR THE PROPOSED ACTION

1.1 Introduction and Background

The Department of the Air Force (DAF) is evaluating the potential environmental effects associated with DAF's authorization of the redevelopment of Space Launch Complex (SLC)–6 to support Falcon 9 and Falcon Heavy operations, including launch and landing at Vandenberg Space Force Base (VSFB); DAF's authorization of an increase in Falcon 9 launches and landings at VSFB and downrange landings in the Pacific Ocean; and the Federal Aviation Administration's (FAA's) licensing Space Exploration Technologies Corporation's (SpaceX) Falcon operations at VSFB and approval of related airspace closures.

The DAF is the lead agency for the Proposed Action and is responsible for the scope and content of this Environmental Impact Statement (EIS) in accordance with (IAW) the Memorandum of Understanding (MOU) between FAA and DAF.[1] The FAA and United States (U.S.) Coast Guard (USCG) are cooperating agencies.

The FAA is a cooperating agency because the scope of the Proposed Action includes the FAA's issuance of licenses along with potential license renewals and modifications for SpaceX Falcon non-Department of Defense (DOD) operations and approval of related airspace closures. The FAA's regulatory responsibilities concerning commercial space operations generally are mainly derived from the Commercial Space Launch Act of 1984, as amended and codified at 51 United States Code (USC) Sections 50901–50923, which authorizes the Secretary of Transportation to oversee, license, and regulate commercial launch and reentry activities, and the operation of launch and reentry sites within the United States or as carried out by U.S. citizens. Section 50905 directs the Secretary of Transportation to exercise this responsibility consistent with public health and safety, safety of property, and the national security and foreign policy interests of the United States. In addition, Section 50903 requires the Secretary of Transportation to encourage, facilitate, and promote commercial space launches and reentries by the private sector. As codified at 49 Code of Federal Regulations (CFR) Section 1.83(b), the Secretary of Transportation has delegated authority to carry out these functions to the FAA Administrator.

The USCG is a cooperating agency because of its role in maritime safety and regulatory authority over waters subject to jurisdiction of the U.S., pursuant to the Ports and Waterways Safety Act, 46 USC Section 700. The USCG also has regulatory authority of U.S. and foreign flagged vessels as outlined in Title 46 of the CFR and has a requirement to review and advise Space Launch Delta 30 (SLD 30) on all launch and reentry site evaluation risk assessments with a focus on vessel navigation safety.

This EIS assesses the potential environmental, social, economic, historic, and cultural impacts of the Proposed Action and alternatives and was prepared IAW the National Environmental Policy Act (NEPA), as amended by the Fiscal Responsibility Act of 2023 (Public Law 118-5; FRA); the DOD NEPA Implementing Procedures; the DAF Policy for Implementation of NEPA (7 July 2025); Executive Order (EO) 14154 (*Unleashing American Energy*), and FAA Order 1050.1F, *Environmental Impacts: Policy and Procedures*[2]. The DAF and FAA are aware that the President of the United States has issued EO 14154, *Unleashing American Energy*, which revoked EO 11991, which amended EO 11514. The Council on Environmental Quality (CEQ) has rescinded the CEQ NEPA regulations, effective 11 April 2025.

Implementation of the Proposed Action would support the DAF's statutory obligation to ensure capabilities to launch and insert necessary national security payloads into space (10 USC Section 2273). This would be accomplished through

[1] https://www.faa.gov/media/28501 .

[2] On 30 June 2025, FAA rescinded FAA Order 1050.1F and issued FAA Order 1050.1G, FAA National Environmental Policy Act Implementing Procedures, to update FAA's NEPA implementing procedures. See Notice of Rescission of FAA Order 1050.1F, Availability of FAA Order 1050.1G, Request for Comments, 90 FR 29,615 (3 July 2025). Because the preparation of this EIS was already underway when this revision to FAA Order 1050.1 took place, and because this revision does not change the analysis of environmental effects for this proposed action, this EIS continues to reference FAA Order 1050.1F.

Falcon operations at VSFB, including Falcon Heavy, with a focus on heavy-lift missions supporting the DAF, DOD, and other National Security Space Launch requirements and objectives. SpaceX currently launches U.S. Government and commercial payloads using the Falcon 9 from SLC-4. SpaceX supports, and is under contract for, the full spectrum of U.S. Government space mission requirements, including spacecraft launches for National Aeronautics and Space Administration (NASA) and the DOD. The introduction of Falcon Heavy at SLC-6 would return heavy-lift capability at VSFB to the U.S. Government, which has been absent since the final flight of Delta IV Heavy in 2022. Falcon Heavy has been successfully launching from Launch Complex (LC)-39A at Kennedy Space Center (KSC) since 2018.

The FAA's federal action is to issue licenses to SpaceX for Falcon operations at VSFB per 14 CFR Part 400, along with potential renewals and modifications to the license within the scope of operations analyzed in this EIS. SpaceX currently operates at SLC-4 under launch license LLO 18-111. In addition, the FAA must approve related airspace closures for launch and landing operations. After completion and acceptance of the NEPA process, the FAA may issue its own Record of Decision to support the issuing, modifying, or renewing of a license to SpaceX and approving related airspace closures. The FAA will draw its own conclusions from the analysis presented in this EIS and assume responsibility for its environmental decisions and any related mitigation measures. For the FAA to fully adopt this analysis to support its determination without supplementation, the EIS must meet the requirements of FAA Order 1050.1F, which contains the FAA's policies and procedures for compliance with NEPA. Successfully completing the environmental review process does not guarantee that the FAA would license SpaceX operations or approve related airspace closures.

The DAF most recently assessed the environmental impacts of Falcon 9 launches at SLC-4, downrange landings in the Pacific Ocean, and first-stage landings at VFSB in the 2024 *Final Environmental Assessment for Falcon 9 Cadence Increase at Vandenberg Space Force Base, California* (2024 Environmental Assessment [EA]*;* DAF 2024a). The 2024 EA contains a summary of prior environmental documentation for Falcon 9 at VSFB; this document is incorporated by reference in this EIS where applicable.

Although never implemented at VSFB, the DAF previously analyzed Falcon Heavy operations at SLC-4 in the *Final Environmental Assessment for Falcon 9 and Falcon Heavy Launch Vehicle Programs from Space Launch Complex 4 East, Vandenberg Air Force Base, California* (2011 EA; DAF 2011). The 2011 EA is incorporated by reference in this EIS where applicable.

The FAA, with the DAF as a cooperating agency, most recently analyzed Falcon Heavy operations at LC-39A in the *Final Environmental Assessment and Finding of No Significant Impact for SpaceX Falcon Launches at Kennedy Space Center and Cape Canaveral Air Force Station* (2020 EA; FAA 2020a). The 2020 EA is incorporated by reference where applicable.

SLC-6 was constructed to support the DAF Titan program and then modified for the NASA and DAF Space Shuttle program; however, both programs were cancelled prior to their scheduled first launch at VSFB. SLC-6 was reactivated in the 1990's to support the Lockheed Martin Athena program. The DAF prepared the *Final Environmental Impact Statement for the Evolved Expendable Launch Vehicle Program* (DAF 1998) and *Supplemental Environmental Impact Statement for the Evolved Expendable Launch Vehicle Program* (DAF 2000) analyzing environmental impacts of launch pad modifications and Delta IV launches at SLC-6. Delta IV launches occurred from 2006 to 2022 under Boeing and then United Launch Alliance (ULA) in medium and heavy configurations, for a total of ten missions.

To cut down on bulk without impeding agency and public review of the Proposed Action, the following documents are incorporated by reference and their relevance is discussed throughout the EIS where these documents are referenced:

- *Final Environmental Assessment Falcon 9 Cadence Increase at Vandenberg Space Force Base, California* (2024 EA; DAF 2024a).[3] DAF issued a Finding of No Significant Impact (FONSI) and an amended FONSI.

[3] https://www.vandenberg.spaceforce.mil/About-Us/Environmental/EAS/

- *Final Supplemental Environmental Assessment Falcon 9 Cadence Increase at Vandenberg Space Force Base, California and Offshore Landing Locations* (2023 Supplemental Environmental Assessment [SEA]; DAF 2023).[4] DAF issued a FONSI.
- *Final Environmental Assessment and Finding of No Significant Impact for SpaceX Falcon Launches at Kennedy Space Center and Cape Canaveral Air Force Station* (FAA 2020a).[5] The FAA issued a FONSI.
- *Final Supplemental Environmental Assessment Launch, Boost-Back, and Landing of the Falcon 9 at Vandenberg Air Force Base, California and Offshore Landing Contingency Options* (2018 SEA; DAF 2018).[6] DAF issued a FONSI.
- *Final Environmental Assessment and Finding of No Significant Impact Boost-Back and Landing of the Falcon 9 Full Thrust First Stage at SLC-4 West Vandenberg Air Force Base, California and Offshore Landing Contingency Option* (2016 EA; DAF 2016).[7] DAF issued a FONSI.
- *Final Environmental Assessment for Launch of NASA Routine Payloads on Expendable Launch Vehicles* (2011 NASA EA; NASA 2011).[8] NASA issued a FONSI.
- *Final Environmental Assessment for Falcon 9 and Falcon 9 Heavy Launch Vehicle Programs from Space Launch Complex 4 East, Vandenberg Air Force Base, California* (2011 EA; DAF 2011).[9] DAF issued a FONSI.

These documents were reviewed to identify any changes in existing conditions or expected effects that have occurred since their publication. Any changes that were identified are incorporated into this EIS.

1.2 Purpose of Action

The purpose of the Proposed Action is to increase the space launch mission capability of the U.S. DOD, NASA, and other federal and commercial customers, and to enhance the resilience and capacity of the nation's space launch infrastructure, while promoting a robust and competitive national space industry. As directed by U.S. policy (10 USC Section 2273, "Policy regarding assured access to space: national security payloads"; see also see also Executive Order 14335, *Enabling Competition in the Commercial Space Industry* (Aug. 13, 2025)[10], the U.S. seeks to provide greater launch and landing capabilities and infrastructure to support national security objectives, including deploying satellites and other space assets that enable intelligence, reconnaissance, and global security operations. The U.S. aims to promote a hybrid space architecture that diversifies access to space, reduces dependency on singular systems, and ensures rapid reconstitution capabilities.

1.3 Need for Action

The Proposed Action is needed to meet current and near-term U.S. Government space launch requirements from the Western Range[11], specifically for medium and heavy-lift launches to polar and other orbits less reliably available elsewhere, without compromising current launch capabilities. The Proposed Action is also needed to expand launch

[4] https://www.vandenberg.spaceforce.mil/Portals/18/documents/Environmental/EIAP-2023-05-1_SEA_SpaceX_Falcon9CadenceIncrease.pdf?ver=gslu4FWj4nqnZsbyzmodpA%3d%3d

[5] https://drs.faa.gov/browse/excelExternalWindow/DRSDOCID1266190960202312081602080001?modalOpened=true

[6] https://www.vandenberg.spaceforce.mil/Portals/18/documents/Environmental/EIAP-2018-01-31_SEA_Falcon9_Launch-Boost-back.pdf?ver=kTLZUufAucxBEFEzzsQIAw%3d%3d

[7] https://www.vandenberg.spaceforce.mil/Portals/18/documents/Environmental/EIAP-2016-04-1_EA_Falcon9_Boost-back.pdf?ver=ICyyMrxyiTGXagCmf29TXA%3d%3d

[8] https://netspublic.grc.nasa.gov/main/FINAL%20NASA%20Routine%20Payload%20EA.pdf

[9] https://www.vandenberg.spaceforce.mil/Portals/18/documents/Environmental/EIAP-2011-03-1_EA_Falcon9-SLC-4E.pdf?ver=ltWVg_TKsa8haZ0zvhdM6A%3d%3d

[10] https://www.federalregister.gov/documents/2025/08/19/2025-15822/enabling-competition-in-the-commercial-space-industry

[11] The Western Range is the DOD space launch range that supports launches centered at Vandenberg Space Force Base.

capacity by returning heavy-lift launch capability to the Western Range. Finally, the Proposed Action is needed to fulfill (in part) 10 USC Section 2276(a), "Commercial space launch cooperation," authorizing the Secretary of Defense to:

- Maximize the use of the capacity of the space transportation infrastructure of the DOD by the private sector in the U.S.;
- Maximize the effectiveness and efficiency of the space transportation infrastructure of the DOD;
- Reduce the cost of services provided by the DOD related to space transportation infrastructure and launch support facilities and space recovery support facilities;
- Encourage commercial space activities by enabling investment by covered entities in the space transportation infrastructure of the DOD; and
- Foster cooperation between DOD and covered entities[12].

The public's interest in commercial space, as identified in the National Space Policy[13], largely intersect with the government interests identified, including greater mission capability for space exploration, and advancing reliable and affordable access to space which in turn advances the scientific and national security benefits of the U.S. space program as a whole.

1.4 Interagency/Intergovernmental Coordination and Consultations

1.4.1 Government to Government Consultation

IAW Section 106 of the National Historic Preservation Act (NHPA), EO 13175, DOD Instruction 4710.02, "DOD Interactions with Federally Recognized Tribes," and the DAF Instruction 90-2002, "Air Force Interaction with Federally Recognized Tribes," the U.S. Space Force (USSF) engaged with the Santa Ynez Band of Chumash Indians (SYBCI). The SYBCI responded on 21 January 2025, that the Tribe has concerns the Proposed Action would affect a perceived traditional cultural landscape and therefore requested a site visit. The Installation Tribal Liaison Officer (ITLO) responded on 21 January 2025, requesting the Tribe schedule a site visit at their earliest convenience. On 29 January 2025, the Tribe requested a site visit for 26 or 27 February. The ITLO confirmed either date would work and requested the Tribe cement a date and identify perceived potential effects. The Tribe responded on 29 January 2025, stating they would schedule a site visit, discuss internally and respond. The ITLO contacted the Tribe again on 7 February 2025, to solicit comment. The Draft EIS was provided to the Tribe on 23 May 2025 for their review and comment. No response was received. As of certification of the Final EIS, the Tribe has not scheduled a site visit or identified any perceived potential effects. A copy of the tribal letter is included in Appendix A.

1.4.2 Interagency Coordination

During the development of this EIS, DAF coordinated with various local, state, and federal agencies regarding the Proposed Action and will continue to coordinate with these agencies as required.

IAW Section 106 of the NHPA, DAF engaged with the California State Historic Preservation Office (SHPO) and SYBCI over potentially affected historic properties. The SHPO concurred with the DAF's finding of no historic properties affected on 16 October 2024 and 6 February 2025 (see Appendix A and Section 3.8).

IAW Section 7 of the Endangered Species Act (ESA), DAF engaged with the United States Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). The DAF initiated Section 7 consultation with the USFWS on 9 April 2025 (see Appendix B and Section 3.5), and on 21 March 2024 with the NMFS. The USFWS issued a Biological Opinion (BO) on 21 August 2025 (Appendix B). NMFS issued a Section 7 Letter of Concurrence (LOC) on 17 April 2024 (Appendix C). The Proposed Action would be covered under DAF's April 2024 Letter of Authorization

[12] "Covered entity" means a non-Federal entity that is organized under the laws of the U.S. or of any jurisdiction within the U.S. and is engaged in commercial space activities.

[13] https://trumpwhitehouse.archives.gov/wp-content/uploads/2020/12/National-Space-Policy.pdf

(LOA) from NMFS under the Marine Mammal Protection Act (MMPA). The LOA allows specified launch programs to unintentionally take small numbers of marine mammals, limited to Level B harassment (behavioral harassment) as defined in the MMPA. On 7 January 2025, NMFS concurred that any marine mammal take from sonic booms impacting coastal mainland California in southeastern Santa Barbara, and Ventura Counties was not likely to exceed the number of authorized takes in the LOA and determined that modifying the LOA was not warranted (see Appendix C and Section 3.6).

Pursuant to the Coastal Zone Management Act (CZMA), DAF prepared a Consistency Determination (CD) and submitted it to the California Coastal Commission (CCC) on 13 June 2025 (see Section 3.9). The CCC voted to object to the DAF's CD on 14 August 2025 and issued a letter of objection to the CD on 26 August 2025. Under the CZMA and its implementing regulations, the DAF may proceed with the Proposed Action over a CCC objection if it finds the Proposed Action is fully consistent with the enforceable policies of California's approved Coastal Management Program. See 15 CFR Section 930.43(d)(1)-(2).

IAW the Department of Transportation Act of 1966, now codified at 49 USC Section 303, DAF coordinated with the FAA regarding compliance with Section 4(f), which pertains to potential effects on public recreational resources, wildlife refuges, and historic sites.

1.5 Public Participation

A variety of public involvement activities, tools, and techniques were used to engage the public and agencies during the EIS process, including:

- Project website (https://vsfbfalconlauncheis.com/),
- In-person and virtual public meetings during the public scoping period and public hearings during the Draft EIS review period,
- Letters mailed to stakeholders announcing meetings and general project information,
- Newspaper advertisements soliciting public input and announcing document availability and public involvement opportunities, and
- Social media posts and press releases.

Comments and responses to substantive comments can be found in Appendix E.

1.5.1 Notice of Intent

The DAF published the Notice of Intent (NOI) to prepare an EIS in the *Federal Register* (FR) on 13 December 2024. Notices were also published in local and regional newspapers to inform the public and government agencies of the EIS and announce the scoping comment period and meetings. The newspaper notices were provided in English and Spanish.

Pursuant to EO 11990 and EO 11988, and the Department of the Air Force Manual (DAFMAN) 32-7003, DAF requested public comments during scoping to determine if there were any public concerns regarding the Proposed Action's potential impact to floodplains and wetlands and seek input on potential alternatives. The NOI also informed the public of this requirement.

1.5.2 Scoping

Three in-person scoping meetings were held at the following dates, times, and locations:

- 14 January 2025 (5:00 p.m.–8:00 p.m. Pacific Time), Veterans of Foreign Wars Post 1679, Ventura, CA
- 15 January 2025 (5:00 p.m.–8:00 p.m. Pacific Time), Westside Neighborhood Center, Santa Barbara, CA
- 16 January 2025 (5:00 p.m.–8:00 p.m. Pacific Time), Dick DeWees Community Center, Lompoc, CA

The locations and times were published in local newspapers (Lompoc Record, Los Angeles Times, Ojai Valley News, Santa Barbara Independent, Santa Maria Times, and Ventura County Star) and on the EIS website a minimum of 15 days prior to the meetings. A virtual meeting was conducted online at 6:00 p.m. Pacific Time on 23 January 2025. The meetings provided an opportunity for attendees to learn more about the preliminary description of the Proposed Action and Alternatives and provide an early and open process to assist the DAF and its Cooperating Agencies in determining the scope of issues for analysis in the EIS, including identifying significant environmental issues and those which can be eliminated from further study. During the in-person scoping meetings, project team members were available to provide information about the Proposed Action, and there was an opportunity to provide oral and written comments. Scoping meeting materials were provided in English and Spanish. A summary of the scoping process is included in Appendix E.

1.5.3 Public Hearings

Three in-person public hearings were held at the following dates, times, and locations:

- 10 June 2025 (5:00 p.m.–8:00 p.m. Pacific Time), Four Points by Sheraton/Ventura Harbor Resort, 1050 Schooner Dr., Ventura, CA 93001
- 11 June 2025 (5:00 p.m.–8:00 p.m. Pacific Time), Santa Barbara Museum of Natural History, 2559 Puesta del Sol, Santa Barbara, CA 93105
- 12 June 2025 (5:00 p.m.–8:00 p.m. Pacific Time), Hilton Garden Inn, 1201 North H St., Lompoc, CA 93436

The locations and times were published in local newspapers (Lompoc Record, Los Angeles Times, Ojai Valley News, Santa Barbara Independent, Santa Maria Times (English and Spanish), and Ventura County Star) and on the EIS website a minimum of 15 days prior to the hearing. A virtual hearing was conducted online at 6:00 p.m. Pacific Time on 18 June 2025. The hearing provided an opportunity for attendees to learn more about the Draft EIS and provide an open process to assist the DAF and its Cooperating Agencies in determining the additional issues for analysis in the Final EIS, including identifying significant environmental issues not analyzed in the Draft EIS. During the in-person public hearings, project team members were available to provide information about the Draft EIS, and there was an opportunity to provide oral and written comments. Public hearing materials were provided in English and Spanish. A summary of the Draft EIS review period and hearings, along with response to comments received on the Draft EIS, is included in Appendix E.

2 ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 Proposed Action

The Proposed Action is to increase the annual Falcon launch cadence at VSFB through launch and landing operations at SLC-4 and SLC-6, including modification of SLC-6 for Falcon 9 and Falcon Heavy launch vehicles to support future U.S. Government and commercial launch service needs. The DAF would also authorize an increase in Falcon 9 launches from SLC-4. No modification of SLC-4 is proposed. The overall launch cadence for Falcon 9 and Falcon Heavy at both SLCs, combined, would be up to 100 launches per year. The Falcon Heavy, which has not launched from VSFB in the past, would launch and land up to five times per year from and at SLC-6. The locations of SLC-4 and SLC-6 on VSFB can be seen in Figure 2.1-1.

The FAA's federal action is to license SpaceX's commercial launches and landings at VSFB, described above. The FAA's federal action also includes the issuance of temporary airspace closures. In addition, Space Launch Delta 30 would need to approve the Program on the range, including modifications to the Program. These modifications encompass changes to planning, construction, operations, and vehicle configurations.

2.1.1 Launch Vehicle

SpaceX would continue to launch Falcon 9 from SLC-4 and when modified, from SLC-6. Falcon Heavy would only launch from SLC-6. Falcon 9 is approximately 229 feet (ft) tall and produces approximately 1.7 million pounds (lbs) of thrust at liftoff, and utilizes Rocket Propellant-1 (RP-1) and liquid oxygen (LOX) as propellants (Figure 2.1-2). The Falcon 9 first stage booster has four deployable landing legs which are locked against the first stage during ascent. These legs are used on missions that include first stage landings downrange or at VSFB. Four grid fins near the top of the first stage support precision reentry and landing operations. The grid fins help align the first stage booster for reentry after separating from the rest of the launch vehicle in space.

Falcon Heavy is a heavy-lift vehicle, also approximately 229 ft tall, that produces 5.13 million lbs of thrust at liftoff. Merlin engines are used on both stages of Falcon Heavy. The center core and two side boosters are essentially the same design as a Falcon 9 first stage booster; thus, Falcon Heavy uses the same type of propellants as Falcon 9. Additionally, Falcon Heavy uses the same second stage as Falcon 9. A comparison of Falcon 9 and Falcon Heavy is shown in Figure 2.1-2. No modifications are proposed to Falcon 9 compared to the 2024 EA (DAF 2024a) and Falcon Heavy compared to the 2020 EA (FAA 2020a).

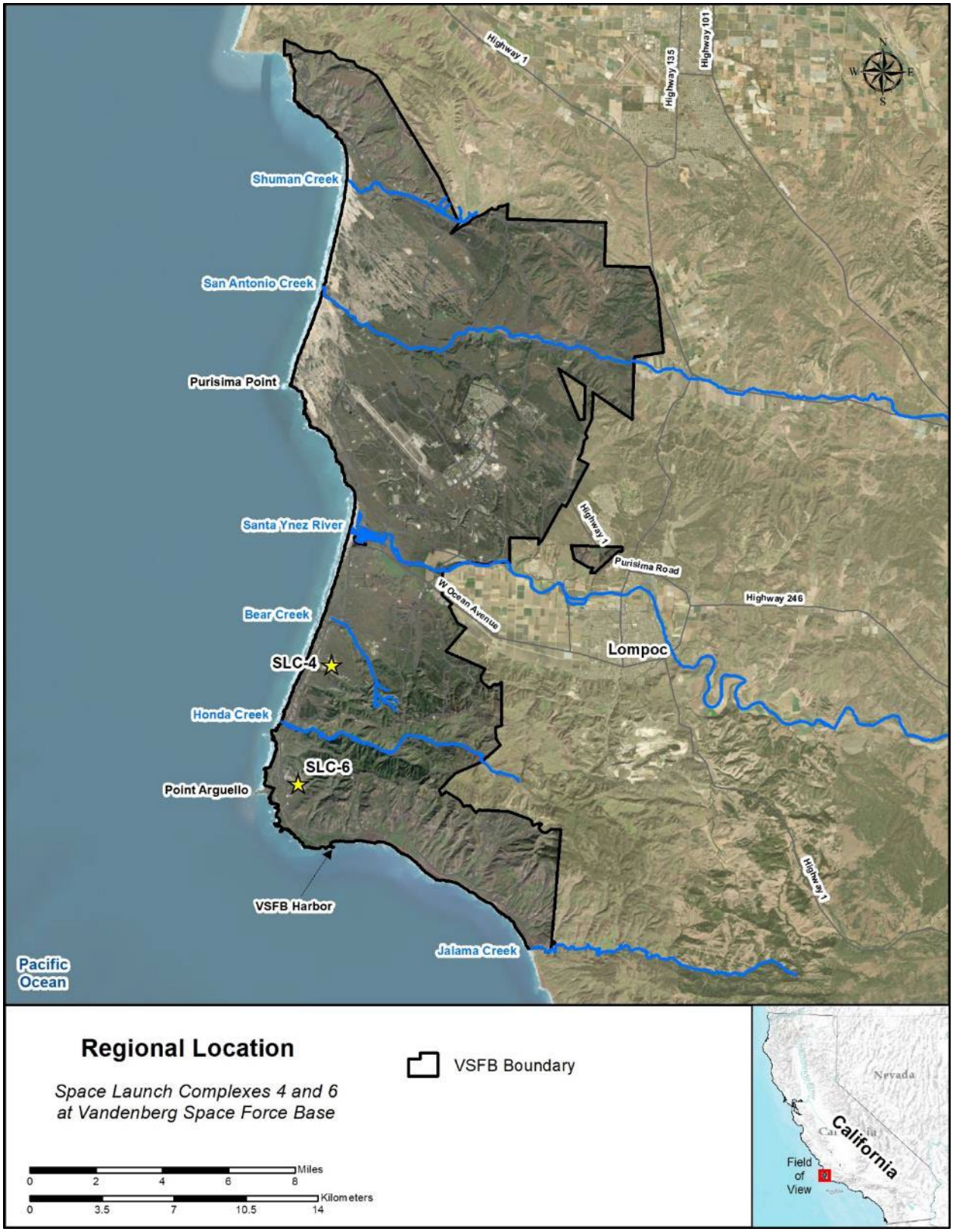

Figure 2.1-1. Project Location Map

Figure 2.1-2. Falcon 9 and Falcon Heavy Launch Vehicles

2.1.2 Launch and Landing Operations

SpaceX would conduct launch operations in the same way as described in Section 2.2 of the 2018 SEA (DAF 2018) and previous environmental documents. One to three days before each launch, an engine static fire test, which lasts a few seconds, may be performed. The need to conduct a static fire test depends on the mission, but there would be no more than 50 static fire events across the program per year. Due to weather conditions, orbital mechanics (i.e., destination orbit, inclination, eccentricity, and altitude), airspace considerations, and range availability, launch operations could occur at any time of day or night and at any time during the year. The DAF is working to adjust many launch times to occur between 6 a.m. and 10 p.m. However, some missions can only be launched outside of these hours because of mission-specific technical, orbital, safety, and regulatory factors. The Earth's rotation and the required payload orbital plane alignment constrain launch opportunities within a day. Launches could occur from both launch pads on the same day. Following each launch, SpaceX would perform a landing of the first stage(s), either downrange on a droneship or at landing zones at VSFB. Mission objectives may occasionally require expending the first stage booster(s) within the recovery area in the Pacific Ocean (Figure 2.1-3), as described in Section 2.1.2.4.

Typically, five weather balloons are released prior to each launch to measure wind speed. The data are used to create wind profiles that help determine if it is safe to launch and land the vehicle. A radiosonde, the size of a half-gallon milk carton, is attached to each weather balloon to measure and transmit atmospheric data to the launch operator. The latex balloon rises to approximately 20– 30 kilometers (km) above Earth's surface and bursts. The radiosonde and shredded balloon pieces fall back to Earth and are not recovered. The radiosonde does not have a parachute and is expected to sink to the ocean floor.

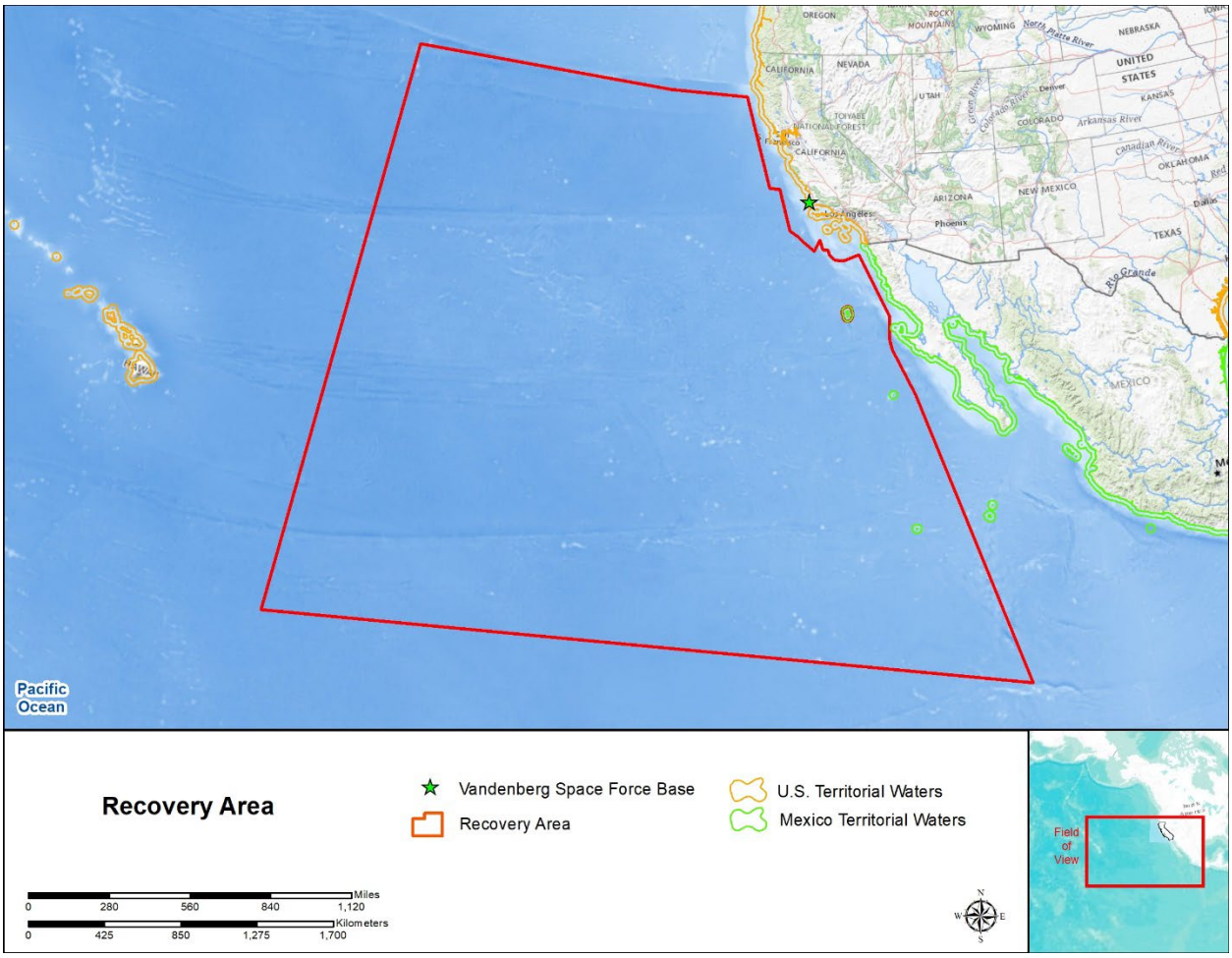

Figure 2.1-3. Recovery Area

2.1.2.1 Launch Safety

SpaceX, the DAF, the FAA, and the USCG implement numerous protocols and procedures to assess, avoid, mitigate, and minimize potential risks to public safety and the environment during space launch, which are discussed throughout this EIS. The Falcon launch vehicle is proven as one of the most reliable space launch vehicles ever developed, with a launch success rate of over 99 percent covering over 400 launches since June 2010. Due to the Falcon 9 and Falcon Heavy vehicle success rate, launch failure would be an extremely low probability and would represent an off-nominal, worst-case scenario and is not assessed in detail for these reasons. SpaceX implements an Operations Safety Plan at SLC-4, and in the event of a launch failure, SpaceX would activate an Emergency Action Plan. SpaceX would develop an Operations Safety Plan and Emergency Action Plan that includes SLC-6.

2.1.2.1.1 Shipping Lanes

The Proposed Action does not include altering the dimensions of shipping lanes. USCG District Southwest was granted specific regulatory authority to restrict vessel movement, implement safety and warning zones, and provide early warning advisement, but all responsibility to limit risk to navigation safety is solely on SpaceX. USCG District Southwest would continue to advise SpaceX and SLD 30 when the risk exceeds acceptable levels, and SpaceX would be responsible for minimizing the risk with alternate strategies before formal publications. VSFB is the headquarters of SLD 30, which manages all space launch operations from the Western Range. Federal government agencies, including the USCG, are responsible for ensuring maritime safety as required by applicable statutes and regulations, such as the

Ports and Waterways Safety Act, 46 USC Sections 70001–70054 and implementing regulations, 33 CFR Part 1 (*General Provisions*), 14 CFR Part 450 (*Launch and Reentry License Requirements*), and 40 CFR Section 229.3 (*Transportation and Disposal of Vessels*). To comply with the necessary notification requirements, SpaceX would continue to notify USCG of any upcoming launch operations to ensure safe launches over the high seas and navigable waters of the U.S. (WOTUS), consistent with current procedures. For each launch, the USCG would continue to be responsible for issuing a Notice to Mariners (NOTMAR) that provides the hazard operation area locations before each mission. A NOTMAR provides notice of temporary changes in conditions or hazards in navigable waterways with maritime traffic to assist in mitigating risks for dangers associated with waterway users. This tool provides an established and reliable line of communication with the maritime public. The NOTMAR would include the operations dates and times and coordinates of the hazardous operation area.

2.1.2.1.2 Airspace

The Proposed Action does not include altering the dimensions (shape and altitude) of the airspace. All launch and reentry operations would be infrequent and of short duration and comply with the necessary notification requirements, including issuing Notice to Airmen (NOTAMs), as defined in agreements required for an FAA issued launch license. Advance notice via NOTAMs and identifying Aircraft Hazard Areas (AHAs) assist general aviation pilots to schedule around any temporary disruption of flight activities in the operation area. A NOTAM provides notice of unanticipated or temporary changes to components of, or hazards in, the National Airspace System (NAS) (FAA Order 7930.2U, Notice to Airmen). The FAA issues a NOTAM at least 24 hours before a launch or reentry activity in the airspace to notify pilots and other interested parties of temporary conditions. SpaceX regularly provides the FAA with updates and schedule changes to their notional three-month launch schedule to minimize interruption to air traffic. The FAA's licensing requirements, the process for closures of the NAS, and SLD 30 Range Safety actions during launch operations are described in Section 2.2.1 of the 2023 SEA (DAF 2023). Western Range operations, including SpaceX's launches from VSFB, follow the launch/reentry communication and coordination procedures stated in a Letter of Agreement (dated 7 April 2020; FAA 2020b) between SLD 30 and the FAA.

2.1.2.2 Launch Frequency

The DAF proposes to increase the Falcon launch cadence at VSFB from 50 to up to 100 launches per year. SLD 30 maintains the final authority to approve individual launches, thus completion of the NEPA process does not guarantee every launch would be approved. SpaceX has continued to improve its turn-around time between launches, which has provided more opportunity for launches at SLC-4. The introduction of SLC-6 provides additional capacity for Falcon launches, including Falcon Heavy. SpaceX would launch Falcon Heavy up to five times per year from SLC-6.

SpaceX could launch Falcon 9 from either SLC-4 or SLC-6 and the breakdown of the cadence at each pad would be determined by the manifest and the Western Range operations. An example scenario of the breakdown in cadence and estimated launch schedule is included in Table 2.1-1.

Table 2.1-1. Estimated Future Falcon Launch Frequency

Year	SLC-4	SLC-6		Total
	Falcon 9	Falcon 9	Falcon Heavy	
2025	70	-	-	70
2026	70	11	1	82
2027	70	25	5	100
2028	70	25	5	100

2.1.2.3 Trajectories

Trajectories (i.e., the flight path of rockets) from SLC-4 would remain within the azimuth range of 140 to 325 degrees, as was described in Section 2.2.1.1 of the 2023 SEA and analyzed in that document (DAF 2023). Trajectories from

SLC-6 would also fall within this range. Each trajectory would be provided in SpaceX's Flight Safety Data Package, that identifies, quantifies, assesses and address operational risks, submitted to the FAA before the launch.

2.1.2.4 Landing

Following each launch, the first stage(s) would land either downrange on a droneship in the recovery area (Figure 2.1-3) or at SLC-4 or SLC-6. A droneship landing is shown in Figure 2.1-4. The landing location for each mission is determined by mission objectives such as payload mass and required orbit. After downrange landings, the droneship would then transport the booster to the Port of Long Beach (see Section 2.1.6 for a description of harbor operations). SpaceX has successfully conducted over 400 landings of the Falcon 9 first stage booster and has a 100 percent success rate for Falcon Heavy side core landings on land. Mission objectives may occasionally require expending the first stage booster in the recovery area in the Pacific Ocean (Figure 2.1-3), as described in Section 2.1.1 of the 2011 EA. The Falcon Heavy center core first stage booster is typically expended each launch.

If expended, the first stage would break up upon atmospheric re-entry, and there would be no residual propellant or explosion upon impact with the Pacific Ocean. The first stage remnants are not buoyant and would sink to the bottom of the ocean. In an anomalous situation when an intentionally expended booster does not break up upon atmospheric reentry and impacts the ocean's surface intact, a residual amount of propellants (RP-1 and LOX) would remain in the first stage upon impact. In this situation, the vehicle would possibly experience an explosive event due to mixing remaining fuel. This represents an off-nominal, low probability, and worst-case scenario and is not assessed for these reasons.

SpaceX would continue to land up to 12 first stages per year at SLC-4. In addition, up to 12 missions each year would utilize the proposed landing zones at SLC-6, including five Falcon Heavy missions per year where two boosters would land simultaneously (see Figure 2.1-5 for example of two boosters landing at Cape Canaveral Space Force Station [CCSFS]). The Falcon Heavy center core first stage booster is typically expended each launch but may land on an offshore droneship. Estimated launches with first stage booster landings are included in Table 2.1-2. Including potential Falcon 9 expendable missions, up to 10 launches per year may include expendable first stages that would be deposited anywhere within the recovery area depicted in Figure 2.1-3.

Figure 2.1-4. Falcon 9 Droneship Landing

Figure 2.1-5. Falcon Heavy Boosters Landing at Cape Canaveral Space Force Station

Table 2.1-2. Estimated Launches with First Stage Boosters Landing at VSFB

Year	SLC-4	SLC-6	Total
2025	12	-	12
2026	12	12	24
2027	12	12	24
2028	12	12	24
2029	12	12	24
2030	12	12	24

2.1.2.5 Fairing Recovery

The Falcon 9 and Falcon Heavy vehicle payload systems include a fairing cover that protects payloads (e.g., satellites). The fairing consists of two halves which separate, allowing payload deployment at the desired orbit. Each fairing half contains a parachute system for recovery, which consists of one drogue parachute and one parafoil. Following fairing re-entry, the parachute deploys at a high altitude (approximately 50,000 ft) to begin the initial slowdown and to extract the parafoil. Following successful parafoil deployment, the parachute cuts away. The parachute system slows the fairing's descent to enable a soft splashdown so that the fairing remains intact (Figure 2.1-6). SpaceX attempts to recover both fairings for refurbishment and reuse, as described in Sections 2.2.1.4 and 2.2.2 of the 2023 SEA (DAF 2023). The parachute canopy area is approximately 110 square feet (ft^2) and the fairing parafoils are approximately 3,000 ft^2.

SpaceX would attempt to recover all parachutes and parafoils over this time period, but it is possible that some may not be recovered due to sea or weather conditions at the time of recovery. 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 be saturated and begin to sink. Fairing recovery would occur in the recovery area shown in Figure 2.1-3.

Figure 2.1-6. Payload Fairing Half with Parafoil Deployed

2.1.2.6 Water Use

SpaceX would continue to utilize approximately 70,000 gallons of water per launch at SLC-4 in the flame bucket and as deluge to suppress noise and vibrations, as described in Section 2.2.1.3 of the 2023 SEA (DAF 2023) and incorporated by reference in the 2024 EA (DAF 2024a). Under the Proposed Action, Falcon Heavy would use up to approximately 1.5 million gallons of water per launch and Falcon 9 would use up to approximately 200,000 gallons per launch for deluge and the flame bucket at SLC-6. More water is required at SLC-6 because the existing flame bucket is substantially larger than at SLC-4, thus requiring more water to achieve the same operational objectives in reducing vibration below the vehicle. In addition, a maximum of 1.37 million gallons (4.20 acre-feet [ac-ft]) per year would be required to support the personnel and operational activities at SLC-4, a maximum of 1.19 million gallons (3.64 ac-ft) per year to support personnel at Buildings 398 and 520, and 1.10 million gallons (3.36 ac-ft) per year would be required to support the personnel and operational activities at SLC-6. Therefore, at maximum cadence, the Proposed Action would use up to 21.1 million gallons (65.6 ac-ft) of water per year, which would be approximately 2.3 percent of the total annual water usage on VSFB. VSFB primarily relies on State Water, which is sourced from precipitation and groundwater, primarily from snowmelt in the Sierra Nevada Mountains.

2.1.2.7 Payloads

Payloads and their associated materials/fuels/volumes are mission-dependent but would be similar to current U.S. Government and commercial payloads as described in the 2011 NASA EA (NASA 2011), for which the DAF and the FAA were cooperating agencies. Falcon launches from SLC-4 would continue to have similar payloads to those discussed in Section 2.2.6 of the 2023 SEA (DAF 2023). Launches from SLC-6 would have similar types of payloads to those at SLC-4; however, Falcon Heavy would be capable of carrying larger mass of the same payloads to orbit.

Novel payloads such as reentry capsules would undergo a separate environmental review under NEPA and require their own FAA vehicle operator license.

2.1.3 Personnel and Ground Operations

SpaceX would utilize the same number of personnel analyzed in the 2024 EA (DAF 2024a), a total of 700 staff. Staffing numbers are expected to increase over time as the total launch cadence increases until reaching the previously analyzed 700 personnel. Given that SLC-6 would need to be fully operational to meet this cadence, SpaceX is not anticipating temporary staff such as contractors supporting build-out of SLC-6 to cause an exceedance of 700 personnel on-site at any given time.

The existing SpaceX facilities at SLC-4 and Building 398 (Figure 2.1-7) in conjunction with the new facilities that SpaceX would acquire and renovate at SLC-6, are adequate to support the required personnel. SpaceX would continue to utilize several specialized trucks per launch and transport boosters between SpaceX facilities in Hawthorne, California; Building 398; and hangars at SLC-4, and SLC-6 on VSFB. The first stage, second stage, interstage, and payload are each transported by 18-wheel trucks. Fuel and helium are also delivered by 18-wheel trucks on a weekly basis. Personal vehicles would be used by employees to commute locally on and off site. Payload integration and pre-launch protocols associated with the Proposed Action would remain unchanged. However, these operations would increase in frequency to support up to 100 launches per year.

2.1.4 Utilities

Water use during launch operations are discussed in 2.1.2.6. Existing utilities at SLC-6 such as power, communications, and fluids (primarily water, nitrogen, helium, LOX, and RP-1) systems would be modified or reconstructed for Falcon operations within the existing launch complex as needed. Electrical service to SLC-6 is not anticipated to need upgrades, as it was designed for the Shuttle program and has enough capacity to support Falcon operations. Minor modifications to electrical systems within the launch complex may be needed, such as upgrading transformers or switchgears. Generators would continue to be utilized at SLC-4 and would be used at SLC-6 to support operations and for emergency power.

Personnel at SLC-4 and SLC-6 are not expected to result in septic systems exceeding capacity. The septic system at Building 398 has planned improvements independent of the Proposed Action that are expected to be complete in 2025, and thus would be able to support increased personnel use. SpaceX personnel use of these VSFB facilities would not be expected to impact potable water availability at these facilities or across VSFB.

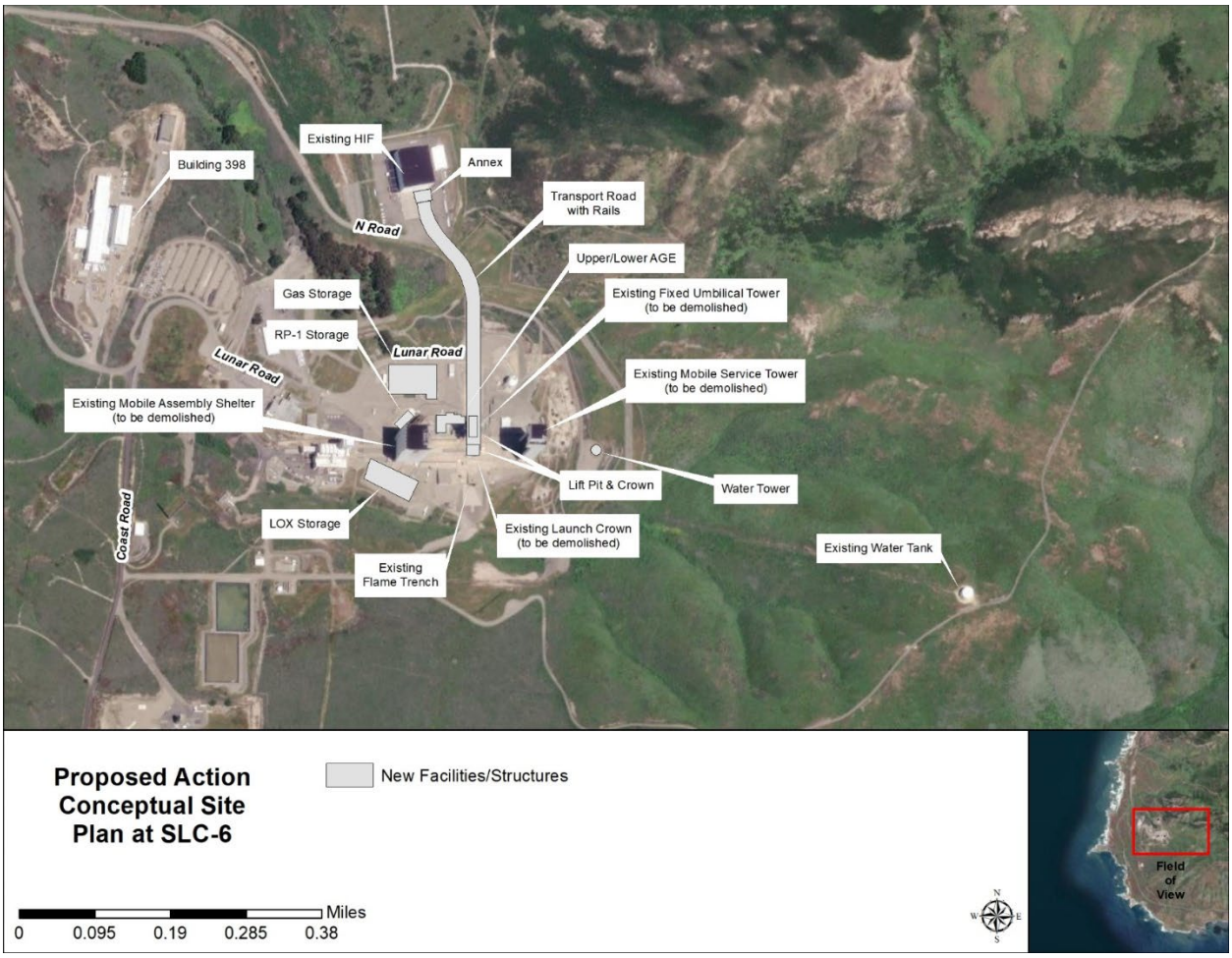

Figure 2.1-7. Proposed Action – SLC-6 Conceptual Site Plan

2.1.5 Vehicle Refurbishment

SpaceX would continue to process vehicles at existing SpaceX facilities such as Building 398. Operations include refurbishing the recovered first stages, boosters, and fairing for reuse in future missions. Up to 110 boosters and 100 fairings would be refurbished each year. Solvents such as isopropyl alcohol, isopar, and Simple Green would be used during these operations, as well as for launch pad operations, facility maintenance, and vehicle system(s) flushing during refurbishment. System flushing includes the purging of residual waste from the vehicle to maintain system health and avoid contamination. Remaining hazardous waste would be contained in drums and disposed of or recycled IAW applicable federal, state, and local regulations (see Section 3.15).

2.1.6 Harbor Operations

SpaceX would continue to transport first stage boosters and fairings from the Port of Long Beach to the VSFB harbor via a "roll-on-roll-off" (RORO) barge. The first stage would be transferred from the droneship to SpaceX's self-propelled modular transporter (SPMT) that is positioned on a small, low draft barge. The barge with the first stage would then be pulled by a tugboat from the Port of Long Beach to the Vandenberg harbor, where it would be unloaded and driven over the road to Building 398 for refurbishment.

The Proposed Action would include increasing from 50 RORO events per year to up to 100 RORO events per year, which return the first stages/boosters along with the fairings. Each harbor operation lasts for approximately four hours, or one tide window. Harbor operations could occur at any time of day, as they are dependent on the tides. The Proposed

Action does not include additional dredging outside the quantity and depth specified by SLD 30's existing permit from the U.S. Army Corps of Engineers.

2.1.7 SLC-6 Modifications

SpaceX would modify SLC-6 to support Falcon 9 and Falcon Heavy launches. Construction would take approximately 18 months and would be expected to start in late 2025 or early 2026, depending upon when the DAF and SpaceX execute the real property instrument for SpaceX to use the VSFB property for operations at SLC-6. Major construction and demolition (C&D) activities would occur during approximately the first 12 months of construction. The remaining construction time would primarily involve construction and activation of infrastructure, such as fluid systems. Four existing structures would be demolished (mobile service tower (MST), mobile assembly shelter (MAS), fixed umbilical tower (FUT), and lift and pit crown; Figure 2.1-7). Explosives would be used to pull down the MST, MAS, and FUT (Figure 2.1-7), during which multiple 10-20 pound explosive charges would be detonated simultaneously. Prior to detonation, the structures would be cut in specified locations in order to guarantee control over tipping direction. This would result in a short impulsive sound, similar to those experienced during first stage landing events at SLC-4, but over a much smaller area, as discussed in Section 3.4.2.1.1. After tip over, mechanical shears would be used to cut the building sections into manageable sizes. Cranes would be utilized to assist with any heavy lifts of the structures. An excavator with a thumb attachment would be used to move the manageable pieces to a dump truck that would haul out the material. The excavators and backhoes to be used would be track mounted. Any staging or temporary storage of materials would occur within areas that have been previously disturbed. Demolition work would occur during daylight hours. The duration of demolition activities may last up to four months, with a majority of that time spent cutting fallen structures and disposing of material.

Construction would generally occur in previously disturbed areas and on existing impervious surfaces, but some earthwork is anticipated which would be identified during the design phase of the project. SpaceX would construct commodity storage tanks (gas, RP-1, and LOX storage), a vehicle erector, water tower(s), ground supporting equipment, and a transport road with rail system from the horizontal integration facility (HIF) to the launch pad (Figure 2.1-7). Where practicable, existing infrastructure would be modified. This could include LOX storage, launch pad apron, access road, and fence line. The existing flame trench would be retained and converted to a unidirectional water-cooled flame diverter, and a deluge/acoustic suppression system would be installed. A water reclamation system may be used that could pump residual deluge water back into the water storage tanks. A hangar would be required for vehicle processing. SpaceX would add five emergency generators for standby power at SLC-6. Construction may occur at any time of the day or night.

Under the Proposed Action, the DAF would authorize SpaceX to modify the HIF to support launch operations at SLC-6. The HIF is an existing hangar developed by ULA north of SLC-6 that was previously used for pre-flight processing of Delta IV (Figure 2.1-7). Modifications would include interior work and construction of an annex on the south side of the building. SpaceX would construct rails from the hangar to the launch pad to transport Falcon.

Approximately 143,000 ft^2 of commodity storage would be required. This includes storage tanks for LOX, RP-1, water, nitrogen, helium, and other launch commodities and may be a combination of new tanks and repurposing existing tanks at SLC-6. A 200-ft water tower would be constructed on the east side of the launch complex near the site of the former water tower. The SLC-6 real property agreement would include an existing 1.25 million gallon water tank uphill to the east of SLC-6 (Figure 2.1-7), which would be used to fill local tanks for pad water supply (e.g., diverter, rainbirds, etc.). Firebreaks would be incorporated as appropriate into the site design, and final site layout is subject to SLD 30 review and approval. A conceptual site plan is shown in Figure 2.1-7.

2.1.7.1 Landing Zones

SpaceX would construct two landing zones approximately 850 ft south of SLC-6 to support landing of first stage Falcon boosters launching from SLC-6. Each landing zone would be made up of a concrete pad surrounded by a gravel apron as follows and depicted in Figure 2.1-8:

- **Two Landing Zones:**
  - 280 ft diameter concrete pad each
  - 60 ft gravel apron surrounding each pad
  - Total diameter of each landing zone: 400 ft
- **Two Landing Pad Pedestals:**
  - 30 ft by 30 ft each
  - Approximately 15 ft tall each

SpaceX would construct a new nitrogen gas line from SLC-6 to a fluids bay at the landing zones. The fluids bay is used to send nitrogen to different systems of the booster after landing. A 30 ft by 30 ft pedestal, which is approximately 15 ft tall, would be constructed at each landing pad. The first stage booster is lifted onto the pedestal during post-flight processing to remove the landing legs prior to transport. Crane storage, a cleared area with gravel to lay down cranes when not in operation, is proposed on the western site boundary. Each landing zone would have a connection to the existing road to support booster transport. Approximately 16 ac would be cleared to construct the landing zones and approximately seven ac would be impervious upon completion of construction. A conceptual layout of the landing zones is shown in Figure 2.1-8.

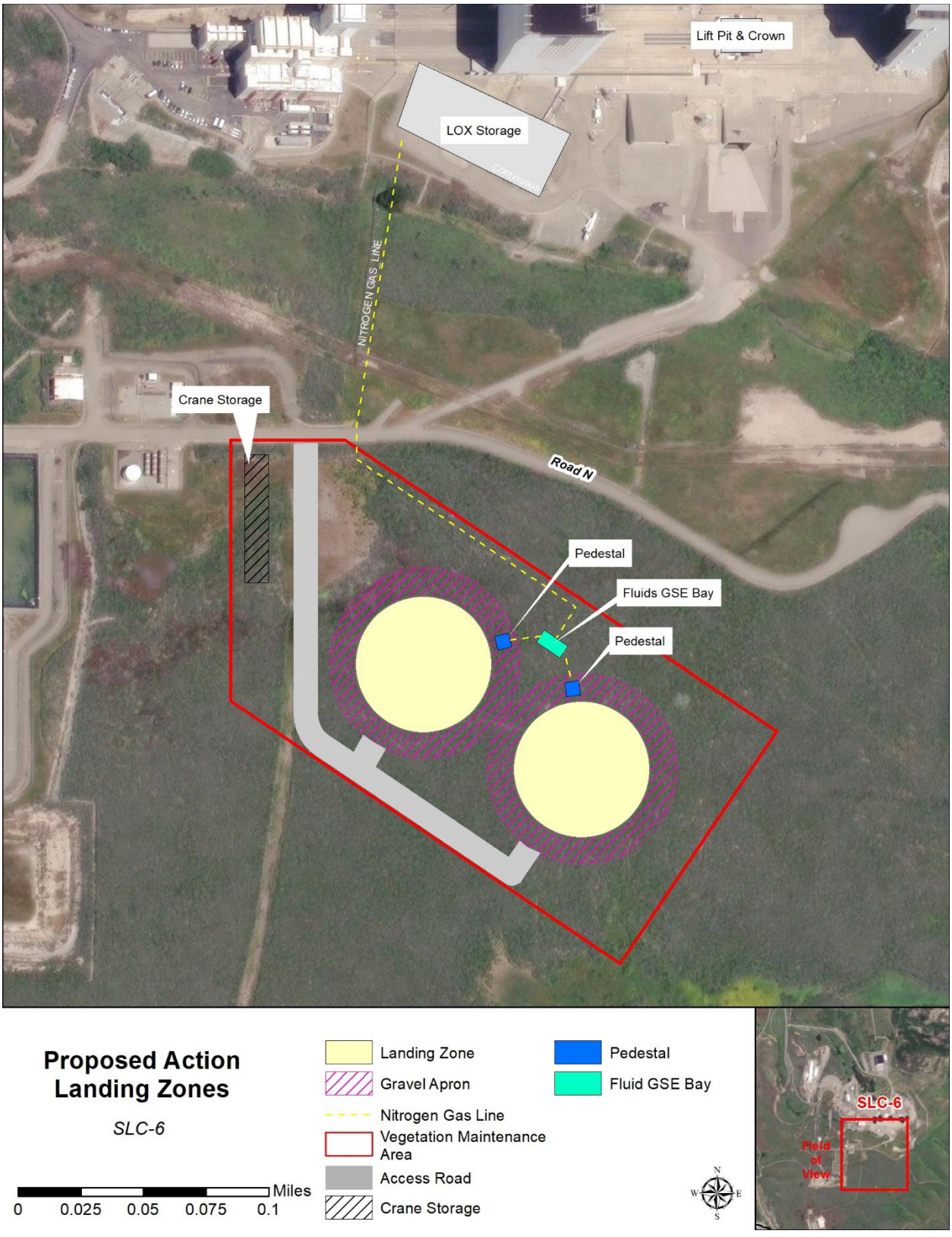

Figure 2.1-8. Proposed Action - Landing Zones

2.1.7.2 Firebreak

A new firebreak is proposed south of the landing zones. Cypress Ridge Road and N Road would also be improved to ensure suitable access for fire defense. These improvements are anticipated to be within the existing roadway footprints. The proposed firebreak is approximately 50 ft wide, shown in Figure 2.1-9, and would connect to the existing firebreak for SLC-8. Cypress Ridge Road, an existing fire access road, would be improved within its existing footprint to protect against potential erosion. Vegetation maintenance would occur within the vegetation maintenance area depicted in Figure 2.1-9.

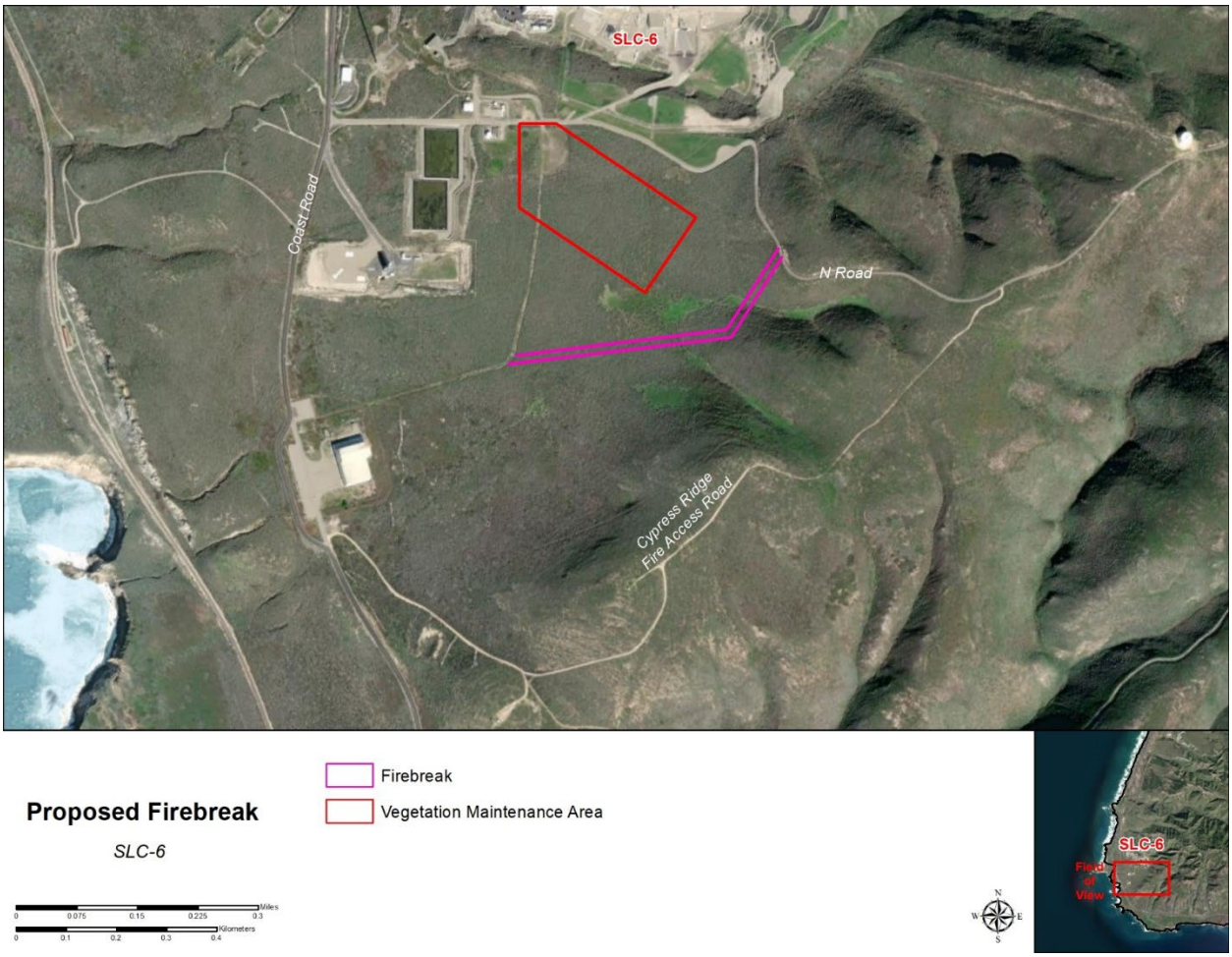

Figure 2.1-9. Proposed Firebreak

2.2 No Action Alternative

Under the No Action Alternative, the DAF would not authorize any Falcon 9 or Falcon Heavy launches or landing operations at, or modifications to, SLC-6, nor would the DAF authorize additional Falcon 9 launches from SLC-4. The FAA would not license Falcon operations at SLC-6 or an increase in Falcon 9 launches at SLC-4. Falcon 9 launches and landings would continue at SLC-4 as currently authorized. No Action effects analysis considers potential effects associated with reasonably foreseeable actions (Table 3.2-3) without consideration of the Proposed Action, because these actions would still occur under the No Action Alternative. Under the No Action Alternative, there would be no new effects on the environmental impact categories analyzed in this EIS compared to those analyzed in the 2024 EA. The No Action Alternative provides the basis for comparing the environmental consequences of the Proposed Action.

2.3 Alternative 1 — New Hangar at SLC-6

Under Alternative 1, the DAF would implement the Proposed Action as described in Section 2.1, but rather than modifying the existing HIF as described in Section 2.1.7, DAF would authorize SpaceX to construct a new approximately 62,000 ft^2 hangar north of the launch pad to support Falcon 9 and Falcon Heavy integration and processing, shown in Figure 2.3-1. Approximately 40,000 cubic yards of fill would be required and would be sourced locally (on VSFB as well as the local region around VSFB). Approximately 244,000 ft^2 of additional impervious area would be added to construct this alternative. Existing stormwater infrastructure is expected to be adequate to support this additional impervious area but would be confirmed during final design of the site. SpaceX would construct a road and rail system from the hangar to the launch pad to transport Falcon. The SLC-6 fence would be relocated and vehicular access from Lunar Road to N Road would be removed. The existing HIF would remain.

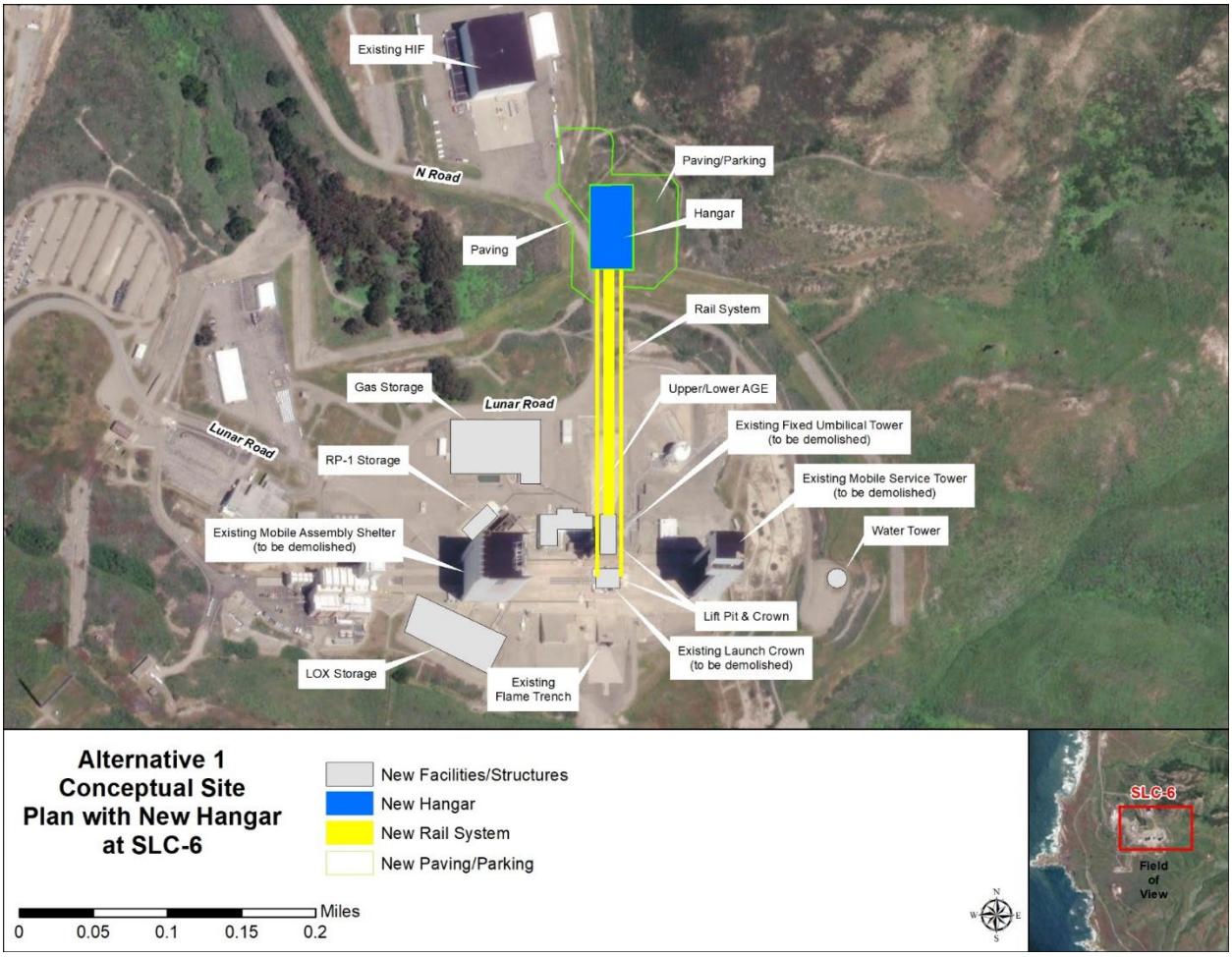

Figure 2.3-1. Alternative 1 – New Hangar at SLC-6

2.4 Alternatives Eliminated

The DAF objectively evaluated reasonable alternatives to the Proposed Action, including alternatives that the DAF eliminated from detailed study in accordance with the DOD NEPA Implementing Procedures and DAF Initial Policy for Implementation of NEPA Guidance Memo. The purpose of and need for the Proposed Action, based on Congress' direction to maximize the use, effectiveness, and efficiency of DOD's space launch infrastructure, effectively eliminated any analysis of alternatives that were not located on a DOD installation.

Other alternatives on VSFB that the DAF considered include SLC-8, Boat Dock, Sudden Flats, and Boathouse Flats. Three of these—Boat Dock, Sudden Flats, and Boathouse Flats—have never been developed or used for launch operations and would not be able to meet the Proposed Action's infrastructure requirements without substantial construction activities, which would not meet the purpose of and need for the Proposed Action and may result in additional environmental impacts. Additionally, Boat Dock is in close proximity to the VSFB harbor, which is needed for delivery of launch vehicles and other hardware, so launching a heavy-lift class vehicle from there would disrupt necessary harbor activity and therefore constrain VSFB launch operations. For its part, SLC-8 was eliminated for two primary reasons: it is a shared multi-user facility currently available for commercial and government launches, and it would require modifications before it could support a heavy-class vehicle. Not only would selecting a shared site impede the Proposed Action's cadence needs, but the modifications necessary would needlessly render a currently usable launch complex unusable for the duration of construction. In sum, the DAF only analyzed SLC-6 to support the Proposed Action because it is the only launch complex on VSFB that can support a heavy-lift class vehicle without extensive modifications and in a manner that would meet the purpose of and need for the Proposed Action.

2.4.1 Cape Canaveral Space Force Station/Kennedy Space Center

SpaceX existing facilities at SLC-40 at CCSFS and LC-39A at KSC were evaluated for reasonableness. SpaceX currently launches Falcon 9 from SLC-40 and launches Falcon 9 and Falcon Heavy from LC-39A. SLC-40 and LC-39A were dismissed from consideration as they predominantly support a different range of trajectories. For example, polar trajectories or those with an inclination greater than 53 degrees cannot be launched from LC-39A or SLC-40 without substantial impacts on vehicle performance, to the point that certain payloads cannot be launched.

2.4.2 Falcon Heavy at SLC-4

Falcon Heavy at SLC-4 was previously analyzed in the 2011 EA. However, modifying SLC-4 to support Falcon Heavy would result in multiple long-duration shutdowns of the launch pad, disrupting many contracted missions including those for the DOD. Modifying SLC-4 to a Falcon Heavy pad would not meet the need to provide additional launch capacity.

2.4.3 Alternative Landing Zone Locations

Falcon Heavy requires landing zones to include a minimum of 140-ft radius paved landing pad with a gravel apron of at least 200-ft radius for each booster and mowed/cleared area to a radius of 295 ft. The landing pads should be at minimum 400 ft apart center to center. Landing pads must be sited perpendicular to the flight path to maintain side core (i.e., side boosters) spacing during landing. These sizes are informed by guidance, navigation, and controls for landing events as well as how the radar altimeter interacts with surrounding items. Falcon Heavy side cores fly differently than a Falcon 9 first-stage booster due to the different aerodynamics on the vehicle from the nose cones, thus have different landing zone requirements. With this in mind, the DAF evaluated alternative landing zones across south VSFB. These alternative sites are discussed below.

2.4.3.1 Within SLC-6 Fence Line

Landing zones within the SLC-6 fence line (Figure 2.4-1) were dismissed due to operational risks and safety concerns to critical assets during booster fly back based on the anticipated trajectories. The number of critical structures within and adjacent to SLC-6, including the existing hangar, launch mount, and Building 375 also introduce potential for violation of radar altimeter requirements during landing events, adding risk to the operation. Additionally, there is no available space at SLC-6 to fit two landing zones without substantial earthwork cutting into the hillside.

2.4.3.2 Delphy Road

Landing zones north of Delphy Road (Figure 2.4-1) were dismissed due to overflight of SLC-5, which is proposed immediately south of Delphy Road. This location would also require evacuating areas of south VSFB during landing

events that would not typically be evacuated, creating conflicts with other operations occurring on VSFB. Commodities to support post-landing processing are not readily available at this location.

2.4.3.3 Building 390

Landing zones at Building 390, located south of SLC-8 (Figure 2.4-1), were eliminated due to the potential to close Coast Road during crane operations at the landing zone after the booster has landed. This would block access to the VSFB harbor until each operation was complete. Additionally, this alternative would require clearing similar habitat types to the Proposed Action. Commodities to support post-landing processing are not readily available at this location.

2.4.3.4 SLC-6 Parking Lot

Landing zones within the SLC-6 parking lot (Figure 2.4-1) were eliminated due to the proximity to Building 398 and associated flight safety concerns. This alternative would not meet flight safety requirements to conduct the landing operation.

2.4.3.5 SLC-4

The DAF evaluated siting a second landing zone at SLC-4 to support Falcon Heavy (Figure 2.4-1). This would require expanding the existing landing zone to support side core landings as well as constructing a second landing zone. These actions would require substantial earthwork due to existing topography and would result in the closure of a substantial amount of south VSFB during landing events, creating conflicts with other launch programs, operations occurring on south VSFB, and the existing Falcon program at SLC-4.

2.4.3.6 Split Landing Zones at SLC-4

The DAF evaluated the potential to construct a single landing zone and land the second booster at SLC-4 (Figure 2.4-1). This alternative would require the existing landing zone at SLC-4 to be expanded to support side core landings. As previously discussed, landing at SLC-4 would result in the closure of a substantial amount of south VSFB during landing events, creating conflicts with other launch programs, operations occurring on south VSFB, and the existing Falcon program at SLC-4.

2.4.3.7 Alternative Undeveloped Sites

Landing zones elsewhere at VSFB on undeveloped land would result in similar environmental impacts but would reduce refurbishment efficiency and result in additional impacts on VSFB roadways, as the boosters would need to be transported further from the landing zones to Building 398. Additionally, landing at undeveloped or previously developed sites elsewhere at VSFB would result in additional areas of VSFB being closed due to operational clear requirements.

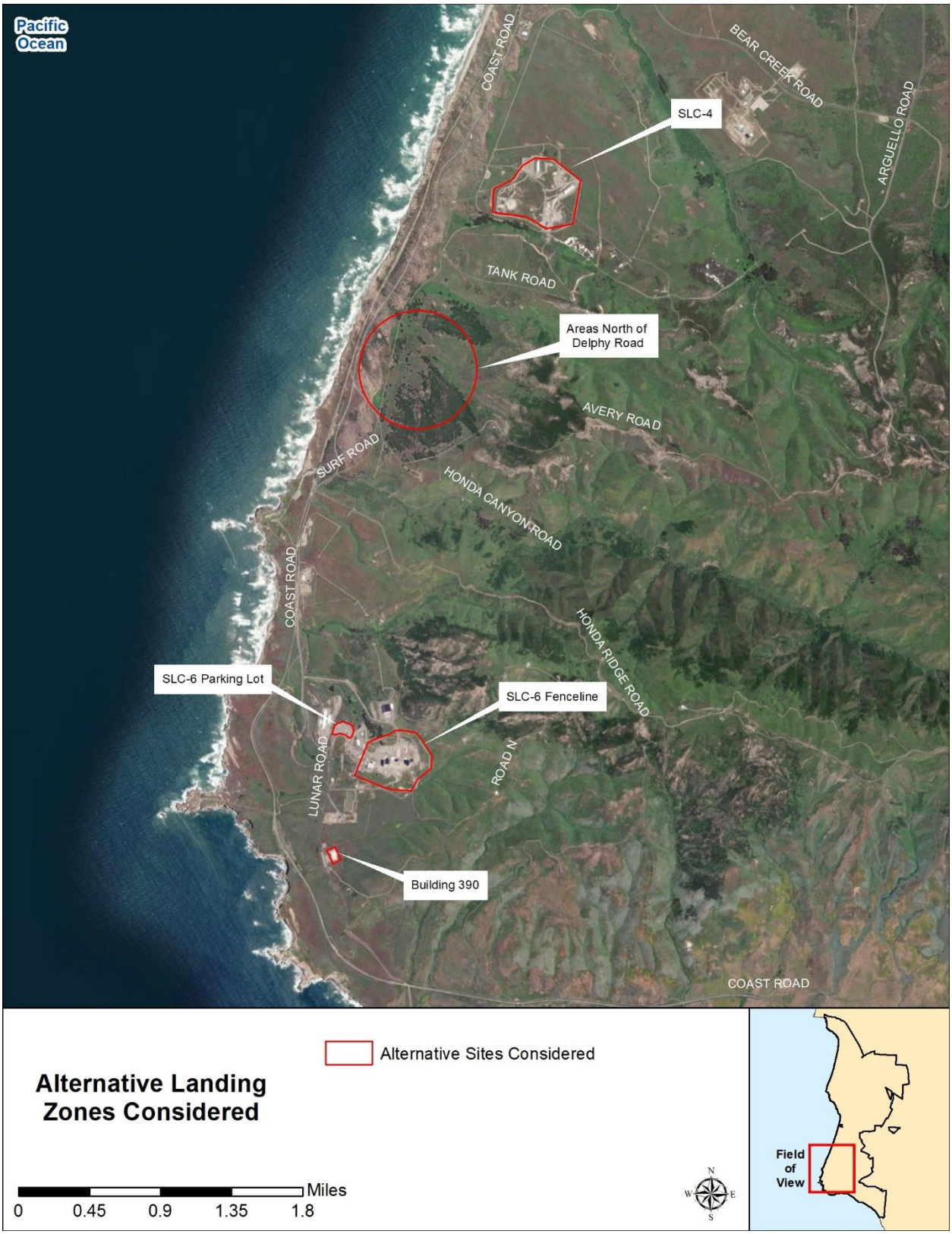

Figure 2.4-1. Alternative Landing Zone Sites Considered

2.5 Permits, Licenses, and Other Authorizations

Table 2.5-1 provides a summary of the permits, licenses, and regulatory requirements that are required for implementing aspects of the Proposed Action.

Table 2.5-1. Permits, Licenses, and Other Requirements

Permit/License	Requirement
FAA Licensing Requirements	Under 14 CFR Part 450, SpaceX would be required to modify its existing or obtain a new vehicle operator license for Falcon operations at VSFB. A vehicle operator license may authorize launch, reentry, or both.
Endangered Species Act	Under Section 7 of the ESA, if the DAF determines the proposed action may affect Federally listed species, DAF is required to consult with USFWS to obtain a BO.
National Historic Preservation Act	Under Section 106 of the NHPA, DAF is required to consult with the SHPO and federally recognized tribes on potential impacts to cultural resources.
Coastal Zone Management Act	Under the CZMA, DAF must submit a CD to the CCC for review for proposed Federal agency activities that may have a reasonably foreseeable effect on any coastal use or resource to determine whether such activities would be undertaken in a manner consistent to the maximum extent practicable with the enforceable policies of the California Coastal Management Program (CCMP).
Clean Air Act (CAA)	Under the CAA, DAF would be required to conduct a General Conformity Analysis to ensure the Proposed Action would not interfere with the ability of California to achieve National Ambient Air Quality Standards (NAAQS) and the State Implementation Plan (SIP).
California Air Quality Act	Under the California Air Quality Act, SpaceX would be required to obtain a permit from the Santa Barbara Air Pollution Control District (SBCAPCD). SpaceX currently conducts operations at VSFB and recovery operations in California waters under a permit from this agency.
Clean Water Act National Pollutant Discharge Elimination System (NPDES) Permit	Section 402 of the Clean Water Act (CWA) addresses water pollution by regulating point sources that discharge pollutants into Waters of the U.S. SpaceX would be required to obtain a NPDES permit from the Central Coast Regional Water Quality Control Board (RWQCB) for operations at SLC-6.
Marine Mammal Protection Act	Under the MMPA of 1972 all marine mammals in the U.S. are protected. NMFS issued regulations and a LOA to DAF which govern unintentional taking of marine mammals incidental to launches and supporting activities. The LOA allows specified launch programs to unintentionally take small numbers of marine mammals, limited to Level B harassment (behavioral harassment) as defined in the MMPA. The DAF is required to comply with the conditions listed in the LOA.

2.6 Comparison of Environmental Consequences and Mitigations by Alternative

Table 2.6-1 provides a summary of the environmental consequences of the Proposed Action, Alternative 1, and No Action Alternative. The summary is based on the findings of the detailed analysis of each of the resource areas, as discussed in Chapter 3 of this EIS. Additionally, the Mitigation and Monitoring subsections in Chapter 3 list environmental protection measures (EPMs) that include measures to avoid and minimize environmental impacts.

Table 2.6-1. Comparison of Environmental Consequences by Alternative

Environmental Resource	Proposed Action	Alternative 1	No Action Alternative
Air Quality	Potential effects to air quality from operations would be similar for the Proposed Action and Alternative 1. However, Alternative 1 would result in higher overall emissions during construction due to the inclusion of a new hangar. Air quality impacts from C&D activities associated with the Proposed Action and Alternative 1 would be temporary. Launch activities included in the Proposed Action and Alternative 1 would result in an increase in emissions due to the increased frequency of launches and launch support activities. However, net annual emissions would not exceed the DAF insignificance thresholds, and EPMs, such as fugitive dust control and internal combustion engine emissions controls, would be used to limit and reduce air quality impacts. General Conformity Rule (GCR) Applicability Analyses for the South Coast Air Quality Management District (SCAQMD) and Ventura County Air Pollution Control District (VCAPCD) have been prepared.		Under the No Action Alternative, SLC-6 modifications and increased Falcon launch cadence on VSFB would not occur, resulting in no impacts on air quality, beyond those described in the 2024 EA. The total annual launch cadence at VSFB is anticipated to increase over time due to other launch providers and local development projects are anticipated to continue, which could result in increased emissions.
Noise	Potential noise effects would be similar for the Proposed Action and Alternative 1. C&D activities would result in temporary, localized increases in noise levels. Due to the location of VSFB, the noise impacts from C&D activities would be far removed from any human sensitive receptors. Therefore, no adverse impacts from noise would occur. Launch operations for both the Proposed Action and Alternative 1 would result in increased noise levels and increase frequency of noise events within the region, causing increased human annoyance. However, each noise event would last less than two minutes and sonic booms last less than one second. Noise modeling indicates that potential launch activities would not exceed 65 dBA outside of VSFB boundaries.		Under the No Action Alternative, there would be no additional Falcon launches beyond the 50 Falcon 9 launches already occurring from SLC-4, and C&D activities at SLC-6 would not occur. However, noise levels would be anticipated to increase over time as launch cadence from other launch providers increases.
Terrestrial/Freshwater And Marine Biological Resources	Potential effects to biological resources would be similar for the Proposed Action and Alternative 1. For both the Proposed Action and Alternative 1, activities associated with C&D would be temporary. Areas where C&D activities are proposed are within the developed area of VSFB where noise and other disturbing activities occur frequently. Construction, demolition, and launch activities would potentially result in impacts to wildlife due to noise, vibration, and visual disturbances. Additionally, there is a risk of harm to wildlife during construction. However, no significant impacts to vegetation or wildlife are anticipated from the		Under the No Action Alternative, SLC-6 modifications and increased Falcon launch cadence on VSFB would not occur, resulting in no impacts on biological resources beyond those described in the 2024 EA. The potential for effects on biological resources from noise, sonic boom overpressure, habitat destruction, artificial lighting, and general disturbance could occur from present and reasonably foreseeable actions.

Environmental Resource	Proposed Action	Alternative 1	No Action Alternative
	implementation of either the Proposed Action or Alternative 1, as EPMs, as outlined in Section 7 consultation with USFWS and the NMFS LOA, would be implemented to avoid, minimize, or characterize potential effects.		
Water Resources	Potential effects to water resources would be similar for the Proposed Action and Alternative 1. Construction, demolition, and launch activities associated would lead to potential direct and indirect impacts to water resources. The Proposed Action and Alternative 1 would result in disturbance of soils, the use of hazardous materials and generation of wastewater, and wastewater discharges. Impacts to water resources could be reduced or avoided through the use of Best Management Practices (BMPs) to manage pollutants in stormwater and non-stormwater runoff, and sediment control and erosion management. Therefore, there would be no significant impacts to water resources from the Proposed Action or Alternative 1.		Under the No Action Alternative, SLC-6 modifications and increased Falcon launch cadence on VSFB would not occur, resulting in no impacts on water resources beyond those described in the 2024 EA. Any present or reasonably foreseeable actions would obtain and operate under the various authorizing/permitting agencies, reducing potential effects to water resources.
Cultural Resources	Potential effects to cultural resources would be similar for the Proposed Action and Alternative 1 with no adverse effects anticipated. The DAF engaged with the California SHPO under Section 106 of the National Historic Preservation Act and initiated consultation with the SYBCI over potentially affected historic properties. The SHPO concurred with the DAF's finding of no historic properties effected, and as of certification of the Final EIS, the tribe has not identified any perceived potential effects to cultural resources. Accordingly, the DAF has completed this consultation.		Under the No Action Alternative, modifications of SLC-6 and increased Falcon launch cadence on VSFB would not occur, resulting in no impacts on cultural resource beyond those described in the 2024 EA.
Coastal Resources	The Proposed Action and Alternative 1 would result in similar potential impacts to coastal resources. Increased launch cadence would result in noise, public access restrictions, and increased impervious surfaces which could increase stormwater runoff. However, BMPs and stormwater management would minimize effects of stormwater runoff, and noise and access restrictions would be temporary in nature. Additional access restrictions compared to what is presently occurring are not proposed. Therefore, the Proposed Action and Alternative 1 would not have a significant impact on coastal resources.		Under the No Action Alternative, SLC-6 modifications and increased Falcon launch cadence at VSFB would not occur, resulting in no impacts on coastal resources beyond those described in the 2024 EA.
Department of Transportation Section 4(f) Resources	The Proposed Action and Alternative 1 do not include any direct impacts Section 4(f) resources. Launch activities would result in occasional, temporary evacuations of public areas, but evacuations would occur infrequently. Noise from launch operations would be for a short duration and would occur infrequently. Therefore, no significant impacts to Section 4(f) resources are anticipated.		Under the No Action Alternative, SLC-6 modifications and increased Falcon launch cadence at VSFB would not occur, resulting in no impacts on Section 4(f) resources, beyond those described in the 2024 EA.
Utilities	While the Proposed Action and Alternative 1 would both increase the amount utility usage at VSFB, the increases would be negligible when compared to the existing available capacity. Neither VSFB's infrastructure nor local/regional utility		Under the No Action Alternative, SLC-6 modifications and increased Falcon launch cadence on VSFB would not occur, resulting in no impacts on utilities beyond those described in the 2024 EA.

Environmental Resource	Proposed Action	Alternative 1	No Action Alternative
	infrastructure would need to be upgraded in order to support the increased utility usage. There would be no significant impacts on utilities.		
Socioeconomics	Impacts to socioeconomics under the C&D activities associated with the Proposed Action and Alternative 1 would be local and temporary. However, these impacts would be beneficial as they would use local labor and supplies. Impacts from launching and landing operations associated with the Proposed Action and Alternative 1 would be positive and long-term in duration. Increased launch activities would result in an increased demand in the workforce, leading to higher per capita incomes.		Under the No Action Alternative, SLC-6 modifications and increased Falcon launch cadence on VSFB would not occur, resulting in no impacts on socioeconomics, beyond those described in the 2024 EA.
Transportation	The Proposed Action and Alternative 1 would not result in adverse impacts to transportation resources due to the low traffic volumes from increased operations, existing capacity of the roadways at and near VSFB, and the temporary increase in daily vehicle traffic during C&D that would result from the Proposed Action and Alternative 1.		Under the No Action Alternative, SLC-6 modifications and increased Falcon launch cadence on VSFB would not occur, resulting in no impacts on transportation, beyond those described in the 2024 EA. Local roadways and transportation corridors would continue to be affected by current traffic conditions and ongoing and planned development.
Human Health and Safety	Activities under the Proposed Action and Alternative 1 could result in increased risks to workers at project locations. However, the establishment and use of safety programs, policies, and procedures for workers and contractors would mitigate impacts to human health and safety. Therefore, there would be no adverse impacts to human health and safety associated with the Proposed Action or Alternative 1.		Under the No Action Alternative, SLC-6 modifications and increased Falcon launch cadence on VSFB would not occur, resulting in no impacts on human health and safety, beyond those described in the 2024 EA. Increased launches would incrementally increase the potential for health and safety effects given that health and safety risks are an inherent component of launch and landing activities. However, implementation of standard health and safety protocols, along with Federal, state, and local agency coordination and emergency response capabilities minimize the risk of health and safety effects.
Hazardous Materials and Waste Management	Activities associated with the Proposed Action and Alternative 1 would require compliance with all pertinent federal, state, and local laws and regulations. Hazardous materials and wastes would be properly identified, labeled, contained, and managed per all applicable regulations. Additionally, relatively small amounts of hazardous materials would be required for the Proposed Action and Alternative 1, and the waste generated would have little to no impact on waste processing capacity. Therefore, the Proposed Action nor Alternative 1 would not result in significant impacts to hazardous materials and waste management.		Under the No Action Alternative, SLC-6 modifications and increased Falcon launch cadence on VSFB would not occur, resulting in no impacts on hazardous materials and waste management, beyond those described in the 2024 EA. Numerous types of hazardous materials would continue to be used to support operations across VSFB. Management of hazardous materials and the resultant hazardous waste would continue to be the responsibility of each individual or organization and all pertinent federal, state, and local laws and regulations would be followed.
Solid Waste Management	Construction, demolition, and launch activities associated with the Proposed Action and Alternative 1 would generate solid waste that can either be recycled of disposed of in existing solid waste facilities. Local solid waste facilities have adequate capacity for the amount of solid waste that would be generated. Therefore, no significant impacts to solid waste management are anticipated from the Proposed Action or Alternative 1.		Under the No Action Alternative SLC-6 modifications and increased Falcon launch cadence on VSFB would not occur, resulting in no impacts on solid waste management, beyond those described in the 2024 EA. Local landfills are anticipated to have adequate capacity to process potential increases in solid waste from present and reasonably foreseeable actions, and these actions would comply with applicable Federal, state, and local regulations regarding solid waste management.

Environmental Resource	Proposed Action	Alternative 1	No Action Alternative
Geology and Soils	The Proposed Action and Alternative 1 would increase the amount of impervious areas at VSFB and any potential impacts to geology and soils would largely be associated with the removal of existing structures and construction of new structures. However, a SWPPP would be prepared to include erosion control measures and BMPs would be implemented during ground-disturbing activities. Additionally, C&D activities would be designed to comply with seismic design standards. Therefore, no long-term or significant impacts to geology or soils are anticipated from the Proposed Action or Alternative 1.		Under the No Action Alternative, modifications to SLC-6 would not occur, nor would there be an increase in the Falcon launch cadence at VSFB, so no impacts to geology and soils would occur. There would be no potential effects to geological resources outside of those experienced routinely by development projects and general seismic activity within California.

3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 Introduction

The resources listed in Table 3.1-1 were considered but not analyzed in this EIS because the resource would not be affected or there would be no change from what was analyzed in previous EAs listed in Section 1.1 (DAF 2011, 2016a, 2018, 2023, 2024a).

Table 3.1-1. Resources not Analyzed

Resource	Reason not Analyzed
Land Use and Aesthetics	The activities under the Proposed Action are consistent with those already conducted at VSFB. A former launch site (SLC-6) would be used for the proposed expansion of SpaceX activities. The proposed activities would be similar to launch activities that have been performed at this site and nearby launch sites on VSFB. The proposed increase in launch cadence would be consistent with existing land use at the project site, would not result in a change to land use or be incompatible with adjacent land uses, such as agricultural land, and would not alter the existing industrial character of the area. Views along the coastline would not change and no alterations to the visual landscape would occur. Therefore, this resource was considered but not analyzed in this EIS.
Visual Effects, Light Emissions, and Visual Resources/Visual Character	The Proposed Action would not change the existing or planned use of VSFB. Launch and landing would occur from existing sites at SLC-4 and SLC-6 on VSFB at any time of the day. Lighting would be used to support night launches; however, nighttime lighting is already present as VSFB for security purposes and the amount of lighting would not increase as a result of the proposed increase in launch cadence, and therefore there would not be additional impacts from lighting to support launch operations. The Proposed Action would conform to the existing designated land uses. The additional proposed launch and landing activities would not differ visually from those activities already occurring at VSFB. Therefore, this resource was considered but not analyzed in this EIS.
Protection of Children from Environmental Health Risks and Safety Risks	The Proposed Action includes activities that regularly occur at VSFB. No component of the Proposed Action would result in a disproportionate health and safety risk to children.
Farmlands	The Proposed Action would not convert prime agricultural land to other uses or result in a decrease in the land's productivity. Therefore, this resource was considered but eliminated from detailed analysis in this EIS
Natural Resources and Energy Supply	The Proposed Action would minimally affect supplies of energy, water, and would not affect asphalt, aggregate, and wood, and other natural resources in the region because the Proposed Action either requires none to relatively small amounts of these resources or there are abundant suppliers available in the region. Therefore, the potential impacts to natural resources are considered but eliminated from detailed analysis in this EIS.
Wild and Scenic Rivers	There are no rivers protected under the California Wild and Scenic Rivers Act within the affected environment. Therefore, this resource was considered but not analyzed in this EIS.

3.2 Foreseeable Environmental Effects

Cumulative impacts are defined as effects on the environment that result from the incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. This section describes the effects of the proposed action when combined with the potential effects that are factually foreseeable, relevant to the DAF's and FAA's decision making process, and for which it is reasonable to hold the DAF and/or FAA responsible for those effects. The depth of this analysis is commensurate with the potential for significant impacts. Any future federal agency actions modifying the launch program would be subject to environmental review.

The region of influence (ROI) for cumulative impacts analyses of each resource are the same areas as defined for each resource's direct and indirect impact analysis, as described below. Past, present, and reasonably foreseeable actions within the ROI include current and future aircraft operations at the airport, rocket launches, rocket engine testing, development in the local area related to activities at VSFB, and any other development that may occur as a result of economic growth in the area. The projects identified in the following sections include those that had or have the potential to affect the environmental impact categories analyzed in this EIS.

3.2.1 Past Actions

Past actions at VSFB; the City of Lompoc, CA; and the Northern Channel Islands (NCI) are primarily tied to rocket launches, construction on VSFB's launch pads, regular military, and commercial use of VSFB (e.g., takeoffs, landings, launches), and Lompoc, CA community development projects (Table 3.2-1).

Table 3.2-1. Past Actions Recently Completed at or around VSFB

- Government and commercial rocket launches and regular aircraft take-offs and landings at VSFB
- Voluntourism restoration project on San Nicolas Island[1]
- Completion of a 22.5 megawatts solar farm on VSFB[2]
- Completion of Building 7000 on VSFB with LEED Gold certified[3]
- Kids Motorsports Park at River Park[4]

Sources: [1]Kleist 2018, [2]VSFB 2018, [3]Balance Green Consulting 2022, [4]City of Lompoc 2016

3.2.2 Present Actions

Present actions at VSFB include rocket launch programs and several residential developments in the adjacent City of Lompoc, CA (Table 3.2-2).

Table 3.2-2. Present Actions at or Around VSFB

- General maintenance and construction on VSFB
- SpaceX rocket launches and landings at SLC-4[1]
- Firefly rocket launches at SLC-2[2]
- Northrop Grumman rocket launches at SLC-8
- Boeing X-37B Spaceplane landings at VSFB[3]
- Regular aircraft take-offs and landings at VSFB
- Missile test launches, North VSFB
- Approved private development projects in Lompoc[4] including:
- Strauss Wind Energy Project in Lompoc[5]
- Lompoc Valley Parks, Recreations and Pool Foundation Project - Lompoc Motorsport Park[6]
- Pier Construction on Santa Cruz Island[7]

Sources: [1]DAF 2023, 2024a, [2]Gray 2022, [3]DAF 2022c, [4]City of Lompoc 2024, [5]Department of Planning and Development Santa Barbara County 2019, [6]City of Lompoc 2016, [7]National Park Service 2024,

3.2.3 Reasonably Foreseeable Actions

Reasonably foreseeable future actions at VSFB include continued rocket launches, regular military aircraft takeoffs and landings, and the development of residential and community real estate in Lompoc, CA (Table 3.2-3).

Table 3.2-3. Reasonably Foreseeable Actions

- General maintenance and construction on VSFB
- Regular aircraft take-offs and landings at VSFB
- Redevelopment of SLC-5 and Phantom rocket launches[1]

- United Launch Alliance rocket launches at SLC-3
- May increase up to 110 space vehicle launches annually (inclusive of the 50 authorized annual Falcon 9 launches) with DOD and commercial payloads from VSFB
- Further infrastructure development for expanded space launch capabilities at VSFB[2]
- Missile test launches, including Sentinel Test mission at VSFB
- Approved private development projects in Lompoc[3]
- U.S. Navy Hawaii-California Training and Testing[4]

Sources: [1]DAF 2024b, [2]Erwin 2022, [3]City of Lompoc 2024, [4]https://www.nepa.navy.mil/hctteis/

3.3 Air Quality

3.3.1 Affected Environment

For air quality, DAF considers this Proposed Action and Alternative 1 as effectively a continuation and an expansion of the previous action for up to 50 launches as described in the 2024 EA (DAF 2024a, for up to 50 launches) and the associated 2025 GCR Determination (DAF 2025) for action related activities within the Los Angeles-South Coast Air Basin (SCAB) Ozone Extreme Nonattainment Area. Additionally, the previous air quality assessment (i.e., the 2024 EA; DAF 2024a) was based on overly conservative assumptions on tugboat routing and operational times that have since been demonstrated to be unrealistic. Therefore, for this expanded air quality impact assessment, the assumptions have been revised. As a result, the EIS air quality assessment started with revising the 2024 projected emissions (for up to 50 launches, per the 2024 EA; DAF 2024a) with the revised assumptions, then evaluated the projected emissions beyond 2024, and finally provided a reevaluation of the 2025 GCR Determination (DAF 2025).

3.3.1.1 Regulatory Setting

Air quality in a given location is defined by the concentration of various pollutants in the atmosphere. Many factors influence the air quality of a region, including the type and amounts of pollutants emitted into the atmosphere, the size and topography of the affected air basin, and the prevailing meteorological conditions. Most air pollutants originate from human made sources, including mobile sources (e.g., cars, trucks, aircraft) and stationary sources (e.g., factories, refineries, power plants), as well as indoor sources (e.g., cleaning solvents and some building materials). Air pollutants are also released from natural sources such as volcanic eruptions and wildfires.

The U.S. Environmental Protection Agency (USEPA) established the National Ambient Air Quality Standards (NAAQS) to regulate the following criteria pollutants: ozone (O_3), carbon monoxide (CO), nitrogen oxides (NO_x, with nitrogen dioxide as an indicatory), sulfur oxides (SO_x, with sulfur dioxide as an indicator), particulate matter less than or equal to 10 microns in diameter (PM_{10}), particulate matter less than or equal to 2.5 microns in diameter ($PM_{2.5}$), and lead (Pb). The CAA establishes air quality regulations and the NAAQS and delegates the enforcement of these standards to the states. O_3, some NO_x, and particulates are formed through atmospheric chemical reactions from other pollutant emissions (called precursors) that are influenced by weather, ultraviolet light, and other atmospheric processes. O_3 is formed in the atmosphere by photochemical reactions of previously emitted NO_x and photochemically reactive volatile organic compounds (VOCs). In addition to criteria pollutants, USEPA also regulates hazardous air pollutants (HAPs). HAPs are emitted from a range of industrial facilities and vehicles. USEPA sets Federal regulations to reduce HAP emissions from stationary sources in the National Emission Standards for Hazardous Air Pollutants (USEPA, 2024a). Federal agencies address emissions of greenhouse gases (GHGs) by reporting and meeting reductions mandated in Federal laws, EOs, and agency policies.

3.3.1.2 DAF Insignificance Indicators

For air quality impact assessments, significance is defined by the degree to which the effects of the proposed action potentially could affect public health or safety. For air impact assessments, the DAF established legally defensible insignificance values (indicators) for actions occurring within attainment areas. Insignificance thresholds are EPA-

established annual emission rates that, if exceeded, would trigger a regulatory requirement. Insignificance indicators are USEPA-established rate thresholds that are partially applied or applied out of context to their intended use; however, can provide a direct gauge of potential impact. Although indicators that are not GCR de minimis values do not trigger a regulatory requirement, they do provide an indication or a warning that the action is potentially approaching a threshold which would trigger a significant regulatory requirement.

3.3.1.3 Regions of Influence

The Proposed Action would occur within the jurisdiction of three local air pollution control districts in California. The Santa Barbara County Air Pollution Control District (SBCAPCD) has jurisdiction over Santa Barbara County. The VCAPCD has jurisdiction over Ventura County. The South Coast Air Quality Management District (SCAQMD) has jurisdiction over Los Angeles County. The Proposed Action includes activities in the South Central Coast Air Basin (SCCAB) and the SCAB. Coastal waters within three nautical miles (nm) of the shore are under the same air quality jurisdiction as the contiguous land areas of the SCCAB. VSFB is located within the SCCAB, which includes San Luis Obispo, Santa Barbara, and Ventura counties. The Proposed Action would also include vessel travel to and from the Port of Long Beach in Los Angeles County, which is located within the SCAB and the SCAQMD, and to and from Vandenberg Harbor, which would involve vessel traffic through SBCAPCD and VCAPCD.

For criteria pollutants, there are three distinct Regions of Influence (ROIs) which apply to both NEPA and GCR assessments: SBCAPCD which includes all activities occurring within Santa Barbara County, VCAPCD which includes all activities occurring within Ventura County, and SCAQMD which includes all activities occurring within Los Angeles County. See Figure 3.3-1 for areal extent of ROIs for criteria pollutants. As such, the air quality impact assessment is summarized separately for each ROI (county) to ensure that each nonattainment or maintenance area is evaluated separately.

None of the Air Districts where any of these proposed actions may occur have adopted the 2010 revisions to 40 CFR Part 93. Consequently, the applicable conformity rules are found at SCAQMD Rule 1901; SBCAPCD Rule 702; and VCAPCD Rule 220. A “nonattainment area” is a geographical area designated by USEPA as exceeding the NAAQS for one or more criteria pollutants. Maintenance areas are former nonattainment areas.

The air quality impact evaluation for this action requires two separate analyses: the CAA General Conformity Analysis and an analysis under NEPA. Impacts of air pollutants emitted by activities in the Pacific Ocean, bays, and inland locations in State waters (i.e., up to 3 nm from the coast) are assessed under the GCR (43 USC 1301 et seq.). Federal actions are exempt from conformity determinations if they do not exceed designated *de minimis* levels for criteria pollutants (40 CFR Part 51.853[b]). Impacts of air pollutants emitted by activities in the Pacific Ocean, bays, and inland locations in U.S. territorial seas (i.e., up to 12 nm from the coast) are assessed under NEPA. Table 3.3-1 presents the air quality DAF insignificance thresholds and indicators that would be applied to the Proposed Action’s and alternatives’ emissions.

Table 3.3-1. Action-Related Insignificance Thresholds/Indicators

Pollutant	Santa Barbara County (SBCAPCD)	Ventura County (VCAPCD)		Los Angeles County (SCAQMD)	
	< 12 nm	≤ 3 nm	3 – 12 nm	≤ 3 nm	3 – 12 nm
	Tons Per Year				
Ozone (NO_x or VOC)	250	50	250	10	250
Carbon Monoxide (CO)	250	250	250	100	250
NOx	250	250	250	250	250
SOx	250	250	250	250	250
PM_{10}	250	250	250	100	250
$PM_{2.5}$ (NOx, VOC, SOx, or NH_3)	250	250	250	70	250
Lead (Pb)	25	25	25	25	25
GHG (as CO_2e)	75,000 (68,039 Metric Tons)				

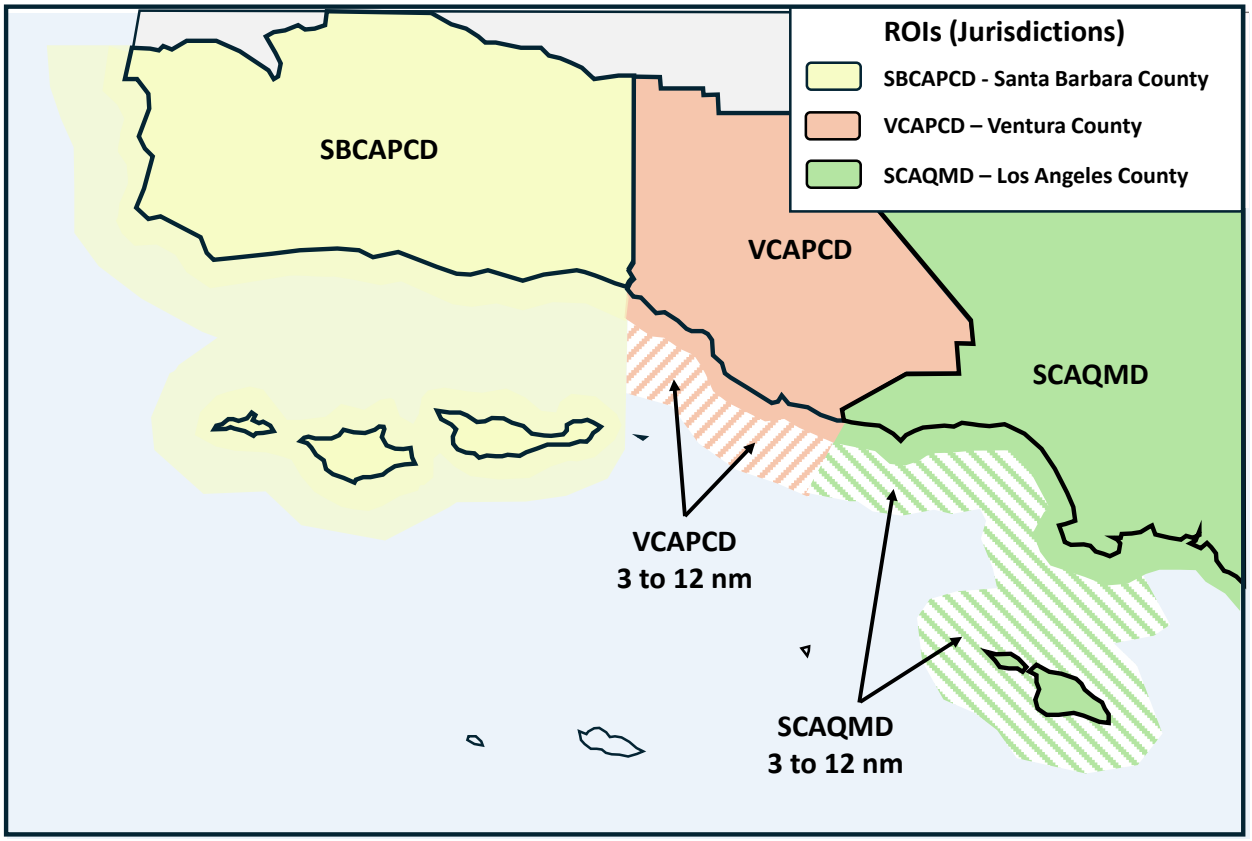

Figure 3.3-1. Criteria Pollutant ROIs (Note: ROI for nonattainment areas (i.e., VCAPCD and SCAQMD) extends seaward out to 3 nm then followed by an attainment area between 3 and 12 nm. Map is not drawn to scale.

3.3.1.4 Climate of the ROIs

The climate of the Pacific Ocean and adjacent land areas is influenced by surface water temperatures, water currents, and wind. Offshore climates are moderate and seldom have extreme seasonal variations because the ocean is slow to change temperature. Ocean currents influence climate by moving warm and cold water between regions. Adjacent land

areas are affected by the wind that is cooled or warmed when blowing over these currents. The wind also moves evaporated moisture from the ocean to adjacent land areas and is a major source of rainfall.

The climate of coastal Southern California and adjacent offshore Pacific Ocean waters consists of warm, dry summers and cool, typically wet winters (although the region has been subject to regular severe drought), mainly influenced by a semi-permanent high-pressure system (the Pacific High) in the eastern Pacific Ocean. This Pacific High maintains clear skies in Southern California for much of the year. When the Pacific High moves south during the winter, this pattern changes and low-pressure centers migrate into the region, bringing precipitation, falling mainly as rain in October-April. The predominant regional wind directions are westerly and west-southwesterly during all four seasons. Surface winds are typically from the north and west (onshore) during the day and from the east (offshore) at night (Dudek 2024).

3.3.1.5 Existing Air Quality

Offshore air quality is generally better than adjacent onshore areas because there are few or no large sources of criteria air pollutants offshore. Much of the air pollutants in offshore areas are transported there from adjacent land areas by low-level offshore winds, so concentrations of criteria air pollutants generally decrease with increasing distance from land. No criteria air pollutant monitoring stations are located in offshore areas, so air quality in the ROI must be inferred from adjacent land areas where air pollutant concentrations are monitored.

Santa Barbara County is in attainment for all NAAQSs. Most of Ventura County is in serious nonattainment for the eight-hour O_3 NAAQS including the area where the Proposed Action would take place. Los Angeles County, where portions of the action would take place, is in extreme nonattainment for the eight-hour O_3 NAAQS, maintenance for CO, nonattainment for Pb, nonattainment for $PM_{2.5}$, and maintenance for PM_{10}. Within attainment areas, SpaceX is required to ensure air quality does not significantly deteriorate due to air emissions associated with the Proposed Action. The Proposed Action is required to demonstrate conformity, also known as General Conformity, with the approved SIP if the net emissions equal or exceed the *de minimis* emission levels in nonattainment and maintenance areas. The SIP prescribes mitigation measures and timelines necessary to bring ambient concentrations of criteria pollutants below the NAAQS. A summary of recent measured air pollutant concentrations in the ROI is provided in detail in Appendix F.

3.3.1.5.1 Criteria Air Pollutants

The atmosphere is composed of several layers: the troposphere, where weather occurs and temperatures decrease with altitude; the stratosphere, which contains the O_3 layer and has increasing temperatures with altitude; and above that, the ionosphere contains charged particles that enable radio communication. Air pollutants emitted more than 3,000 ft above ground level are considered to be above the atmospheric inversion layer and, therefore, do not affect ground-level air quality (USEPA 1992). Emissions released above this altitude are often too highly dispersed within the atmosphere to impact pollutant concentrations over land and the surface of the water in the lower atmosphere, measured at ground-level monitoring stations, upon which federal, state, and local regulatory decisions are based. However, since all of the sources of pollutants are mobile, and it is difficult to determine where exactly emissions would be released within the ROI, all emissions occurring under 3,000 ft are considered when comparing against the *de minimis* thresholds.

Table 3.3-2 shows revised annual emissions from SpaceX activities (including launch and landing activities; static firing; booster and fairing recoveries; work transits; vendor deliveries; and generator use) for each ROI from the currently approved 50 launch events evaluated in the 2024 EA (DAF 2024a). The previous air quality assessment from the 2024 EA was based on overly conservative assumptions on tugboat routing, operational times, and engine load factors that have since been demonstrated to be unrealistic. Therefore, the assumptions have been revised using real-world recorded data from tugboat maneuvers to derive reasonably foreseeable values for primary and support tugboat runtimes and engine load factors. As a result, the 2024 EA emission values were revised using the updated and more informed assumptions, as shown in Table 3.3-2.

Due to the overly conservative assumptions, the 2024 EA overestimated the net annual emissions, and erroneously concluded that NO_x emissions would exceed GCR *de minimis* levels within the SCAQMD starting in 2025. As a result, the SCAQMD provided a set-aside account allowance of 31.26 tons per year (tpy) of NO_x for 2025 through 2030 from the 2016 Air Quality Management Plan (2016 AQMP; SCAQMD 2024). However, as Table 3.3-2 clearly shows, all criteria pollutant emissions (including NO_x) were well below the DAF insignificance thresholds (which include GCR *de minimis* values).

Table 3.3-2. Revised Annual Criteria Pollutant Emissions Under the Baseline Conditions (≤50 launches per year)

ROI (Jurisdiction)	Annual Emissions (tpy)						
	VOC	NO_x	CO	SO_x	PM_{10}	$PM_{2.5}$	Pb
SBCAPCD (≤ 12 nm)	**6.01**	**30.81**	**28.99**	**0.62**	**1.08**	**1.03**	**0.00**
DAF Insignificance Thresholds	250	250	250	250	250	250	25
Exceeded Threshold?	No	No	No	No	No	No	No
VCAPCD (≤ 3 nm)	**0.01**	**0.11**	**0.11**	**0.001**	**0.002**	**0.002**	**0.00**
DAF Insignificance Thresholds	50*	50*	250	250	250	250	25
Exceeded Threshold?	No	No	No	No	No	No	No
VCAPCD (3 to 12 nm)	**0.14**	**1.68**	**2.75**	**0.04**	**0.04**	**0.04**	**0.00**
DAF Insignificance Thresholds	250	250	250	250	250	250	25
Exceeded Threshold?	No	No	No	No	No	No	No
SCAQMD (≤ 3 nm)	**0.17**	**2.41**	**3.42**	**0.04**	**0.07**	**0.07**	**0.00**
DAF Insignificance Thresholds	10*	10*	100*	70*	100*	70*	25*
Exceeded Threshold?	No	No	No	No	No	No	No
SCAQMD (3 to 12 nm)	**0.41**	**5.56**	**7.92**	**0.11**	**0.14**	**0.14**	**0.00**
DAF Insignificance Thresholds	250	250	250	250	250	250	25
Exceeded Threshold?	No	No	No	No	No	No	No

Notes: * Indicates the DAF Insignificance Threshold is actually a GCR de minimis value.
VOC = volatile organic compound, NO_X = nitrogen oxides, CO = carbon monoxide, SO_X = sulfur oxides, PM_{10} = particulate matter ≤ 10 microns in diameter, $PM_{2.5}$ = particulate matter ≤ 2.5 microns in diameter, Pb = lead, tpy = tons per year

Additionally, previously approved activities and baseline conditions involve mobile sources using fossil fuel combustion. GHG emissions can persist in the atmosphere from 12 years for methane to up to 200 years for carbon dioxide (CO_2). Table 3.3-3 shows the revised annual GHG emissions baseline produced under SpaceX activities (including launch and landing activities; static firing; booster and fairing recoveries; work transits; vendor deliveries; and generator use) from the currently approved 50 launch events evaluated in the 2024 EA (DAF 2024a) and compares them against total national GHG emissions.

Table 3.3-3. Revised Annual GHG Emissions Under the Baseline Conditions (≤ 50 launches per year

Emissions of CO_{2e} (Metric tpy)	
Current Environmental Baseline GHG Emissions	29,640
National GHG Emissions	5,981,400,000
Percent of National Emissions	0.000496%
California GHG Emissions	369,200,000
Percent of California Emissions	0.00803%

Notes: CO_{2e} = carbon dioxide equivalent, tpy = tons per year

3.3.2 Environmental Consequences

Air quality impacts would be significant if the Proposed Action would cause pollutant concentrations to exceed one or more of the NAAQS, as established by the USEPA under the CAA, for any of the time periods analyzed in this EIS, or to increase the frequency or severity of any such existing violations. There are no significance thresholds for space launch GHG emissions, nor has the FAA identified specific factors to consider in making a significance determination for GHG emissions.

With the exception of launch, barge, and crane activities, emissions were calculated using the DAF ACAM. ACAM does not provide functionality for launch activities; these emissions were calculated using engine-specific emissions factors derived from PERCORP and VIPER models. The barge and crane activities emissions were calculated using the CalEEMod, which are presented in Appendix F. While this section presents summary tables of each component activity, Appendix F includes detailed assumptions, calculation tables, and air modeling output reports.

3.3.2.1 Proposed Action

3.3.2.1.1 Construction and Operations

With the exception of launch, barge, and crane activities, emissions were calculated using the DAF Air Conformity Applicability Model (ACAM). ACAM does not provide functionality for launch activities; these emissions were calculated using engine-specific emissions factors derived from PERCORP and VIPER models. The barge and crane activities emissions were calculated using the California Emissions Estimator Model (CalEEMod), which are presented in Appendix F. While this section presents summary tables of each component activity, Appendix F includes detailed assumptions, calculation tables, and air modeling output reports.

The Proposed Action would occur within the jurisdiction of three local air pollution control districts: SBCAPCD (which includes Santa Barbara County), VCAPCD (which includes Ventura County), and SCAQMD (which includes Los Angeles County). Santa Barbara County falls within the SBCAPCD's jurisdiction and has no nonattainment/maintenance areas. Each of these three air pollution control districts are considered separate and distinct ROIs. Construction occurs in Santa Barbara County; operations occur within all three counties. It was determined that the portion of Los Angeles County where the Proposed Action would occur encompasses five nonattainment areas and two maintenance areas. Therefore, the air quality impact assessment is summarized separately for each ROI to ensure that each nonattainment or maintenance area is evaluated separately as required under 40 CFR Part 93(e).

Construction under the Proposed Action would result in the temporary addition of pollutants to the local airshed in Santa Barbara County caused by on-site sources (i.e., off-road construction equipment, soil disturbance) and off-site sources (i.e., haul trucks and worker vehicle trips). Construction emissions can vary substantially from day to day, depending on the level of activity; the specific type of operation; and, for dust, the prevailing weather conditions. Therefore, such emission levels can only be approximately estimated with a corresponding uncertainty in precise ambient air quality impacts. Criteria air pollutant emissions associated with temporary construction activities were quantified using the ACAM. Construction schedule assumptions, including phase type, duration, and sequencing, were based on information provided by the project applicant and are intended to represent a reasonable scenario based on the best information available. Implementation of the Proposed Action would generate air pollutant emissions from entrained dust, off-road equipment, vehicle emissions, architectural coatings, and asphalt pavement application. Entrained dust results from the exposure of earth surfaces to wind from the direct disturbance and movement of soil, resulting in PM_{10} and $PM_{2.5}$ emissions.

Operations, which would increase under the Proposed Action with increased launch and landing cadence, would generate criteria pollutant and HAP emissions from mobile sources, including vehicle trips from passenger vehicles and heavy-duty trucks, marine vessels, booster launches and landings, launch vehicle processing, and off-road equipment used for maintenance. The Federal Highway Administration (FWHA) considers projects to have a low potential for effect

for mobile source air toxics when design year traffic is below 140,000–150,000 vehicles per day (FWHA 2016). As discussed in Section 3.13, traffic from the Proposed Action and around VSFB would be substantially lower than these volumes. Accordingly, emissions from vehicular traffic would have low potential effects from mobile source air toxics.

As shown in Table 3.3-4, net annual emissions of the Proposed Action within the SBCAPCD would not exceed the DAF insignificance thresholds. Additionally, the DAF would implement EPMs to minimize emissions from exhaust and dust (Section 3.3.2.5). As such, the Proposed Action would not have an adverse effect on air quality within the SBCAPCD.

Table 3.3-4. SBCAPCD Annual Net Change in Emissions out to 12 nm – Proposed Action

Year	Emission Source	VOC	NO_x	CO	SO_x	PM_{10}	$PM_{2.5}$	Pb	NH_3
		Tons Per Year (tpy)							
2024	Existing Operational (at ≤50 launches)	**6.01**	**30.81**	**28.99**	**0.62**	**1.08**	**1.03**	**0.00**	**0.10**
2025	Operational (at ≤70 launches)	8.41	43.13	40.59	0.87	1.51	1.44	0.00	0.13
	Construction[a]	0.10	1.07	1.03	0.00	4.02	0.04	0.00	0.03
	Total	**8.51**	**44.20**	**41.62**	**0.87**	**5.53**	**1.48**	**0.00**	**0.16**
2026	Operational (at ≤82 launches)	9.86	50.53	47.54	1.02	1.77	1.68	0.00	0.16
	Construction[b]	1.95	3.07	2.69	0.01	1.87	0.10	0.00	0.10
	Total	**11.81**	**53.60**	**50.23**	**1.03**	**3.64**	**1.78**	**0.00**	**0.26**
≥ 2027	Operational (at ≤100 launches)	**12.02**	**61.62**	**57.98**	**1.24**	**2.16**	**2.05**	**0.00**	**0.19**
DAF Insignificance Thresholds (tpy)		**250**	**250**	**250**	**250**	**250**	**250**	**25**	**250**
Year/s Threshold Exceeded		**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**

Notes: [a] Emissions for 2 out of 12 months
[b] Emissions for 10 out of 12 months
VOC = volatile organic compound; NO_x = oxides of nitrogen; CO = carbon monoxide; SO_x = sulfur oxides; PM_{10} = coarse particulate matter; $PM_{2.5}$ = fine particulate matter; <0.01 = reported value less than 0.01; Pb = lead; NH_3 = ammonia (a $PM_{2.5}$ precursor); DAF = Department of the Air Force.

As shown in Table 3.3-5 and Table 3.3-6, net annual emissions of the Proposed Action within the VCAPCD would not exceed the DAF insignificance thresholds. Additionally, the DAF would implement EPMs to minimize emissions from exhaust and dust (Section 3.3.2.5). As such, the Proposed Action would not have an adverse effect on air quality within the VCAPCD.

Table 3.3-5. VCAPCD Annual Net Change in Emissions (<3 nm) – Proposed Action

Year	Emission Source	VOC	NO_x	CO	SO_x	PM_{10}	$PM_{2.5}$	Pb	NH_3
		Tons Per Year (tpy)							
2024	Existing Roll-On-Roll-Off (at ≤50 launches)	0.01	0.11	0.11	0.001	0.002	0.002	0.00	0.00
2025	Roll-On-Roll-Off (at ≤70 launches)	0.01	0.15	0.15	0.002	0.004	0.004	0.00	0.00
2026	Roll-On-Roll-Off (at ≤82 launches)	0.02	0.18	0.18	0.002	0.004	0.004	0.00	0.00
≥ 2027	New Roll-On-Roll-Off (at ≤100 launches)	0.02	0.22	0.22	0.003	0.005	0.005	0.00	0.00
DAF Insignificance Thresholds (tpy)		**50***	**50***	**250**	**250**	**250**	**250**	**25**	**250**

Year/s Threshold Exceeded	None	None	None	None	None	None	None	None

Notes: * Indicates DAF Insignificance Threshold is actually a GCR *de minimis* value.
VOC = volatile organic compound; NO_x = oxides of nitrogen; CO = carbon monoxide; SO_x = sulfur oxides; PM_{10} = coarse particulate matter; $PM_{2.5}$ = fine particulate matter; <0.01 = reported value less than 0.01; Pb = lead; NH_3 = ammonia (a $PM_{2.5}$ precursor); DAF = Department of the Air Force.

Table 3.3-6. VCAPCD Annual Net Change in Emissions (3 to 12 nm) – Proposed Action

Year	Emission Source	VOC	NO_x	CO	SO_x	PM_{10}	$PM_{2.5}$	Pb	NH_3
		Tons Per Year (tpy)							
2024	Existing Roll-On-Roll-Off (at ≤50 launches)	0.14	1.68	2.75	0.04	0.04	0.04	0.00	0.00
2025	Roll-On-Roll-Off (at ≤70 launches)	0.20	2.33	3.85	0.05	0.049	0.049	0.00	0.00
2026	Roll-On-Roll-Off (at ≤82 launches)	0.23	2.73	4.52	0.06	0.058	0.058	0.00	0.00
≥ 2027	New Roll-On-Roll-Off (at ≤100 launches)	0.29	3.33	5.51	0.07	0.07	0.07	0.00	0.00
DAF Insignificance Thresholds (tpy)		**250**	**250**	**250**	**250**	**250**	**250**	**250**	**25**
Year/s Threshold Exceeded		**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**

Notes: VOC = volatile organic compound; NO_x = oxides of nitrogen; CO = carbon monoxide; SO_x = sulfur oxides; PM_{10} = coarse particulate matter; $PM_{2.5}$ = fine particulate matter; <0.01 = reported value less than 0.01; Pb = lead; NH_3 = ammonia (a $PM_{2.5}$ precursor); DAF = Department of the Air Force.

Within the SCAQMD, as shown in Table 3.3-7 and Table 3.3-8, net annual emissions of the Proposed Action would not exceed the DAF insignificance thresholds for VOC, CO, SO_x, PM_{10}, $PM_{2.5}$, Pb, or NH_3. As such, the Proposed Action would not have an adverse effect on air quality in Los Angeles County.

Table 3.3-7. SCAQMD Annual Net Change in Emissions (<3 nm) – Proposed Action

Year	Emission Source	VOC	NO_x	CO	SO_x	PM_{10}	$PM_{2.5}$	Pb	NH_3
		Tons Per Year (tpy)							
2024	Existing Roll-On Roll-Off (at ≤50 launches)	0.08	1.04	1.66	0.02	0.03	0.03	0.00	0.00
	Existing Booster/Payload Fairing Recovery (at ≤50 launches)	0.09	1.37	1.76	0.02	0.04	0.04	0.00	0.00
	Total	**0.17**	**2.41**	**3.42**	**0.04**	**0.07**	**0.07**	**0.00**	**0.00**
2025	Roll-On-Roll-Off (at ≤70 launches)	0.11	1.45	2.32	0.02	0.04	0.04	0.00	0.00
	Booster/Payload Fairing Recovery (at ≤70 launches)	0.13	1.92	2.46	0.04	0.05	0.05	0.00	0.00
	Total	**0.24**	**3.37**	**4.78**	**0.06**	**0.09**	**0.09**	**0.00**	**0.00**
2026	Roll-On-Roll-Off (at ≤82 launches)	0.12	1.70	2.72	0.02	0.05	0.05	0.00	0.00
	Booster/ Payload Fairing Recovery (at ≤82 launches)	0.16	2.25	2.88	0.04	0.06	0.06	0.00	0.00
	Total	**0.28**	**3.95**	**5.60**	**0.06**	**0.11**	**0.11**	**0.00**	**0.00**
≥ 2027	Roll-On-Roll-Off (at ≤100 launches)	0.15	2.07	3.32	0.03	0.06	0.06	0.00	0.00

	Booster/ Payload Fairing Recovery (at ≤100 launches)	0.19	2.74	3.51	0.05	0.07	0.07	0.00	0.00
	Total	**0.34**	**4.81**	**6.83**	**0.08**	**0.13**	**0.13**	**0.00**	**0.00**
DAF Insignificance Thresholds (tpy)		**10***	**10***	**100***	**70***	**100***	**70***	**25***	**70***
Year/s Threshold Exceeded		**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**

Notes: * Indicates DAF Insignificance Threshold is actually a GCR *de minimis* value.
VOC = volatile organic compound; NO_x = oxides of nitrogen; CO = carbon monoxide; SO_x = sulfur oxides; PM_{10} = coarse particulate matter; $PM_{2.5}$ = fine particulate matter; <0.01 = reported value less than 0.01; Pb = lead; NH_3 = ammonia (a $PM_{2.5}$ precursor); DAF = Department of the Air Force.

Table 3.3-8. SCAQMD Annual Net Change in Emissions (3 to 12 nm) – Proposed Action

Year	Emission Source	VOC	NO_x	CO	SO_x	PM_{10}	$PM_{2.5}$	Pb	NH_3
		Tons Per Year (tpy)							
2024	Existing Roll-On Roll-Off (at ≤50 launches)	0.13	1.45	2.65	0.04	0.03	0.03	0.00	0.00
	Existing Booster/Payload Fairing Recovery (at ≤50 launches)	0.28	4.11	5.27	0.07	0.11	0.11	0.00	0.00
	Total	**0.41**	**5.56**	**7.92**	**0.11**	**0.14**	**0.14**	**0.00**	**0.00**
2025	Roll-On-Roll-Off (at ≤70 launches)	0.18	2.00	3.71	0.05	0.04	0.04	0.00	0.00
	Booster/Payload Fairing Recovery (at ≤70 launches)	0.39	5.76	7.37	0.10	0.15	0.15	0.00	0.00
	Total	**0.57**	**7.76**	**11.08**	**0.15**	**0.19**	**0.19**	**0.00**	**0.00**
2026	Roll-On-Roll-Off (at ≤82 launches)	0.21	2.35	4.35	0.06	0.05	0.05	0.00	0.00
	Booster/ Payload Fairing Recovery (at ≤82 launches)	0.46	6.75	8.63	0.11	0.18	0.18	0.00	0.00
	Total	**0.67**	**9.10**	**12.98**	**0.17**	**0.23**	**0.23**	**0.00**	**0.00**
≥ 2027	Roll-On-Roll-Off (at ≤100 launches)	0.25	2.86	5.30	0.07	0.06	0.06	0.00	0.00
	Booster/ Payload Fairing Recovery (at ≤100 launches)	0.56	8.23	10.53	0.14	0.22	0.22	0.00	0.00
	Total	**0.81**	**11.09**	**15.83**	**0.21**	**0.28**	**0.28**	**0.00**	**0.00**
DAF Insignificance Thresholds (tpy)		**250**	**250**	**250**	**250**	**250**	**250**	**250**	**25**
Year/s Threshold Exceeded		**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**

Notes: VOC = volatile organic compound; NO_x = oxides of nitrogen; CO = carbon monoxide; SO_x = sulfur oxides; PM_{10} = coarse particulate matter; $PM_{2.5}$ = fine particulate matter; <0.01 = reported value less than 0.01; Pb = lead; NH_3 = ammonia (a $PM_{2.5}$ precursor); DAF = Department of the Air Force.

3.3.2.1.2 General Conformity Rule Analysis for Proposed Action

The GCR determination process is intended to demonstrate that a proposed federal action will not (1) cause or contribute to new violations of a NAAQS, (2) interfere with provisions in the applicable SIP for maintenance of any NAAQS, (3) increase the frequency or severity of existing violations of any standard, or (4) delay the timely attainment of any standard. As such, for GCR determination, the Proposed Action needs to conform to the latest approved SIP/AQMP.

The GCR Applicability Analysis (net change in annual emissions analysis) results for the worst-case year (highest net change in emissions) are depicted in Table 3.3-9. Within the SBCAPCD ROI: the SBCAPCD (including Santa Barbara County) is in attainment for all NAAQS (see Table 3.3-4 and Table 3.3-9); therefore, GCR does not apply. Within the

VCAPCD ROI: the VCAPCD (including Ventura County) is in serious nonattainment for the 2008 and 2015 8-hour O_3 NAAQS. As shown in Table 3.3-6 and Table 3.3-9, the net annual emissions from the Proposed Action within Ventura County would not exceed the GCR *de minimis* thresholds for VOC or NO_x. Therefore, the Proposed Action would have an insignificant impact on air quality within the VCAPCD and a GCR determination is not required. Within the SCAQMD ROI, the SCAQMD (including Los Angeles County) is designated as an extreme non-attainment area for O_3, serious non-attainment for $PM_{2.5}$, nonattainment area for Pb, maintenance area for PM_{10}, and maintenance area for CO. As shown in Table 3.3-9, the Proposed Action's emissions would not exceed the GCR *de minimis* thresholds for NO_x (a precursor for O_3), VOC (another precursor for O_3), $PM_{2.5}$, SO_x (a precursor for $PM_{2.5}$), NH_3 (another precursor for $PM_{2.5}$), PM_{10}, Pb, or CO. The DAF initially submitted a draft amended GCD to SCAQMD seeking a concurrence. Following engagement with SCAQMD and internal review of emissions values, the DAF determined that NOx emissions from the Proposed Action are *de minimis.* Therefore, the Proposed Action would have an insignificant impact on air quality within the SCAQMD and a GCR determination is not required.

Table 3.3-9. GCR Applicability Analysis Results for Proposed Action Maximum Launch Cadence Year

Designated Area		Annual Net Change in Emissions (tpy)	De Minimis Value (tpy)	Analysis Results
SBCAPCD (Santa Barbara Co.)	None	N/A	N/A	In Attainment
VCAPCD (Ventura Co.)	Ventura County Serious 8-Hour Ozone Area (2008 & 2015 NAAQSs)	VOC = 0.02 NOx = 0.22	50 50	*De Minimis*
SCAQMD (Los Angeles Co.)	Los Angeles-South Coast Air Basin 8-Hour Ozone Extreme Nonattainment Area (2008 & 2015 NAAQSs)	VOC = 0.34 NOx = 4.81	10 10	*De Minimis*
	Los Angeles-South Coast Air Basin PM 2.5 Serious Nonattainment Area (2006, 2012, & 2024 NAAQSs)	PM 2.5 = 0.13 PM 2.5 Precursors VOC = 0.34 NOx = 4.81 NH3 = 0.00 SOx = 0.08	70	*De Minimis*
	Los Angeles-South Coast Air Basin PM 10 Maintenance Area (1987 NAAQS)	PM 10 = 0.13	100	*De Minimis*
	Los Angeles-South Coast Air Basin Pb Nonattainment Area (2008 NAAQS)	Pb = 0.00	25	*De Minimis*
	Los Angeles-South Coast Air Basin CO Maintenance Area (1971 NAAQS)	CO = 6.83	100	*De Minimis*
Notes: GCR *de minimis* values from 40 CFR 51.853 and 40 CFR 93.153(b)(1); Table includes ozone precursors (i.e., VOC and NOx). Reference & Data Source: 2025 Revised Air Quality Technical Report (see Appendix F)				

Therefore, DAF concludes that the Proposed Action complies with the requirements of the GCR regulations and conforms to the applicable SIP based on none of the annual net changes in estimated emissions associated with the Proposed Action are above the GCR *de minimis* values established in 40 CFR 93.153 (b).

3.3.2.1.3 Greenhouse Gas Analysis for Proposed Action

Construction under the Proposed Action would result in GHG emissions, which are primarily associated with use of off-road construction equipment, on-road haul trucks, on-road vendor trucks, and worker vehicles. The FAA has not proposed or adopted relevant quantitative GHG thresholds for construction-generated emissions. ACAM and spreadsheet models were used to calculate the annual GHG emissions based on the construction scenario discussed in Sections 2.1.7 and 2.3. Operation of the Proposed Action would generate GHG emissions through motor vehicle

trips; landscape maintenance equipment operation and hearths (area sources); energy use (natural gas, diesel fuel, and electricity); solid waste disposal; and water supply, treatment, and distribution and wastewater treatment. CalEEMod was used to calculate the annual GHG emissions based on the operational assumptions described in Appendix F. The estimated net operational GHG emissions from the Proposed Action are shown in Table 3.3-10. Details of the emissions calculations are provided in Appendix F.

Table 3.3-10. Estimated Net Annual GHG Emissions – Baseline Conditions vs. Proposed Action

Action	Annual GHG Emissions (metric tpy)			
	CO_2	CH_4	N_2O	CO_{2e}
Baseline Conditions (≤ 50 launches/year)	29,321.51	6.03	0.35	29,640.44
Proposed Action (≤ 100 launches/year)	57,563.02	12.04	0.61	58,162.88

When accounting for the baseline emissions reflected in the 2024 EA, the Proposed Action would result in an additional 11,806.88 metric tons of CO_2e per year. The annual emissions of the Proposed Action represent just 0.0157% of California's total annual emissions.

An emerging area of research focuses on the potential effects of rocket launches on O_3 levels and emissions in the upper atmosphere. While some research has indicated there may be such effects, primarily from black carbon impacting the ozone layer and/or global temperatures, currently there is neither a regulatory requirement nor a generally accepted method for analyzing these impacts. The DAF examined the research that has been published on this topic to date and determined the necessary data and tools do not exist to accurately estimate emissions of black carbon from rockets and any associated effects.

3.3.2.1.4 Airspace Air Quality Impacts Analysis for Proposed Action

Airspace closures associated with commercial space operations would result in additional aircraft emissions mainly from aircraft being re-routed and expending more fuel. Minimal, if any, additional emissions would be generated from aircraft departure delays because the FAA has rarely, if ever, received reportable departure delays associated with launches at VSFB. Any delays in aircraft departures from affected airports would be short term. These temporary increases in aircraft emissions could increase up to a maximum of 100 times per year. The amount of time that affected aircraft spend being re-routed would be short term and the number of aircraft that would be impacted per launch would not be expected to produce additional emissions that would have a notable impact on air quality. Therefore, these emissions increases are not expected to result in an exceedance of a NAAQS for any criteria pollutant. Emissions from aircraft being re-routed would occur above 3,000 ft (the mixing layer) and thus would not affect ambient air quality. Therefore, airspace closures associated with the Proposed Action are not expected to result in significant air quality impacts. In addition, the increases in GHGs caused by short-term airspace closures during commercial space operations under the Proposed Action is not expected to result in significant climate-related air quality impacts.

3.3.2.2 Alternative 1

3.3.2.2.1 Construction and Operations

Under Alternative 1, the DAF would implement the Proposed Action Alternative as described above, but rather than modifying the existing HIF, DAF would authorize SpaceX to construct a new approximately 62,000 ft^2 hangar north of the launch pad to support Falcon 9 and Falcon Heavy integration and processing. All other aspects of Alternative 1 would be identical to the Proposed Action. As such, the only deviations under Alternative 1 from the net emissions projected for the Proposed Action are from the new hangar construction within the SBCAPCD (Santa Barbara County). Within the SBCAPCD ROI, as shown in Table 3.3-11, the change in net emissions attributed to the hangar construction had only a slight impact on the net emission within the SBCAPCD. Therefore, as depicted in Table 3.3-11, net annual emissions of Alternative 1 within the SBCAPCD would not exceed the DAF insignificance thresholds. Additionally, the

DAF would implement EPMs to minimize emissions from exhaust and dust (Section 3.3.2.5). As such, Alternative 1 would not have an adverse effect on air quality within the SBCAPCD.

Table 3.3-11. SBCAPCD Annual Net Change in Emission – Alternative 1

Year	Emission Source	VOC	NO_x	CO	SO_x	PM_{10}	$PM_{2.5}$	Pb	NH_3
		Tons Per Year (tpy)							
2024	Existing Operational (at ≤50 launches)	**6.01**	**30.81**	**28.99**	**0.62**	**1.08**	**1.03**	**0.00**	**0.10**
2025	Operational (at ≤70 launches)	8.41	43.13	40.59	0.87	1.51	1.44	0.00	0.13
	Construction[a]	0.11	1.17	1.09	0.00	4.19	0.04	0.00	0.03
	Total	**8.52**	**44.30**	**41.68**	**0.87**	**5.70**	**1.48**	**0.00**	**0.16**
2026	Operational (at ≤82 launches)	9.86	50.53	47.54	1.02	1.77	1.68	0.00	0.16
	Construction[b]	1.97	3.43	2.77	0.01	1.89	0.10	0.00	0.13
	Total	**11.83**	**53.96**	**50.31**	**1.03**	**3.66**	**1.78**	**0.00**	**0.29**
≥ 2027	Operational (at ≤100 launches)	**12.02**	**61.62**	**57.98**	**1.24**	**2.16**	**2.05**	**0.00**	**0.19**
DAF Insignificance Thresholds (tpy)		**250**	**250**	**250**	**250**	**250**	**250**	**25**	**250**
Year/s Threshold Exceeded		**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**

Notes: [a] Emissions for 2 out of 12 months
[b] Emissions for 10 out of 12 months
VOC = volatile organic compound; NO_x = oxides of nitrogen; CO = carbon monoxide; SO_x = sulfur oxides; PM_{10} = coarse particulate matter; $PM_{2.5}$ = fine particulate matter; <0.01 = reported value less than 0.01; Pb = lead; NH_3 = ammonia (a $PM_{2.5}$ precursor); DAF = Department of the Air Force.

Within the VCAPCD ROI, given the activities associated with Alternative 1 are identical to the activities associated with the Proposed Action within the VCAPCD, the net annual emissions of Alternative 1 are the same as for the Proposed Action (see Table 3.3-5 for values) within the VCAPCD and would not exceed the DAF insignificance thresholds. Additionally, net annual VOC and NO_x (ozone precursors) emissions would not exceed the GCR *de minimis* values; therefore, the Applicability Analysis indicated that a GCR Determination is not required. As such, Alternative 1 would not have an adverse effect on air quality within the VCAPCD.

Within the SCAQMD ROI, the activities associated with Alternative 1 are identical to activities associated with the Proposed Action within the SCAQMD. As shown in Table 3.3-7 and Table 3.3-9, the Proposed Action's, and therefore Alternative 1's, emissions would not exceed the GCR *de minimis* thresholds for NO_x (a precursor for O_3), VOC (another precursor for O_3), $PM_{2.5}$, SO_x (a precursor for $PM_{2.5}$), NH_3 (another precursor for $PM_{2.5}$), PM_{10}, Pb, or CO. Therefore, Alternative 1 would have an insignificant impact on air quality within the SCAQMD and a GCR determination is not required.

3.3.2.2.2 General Conformity Rule Analysis for Alternative 1

Santa Barbara County is in attainment for all NAAQS; therefore, the GCR does not apply there. The GCR applies in both VCAPCD and SCAQMD due to their attainment status, but the net emissions in those locations under Alternative 1 are identical to the net emissions under the Proposed Action. Therefore, conclusions regarding GCR are the same and all actions to be taken by the DAF with regard to the GCR for Alternative 1 would be the same as the Proposed Action.

3.3.2.2.3 Greenhouse Gas Analysis for Alternative 1

Construction under Alternative 1 would result in GHG emissions, which are primarily associated with use of off-road construction equipment, on-road haul trucks, on-road vendor trucks, and worker vehicles. Operation of the Proposed Action and Alternative 1 would be identical. CalEEMod was used to calculate the annual GHG emissions based on the operational assumptions described in Appendix F. The estimated net operational GHG emissions from Alternative 1 are shown in Table 3.3-12. Details of the emissions calculations are provided in Appendix F.

Table 3.3-12. Estimated Operational GHG Emissions – Alternative 1

Alternative	Annual GHG Emissions (metric tpy)			
	CO_2	CH_4	N_2O	CO_{2e}
Alternative 1 (≤ 50 launches/year)	29,488.51	6.03	0.38	29,815.44
Alternative 1 (≤ 100 launches/year)	57,730.02	12.04	0.64	58,337.88

3.3.2.2.3.1 Airspace Air Quality Impacts Analysis for Alternative 1

Operation of the Proposed Action and Alternative 1 would be identical and therefore have the same potential impacts on airspace as discussed in 3.3.2.1.4.

3.3.2.3 No Action Alternative

Under the No Action Alternative, modifications of SLC-6 and increased Falcon launch cadence on VSFB would not occur, resulting in no impacts on air quality, beyond those described in the 2024 EA (DAF 2024a) which increased the Falcon 9 launch cadence to 50 launches per year. As stated in Section 2.2, the No Action effects analysis considers potential effects associated with reasonably foreseeable actions (Table 3.2-3) without consideration of the Proposed Action, because these actions would still occur under the No Action Alternative. The total annual launch cadence at VSFB is anticipated to increase over time due to other launch providers and local development projects are anticipated to continue, which could result in increased launch and development-related emissions.

3.3.2.4 Cumulative Effects

Cumulative effects are impacts on the environment which result from the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively, significant actions taking place over a period of time. However, the GCR *de minimis* levels are too low to cause or contribute to exceeding one or more NAAQSs which are measured regionally and cumulatively to define adverse impacts. As such, GCR *de minimis* values are also too low to be regionally or cumulatively harmful to public health and the environment. Therefore, any proposed action within a designated NAAQS nonattainment or maintenance area that is projected to result in annual net emissions (direct and indirect) below the *de minimis* levels, is considered insignificant to regional and cumulative air quality impacts. Given thresholds are derived for areas in attainment for NAAQS and are based on GCR *de minimis* values, any proposed action within a NAAQS attainment area that is projected to result in annual net emissions (direct and indirect) below the *de minimis* levels, is also considered insignificant to regional and cumulative air quality impacts. Both the Proposed Action and Alternative 1 are below the GCR *de minimis* or DAF insignificance thresholds for all criteria pollutants for each of the air quality ROIs (i.e., SBCAPCD, VCAPCD, and SCAQMD). As a result, both the Proposed Action and Alternative 1 are considered insignificant to regional and cumulative air quality impacts.

Weather stressors could impact implementation of the Proposed Action and Alternative 1 at VSFB and the adaptation strategies needed to respond to future conditions. Operations at VSFB have adapted to their changing weather impacts. However, exacerbation of these conditions in the future could impede proposed activities during extreme events. The

DAF will continue to assess weather related risks and improve the resilience of military installations. Implementation of these measures would mitigate the effects of weather stressors on the Proposed Action and Alternative 1.

3.3.2.5 Mitigation and Monitoring

Implementing the EPMs outlined below would avoid or minimize potential adverse effects to air quality during the Proposed Action. Qualified SpaceX personnel or contractor staff would oversee fulfilling EPMs. The SBCAPCD and CARB require the EPMs described below to decrease emissions, as applicable to the Proposed Action.

- 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 Equipment Registration Program or have a valid SBCAPCD Permit to Operate.
- Ultra-low sulfur diesel fuel (15 parts per million by volume) will be used for all diesel equipment.
- CARB-developed idling regulations will be followed for trucks during loading and unloading.
- When feasible, equipment will be 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.
- USEPA or CARB-certified diesel catalytic converters, diesel oxidation catalysts, and diesel particulate filters may be installed on all diesel equipment.
- SpaceX shall adhere to the CARB In-Use Off-Road Diesel-Fueled Fleets Regulation (CARB 2024) for fleet management and fuel selection.
- CARB diesel will be the only fuel combusted in the engines while in California Coastal Waters.

3.4 Noise

3.4.1 Affected Environment

3.4.1.1 Regulatory Setting

A description of noise/sound, applicable regulations, ambient sound guidance documents, Federal Interagency Committee on Urban Noise (1980) criteria, and USEPA noise standards is contained in Appendix G. Sound is a physical phenomenon consisting of pressure fluctuations that travel through a medium, such as air, and are sensed by the human ear. Noise is considered unwanted sound that can disturb routine activities (e.g., sleep, conversation, student learning) and can cause annoyance.

3.4.1.2 Region of Influence

The sound ROI includes the area with the potential to be affected by noise from the proposed action. Rocket engine noise is predictable and sustained based on knowledge of launch times and trajectory whereas sonic booms are acute, non-sustained, and highly dependent on trajectory, speed of launch vehicle, altitude, as well as atmospheric conditions. A sonic boom is an impulsive noise similar to thunder caused when an aircraft or rocket vehicle exceeds the speed of sound. Booms with overpressures of about 1.0 pound per square foot (psf) are audible and can startle people, but generally do not cause adverse effects such as damage to structures (Plotkin et al. 1997a; Benson 2013; National Oceanic and Atmospheric Administration [NOAA] 2024). The 1.0 psf sonic boom noise contours fully encompasses any areas affected by launch, landing, and static fire rocket engine noise or associated vibrations, which are depicted by A-weighted decibels (dBA; A-weighting is an adjustment applied to sound measurement to reflect how a noise is perceived by the human ear) contours shown in Figure 3.4-2.

As a conservative measure, the 100 unweighted decibel (dB) contour was also used to define the ROI for noise to address potential damage to structures. Noise frequencies with potential to induce structural vibrations include

frequencies that are inaudible to the human ear, and structural effects are often assessed using unweighted dB. Therefore, the ROI for noise was determined by examining areas that could potentially receive a 1.0 psf sonic boom or 100 dB engine noise from model results, which are presented later in this section.

3.4.1.3 Noise Metrics

3.4.1.3.1 Day-Night Average Sound Level & Community Noise Equivalent Level

The Day-Night Average Sound Level (DNL) metric is the energy-averaged sound level measured over a 24-hour period, with a 10 dBA penalty assigned to noise events occurring between 10:00 p.m. and 7:00 a.m. (acoustic night). The A-weighted DNL is the standard noise metric used by the U.S. Department of Housing and Urban Development, FAA, USEPA, and the DOD (used surrounding air installations). Most people are exposed to sound levels of 50–55 dBA DNL or higher on a daily basis. Noise-sensitive land uses, such as housing, schools, and medical facilities, are considered compatible in areas where the DNL is less than 65 dBA. Therefore, the 65 dBA DNL noise contour is typically used to determine compatibility of military operations with local land use. Under FAA Order 1050.1F, significant noise impacts would occur if the Proposed Action would increase noise by DNL 1.5 dB or more for a noise sensitive area that is exposed to noise at or above the DNL 65 dBA noise contour, or that would be exposed at or above the DNL 65 dB level due to a DNL 1.5 dB or greater increase in noise exposure, when compared to the No Action alternative for the same timeframe.

Per FAA Order 1050.1F, Community Noise Equivalent Level (CNEL) may be used in lieu of DNL for the FAA actions needing approval in California. CNEL, like DNL, is an energy-averaged sound level measured over a 24-hour period. CNEL, like DNL adds a 10 times weighting (equivalent to a 10 dBA "penalty") to each operation between 10:00 p.m. and 7:00 a.m. CNEL also includes a three times weighting (equivalent to an approximately five dBA penalty) for each operation during evening hours (7:00 p.m. to 10:00 p.m.). As such, DNL and CNEL are very similar, have been determined to be a reliable measure of long-term community annoyance, and are used for this analysis. Transient residential use such as motels may be considered compatible within the 65 dBA CNEL noise contour where adequate noise attenuation is provided.

C-weighting is a frequency weighting that measures the impact of loud noises on the human ear. C-weighting is used for peak sound pressure measurements, such as measuring impulsive noise (e.g., sonic booms, clapping, or banging), which better accounts for the full experience of these impulsive sounds than A-weighting. C-weighted DNL (CDNL) of 60 C-weighted decibels (dBC) is considered equivalent to DNL 65 dBA from a human annoyance perspective (National Research Council 1981). Therefore, like the DNL significance threshold, if the Proposed Action would result in a noise-sensitive area experiencing CDNL 60 dBC or higher, that would be considered a significant impact. Given unique characteristics of commercial space operations, the FAA's guidance recommends that other supplemental noise metrics may also be used in conjunction with DNL to describe and assess noise effects for commercial space operations. The FAA does not use these supplemental metrics to make decisions. Rather, the FAA has established a system of noise measurement that comprises a single, core decision-making metric, the A-weighted DNL. The FAA's NEPA implementing policies and procedures did not exempt commercial space transportation from this threshold. See FAA Order 1050.1F at Exhibit 4-1. Until the FAA revises its noise policy, all actions including commercial space transportation actions, are subject to this metric and significance threshold[14].

[14] The FAA determined that changes in transportation use, public expectations, and technology warranted a review of its civil aviation noise policy. On 13 January 2021, the FAA published in the Federal Register a notice entitled, "*Review of FAA Aircraft Noise Policy and Research Efforts: Request for Input on Research Activities to Inform Aircraft Noise Policy*", 86 FR 2722, which described the FAA's noise research portfolio and a first of its kind nationally scoped survey that updated FAA's understanding of the dose-response relationship between exposure to aircraft noise and community annoyance (Neighborhood Environmental

3.4.1.3.2 Equivalent Sound Level

The Equivalent Sound Level (L_{eq}), measured in dB, is a cumulative noise metric that represents the average sound level (on a logarithmic basis) over a specified period of time—for example, an hour, a school day, daytime, nighttime, weekend, facility rush periods, or a full 24-hour day.

3.4.1.3.3 Maximum Sound Pressure Level

The maximum sound pressure level (L_{max}) is the highest time-weighted sound level measured during a noise event during a given period of time. Often, this parameter is described along with information about the weightings used (for example, maximum A-weighted decibels [L_{Amax}] indicates the maximum level measured with A-weighting). The L_{Amax} is often used in determining the potential for hearing impairment under the Occupational Safety and Health Administration (OSHA). Further, it is important to note that this is not the same as highest instantaneous sound level (L_{peak}), which is the highest instantaneous sound level in dB, with no weighting. The L_{peak} metric can also be used when considering potential vibration effects on structures from propulsion noise.

3.4.1.3.4 Pounds per Square Foot

While rocket launches are typically measured in L_{max} or L_{eq}, psf is used to present units of peak overpressure. The peak pressure of a sonic boom in psf can be converted to the peak sound pressure level in dB (L_{peak}) by the mathematical relationship of: $L_{peak} = 127.6 + 20 \log_{10}(psf)$. These units are often used when considering potential effects of sonic booms on hearing impairment and vibrations on structures.

3.4.1.4 Sensitive Receptors

Noise sensitive areas are those areas where noise interferes with normal activities. These include off-base residential, educational, health, and religious sites, parks, recreational areas, wildlife refuges, and cultural sites. Users of designated recreational areas are considered sensitive receptors. Dependent on the action, noise sensitive land uses on and near VSFB, southeastern Santa Barbara County, Ventura County, and northwestern Los Angeles County (e.g., residential areas, hospitals, schools, and libraries) could be impacted. No human sensitive receptors are located on or near the SLC-4 or SLC-6 project sites, which are located over five mi away from off-base receptors. In addition, with the exception of being a recreational area, there are no other human sensitive receptors at Channel Islands National Park.

Survey or NES). FAA also requested input on the FAA's research activities that would inform the FAA's noise policy and would inform the future direction of the FAA noise research portfolio. The NES showed that a higher percentage of people were "highly annoyed" by aircraft noise across all levels of noise exposure that were studied. In addition to setting forth the FAA noise policy and research efforts, this Notice described the results of research into the societal benefits and costs of noise mitigation measures. On May 1, 2023, the FAA published in the Federal Register a notice entitled "*Request for Comments on the Federal Aviation Administration's Review of the Civil Aviation Noise Policy, Notice of Public Meeting*" (88 FR 26641). In this notice, the FAA announced that it intends to consider how changes to the FAA civil aviation noise policy may better inform agency decisions and the types of impacts FAA considers in making decisions (e.g., community annoyance, certain types of adverse health impacts highly correlated with aviation noise exposure). The FAA requested suggestions of potential improvements to how the FAA analyzes, explains, and presents changes in exposure to civil aviation noise. In this notice, the FAA specifically sought public comments on whether it should establish noise thresholds for low-frequency events, such as those associated with the launch and reentry of commercial space transportation vehicles authorized by the FAA Office of Commercial Space Transportation, which metrics should be used to establish these noise thresholds, and the appropriate noise exposure level to define the threshold of significant noise impacts. As part of this policy review, FAA is also examining the body of scientific and economic literature to understand how aviation noise correlates with annoyance as well as environmental, economic, and health impacts. The FAA is also evaluating whether any of these impacts are statistically significant and the metrics that may be best suited to disclose them. Until this policy development process is concluded, the FAA will continue to rely on DNL to make decisions regarding the significance of potential noise impacts.

3.4.1.5 Baseline Noise Conditions

Existing noise levels on VSFB are generally quite low due to the large areas of undeveloped landscape and sparse noise sources. Background noise levels are primarily driven by wind noise; louder noise levels can be found near industrial facilities and transportation routes, including the railway. Regularly occurring sources of noise near launch facilities include crashing ocean surf, which generates approximately 78 dBA (6.6 ft tall waves) and can be louder during high surf events (Bolina & Abom 2010). Ambient sound levels were characterized at Surf Beach, approximately 5.3 mi north of SLC-4 reported at 45.5 dBA L_{eq} at night, 51.8 dBA L_{eq} during the day, and 53.1 dBA L_{eq} during the evening. Rocket launches and aircraft overflights create louder intermittent noise levels, while ambient in-air noise levels are driven primarily by wind and wave noise. Noise levels in the adjacent City of Lompoc, CA are primarily driven by transportation noise and regional aircraft activities. DNLs are typically between 55 and 65 dBA (City of Lompoc 2014). In addition, Blue Ridge Research and Consulting, LLC (Blue Ridge) used data from a 12-month period spanning 2023 and 2024 to develop baseline CNEL contours that describe the cumulative noise exposure from launch and landing activities during this period and found that the Baseline CNEL 65 dBA contour did not encompass any land outside VSFB boundaries (Blue Ridge 2024).

3.4.2 Environmental Consequences

Per FAA Order 1050.1F, noise impacts would be significant if the Proposed Action would increase noise by DNL 1.5 dBA or more for a noise-sensitive area that is exposed to noise at or above the DNL 65 dBA noise exposure level, or that would be exposed at or above the DNL 65 dBA level due to a DNL 1.5 dBA or greater increase, when compared to the No Action Alternative for the same timeframe. For example, an increase from DNL 65.5 dB to 67 dB is considered a significant impact, as is an increase from DNL 63.5 dBA to 65 dBA. The CNEL may be used in lieu of DNL for FAA actions in California. The analyses below also consider the intensity (loudness) and context (proximity to sensitive receptors) in determining if noise impacts would be significant.

Noise modeling, using RNOISE software to estimate rocket engine noise (Plotkin et al. 1997b; Plotkin 2010) and PCBoom software to estimate sonic boom levels (Page et al. 2010; Bradley et al. 2018) was performed to estimate sound levels generated from the proposed activities at SLC-4 and SLC-6. The model results are referenced herein, but a detailed description of assumptions, methodology, and results are provided in detail in Appendix G (KBR 2025).

3.4.2.1 Proposed Action

The scope of this noise analysis is limited to construction noise and the launch, boost-back, and landing of the Falcon 9 and Falcon Heavy as described in Chapter 2. Vessel transit activities are excluded from the noise analysis as their activity is removed from sensitive receptors. There are therefore three noise components to the Proposed Action: (1) noise generated during C&D activities; (2) continuous engine noise created during static fire tests (lasting several seconds), launch ascent (lasting several minutes), and first stage and booster landings (lasting approximately 60 seconds); and (3) impulsive sonic booms created during the launch of the rocket and the returning first stages and boosters (both lasting less than one second). Static fire, launch engine noise, landing engine noise and impacts on human sensitive receptors are presented in units of LA_{max}. Sonic booms are presented in terms of psf.

3.4.2.1.1 Construction and Demolition Activities

C&D activities at SLC-6 would involve using diesel-powered heavy equipment for tasks, including excavation, filling, delivering materials, mixing and pouring concrete and asphalt, trenching, and erecting structures. Construction equipment (e.g., excavators, tractors, and trucks) could generate temporary noise levels between 82 and 88 dBA at a distance of 50 ft. Based on data for typical noise ranges (Washington State Department of Transportation 2012), materials-handling equipment (concrete mixers) could generate noise levels ranging from 75 to 85 dBA at 50 ft. In general, noise levels generated from non-pile driving construction activities are expected to range from 75 to 88 dBA at 50 ft (Table 3.4-1). These construction activities are far removed from any human sensitive receptors. As described in

Appendix G, sound levels decay with increasing distance. Within 1,500 ft, the received level of construction activities would be below 60 dBA, equivalent to an automobile passing 100 ft away. Noise from the C&D activities would be entirely restricted to within the VSFB boundary, with the exception of the use of explosives to aid demolishing the MST, MAS, and FUT (Figure 2.1-7). A linear propagation model (International Ammunition Technical Guidelines 2021) was used to estimate the resultant noise levels and affected areas. The distance at which the impulsive noise caused by the explosion would attenuate to 140 dB L_{max} (4.17 psf) is estimated to be approximately 0.57 mi from SLC-6, 130 dB L_{max} (1.32 psf) at approximately 1.19 mi, and 120 dB L_{max} (0.42 psf) at approximately 3.79 mi (Figure 3.4-1). This would cause a short impulsive sound, similar to the sonic boom experienced during first stage landing events, as discussed below, but over a much smaller area (Figure 3.4-1). Therefore, construction activities at SLC-6 would not have a significant impact on the acoustic environment.

Table 3.4-1. Anticipated Construction Equipment Used and Typical Sound Levels

Equipment Description	Impact Device?	Actual Measured Average L_{Amax} at 50 feet (dBA)	Approximate Received L_{Amax} at 300 feet (dBA)
Compactor (ground)	No	83	67
Concrete Mixer Truck	No	79	63
Dump Truck	No	76	60
Crane	No	81	62
Welder/Torch	No	74	<50
Jackhammer	No	89	73
Excavator	No	81	65
Grader	No	89	73
Paver	No	77	61
Pickup Truck	No	75	59
Roller	No	80	64
Shears	No	93	82
Loader	No	84	68

Note: L_{Amax} = A-weighted maximum sound level

Source: (Washington State Department of Transportation 2012)

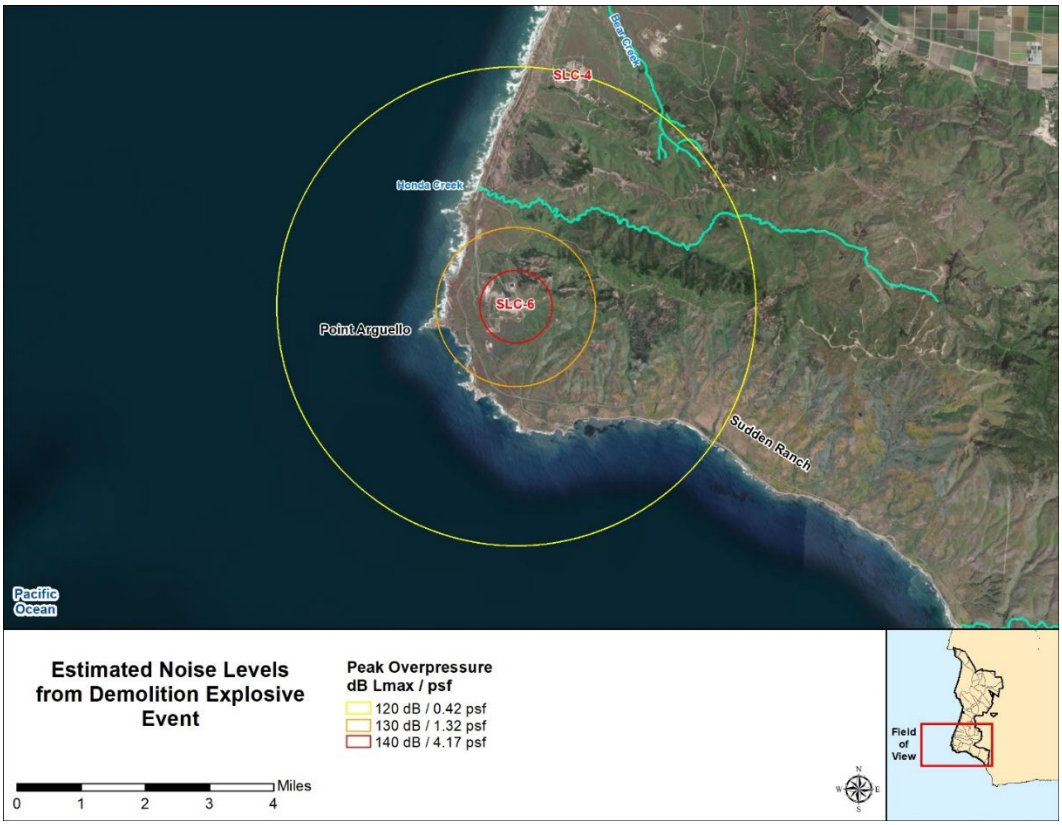

Figure 3.4-1. Estimated Impulsive Noise Levels from Explosives used During Demolition

3.4.2.1.2 Static Fire, Launch, and Landing Rocket Engine Noise

Falcon 9 at SLC-4 and SLC-6

The 90 dBA through 130 dBA L_{Amax} contours during Falcon 9 launches at SLC-4 are shown in Figure 3.4-2. These contours represent the maximum levels estimated for each Falcon 9 launch at SLC-4. The higher contours (100 – 130 dBA L_{Amax}) are located within about four mi of SLC-4. Only the 90 dBA L_{Amax} contour extends beyond the VSFB property line to the western side of Lompoc, CA (Figure 3.4-2; KBR 2025). If a Falcon 9 launch occurs during the day, when background levels are in the 50 to 60 dBA L_{Amax} range, residents to the north, east, and south are more likely to notice launch noise levels above 70 dBA L_{Amax} (KBR 2025). If the same launch occurs during the night, when background levels are lower than during the day (e.g., below 40 to 50 dBA L_{Amax} range), residents over a broader area to the north, east, and south are more likely to notice launch noise levels that exceed 60 dBA L_{Amax} (KBR 2025). A prevailing on-shore or off-shore breeze may also strongly influence noise levels in these communities (historically, winds are most often from the west for 3.9 months per year, from 11 May to 9 September, with a peak percentage of 60 percent on 16 July; KBR 2025). Noise-induced structural vibration during Falcon 9 launches may cause annoyance to building occupants because of induced secondary vibrations, or "rattle" of objects within the building—hanging pictures, dishes, plaques, and bric-a-brac. Rattling objects are more likely to occur with sounds that last several minutes at greater than 110 dB L_{max}. Predicting whether an object will rattle when subjected to noise depends on several characteristics of the object and setting (e.g., mass of the object, quality of integration within the supporting structure), characteristics of the structure (heavier structural elements respond less strongly), and characteristics of the noise (e.g., predominant frequencies and intensity).

Launch events are the loudest engine noise events of all the proposed Falcon flight and test operations. Accordingly, Falcon launch single event noise levels were evaluated using guidelines for hearing conservation. An estimate of the

areas in the vicinity of Falcon 9 launches at SLC-4 and SLC-6, where a hearing conservation program should apply was made using OSHA's permissible daily noise exposure limit of 115 dBA L_{Amax} (slow response) for a duration of 0.25 hours or less. Noise levels are less than OSHA's 115 dBA L_{Amax} upper noise limit guideline at distances greater than approximately 1.5 mi from the launch pads (KBR 2025). Falcon 9 launch noise events last a few minutes at most, at a single location, with the highest noise levels occurring for less than a minute such that OSHA's 115 dBA L_{Amax} daily noise exposure limit is not expected to be exceeded (KBR 2025). However, noise-induced stress can activate the body's sympathetic nervous system, leading to elevated blood pressure and heart rate (Sobotova et al. 2013). Noise at night, even at relatively low levels, can disrupt sleep cycles, reduce sleep quality, and lead to long-term health consequences such as fatigue and cognitive impairments (Basner 2005). Additionally, noise exposure can contribute to stress, anxiety, depression, and reduced overall well-being and interfere with concentration, productivity, and relaxation, exacerbating psychological distress (Stansfeld & Matheson 2003). The frequency of these events would not be expected to cause chronic health problems, and DAF would attempt to minimize the number of launches between 10 p.m. and 6 a.m. to the maximum extent practicable.

Falcon 9 launches from SLC-6 were estimated to generate similar levels and extents of noise contours compared with Falcon 9 launch contours at SLC-4 (Figure 3.4-4). Therefore, most of the preceding discussion about launch noise exposure at SLC-4 applies as well to SLC-6 with the notable difference that SLC-6 is located about 3.5 mi south/southwest of SLC-4. For this reason, noise exposure in Lompoc, CA is estimated to be less from Falcon 9 launches at SLC-6, compared with Falcon 9 launches at SLC-4 (Figure 3.4-4; KBR 2025).

For Falcon 9 booster landings at SLC-4 and SLC-6, the 90 dBA L_{Amax} contour is entirely within the VSFB property line (Figure 3.4-2 and Figure 3.4-4). Residents of Lompoc, CA may notice Falcon 9 landing event levels above 60 dBA L_{Amax} especially for nighttime events. Compared with the Falcon 9 orbital launch noise levels, discussed above, Falcon 9 descent/landing noise levels at SLC-4 and SLC-6 are considerably lower due to the much lower total engine thrust and limited firing schedule used for landing operations. Additionally, SLC-6 is located about 3.5 mi south of SLC-4 such that noise exposure from landings at SLC-6 occurs further south. For this reason, noise exposure in Lompoc, CA is estimated to be less from Falcon 9 landings at SLC-6, compared with Falcon 9 landings at SLC-4 (KBR 2025).

The 90 dBA L_{Amax} contour for Falcon 9 static fire events at SLC-4 does not extend off VSFB property (Figure 3.4-4). To the west of SLC-4, this contour extends much farther out due to modeling sound propagation over water compared with propagation over land to the east. Residents of Lompoc, CA may hear Falcon 9 static test events above 60 dBA L_{Amax}, and particularly at night and if onshore wind conditions favor sound propagation to the east (KBR 2025).

For a Falcon 9 static fire test at SLC-6, the location is about 3.5 mi south/southwest of SLC-4 such that the 90 dBA L_{Amax} contour does not extend off VSFB property (Figure 3.4-4). Like static fire tests at SLC-4, residents of Lompoc, CA may hear Falcon 9 static test events at SLC-6 that generate levels above 60 dBA L_{Amax} in the community, and particularly at night and if onshore wind conditions favor sound propagation to the east (KBR 2025).

The potential for structural damage due to launch, landing, and static fire test events and their associated noise levels and vibrations was assessed using the findings from an applicable study which ascertained whether range activities would cause structural damage (i.e., test, evaluation, demilitarization, and training activities of items such as weapons systems, ordinance, and munitions; Fenton & Methold 2016). The study found that structural damage is improbable below 140 dB L_{max} (unweighted), damage to glass or plaster in good condition was unlikely below 140 dB L_{max}. and superficial damage to structures was unlikely below 134 dB L_{max} (Fenton & Methold 2016). However, damage associated with noise and vibrations may occur to lightweight or brittle structural elements in poor condition, such as windows and plaster that are pre-cracked, prestressed, older and weakened, or poorly mounted (Maglieri et al. 1966; Benson 2013; Fenton & Methold 2016).

Applying these guidelines suggests that no structural damage is expected from Falcon 9 launches or any of the other Falcon 9 operations that generate lower noise levels than launches. The 134 dB L_{max} contour for all Falcon 9 flight and

test operations is well within VSFB property, such that no off-base structural damage would be expected (KBR 2025). The L_{max} 110 dB through 140 dB contours estimated for Falcon 9 orbital launch events at SLC-4 and SLC-6 are shown in Figure 3.4-3 and Figure 3.4-5. Falcon 9 launch events from SLC-4 and SLC-6 are estimated to generate L_{max} of 134 dB approximately 0.5 mi from the launch pads, well within VSFB property (KBR 2025).

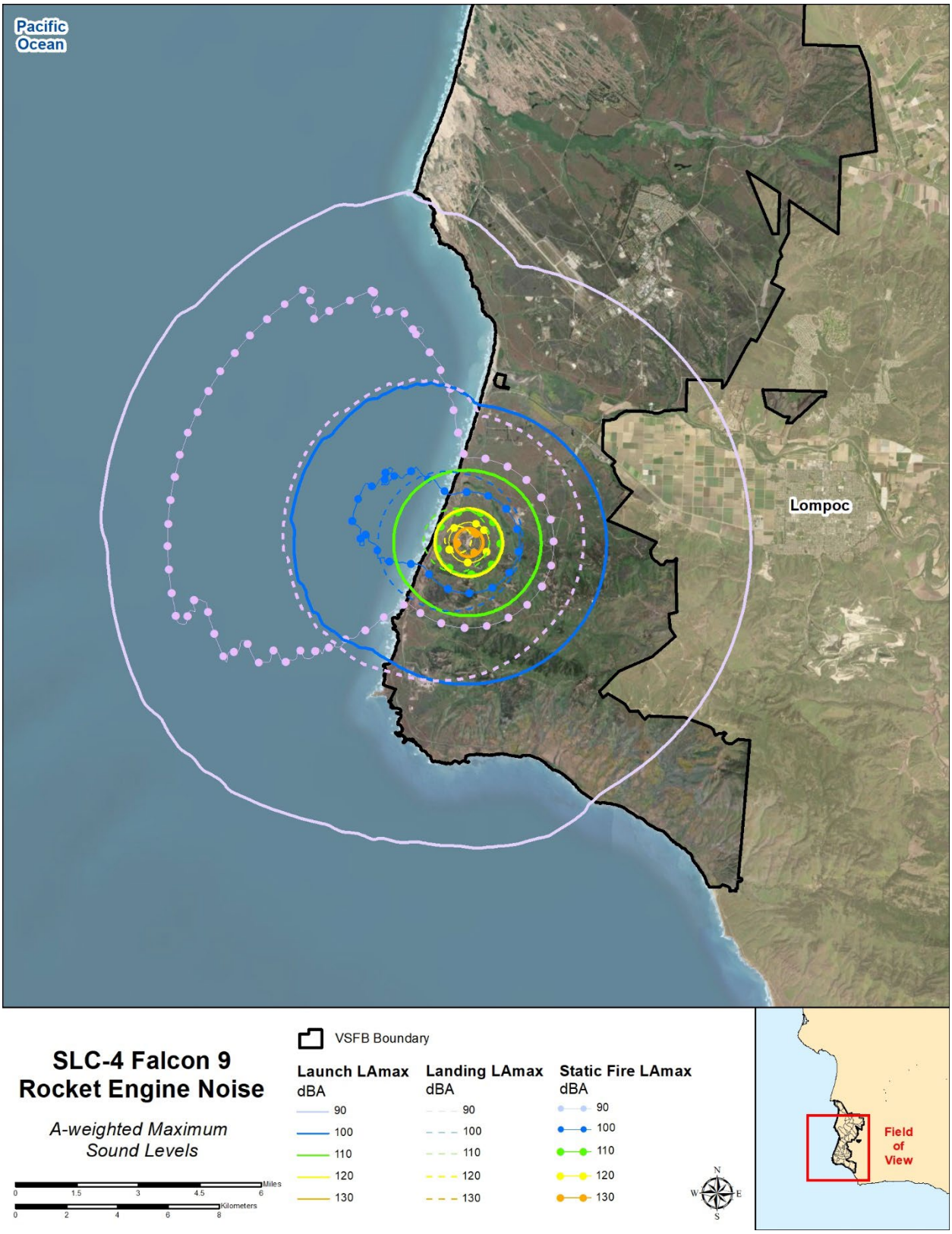

Figure 3.4-2. Falcon 9 Static Fire, Launch, and Landing Rocket Engine Noise Model Results at SLC-4

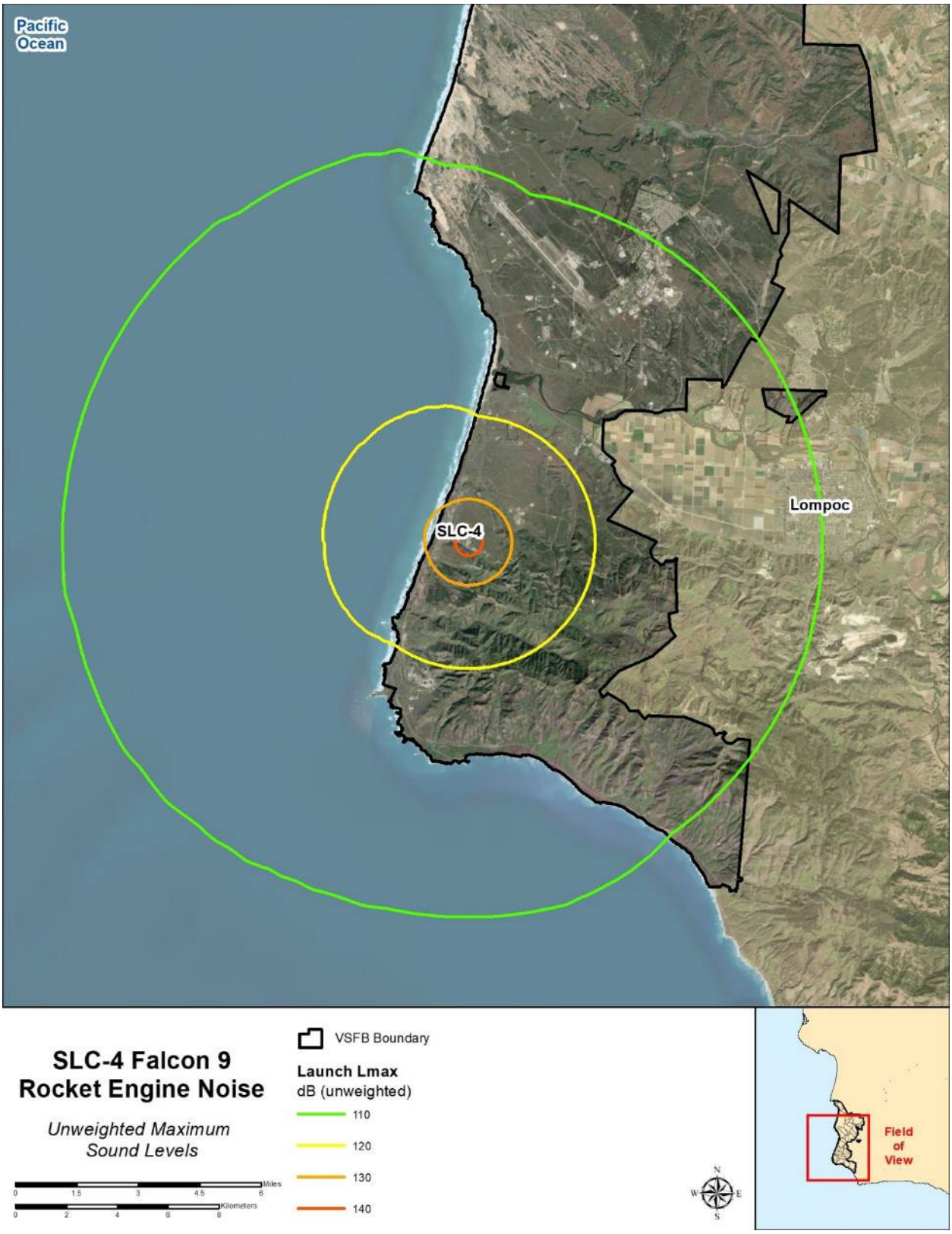

Figure 3.4-3. Unweighted L_{max} Contours for Falcon 9 Launch at SLC-4

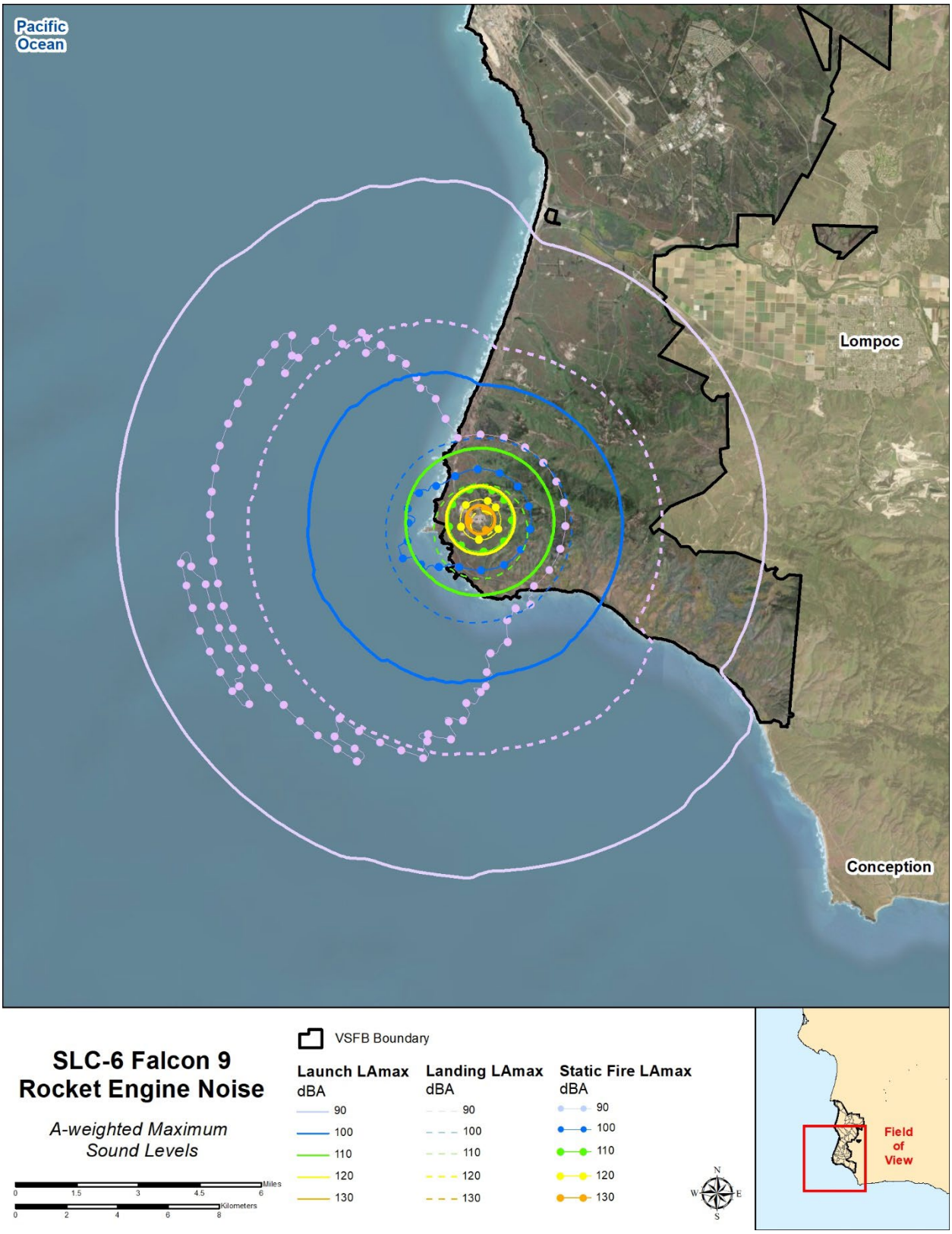

Figure 3.4-4. Falcon 9 Static Fire, Launch, and Landing Rocket Engine Noise Model Results at SLC-6

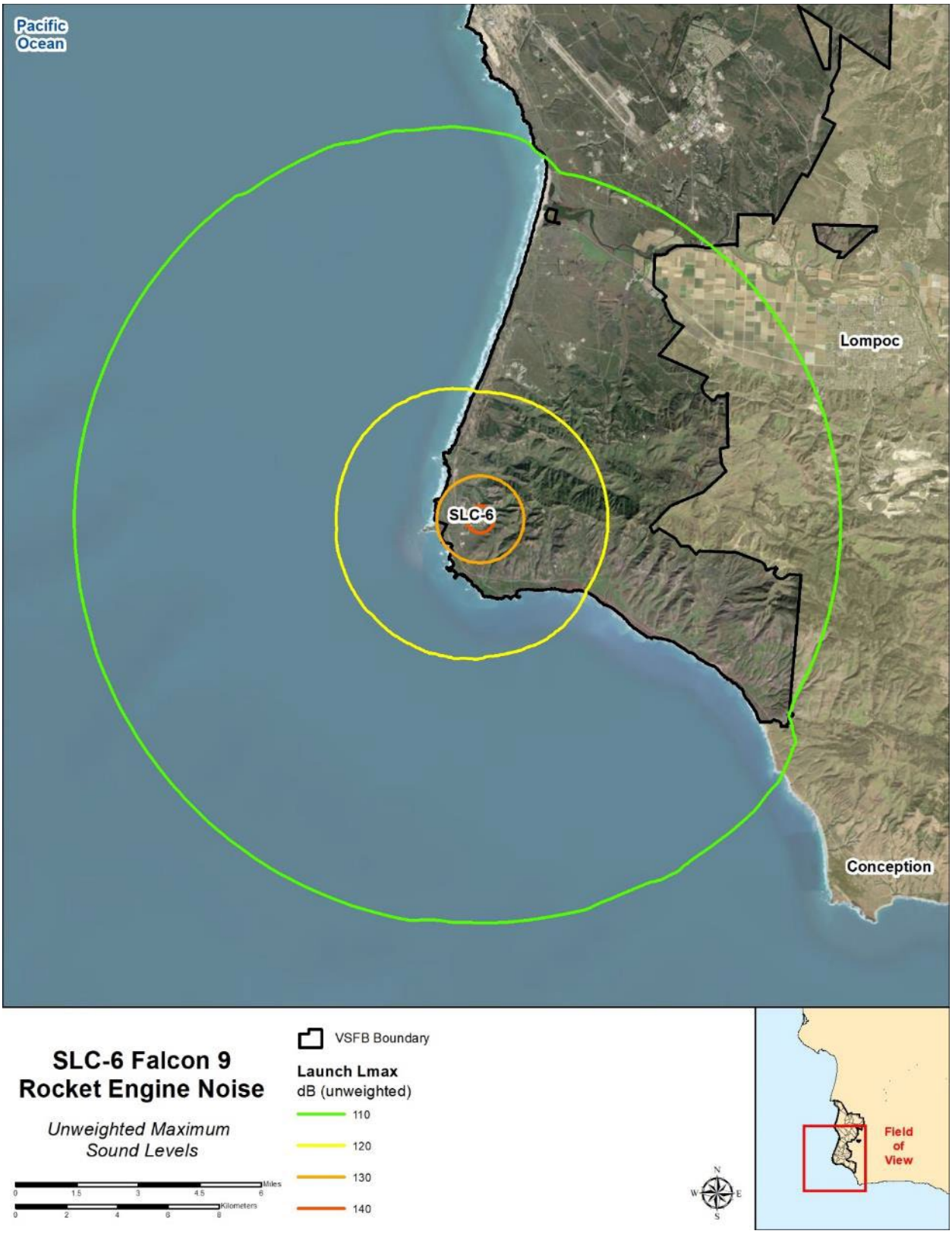

Figure 3.4-5. Unweighted L_{max} Contours for Falcon 9 Launch at SLC-6

Falcon Heavy at SLC-6

The 90 through 140 dBA L_{Amax} contours for Falcon Heavy activities at SLC-6 are shown in Figure 3.4-6. The higher maximum sound level contours (100–140 dBA L_{Amax}) are located within about five mi of SLC-6; the 100 dBA contour remains mostly within the VSFB property line. Only the 90 dBA L_{Amax} contour extends beyond the VSFB property line, as far as the western side of Lompoc, CA. If a Falcon Heavy launch occurs during the day, when background levels are in the 50 to 60 dBA L_{Amax} range, residents of Lompoc, CA may notice launch noise levels above 70 dBA L_{Amax} and up to 90 dBA L_{Amax} (KBR 2025). If the same launch occurs during the night, when background levels are lower than during the day (e.g., below 40 to 50 dBA L_{Amax} range), Lompoc residents and the residents of Orcutt, CA to the north and Conception, CA to the south may notice launch noise levels that exceed 60 dBA L_{Amax} (KBR 2025). As discussed above, winds strongly influence noise levels in these communities. Noise-induced structural vibration during Falcon Heavy launches could cause annoyance to building occupants because of induced secondary vibrations, or "rattle" of objects within the building.

The launch event is the loudest single event of all Falcon Heavy flight and test operations at SLC-6 and, like the analysis done for the Falcon 9, Falcon Heavy launch single event noise levels were assessed for hearing conservation and potential structural damage. Falcon Heavy orbital launches at SLC-6 noise events last a few minutes at most, with the highest noise levels occurring for less than a minute. OSHA's 115 dBA L_{Amax} maximum guideline (OSHA 2024) can be used as a conservative limit for hearing conservation. Noise levels during Falcon Heavy launches would be less than OSHA's 115 dBA L_{Amax} upper noise limit guideline at distances greater than approximately three mi from the launch pad (Figure 3.4-6). However, as discussed above, noise-induced stress can increase blood pressure and heart rate (Sobotova et al. 2013). Noise at night can disrupt sleep cycles and reduce sleep quality which could lead to long-term health consequences (Basner 2005). Noise can contribute to stress, anxiety, depression, and reduced overall well-being, exacerbating psychological distress (Stansfeld & Matheson 2003). The DAF would attempt to minimize the number of launches between 10 p.m. and 6 a.m. to the maximum extent practicable. The frequency of these events would not be expected to cause chronic health problems.

The L_{max} 110 dB through 140 dB contours estimated for Falcon Heavy orbital launch events at SLC-6 are shown in Figure 3.4-7. These contours include the L_{max} 130 dB and 140 dB contours, and in between the 134 dB contour (not shown), used to assess the potential for damage in the same manner as described above for Falcon 9. The 134 dB L_{max} contour for Falcon Heavy launches at SLC-6 is approximately one mi from the pad and located well within VSFB property, such that no structural damage is expected in off-base areas. Similarly, no off-base damage is expected from the other Falcon Heavy flight and test operations which generate lower noise levels than launches (KBR 2025). Damage associated with noise and vibrations may occur to lightweight or brittle structural elements in poor condition, such as windows and plaster that are pre-cracked, prestressed, older and weakened, or poorly mounted (Maglieri et al. 1966; Benson 2013; Fenton & Methold 2016).

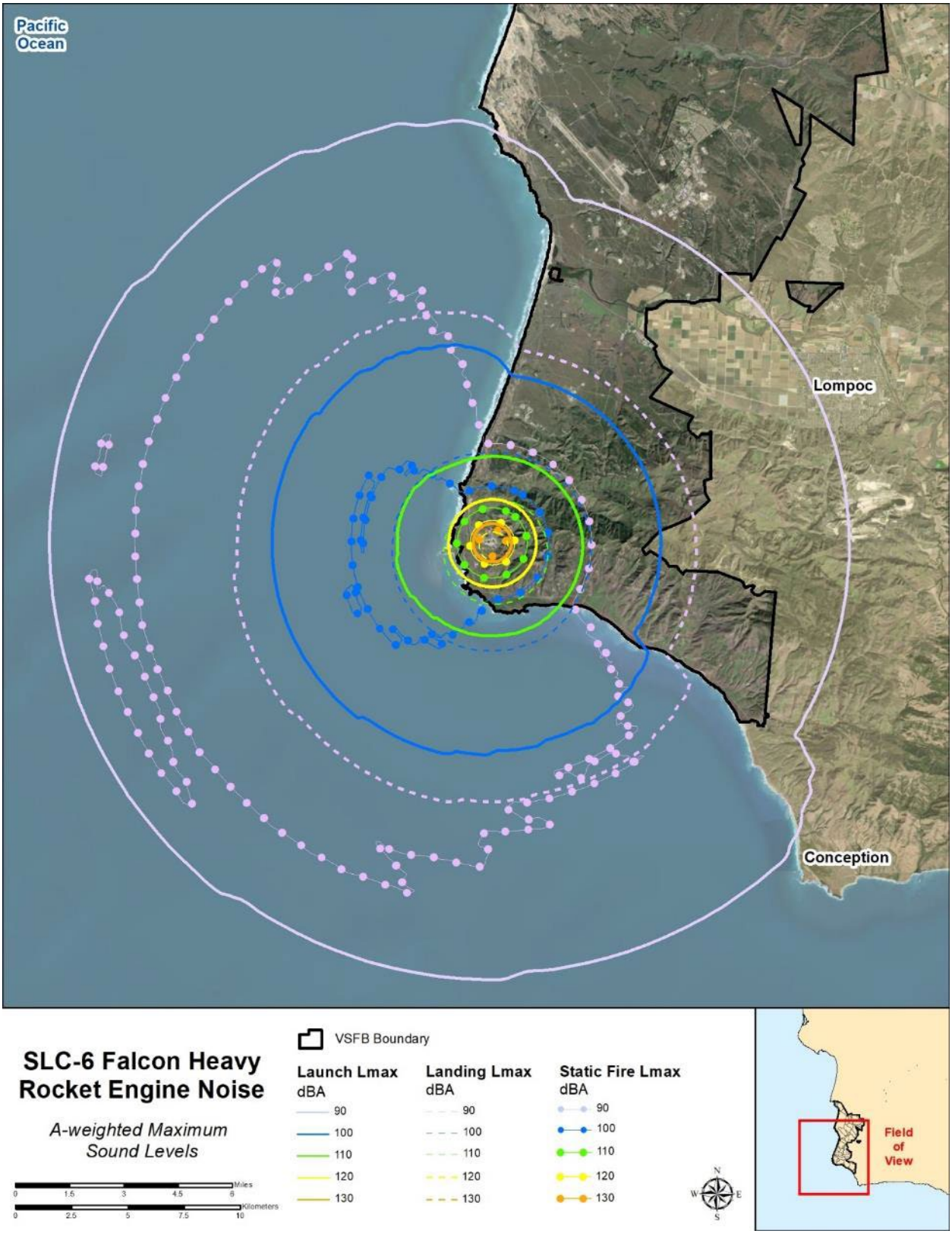

Figure 3.4-6. Falcon Heavy Static Fire, Launch, and Landing Rocket Engine Noise Model Results at SLC-6

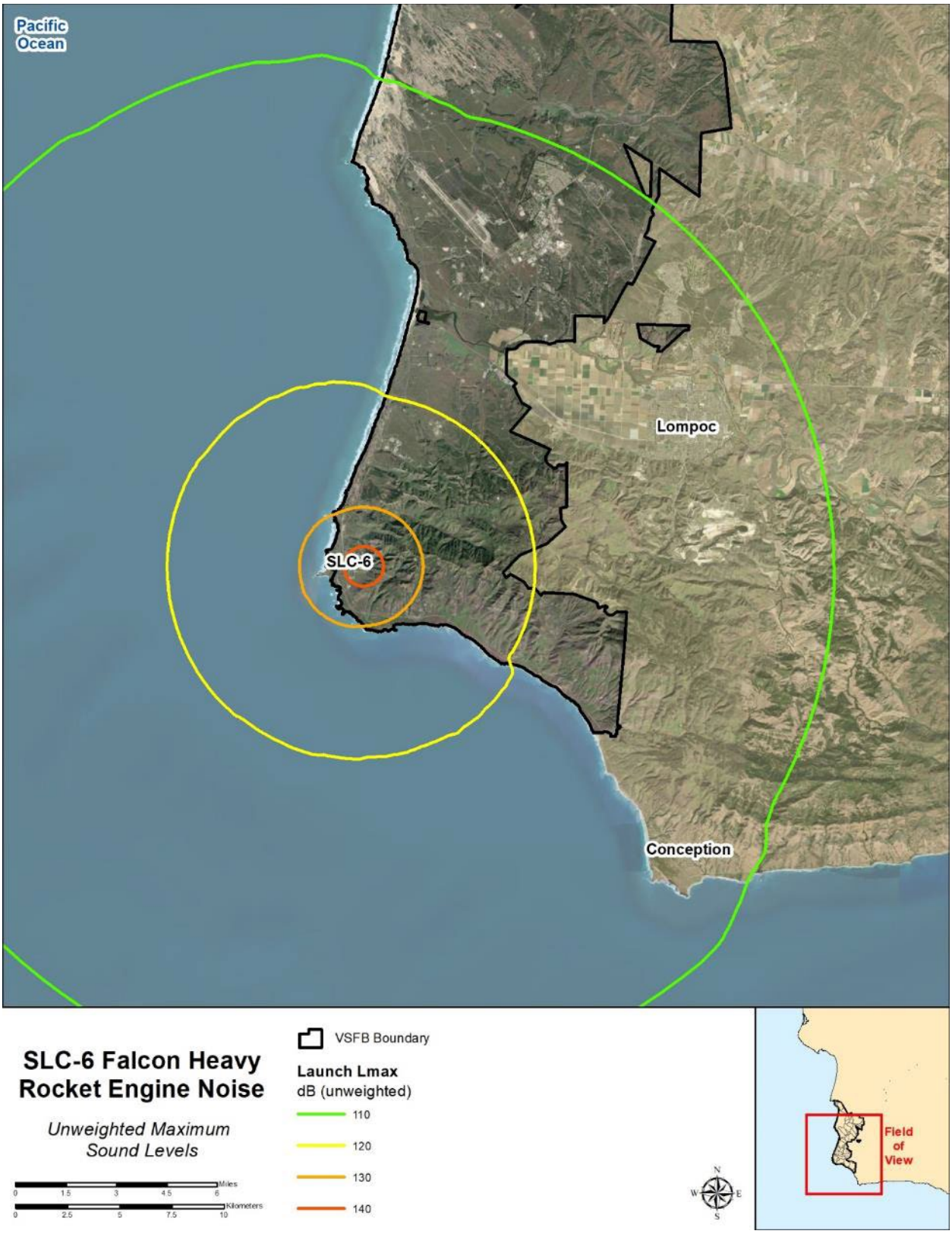

Figure 3.4-7. Unweighted L_{max} Contours for Falcon Heavy Launch at SLC-6

3.4.2.1.3 Community Noise Equivalent Level

A CNEL exceeding 65 dBA is generally considered unacceptable for a residential neighborhood and is used to define the area of potentially significant noise impacts on communities. CNEL was estimated for projected launch, landing, and static fire test operations at SLC-4 and SLC-6. These estimates were made for each operation type (i.e., Falcon 9 launches, landings, and static fire tests at SLC-4 and SLC-6 and Falcon Heavy launches, landings, and static fire tests at SLC-6) and the results indicated that none of the operation types alone are expected to cause adverse community noise exposure using the CNEL 65 dBA contour (KBR 2025; Appendix G). Additionally, when CNEL was assessed for the proposed maximum cadence which includes all combinations of these operation types assuming an almost equal distribution between night and day activities, noise exposure was still estimated to be less than CNEL 65 dBA in populated areas east of the VSFB property line. The resulting CNEL estimates for the combined annual operations are shown in Figure 3.4-8. The CNEL 65 dBA contour is located entirely within the VSFB property and does not include residential land use. Therefore, the Proposed Action would not result in significant impacts related to noise and noise-compatible land use.

3.4.2.1.4 Noise-Induced Sleep Disturbance / Probability of Awakening

Elevated noise levels above the background may cause sleep disturbance which can prevent people from falling asleep or wake them from sleep. Using the DOD's most recent guidance on estimating noise induced sleep disturbance (Office of the Assistant Secretary of Defense 2025), the DAF estimated percent awakenings (PA) using the Federal Interagency Committee on Aviation Noise (FICAN) updated (1997) recommended dose-response curve (U.S. Air Force Research Laboratory 1998), interpreted to be the "maximum percent of the exposed population expected to be behaviorally awakened" for a given residential population. The FICAN 1997 relationship, detailed in Section 7 of Appendix G, provides a method to estimate PA from at least one noise event per night. This relationship utilizes the estimated interior SEL resulting from proposed nighttime Falcon 9 or Falcon Heavy operations to provide a conservative estimate (based on the most recent sleep disturbance studies at the time) of the percentage of the population that would be awakened at least once per night.

As detailed in Section 7 of Appendix G, off-base populated areas are located within the 90 dB through 110 dB SEL contours for Falcon 9 launches, with the population of Lompoc, CA located mostly within the 90 dB through 100 dB sound exposure level contours. These noise levels correspond to a PA of 5 to 8 percent at nighttime if windows are closed and a PA of 8 to 11 percent if windows are open, indicating that roughly 5 to 11 percent of the population of Lompoc have the potential to be awakened by Falcon 9 nighttime launch events. The PA estimates for Lompoc with windows open would increase up to 13 percent for Falcon Heavy nighttime launch events and about 8 percent for Falcon Heavy nighttime landing events. The PA for all other nighttime noise events, including Falcon 9 landings and static fire tests by both vehicles, is expected to be below 5 percent.

3.4.2.1.5 Launch and Landing Sonic Boom

Sonic Boom from Falcon 9 and Falcon Heavy Launches at SLC-4 and SLC-6

Sonic boom model profiles for Falcon 9 launches from SLC-4 and SLC-6 are similar to those analyzed in previous Section 4.2 of the 2023 SEA (DAF 2023) and Section 3.2 of the 2024 EA (DAF 2024a), with the exception of an increase in frequency due to higher cadence. Falcon launches with easterly trajectories may result in sonic booms that impact southeastern Santa Barbara, Ventura, and northwestern Los Angeles Counties (Figure 3.4-9). Even with identical trajectories, atmospheric conditions create considerable variation in where ascent sonic booms impact the ground and the level at which they impact. To account for this variation, the DAF utilized multiple meteorological parameters in the PCBoom model. These data were sampled from a 10-year collection of radiosonde data for weather balloons released by the VSFB weather squadron multiple times per day throughout the 10-year span. They include pressure, temperature, wind speed, and wind direction along an elevational profile from ground, every 1,000 ft. to 110,000 ft. The DAF used eight representative SpaceX easterly trajectories, and modeled each trajectory between 29 and 40 times,

with each run representing 1 of between 29 and 40 randomly selected meteorological profiles that capture potential weather conditions throughout the year. This resulted in 308 total model outputs. Figure 3.4-9 depicts all 308 model outputs overlaid onto southern California. Of the sonic booms model runs that overlapped Santa Barbara, Ventura, and Los Angeles Counties, the proportion of the ranges of predicted boom levels across each area is shown in Table 3.4-2. These proportions are rough estimates of the probability for potential sonic boom locations and intensities for SpaceX missions with easterly trajectories (Table 3.4-2). These estimated values have been generally consistent with sonic boom measurements in these areas, with the exception of a 4.4 psf sonic boom being detected in Santa Barbara County during one Falcon 9 mission Note that Figure 3.4-9 shows 308 sonic boom model outputs overlaid with each model output depicted as an array of points on the landscape representing potential boom levels, rather than contours for single model outputs that are depicted in Figure 3.4-10 through Figure 3.4-13.

Table 3.4-2. Percentage of Easterly Trajectory Model Runs Producing Sonic Booms in Each County at the Levels Indicated as Depicted in Figure 3.4-9 (Note: highest level estimated in each county from model presented in parentheses)

County	Percentage of Sonic Boom Levels Overlapping			
	0.01-1 psf	1-2 psf	2-3 psf	3+ psf
Santa Barbara	12.0%	7.8%	1.3%	0.3% (3.7 psf)
Ventura	84.7%	19.5%	2.9% (2.3 psf)	0%
Los Angeles	100% (0.8 psf)	0%	0%	0%

Figure 3.4-10 shows the sonic boom footprint for the Falcon Heavy launch from SLC-6. The ascent phase of the launch would generate a broad forward-facing crescent region as the vehicle pitches over. The Falcon Heavy pitches over faster (at a lower altitude) than the Falcon 9 which, along with its shape factor, contributes to a wider crescent-shaped contour. Peak sonic boom levels from Falcon Heavy launch are expected to be similar to Falcon 9 levels, between 0.1 and approximately 7.0 psf mostly over the Pacific Ocean and the NCI. Figure 3.4-10 represents the sonic boom model results for two trajectories modeled using one standard set of atmospheric conditions. However, the sonic boom produced by Falcon Heavy when flying easterly trajectories is expected to result in similar sonic boom levels and areas of geographic impact over southeastern Santa Barbara, Ventura, and northwestern Los Angeles Counties, as depicted in Figure 3.4-9.

In southeastern Santa Barbara, Ventura, and northwestern Los Angeles Counties, residents would likely hear occasional sonic booms, which would vary in impact location and levels depending on mission trajectories and weather conditions. As discussed above for sonic booms generated during landing events at SLC-4 and SLC-6, sonic booms in southeastern Santa Barbara, Ventura, and northwestern Los Angeles Counties could cause structural vibration and secondary vibrations of objects may cause annoyance to building occupants.

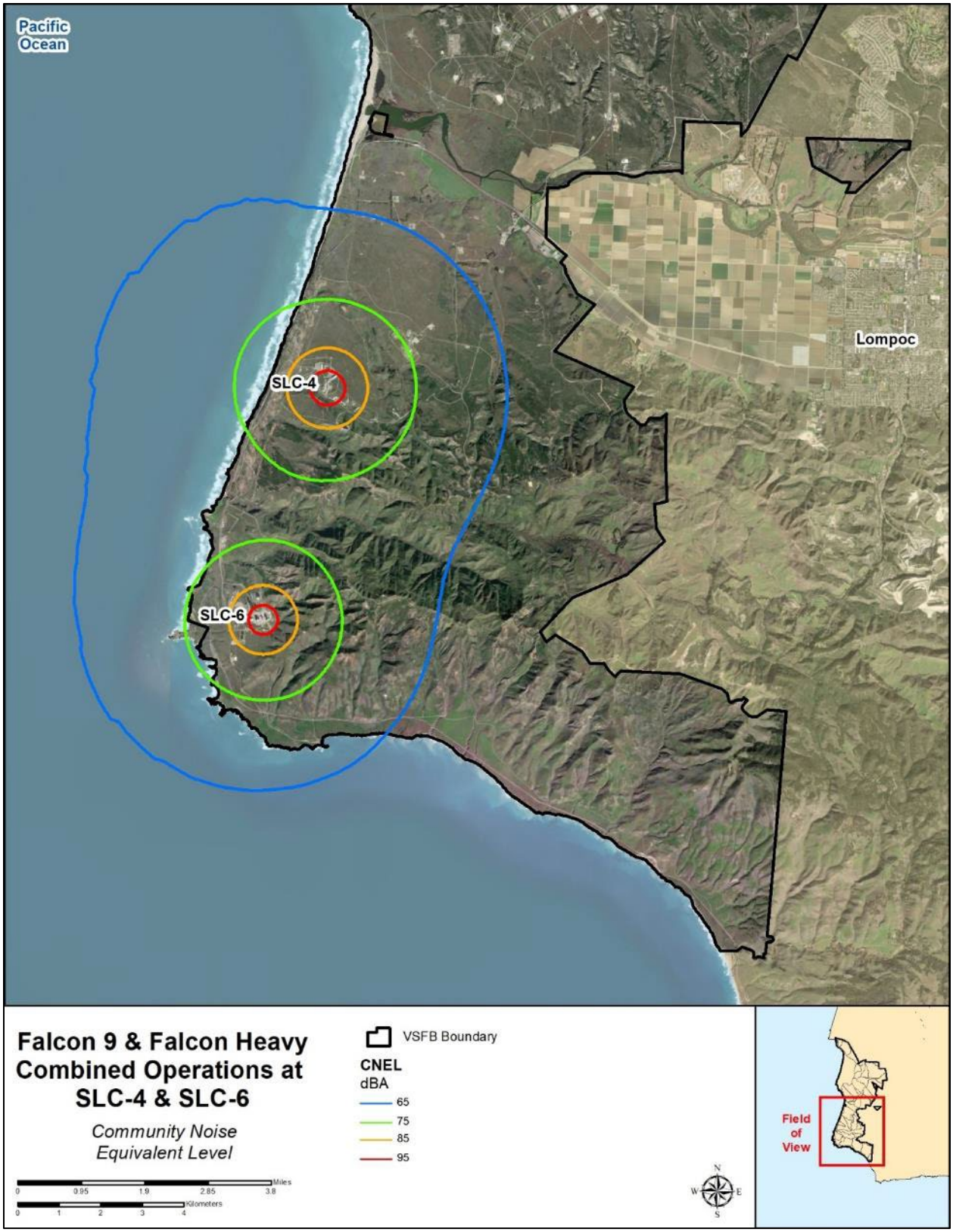

Figure 3.4-8. Falcon 9 and Falcon Heavy CNEL Contours for Combined Operations at SLC-4 and SLC-6

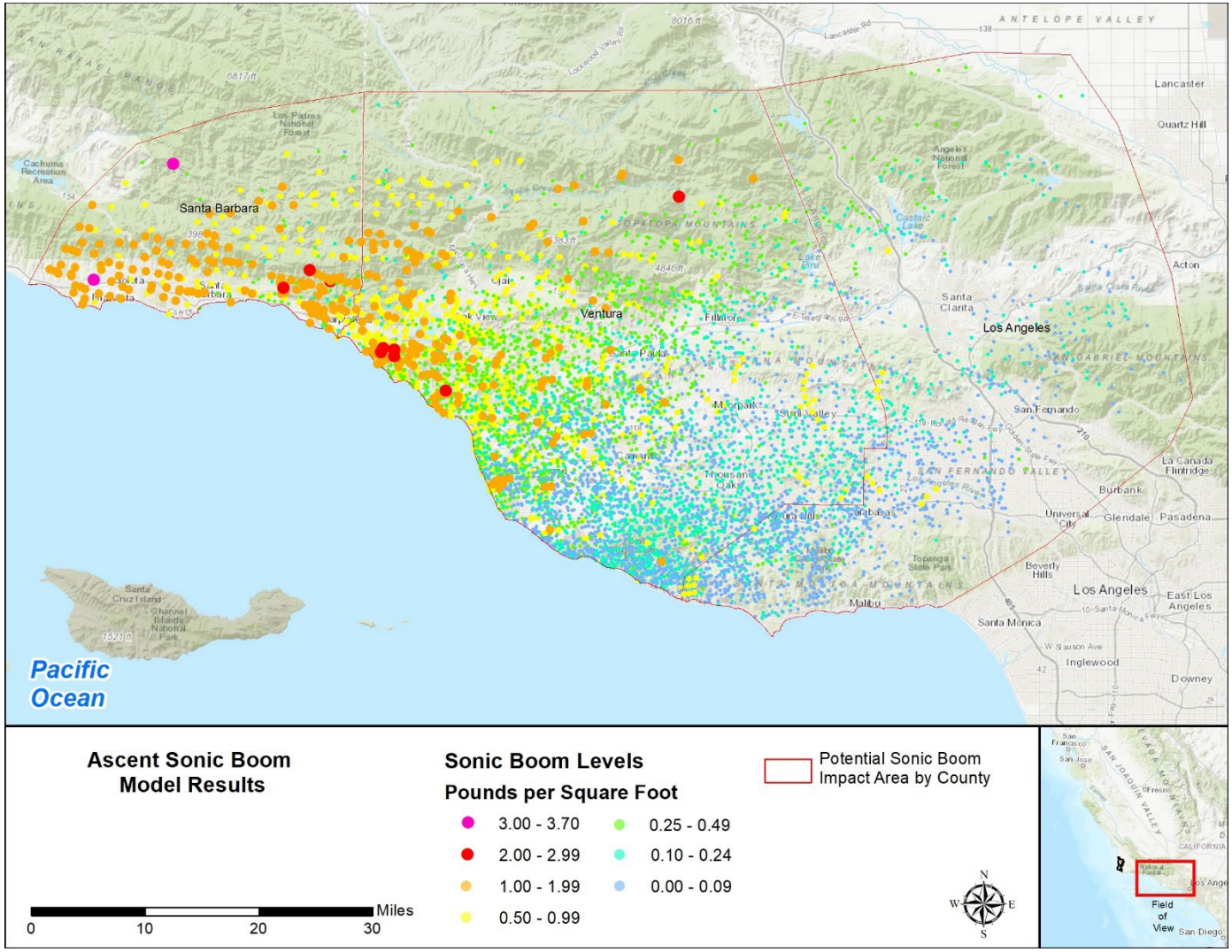

Figure 3.4-9. Sonic Boom Model Results for 308 Runs for Easterly SpaceX Falcon 9 Trajectories Showing Range of Possible Boom Impact Areas and Levels, Depending on Meteorological Conditions (Note: the image is intended to show the array of potential sonic booms; no single launch would result in impacts across the entire areas depicted nor at the specific levels depicted)

Figure 3.4-10. Examples of Sonic Boom Model Results for two Launch Trajectories of Falcon Heavy from SLC-6 Under a Standard Atmosphere

Sonic Boom from Falcon 9 Landings at SLC-4 and SLC-6

Sonic boom footprints for Falcon 9 first stage landings at SLC-4 and SLC-6 were computed using PCBoom and sample mission trajectories that depict an estimated worst-case scenario in terms of boom levels and extent of the impact footprint (KBR 2025). Figure 3.4-11 shows an example sonic boom footprint, in the form of overpressure contours in psf for the Falcon 9 first stage landing at SLC-4. The boom levels in the vicinity of the SLC-4 landing pad range from about 5.0 to 7.5 psf. Boom levels on VSFB range from 0.1 to approximately 5.0 psf, potentially higher, in areas away from the landing pad. The broad crescent, with boom levels of 0.1 psf is located mostly over the Pacific Ocean, however this contour surrounds VSFB and Lompoc, CA to the east, and Orcutt, CA to the north, as well as Conception, CA to the south.

Figure 3.4-12 shows an example sonic boom footprint for the Falcon 9 first stage landing at SLC-6. The sonic boom footprint for the landing at SLC-6 has a similar shape and overpressure levels as the footprint for the landing at SLC-4 as described previously. The difference is the landing trajectory at SLC-6. The boom levels in the vicinity of the landing pad at SLC-6 range from about 5.0 to approximately 8.0 psf. Boom levels on VSFB range from 0.1 to approximately 5.0 psf in areas away from the landing pad. The broad crescent, with boom levels of 0.1 psf is located mostly over the Pacific Ocean; however, this contour surrounds VSFB, Lompoc, CA to the east, Orcutt, CA to the north, as well as Conception, CA and the NCI to the south where boom levels range from 0.1 to approximately 2.0 psf.

Residents in Lompoc and surrounding communities would hear occasional sonic booms, which would vary in impact location and levels depending on mission trajectories and weather conditions. As previously discussed, structural vibration from sonic boom may cause annoyance to building occupants because secondary vibrations, or "rattle" of objects within the building.

Noise-induced stress can increase blood pressure and heart rate (Sobotova et al. 2013). Noise at night can disrupt sleep and reduce sleep quality, leading to long-term health consequences (Basner 2005). Noise exposure can also contribute to stress, anxiety, depression, and reduced overall well-being (Stansfeld & Matheson 2003). The DAF would attempt to minimize the number of launches between 10 p.m. and 6 a.m. to the maximum extent practicable. The frequency of these events would not be expected to cause chronic health problems.

Sonic Boom from Falcon Heavy Landings at SLC-6

Figure 3.4-13 shows two examples of sonic boom overpressure contours, each for one representative trajectory of one Falcon Heavy booster landing at SLC-6. The sonic boom footprint for the landing at SLC-6 has a similar shape to the Falcon 9 landings described previously. Overpressure levels for the Falcon Heavy booster landing at SLC-6 are also like those for Falcon 9 landings, except higher overpressure levels are expected near the oval boom footprint region, centered on the landing pad, due to the vehicle transitioning from supersonic to subsonic at a lower altitude. While Figure 3.4-13 shows two sonic boom footprints, each for one Falcon Heavy booster landing, each recovery operation may involve two booster landings at SLC-6 at close to the same time such that multiple nearly simultaneous booms are expected to be heard from both vehicles. The expected sonic boom contours would not be substantially different than those depicted in Figure 3.4-13, although two boosters landing simultaneously would result in minor increases to cumulative noise metrics.

Similarly to Falcon 9 first stage landings, residents in Lompoc and surrounding communities would hear occasional sonic booms during missions with Falcon Heavy booster landings at SLC-6. These would vary in impact location and levels depending on mission trajectories and weather conditions. As discussed above, sonic booms during booster landings at SLC-6 can cause structural vibration and annoy building occupants because of induced secondary vibrations, or "rattle" of objects within the building.

As discussed above, noise-induced stress can lead to elevated blood pressure and heart rate (Sobotova et al. 2013). Noise at night can disrupt sleep and reduce sleep quality, leading to long-term health consequences (Basner 2005).

Noise can also contribute to stress, anxiety, depression, and exacerbating psychological distress (Stansfeld & Matheson 2003). The DAF would attempt to minimize the number of launches between 10 p.m. and 6 a.m. to the maximum extent practicable. The frequency of these events is not expected to cause chronic health problems.

Potential for Structural Damage from Falcon 9 and Falcon Heavy Sonic Booms at SLC-4 and SLC-6

Falcon 9 and Falcon Heavy launches and landings at SLC-4 and SLC-6 have the potential to cause damage to structures depending on the overpressure levels the structures are exposed to as well as the construction quality and condition of the structures. Launches typically generate sonic booms over water which are not expected to damage structures; though the Northern Channel Islands, located near the California coastline south of VSFB, are an example of a place where structures (including historic structures) get exposed to sonic booms, in this case from VSFB launches.

The following sections include a metric and criteria level for damage assessment, describe the potential for structural damage using a couple of applicable sonic boom levels as examples (i.e., levels that are generated over land by the VSFB launch and landing operations), and then assess the damage potential for each type of Falcon 9 or Falcon Heavy launch or landing operation examined in this study.

Structural damage assessments are based on data in the FAA's Hershey and Higgins (1976) report *Statistical Model of Sonic Boom Structural Damage*, as well as in Haber and Nakaki's (1989) *Sonic Boom Damage to Conventional Structures*, which describe damage probabilities for different structural components, for various sonic boom overpressure levels and associated vibration. Windows that are pre-damaged or in poor condition could possibly exhibit progression of damage over multiple exposures to booms between 2.0 and 4.0 psf (Higgins 1965). At 10 psf, superficial damage to brittle structural elements such as plaster and damage to windows becomes more likely but is generally still expected to be very low probability and predominantly due to poor existing conditions such as pre-cracked, prestressed, older and weakened, or poorly mounted windows (Maglieri et al. 1966; Benson 2013; Fenton & Methold 2016). Damage associated with noise and sonic booms is typically limited to lightweight or brittle structural elements, such as windows and plaster. More massive structural elements (e.g., elements providing structural integrity) are affected by noise and sonic booms to much a lesser degree. The 2.0 psf (pounds per square foot) and 4.0 psf are used to assess the potential for structural damage since areas within the vicinity of VSFB property are most likely to be exposed to booms within this range of overpressure levels during booster landing operations; also, 2.0 psf is taken to be the low threshold level for window (glass) breakage.

Hershey and Higgins (1976) used statistical modeling techniques to estimate the following structural damage potential for overpressure levels of 2.0 and 4.0 psf:

- 2.0 psf
  - Windows: The probability of window breakage at 2.0 psf is relatively low but not negligible. Studies have shown that the breakage probability for windows can range from about one in 10,000 to 1 in 1,000,000.
  - Plaster and Bric-a-Brac: Items like plaster and small decorative objects (bric-a-brac) have a slightly higher probability of damage, but it is still quite low. For plaster, the probability can range from about 1 in 1,000 to 1 in 10,000.
  - Structural Damage: Significant structural damage, such as to brick walls, is very unlikely at 2.0 psf. The probability is extremely low, often less than one in 1,000,000.
- 4.0 psf
  - Windows: The probability of window breakage increases significantly at 4.0 psf. Studies suggest that the breakage probability for windows can range from about one in 100 to one in 1,000.
  - Plaster and Bric-a-Brac: Items like plaster and small decorative objects have a higher probability of damage at 4.0 psf. For plaster, the probability can range from about one in 100 to one in 1,000.

- Structural Damage: While significant structural damage to well-built buildings is still relatively low, the probability increases. For example, brick walls might have a damage probability ranging from about one in 10,000 to 1 in 100,000.

Overall, while 4.0 psf sonic booms are more likely to cause damage compared to 2.0 psf, the extent of damage still depends on other factors, including the construction quality and maintenance of the structures. However, as indicated in the model results in Table 3.4-2, sonic booms at that level are infrequent in areas outside of VSFB and unlikely to impact the nearest town, Lompoc, CA. In the unlikely event that damage to a structure outside the boundaries of VSFB were to occur because of ongoing SpaceX launch operations, SpaceX would be responsible for resolving that damage. SpaceX is required to maintain insurance in the event that their activities result in claims of structural damage. Property owners may contact SpaceX directly to submit claims and evidence in support of the damage claim. Information on how to make a damage claim is also available on the VSFB website (www.vandenberg.spaceforce.mil/Contact-Us/).

3.4.2.1.6 C-weighted Day-Night Average Sound Level

A CDNL is DNL computed with C-weighting, which has more emphasis placed on low frequencies below 1,000 hertz (Hz). This metric is used as a cumulative measure of noise events having lower frequency content and higher levels (e.g., sonic booms, large caliber weapons, and blast noise events). As described in detail in Appendix G, the cumulative sonic boom levels were estimated for the projected annual Falcon 9 and Falcon Heavy landing operations at SLC-4 and SLC-6. Realized CDNL levels are anticipated to vary year over year as the number of landings conducted is dependent on the launch manifest and may be lower than what is analyzed here. Additional variability may be driven by differences in atmosphere at the time of individual landings. Conservatively estimating that all operations occurred at night, the maximum CDNL was estimated at 58.0 dBC. Analyzing the existing conditions with those same assumptions (12 landings at night), this would result in an increase of approximately 3.7 dBC. Since the FAA uses CDNL 60 dBC as the significance threshold for determining land use compatibility, the cumulative sonic boom levels from Falcon 9 and Falcon Heavy landing operations would be below the threshold for acceptable land use.

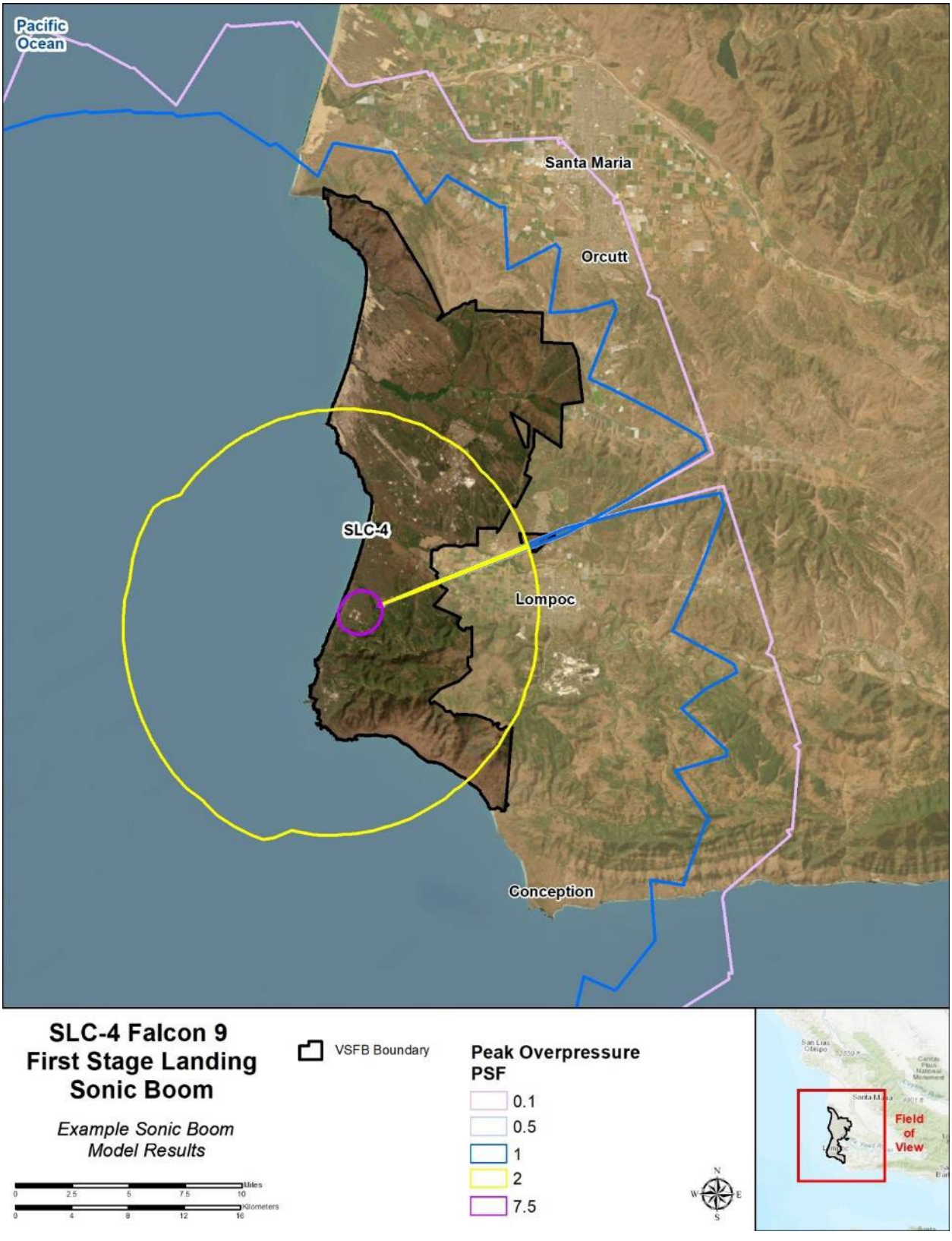

Figure 3.4-11. Example Sonic Boom Model Results for Falcon 9 First Stage Landing at SLC-4W

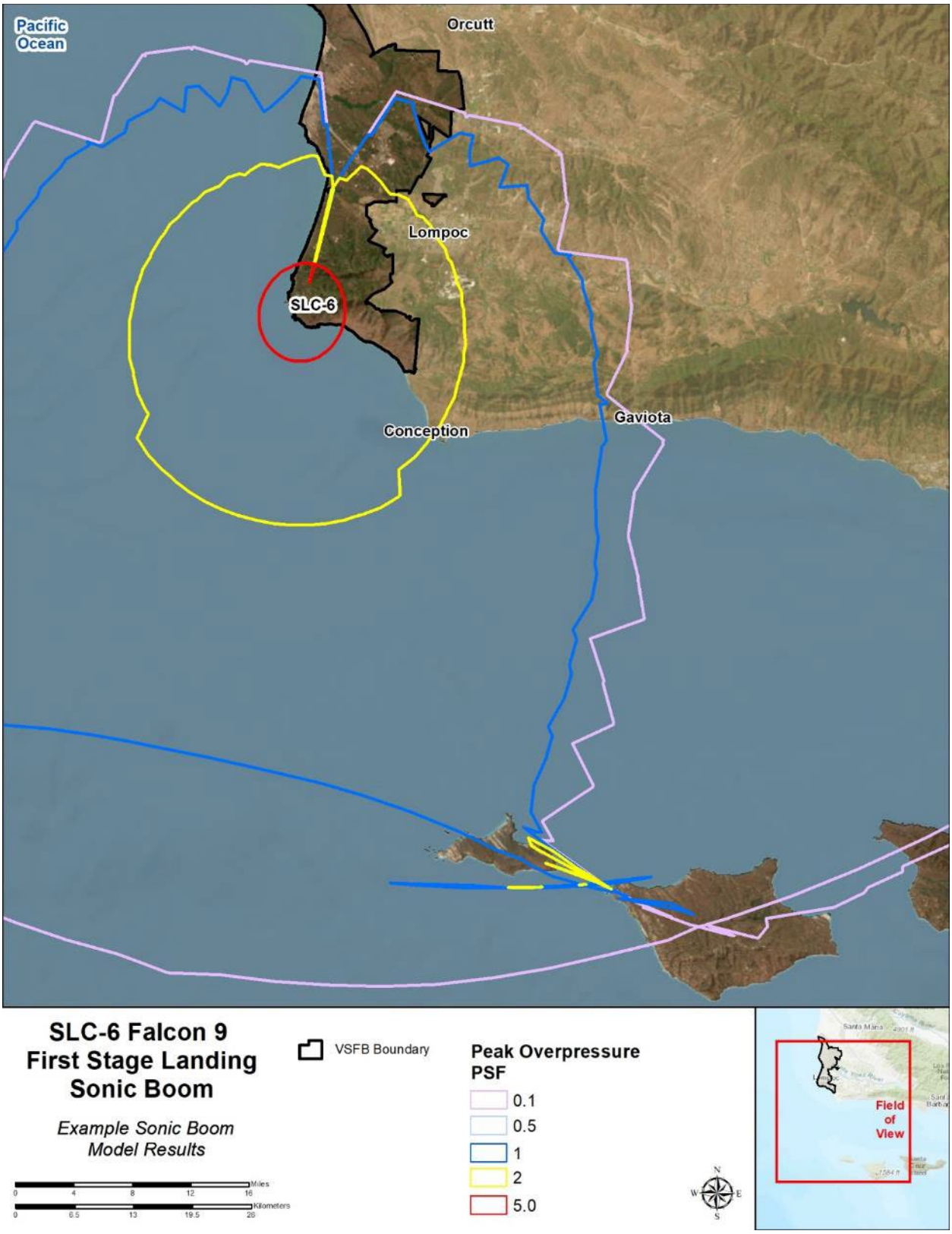

Figure 3.4-12. Example Sonic Boom Model Results for Falcon 9 First Stage Landing at SLC-6

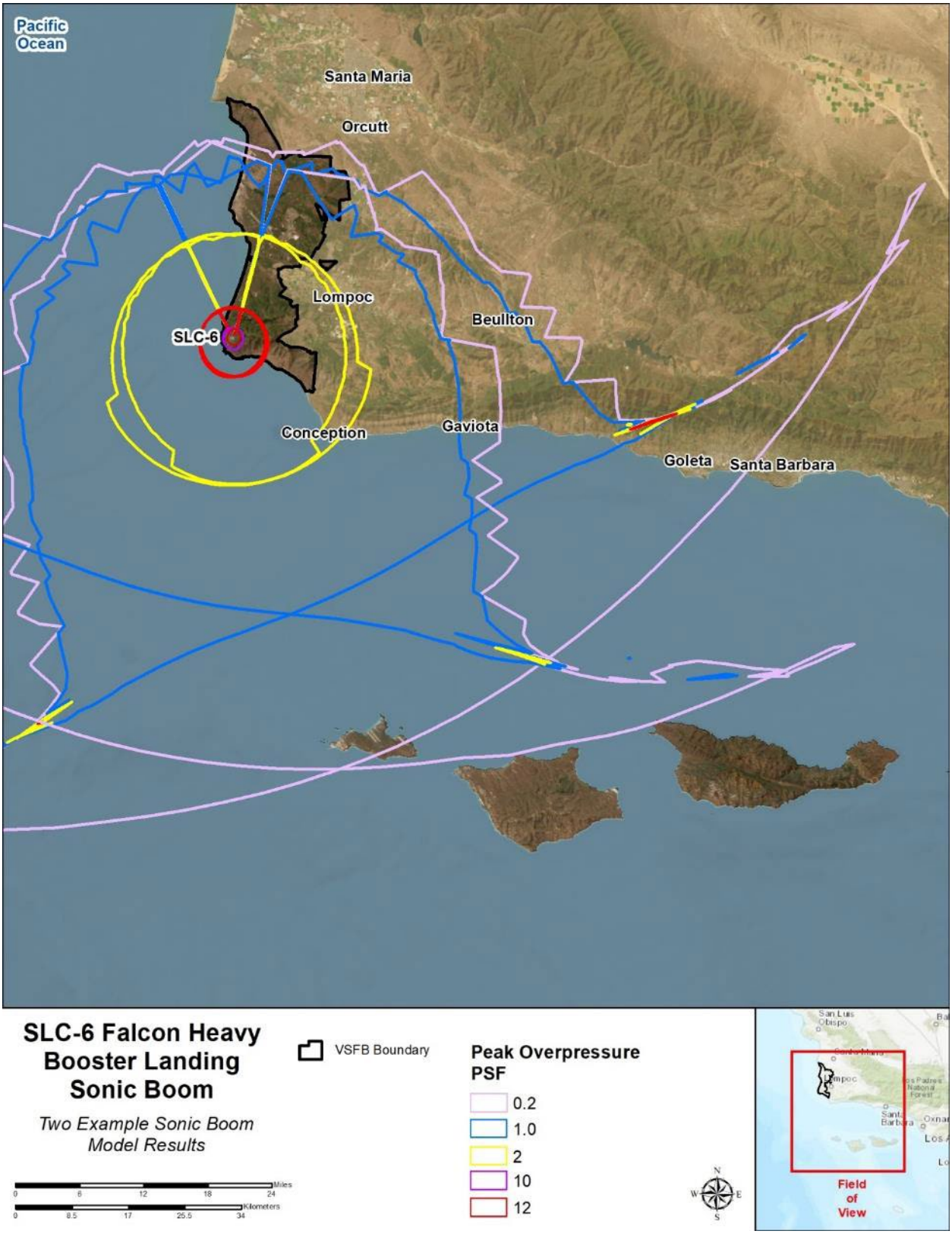

Figure 3.4-13. Examples of Two Sonic Boom Model Results for Falcon Heavy Booster Landing at SLC-6

3.4.2.1.7 Airspace

Airspace closures associated with commercial space operations could result in temporarily grounded aircraft at affected airports and re-routing en-route flights on established alternate flight paths. The FAA has rarely, if ever, received reportable departure delays associated with launches at VSFB. Aircraft could be temporarily grounded if airspace above or around the airport is closed. Ground delays are also used under some circumstances to avoid airborne reroutes. If aircraft were grounded, noise levels at the airport could temporarily increase as the planes sit idling waiting for takeoff. Depending on the altitude at which aircraft approach an airport, there could be temporary increases in noise levels in communities around the airports. However, aircraft would travel on existing en-routes and flight paths that are used daily to account for weather and other temporary restrictions. Not all launch and reentry missions would affect the same aircraft routes or the same airports and re-routing associated with launch-related closures represents a small fraction of the total amount of re-routing that occurs from all other reasons in any given year. Any incremental increases in noise levels at individual airports would only last the duration of the airspace closure, meaningful change to existing DNL at the affected airports and surrounding areas is not expected. Therefore, airspace closures due to increased Falcon launches at SLC 4 and SLC-6 are not expected to result in significant noise impacts.

3.4.2.2 Alternative 1

Operations under Alternative 1 would be the same as the Proposed Action and would generate the same types and levels of noise as discussed in Section 3.4.2.1. The only difference between Alternative 1 and the Proposed Action is the construction of a new hangar, which would have similar levels of noise generated during construction. Therefore, Alternative 1 would not result in significant impacts on the noise environment.

3.4.2.3 No Action Alternative

Under the No Action Alternative, modifications of SLC-6 and increased Falcon launch cadence on VSFB would not occur, resulting in no impacts on the noise environment, beyond those described in the 2024 EA (DAF 2024a), which increased the Falcon 9 launch cadence to 50 launches per year. As stated in Section 2.2, the, effects analysis of the No Action Alternative considers potential effects associated with reasonably foreseeable actions (Table 3.2-3) without consideration of the Proposed Action, because these actions would still occur. Under the No Action Alternative, the annual launch cadence at VSFB is anticipated to increase over time thus an increase in propulsion time-averaged noise levels on and around VSFB. The DAF anticipates that overall launch frequency on VSFB would not exceed 15 missile and 110 rocket launches per year cumulatively across all programs. The exact vehicle type and frequency of launches is unknown at this time, but different launch vehicles and their potential noise levels are discussed further in Section 3.4.2.4.

3.4.2.4 Cumulative Effects

The DAF anticipates that overall launch frequency on VSFB would not exceed 15 missile and 110 rocket launches per year cumulatively across all launch service providers. Sonic booms on the NCI resulting from VSFB space vehicle launches are dependent upon the trajectory of the launch in addition to the size of the launch vehicle; for example, small launch vehicles are much less likely to result in a sonic boom. The DAF estimates that fewer than 10 percent of small launch vehicles, 25 percent of medium launch vehicles, and 33 percent of large launch vehicles would result in a sonic boom at the NCI. Most frequently sonic booms impact San Miguel and occasionally Santa Rosa Islands at around 2.0 psf or less. Areas impacted by engine noise produced during rocket and missile launches greater than 100 dB L_{max} are shown in Table 3.4-3. Noise effects associated with launch and missile activities on VSFB are relatively short (typically no more than several minutes per event). Each noise event from launches would last less than two minutes. The anticipated offshore sonic boom events resulting from launches would be infrequent. Blue Ridge evaluated and modeled all reasonably foreseeable future rocket launch activities on VSFB and found that the resultant CNEL 65 dBA contour would not encompass any land outside VSFB boundaries. Therefore, the Proposed Action and Alternative 1 when

analyzed with other past, present, or reasonably foreseeable projects, would not result in significant cumulative noise impacts or cause exceedances of 24-hour DNL or CNEL thresholds.

Table 3.4-3 Past, Present, and Reasonably Foreseeable VSFB Space Launch Vehicle Programs and Noise Levels

Facility	Category[1]	Height	Maximum Engine Launch Noise (dB)[2]	Maximum Engine Launch Noise (dBA)[2]	Status
SLC-2W	Medium	128 ft	198	Not available	Discontinued
SLC-2W	Small	95 ft	120[3]	115	Active
SLC-3E	Medium	191 ft	135	115	Discontinued
SLC-3E	Medium	200 ft	120[4]	120[5]	Future Program[6]
SLC-4E	Medium	230 ft	150	150	Active
SLC-5	Small	79 ft	144	120	Future Program[6]
SLC-6	Heavy	236 ft	133[7]	Not available	Discontinued
SLC-8	Small	81 ft	137[8]	Not available	Active
SLC-8	Small	55 ft	144	Not available	Future Program[6]
SLC-9	Heavy	360 ft	120[9]	120[10]	Future Program[6]
SLC-11	Small	126 ft	130	120	Future Program[6]
LF-576E	Small	88 ft	120[11]	120	Future Program[6]
TP-01	Small	78 ft	120	Not available	Active

[1] Categories 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
[2] Decibels (dB) and A-weighted decibels (dBA) reported here are for launch noise in the immediate vicinity of the launch pad unless otherwise stated
[3] Within 0.5 miles of launch pad
[4] Within 4.4 miles of launch pad
[5] Within 0.5 miles of launch pad
[6] All future launch program specifications should be considered notional and subject to change.
[7] Highest recorded dB from monitored launches. Data is from NROL-49 Delta IV Heavy launch in January 2011; data recorded approximately 1.8 miles away from launch pad
[8] Based on maximum static fire testing noise level
[9] Within 5.6 miles of launch pad
[10] Within 0.6 miles of launch pad
[11] Within 0.5 miles of launch pad
LF = Launch Facility; TP = Test Pad; TBD = To Be Determined

There are currently no significant construction projects underway or being planned in the vicinity of SLC-6. Noise as a result of C&D activities under the Proposed Action and Alternative 1 would be temporary and limited to SLC-6 and nearby areas and therefore would not result in significant cumulative impacts on the noise environment.

3.4.2.5 Mitigation and Monitoring

Implementing the following EPM would avoid or minimize potential adverse effects to noise during the Proposed Action. In order to minimize any potential disturbance to human populations as a result of sonic boom, SLD 30 provides notification prior to each launch mission through social media and an opt-in launch alert text and email system, which includes a message indicating areas of potential sonic boom impact.

3.5 Terrestrial/Freshwater Biological Resources

3.5.1 Affected Environment

3.5.1.1 Regulatory Setting

Section 7 of the ESA requires federal agencies to ensure that any action they authorize, fund, or carry out does not jeopardize federally listed species or adversely modify their designated critical habitat. This is accomplished through a well-defined consultation process with the USFWS and/or NMFS. If the DAF determines that a proposed action may affect federally listed species or their designated critical habitat, then they must engage in a Section 7 consultation with the USFWS and/or NMFS (as applicable). If the Proposed Action is determined, through the consultation process, to be not likely to jeopardize the continued existence of federally listed species or to adversely modify their critical habitat, then the USFWS/NMFS will provide an incidental take statement in their BO, along with reasonable and prudent measures to avoid and/or minimize the adverse effect of the proposed action on listed species or their designated critical habitat. Also, when evaluating project impacts, USSF policy is to consider other federal special status species, state-listed protected species, and species protected by state law. In California, these include species that the California Department of Fish and Wildlife (CDFW) designates per the California Fish and Game Code Sections 3511, 4700, 5050, and 5515 as "fully protected" wildlife species. "Fully protected" designation means the species is at risk of extinction within California. This term was used before California's Endangered Species Act became law. Pursuant to the requirements of the Sikes Act of 1997 (16 USC Section 670a et seq.), CDFW is a signatory on the SLD 30 Integrated Natural Resources Management Plan (INRMP; DAF 2021a) and are actively engaged as a full partner in its implementation, including the conservation and recovery of all Federal and State protected species. Although SLD 30's INRMP is not subject to California's requirements, SLD 30 protects and conserves these species when practicable and consistent with the military mission. SLD 30 also must comply with requirements of the Migratory Bird Treaty Act (MBTA) of 1918 (16 USC Sections 703-712) as amended. The MBTA protects native migratory birds, including their eggs, active nests, and young.

Section 4(a)(3)(B)(i) of the ESA was amended by the National Defense Authorization Act of 2004 to preclude the Secretaries of Interior (USFWS) and Commerce (NMFS) from designating critical habitat on any lands or other geographical areas owned or controlled by the DoD, or designated for its use, that are subject to an approved DOD INRMP developed under the Sikes Act, provided the appropriate Secretaries certify in writing that the INRMP benefits the federally listed species. As a result, there should be no critical habitat designated on VSFB under the ESA.

3.5.1.2 Region of Influence

The ROI for terrestrial/freshwater biological resources (i.e., plants and animals living in the terrestrial environment or freshwater systems) includes non-marine areas potentially impacted by construction, sonic boom, rocket engine noise, including the Noise ROI (Section 3.4.1.2) as well as areas with increased water usage due to the need for more water to support increased launch operations, which includes VSFB and the surrounding region, as well as the NCI, southeastern Santa Barbara County, and portions of Ventura and northwestern Los Angeles Counties.

3.5.1.3 Methodology

The DAF reviewed prior special status species survey and monitoring data, biological reports, California Natural Diversity Database records, and the USFWS Information for Planning and Consultation website to assess the documented and potential occurrence, distribution, and habitat use of plants and animals, including special status species, within the ROI (CDFW 2025). Biological surveys of the area surrounding SLC-4 were performed as part of the 2016 EA and 2018 SEA (DAF 2016a, 2018) and the Spring Canyon area is surveyed annually under the requirements of the 2023 and 2024 BOs (USFWS 2023, 2024a). There was no need to perform additional field surveys at SLC-4 for this EIS because the Proposed Action does not require any construction-related ground disturbance at this location, the maximum number of first stage landings (12) at SLC-4W would not change from what was described in the 2023 and

2024 BOs (USFWS 2023, 2024a), and recent survey data are available for all relevant species in the areas potentially impacted at that location.

Biological surveys of the proposed construction areas at SLC-6 were performed during October and November 2023. A qualified biologist performed meandering surveys throughout the areas where construction is proposed, mapping any federally listed species encountered and assessing habitat for suitability and potential occurrence of these species.

3.5.1.4 Vegetation Resources

Vegetation alliances were classified and mapped following the Manual of California Vegetation Second Edition (Sawyer et al. 2009). Figure 3.5-1 shows the vegetation (a mix of upland types) within the biological survey areas, while Table 3.5-1 through Table 3.5-5 provides areas of each vegetation alliance. The alliances detected within the biological survey areas below are representative of the vegetation alliances at and common surrounding SLC-6.

Table 3.5-1. Vegetation Alliances Within the Biological Survey Area for the Firebreak

Alliance	Common Name	Dominant Species	Acres
Anthropogenic - Disturbed	Anthropogenic - Disturbed	40% *Lysimachia arvensis*; 20% *Baccharis pilularis*; 15% *Artemisia californica*	0.003
Artemisia californica - Salvia leucophylla Alliance	California Sagebrush - Purple Sage Scrub	93% *Artemisa californica*; 10% *Lysimachia arvensi*	1.51
		95% *Artemisa californica*	0.20
Artemisia californica - Baccharis pilularis Alliance	Mixed California Sagebrush and Coyote Bush Scrub Alliance	33% *Artemisa californica*; 33% *Baccharis pilularis*; 33% *Diplacus aurantiacus*	0.04
		35% *Artemisia californica*; 35% *Baccharis pilularis*; 35% *Brassica nigra*	0.07
		35% *Artemisia californica*; 35% *Baccharis pilularis*; 35% mixed *Avena* spp. and *Bromus* spp.	0.03
Baccharis pilularis Alliance	Coyote Bush Scrub Alliance	40% *Baccharis pilularis*; 30% *Artemisa californica*	0.27
Brassica nigra - Centaurea (*solstitialis, melitensis*) Alliance	Upland Mustards or Star-Thistle Fields	100% *Silybum marianum*	0.03
Leymus condensatus Alliance	Giant Wild Rye Grassland	34% *Baccharis pilularis*; 33% *Artemisa californica*; 33% *Elymus condensatus*	0.12
		60% *Elymus condensatus*; 20% *Baccharis pilularis*; 19% *Artemisa californica*	0.05
Developed	Pavement	Unvegetated	0.01
		Total	**2.34**

Table 3.5-2. Vegetation Alliances Within the Biological Survey Area for the Nitrogen Line

Alliance	Common Name	Dominant Species	Acres
Artemisia californica - Baccharis pilularis Alliance	Mixed California Sagebrush and Coyote Bush Scrub Alliance	45% *Artemisia californica*; 45% *Baccharis pilularis*; 10% *Rhus integrifolia*	0.03
Avena spp. - *Bromus* spp. Alliance	Wild Oats and Annual Brome Grassland	50% mixed grass; 25% *Baccharis pilularis*; 15% *Artemisia californica*	0.40
Baccharis pilularis Alliance - Disturbed	Coyote Brush Scrub; disturbed	15% *Baccharis pilularis*; 15% *Diplacus aurantiacus*; 15% *Carpobrotus* sp.; 55% dead mixed annual grasses and mustards	0.02

Hesperocyparis macrocarpa - *Pinus radiata* Alliance	Monterey Cypress - Monterey Pine Woodland Stands	100% *Hesperocyparis macrocarpa*	0.03
Mesembryanthemum spp. - *Carpobrotus* spp. Alliance	Ice Plant Mats	90% *Carpobrotus* sp.; 10% assorted non-natives	0.004
Developed	Pavement	Unvegetated	0.05
Plantago coronopus Alliance	Cutleaf Plantain Semi Natural Alliance	50% *Plantago coronopus*; 20% dead annuals	0.06
		Total	**0.60**

Table 3.5-3. Vegetation alliances within the biological survey area for the Landing Zones

Alliance	Common Name	Dominant Species	Acres
Anthropogenic - Disturbed	Anthropogenic - Disturbed	25-50% mixed *Juncus bufonius*; *Juncus falcatus*; *Polypogon monspeliensis*	0.05
		15% *Artemisia californica*; 10% *Lysimachia arvensis*	0.12
		25% *Lysimachia arvensis*	0.07
		15% mixed *Erigeron canadensis* & *Lysimachia arvensis*	0.05
Artemisia californica - *Salvia leucophylla* Alliance	California Sagebrush - Purple Sage Scrub	70% *Artemisia californica*; 15% *Baccharis pilularis*; 40% *Lysimachia arvensis*	0.57
		70% *Artemisia californica*; 20% *Baccharis pilularis*	1.04
		80% *Artemisia californica*; 15% *Baccharis pilularis*	1.22
		90% *Artemisia californica*	17.09
Artemisia californica - *Baccharis pilularis* Alliance	Mixed California Sagebrush and Coyote Bush Scrub Alliance	25% *Artemisia californica*; 25% *Baccharis pilularis*; 25% *Juncus patens*	0.24
		35% *Artemisia californica*; 35% *Baccharis pilularis*; 35% *Brassica nigra*	0.07
		35% *Artemisia californica*; 35% *Baccharis pilularis*; 35% mixed *Avena* spp. and *Bromus* spp.	1.05
		40% *Artemisia californica*; 40% *Baccharis pilularis*	0.24
Avena spp. - *Bromus* spp. Alliance	Wild Oats and Annual Brome Grassland	100% mixed *Avena* spp. and *Bromus* spp.	0.40
		75% mixed *Avena* spp. and *Bromus* spp.; 50% *Carduus pycnocephalus*	0.12
Baccharis pilularis Alliance	Coyote Bush Scrub Alliance	50% *Baccharis pilularis*; 35% *Artemisia californica*	0.52
Lolium perenne Alliance	Perennial Rye Grass Fields	35% *Festuca perennis*; 25% *Plantago coronopus*; 15% *Deinandra increscens increscens*; 10% *Baccharis pilularis*; 10% *Bromus hordeaceus*; 10% *Bromus madritensis*	1.54
Developed	Pavement	Unvegetated	0.05

Alliance	Common Name	Dominant Species	Acres
Toxicodendron diversilobum - *Baccharis pilularis* Alliance	Mixed Poison Oak and Coyote Bush Scrub Alliance	19% *Baccharis pilularis*; 19% *Erigeron canadensis*; 19% *Polypogon monspeliensis*; 19% *Rubus ursinus*; 19% *Toxicodendron diversilobum*	0.08
		Total	**24.53**

Table 3.5-4. Vegetation Alliances Within the Biological Survey Areas of the Proposed Action – HIF Concept

Alliance	Common Name	Dominant Species	Acres
Artemisia californica - *Salvia leucophylla* Alliance	California Sagebrush - Purple Sage Scrub	70% *Artemisia californica*; 15% *Ceanothus thrysiflorus*; 10% *Baccharis pilularis*	0.41
Baccharis pilularis Alliance	Coyote Bush Scrub Alliance	35% *Baccharis pilularis*; 25% *Ceanothus thrysiflorus*; 25% *Agrostis pallens*; 10% *Rubus ursinus*	0.57
		60% *Baccharis pilularis*; 35% *Agrostis pallens*; 20% *Rubus ursinus*	0.40
Brassica nigra - *Centaurea* (*solstitialis, melitensis*) Alliance	Upland Mustards or Star-Thistle Fields	50% *Brassica nigra/Hirschfeldia incana*; 35% dead non-native annuals	0.36
Ceanothus thrysiflorus Alliance	Blue Blossom Chaparral	75% *Ceanothus thrysiflorus*; 20% *Baccharis pilularis*; 10% *Toxicodendron diversilobum*	0.66
Leymus condensatus Alliance	Giant Wild Rye Grassland	33% *Artemisia californica*; 33% *Baccharis pilularis*; 33% *Elymus condensatus*	0.15
		Total	**2.56**

Table 3.5-5. Vegetation Alliances Within the Biological Survey Area for Alternative 1 – New Hangar at SLC-6

Alliance	Common Name	Dominant Species	Acres
Anthropogenic - Disturbed	Anthropogenic - Disturbed	10% *Acmispon glaber*; 10% *Stipa pulchra*	0.19
Artemisia californica - *Salvia leucophylla* Alliance	California Sagebrush - Purple Sage Scrub	40% *Artemisa californica*; 20% *Baccharis pilularis*; 15% *Agrostis pallens*	1.40
Avena spp. - *Bromus* spp. Alliance	Wild Oats and Annual Brome Grassland	25% *Bromus hordeaceus*; 25% *Hirschfeldia incana*; 25% *Plantago coronopus*	1.43
Baccharis pilularis Alliance	Coyote Bush Scrub Alliance	90% *Baccharis pilularis*; 10% dead annual non-native grass	0.04
Baccharis pilularis Alliance - Disturbed	Coyote Brush Scrub; disturbed	15% *Baccharis pilularis*; 15% *Diplacus aurantiacus*; 15% *Cortaderia jubata*; 55% dead mixed annual grasses and mustards	0.08
Conium maculatum - *Foeniculum vulgare* Alliance	Poison Hemlock or Fennel Patches	20% *Foeniculum vulgare*; 20% *Helminthotheca echioides*; 10% *Baccharis pilularis*; 50% *Plantago coronopus* and associated non-natives and concrete chunks	0.18
Juncus (*effusus, patens*) - *Carex* (*pansa, praegracilis*) Alliance	Soft and Western Rush - Sedge Marsh	35% *Juncus patens*; 35% *Polypogon monspeliensis*	0.04
Developed	Pavement	Unvegetated	1.23

Plantago coronopus Alliance	Cutleaf Plantain Semi Natural Alliance	50% *Plantago coronopus*; 30% mixed *Avena* spp. and *Bromus* spp.; 10% *Hedypnois rhagadioloides*	0.34
		50% *Plantago coronopus*; 20% dead annuals	3.14
Salix lasiolepis Alliance	Arroyo Willow Thicket	95% *Salix lasiolepis*	0.03
Salvia mellifera Alliance	Black Sage Scrub	60% *Salvia melifera*; 20% *Rhus integrifolia*; 10% *Artemisa californica*	0.03
		Total	**8.13**

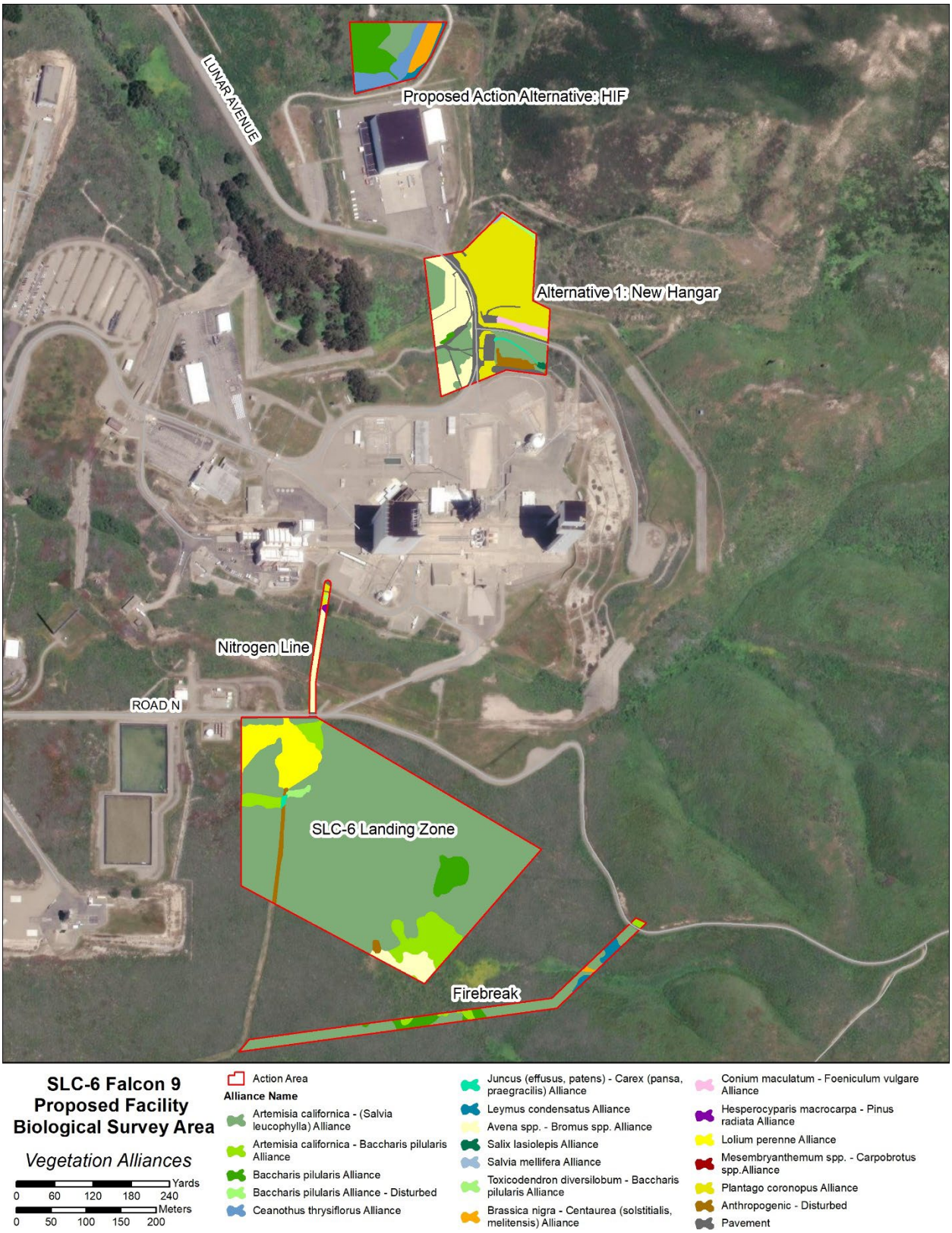

Figure 3.5-1. Vegetation Alliances Within the Biological Survey Areas

3.5.1.5 Wildlife Resources

The following species were determined to occur within the ROI as a result of the surveys and research described in Section 3.5.1.3. Common birds within the ROI include house finch (*Carpodacus mexicanus*), Brewer's blackbird (*Euphagus cyanocephalus*), cliff swallow (*Hirundo pyrrhonota*), barn swallow (*Hirundo rustica*), and California thrasher (*Toxostoma redivivum*). Amphibians within the ROI include the Baja California treefrog (*Pseudacris hypochondriaca*), Monterey ensatina (*Ensatina eschscholtzii*), and black-bellied slender salamander (*Batrachoseps nigriventris*). Reptiles include western fence lizard (*Sceloporus occidentalis*), western skink (*Eumeces skiltonianus*), and southern Pacific rattlesnake (*Crotalus oreganus helleri*). Various mammal species are also expected to occur within the ROI, including brush rabbit (*Sylvilagus bachmani*), coyote (*Canis latrans*), black bear (*Ursus americanus*), and California ground squirrel (*Otospermophilus beecheyi*). Small mammals include kangaroo rats (*Dipodomys* spp.) and pocket gopher (*Thomomys bottae*). Bat species in the area include big brown bat (*Eptesicus fuscus*) and western red bat (*Lasiurus blossevillii*). The NCI host the island scrub jay (*Aphelocoma insularis*), Channel Islands spotted skunk (*Spilogale gracilis amphialus*), island fox (*Urocyon littoralis*), and the island deer mouse (*Peromyscus maniculatus santacruzae*).

3.5.1.6 Special Status Wildlife Species

Species were considered "special status" if they met at least one of the criteria listed in Table 3.5-6. Potential occurrence was determined based on past documentation of special status species within the vicinity of the ROI and suitability of habitat and occurrence within the region (Table 3.5-7 through Table 3.5-12). For each federally listed species included below, the status, life history, occurrence in the ROI (including maps), and description of Critical Habitat (including maps) occurring in the ROI are included in the Biological Assessment in Appendix B and Appendix H.

Table 3.5-6. Terrestrial Special Status Species Considered

Special-Status Biological Resources
Plant and wildlife species that are federally listed, proposed for listing, or candidates for listing[15]
Plant and wildlife species that have been delisted[15]
Plant and wildlife species that are state listed or candidates for listing[16]
California fully protected species[17]
Wildlife species considered California Species of Special Concern by CDFW[18]
Plant species listed as endangered, threatened, or rare by the state of California[19]
Golden eagles and bald eagles protected under the Bald and Golden Eagle Protection Act[20]
Federal Birds of Conservation Concern[21]
Winter roost locations for monarch butterflies protected under the Local Coastal Program of Santa Barbara County[22]

[15] https://ipac.ecosphere.fws.gov/

[16] https://wildlife.ca.gov/Conservation/CESA/One-Year-Reviews

[17] https://wildlife.ca.gov/Conservation/Fully-Protected

[18] https://wildlife.ca.gov/Conservation/SSC

[19] CDFW 2025

[20] https://www.fws.gov/law/bald-and-golden-eagle-protection-act

[21] https://www.fws.gov/media/birds-conservation-concern-2021

[22] https://santabarbaraca.gov/government/priorities-policies/local-coastal-program

Table 3.5-7. Federal and State Special Status Invertebrate Species Occurrence Within the ROI

Species	Status		Occurrence within the ROI
	Federal	California	
Crotch bumble bee (*Bombus crotchii*)	-	SSC	Present in the noise footprint on VSFB, in southeastern Santa Barbara, Ventura, and northwestern Los Angeles Counties.
Monarch butterfly (*Danaus plexippus*)	P	Special Animal	Overwintering stands within noise footprint on VSFB, in southeastern Santa Barbara, Ventura, and northwestern Los Angeles Counties.

Notes: P = Proposed for listing under the ESA; SSC = California Species of Special Concern; "Special Animals" is a broad term used to refer to all the animal taxa tracked by the CDFW.

Table 3.5-8. Special Status Freshwater Fish Species Occurrence Within the Terrestrial Portion of the ROI

Species	Status		Occurrence within the ROI
	Federal	California	
Tidewater goby (*Eucyclogobius newberryi*)	FT	SSC	Present in San Antonio Creek, Santa Ynez River, and Jalama Creek on VSFB. Present in coastal streams within the noise footprint in southeastern Santa Barbara, Ventura, and northwestern Los Angeles Counties.
Unarmored Threespine Stickleback (*Gasterosteus aculeatus*)	FE	SE	Present in San Antonio Creek on VSFB and the Santa Clara River drainage in Ventura and northwestern Los Angeles Counties.
Arroyo chub (*Gila orcuttii*)	-	SSC	Present in San Antonio Creek on VSFB. Present within the noise footprint on Malibu and Calleguas Creeks in Ventura and northwestern Los Angeles Counties.
Steelhead - southern California DPS (*Oncorhynchus mykiss*)	FE	Candidate, SSC	Present within the noise footprint in coastal streams and rivers of Santa Barbara (including the Santa Ynez River and potentially Jalama Creek on VSFB) and northwestern Los Angeles Counties.

Notes: DPS = Distinct Population Segment; FE = Federally Endangered Species; FT = Federally Threatened Species; SE = State Endangered Species; SSC = California Species of Special Concern

Table 3.5-9. Special Status Amphibian Species Occurrence Within the Terrestrial Portion of the ROI

Species	Status		Potential Occurrence within the ROI
	Federal	California	
California tiger salamander Santa Barbara DPS (*Ambystoma californiense*)	FE	ST	Not present on VSFB. Present within noise footprint in Santa Barbara County.
Coast range newt (*Taricha torosa*)	-	SSC	Not present on VSFB. Present within the noise footprint in coastal streams of Santa Barbara, Ventura, and northwestern Los Angeles Counties
California red-legged frog (*Rana draytonii*)	FT	SSC	Present on VSFB and within noise footprint in Santa Barbara County.

Arroyo toad (*Anaxyrus californicus*)	FE	SSC	Not present on VSFB. Present within noise footprint in Santa Barbara, Ventura, and northwestern Los Angeles Counties.
Western spadefoot (*Spea hammondii*)	P	SSC	Present on VSFB and within noise footprint in Santa Barbara, Ventura, and northwestern Los Angeles Counties.

Notes: FE = Federally Endangered Species, FT = Federally Threatened Species; P = proposed for listing under the ESA; SSC = California Species of Special Concern; ST = State Threatened Species

Table 3.5-10. Special Status Reptile Species Occurrence Within the Terrestrial Portion of the ROI

Species	Status		Potential Occurrence within the ROI
	Federal	California	
Northern legless lizard (*Anniella pulchra*)	-	SSC	Present within the noise footprint in Santa Barbara County, including VSFB.
Southern legless lizard (*Anniella stebbinsi*)	-	SSC	Not on VSFB. Present within the noise footprint in Ventura and northwestern Los Angeles Counties.
Coastal whiptail (*Aspidoscelis tigris stejnegeri*)	-	SSC	Not on VSFB. Present within the noise footprint in northwestern Los Angeles County.
Coast horned lizard (*Phrynosoma blainvillii*)	-	SSC	Present within the noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
Southwestern pond turtle (*Actinemys pallida*)	P	SSC	Present within the noise footprint in coastal streams and wetlands of Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
Two-striped garter snake (*Thamnophis hammondii*)	-	SSC	Present within the noise footprint in Honda Creek on VSFB and the noise footprint in western Santa Barbara County. Potential occurrence in the noise footprint in southeastern Santa Barbara and northwestern Los Angeles Counties.

Notes: P = proposed for listing under the ESA; SSC = California Species of Special Concern

Table 3.5-11. Special Status Bird Species Occurrence Within the Terrestrial Portion of the ROI

Species	Status		Potential Occurrence within the ROI
	Federal	California	
Allen's hummingbird (*Selasphorus sasin*)	BCC	-	Present within noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
Ashy storm petrel (*Oceanodroma homochroa*))	-	SSC	Present within the noise footprint and recovery area offshore of the California coast.
Bald eagle (*Haliaeetus leucocephalus*)	BCC; BGEPA	SE; Fully Protected	Documented occasional flyovers on VSFB; foraging habitat within noise footprint. Rarely present within the noise footprint in southeastern Santa Barbara, Ventura, and northwestern Los Angeles Counties.
Bank swallow (*Riparia riparia*)	-	ST	Present within noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
Belding's savannah sparrow (*Passerculus sandwichensis beldingi)*	-	SE	Present in coastal plains within the noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
Black oystercatcher (*Haematopus bachmani*)	BCC	-	Present on sandy beaches and cliffs of VSFB shoreline and within the noise footprint in Santa Barbara, Ventura, and northwestern Los Angeles Counties.
Black skimmer (*Rynchops niger*)	BCC	-	Present in nearshore ocean waters within the noise footprint in Santa Barbara (including offshore of VSFB), Ventura, and northwestern Los Angeles Counties.
Black storm petrel (*Oceanodroma melania*))	-	SSC	Present within the noise footprint and recovery area offshore of the California coast.
Brant (*Branta bernicla*)	-	SSC	Present in nearshore ocean waters within the noise footprint in Santa Barbara (including offshore of VSFB), Ventura, and northwestern Los Angeles Counties.
Burrowing owl (*Athene cunicularia*)	BCC	SSC	Present on VSFB during winter and in coastal plains and agricultural lands within the noise footprint in southeastern Santa Barbara, Ventura, and northwestern Los Angeles Counties.
California brown pelican (*Pelecanus occidentalis californicus*)	-	Fully Protected	Present in nearshore ocean waters and roosts on beaches and rocks within the noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
California condor (*Gymnogyps californianus*)	FE	SE	One documented brief occurrence on VSFB in 2017 within noise footprint. Unlikely to be present on VSFB. Present within noise footprint in Ventura County.
California least tern (*Sterna antillarum browni*)	FE	SE	Present in noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
Cassin's auklet (*Ptychoramphus aleuticus*)	-	SSC	Present within the noise footprint and recovery area offshore of the California coast.
Channel Island song sparrow (*Melospiza melodia graminea*)	-	SSC	Present in noise footprint on Santa Rosa and San Miguel Islands.
Coastal California gnatcatcher (*Polioptila californica californica*)	FT	SSC	Not on VSFB. Present within the noise footprint in Ventura and northwestern Los Angeles Counties.

Species	Status		Potential Occurrence within the ROI
	Federal	California	
Costa's hummingbird (*Calypte costae*)	BCC	-	Present within the noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
Golden eagle (*Aquila chrysaetos*)	BGEPA	Fully Protected	Present within noise footprint on VSFB and Santa Barbara County. Rare in Ventura and northwestern Los Angeles Counties.
Grasshopper sparrow (*Ammodramus savannarum*)	-	SSC	Present in coastal plains within the noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
Island loggerhead shrike (*Lanius ludovicianus anthonyi*)	-	SSC	Present within the noise footprint on Santa Cruz and Santa Rosa Islands.
Lawrence's goldfinch (*Spinus lawrencei*)	BCC	-	Present in shrub and riparian habitat within noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
Least Bell's vireo (*Vireo bellii pusillus*)	FE	SE	Present within noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
Light-footed Ridgeway's rail (*Rallus obsoletus levipes*)	FE	SE	Not on VSFB. Present in coastal salt marshes within the noise footprint of Ventura County.
Loggerhead shrike (*Lanius ludovicianus*)	BCC	SSC; Nesting	Documented in shrub and riparian habitat within noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
Long-billed curlew (*Numenius americanus*)	BCC	-	Present on rocky coastline at low tide and beaches within noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
Marbled godwit (*Limosa fedoa*)	BCC	-	Present on sandy beaches and rocky coastline at low tide within noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
Marbled murrelet (*Brachyramphus marmoratus*)	FT	SE	Present in nearshore ocean waters within noise footprint in Santa Barbara (including offshore of VSFB), Ventura, and northwestern Los Angeles Counties.
Northern harrier (*Circus hudsonius*)	-	SSC; Nesting	Present in grassland within noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
Nuttall's woodpecker (*Dryobates nuttallii*)	BCC	-	Present in riparian habitat within noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
Oak titmouse (*Baeolophus inornatus*)	BCC	-	Present in riparian and non-native tree habitat within noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
Peregrine falcon (*Falco peregrinus anatum*)	BCC; Nesting	Fully Protected; Nesting	Present in coastal habitat within noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
Light-footed Ridgeway' Rail (*Rallus obsoletus levipes*)	FE	Fully Protected	Present in coastal habitat within noise footprint in Santa Barbara, Ventura, and northwestern Los Angeles Counties.
Santa Cruz Island rufous-crowned sparrow (*Aimophila ruficeps obscura*)	-	SSC	Present in noise footprint on Santa Cruz Island.
Short-billed dowitcher (*Limnodromus griseus*)	BCC	-	Present on rocky coastline at low tide and beaches within noise footprint in Santa Barbara, (including VSFB) Ventura, and northwestern Los Angeles Counties.

Species	Status		Potential Occurrence within the ROI
	Federal	California	
Southwestern willow flycatcher (*Empidonax traillii extimus*)	FE	SE	Not present on VSFB. Present within the noise footprint in inland Santa Barbara Country and Ventura and northwestern Los Angeles Counties.
Tufted puffin (*Fratercula cirrhata*)	-	SSC	Present within the noise footprint and recovery area offshore of the California coast.
Whimbrel (*Numenius phaeopus*)	BCC	-	Present on rocky coastline at low tide and beaches within noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
Western snowy plover (*Charadrius nivosus nivosus*)	FT; BCC	SSC; Nesting	Present on rocky coastline at low tide, nests on sandy beaches within noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
Willet (*Tringa semipalmata*)	BCC	-	Present on rocky coastline at low tide and beaches impacted by noise in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
White-tailed kite (*Elanus leucurus*)	-	Fully Protected; Nesting	Present in riparian and non-native tree habitat within noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
Yellow warbler (*Setophaga petechia*)	BCC	SSC; Nesting	Present in riparian habitat within noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.

Notes: BCC = Federal Bird of Conservation Concern; BGEPA = Bald and Golden Eagle Protection Act; FE = Federally Endangered Species; FT = Federally Threatened Species; SE = State Endangered Species; ST = State Threatened Species; SSC = California Species of Special Concern

Table 3.5-12. Special Status Mammal Species Occurrence Within the Terrestrial Portion of the ROI

Species	Status		Potential Occurrence within the ROI
	Federal	California	
Pallid bat (*Antrozous pallidus*)	-	SSC	Present within the noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
Spotted bat (*Euderma maculatum*)	-	SSC	Present within the noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
Townsend's big-eared bat (*Corynorhinus townsendii*)	-	SSC	Present within the noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
Western red bat (*Lasiurus blossevillii*)	-	SSC	Present within the noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
Western mastiff bat (*Eumops perotis californicus*)	-	SSC	Present within the noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
San Diego desert woodrat (*Neotoma lepida intermedia*)	-	SSC	Present within the noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.
South coast marsh vole (*Microtus californicus stephensi*)	-	SSC	Not on VSFB. Present within the noise footprint in Ventura County.
Southern California saltmarsh shrew (*Sorex ornatus salicornicus*)	-	SSC	Not on VSFB. Present in coastal salt marshes of Ventura County.
American badger (*Taxidea taxus*)	-	SSC	Present within noise footprint in Santa Barbara (including VSFB), Ventura, and northwestern Los Angeles Counties.

Notes: SSC = California Species of Special Concern

3.5.2 Environmental Consequences

3.5.2.1 Proposed Action

The following factors were used to determine if a significant impact on biological resources would result from implementing each alternative: the context and intensity of reasonably foreseeable effects, including the extent to which an effect is adverse at some points in time and beneficial in others.

Per FAA Order 1050.1F, impacts would be significant if through the ESA Section 7 consultation process, either the USFWS and/or NMFS determines the proposed action would be likely to jeopardize the continued existence of a federally listed threatened or endangered species or would result in the destruction or adverse modification of federally designated critical habitat. Impacts on biological resources would occur if project-related activities directly or indirectly affect special status species or their habitats. These impacts can be short- or long-term impacts. For example, short-term or temporary impacts can be from noise and long-term impacts can be from the lost habitat supporting wildlife populations.

Potential impacts on biological resources from the Proposed Action include the following: direct physical impacts from C&D activities; indirect impacts resulting from water use for launch and support activities, which could be extracted from the San Antonio Creek Basin; project-related noise disrupting breeding, foraging, or roosting behaviors; project-related noise causing habitat abandonment, including breeding or roosting sites; and project-related noise causing temporary or permanent hearing threshold shifts.

3.5.2.1.1 Vegetation Resources

Under the Proposed Action, approximately 21.3 ac. (native, non-native, and developed) would be developed, including an estimated total of 19.2 ac. of permanent unavoidable impacts on native vegetation alliances. Native vegetation would be avoided to the extent feasible while meeting construction and fire safety requirements.

3.5.2.1.2 Wildlife Resources

Temporary disturbances to terrestrial wildlife species within the ROI would occur during construction, launch, landing, and static fire events. 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 the behavioral responsiveness and physiological sensitivity to noise of those species or similar species.

The various species of wildlife within the ROI, including individuals at VSFB and the surrounding region, the NCI, southeastern Santa Barbara County, and portions of Ventura and northwestern Los Angeles Counties would be expected to react to noise, vibrations, and visual disturbance during launches, landing, and static firings at SLC-4 and SLC-6 in a similar manner that has been documented during monitoring efforts for federally listed species (discussed in Section 3.5.1.6); these may elicit a startle response in individuals may either see, hear, or sense vibrations caused by these activities. Individuals that are at SLC-4 or SLC-6 during launch, landing, or static fire events may experience temporary or permanent shifts in hearing thresholds (the range of noise frequencies that species can perceive), depending on the species sensitivity to noise, length of exposure, and the intensity of the noise. However, vegetation management (i.e., mowing) at SLC-4, which is conducted as part of the routine current SLC-4 management activities, within and around SLC-4 reduces wildlife presence above ground in these areas. 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). Because the areas where loud noises would occur are relatively small, the noise events are temporary, and wildlife presence is reduced due to vegetation management, potential hearing threshold shifts are unlikely or would affect relatively few individuals and not expected to have population-level impacts.

Since 2017 and as of 20 October 2024, of the launches that produced sonic booms that impacted the surface of the earth, approximately 67 percent have impacted the NCI. Depending on mission trajectories, ascent sonic boom may occasionally reach approximately 8.0 psf. Sonic boom footprints vary by mission-specific trajectories and weather conditions and the actual number of impacts above 1.0 psf would likely be less than 100 per year. Since the sonic boom would be disassociated from visual stimuli, wildlife resources on the NCI would likely have less intensity than on VSFB but would still be expected to have a brief startle reaction. Reactions would likely be short term and be unlikely to cause any long-term consequences for individuals or populations. Therefore, the Proposed Action would not have a significant impact on wildlife resources due to launch-related noise.

At maximum cadence, the Proposed Action would use up to 65.6 ac-ft of water per year. This would represent an increase of approximately 2.3 percent of the total annual water usage on VSFB. The current water source for VSFB is via an existing connection between State Water and the VSFB water supply system. VSFB primarily relies on State Water; however, during annual maintenance that lasts two to three weeks, VSFB utilizes four water wells in the San Antonio Creek Basin. VSFB receives an allocated amount from the California State Water Project (SWP). To date, VSFB has not exceeded the amount of the allocation. VSFB utilizes groundwater from the San Antonio Creek Basin when the State allocated water is unavailable, which can be for 1) drought; 2) SWP or California Clean Water Act (CCWA) emergency shutdowns; or 3) the annual CCWA system maintenance each November. As discussed in more detail in Section 3.7.2.1.1, even if pumping 65.6 ac-ft of water from the San Antonio Creek groundwater basin each year, it would have an indetectable effect on water levels and flow rates in the creek over this short period of time (G. Cromwell, U.S. Geological Survey [USGS], pers. comm.). The Proposed Action's water usage would therefore not result in any measurable impacts on flow rates, hydration periods, or water levels that are important for aquatic wildlife species in San Antonio Creek. As a result, the Proposed Action would not have a significant effect on wildlife resources.

3.5.2.1.3 Special Status Terrestrial Species

Potential impacts on ESA-protected species would be similar to those described in Section 3.3.2.1.2 of the 2024 EA (DAF 2024a); with the addition of potential impacts on some species during construction and the proposed increase in cadence. A detailed discussion of potential effects on all ESA-protected species and their Critical Habitat within the ROI is included in the Biological Assessment (Appendix B) and summarized in Table 3.5-13.

The USFWS issued a BO in March 2023 addressing impacts on species listed under the ESA for 36 Falcon 9 launches annually, and provided an incidental take statement for species likely to be adversely affected. SLD 30 completed ESA Section 7 consultation with USFWS to assess the effects of 16 additional launches between 1 October and 31 December 2024, not to exceed a total of 50 Falcon 9 launches during 2024 (USFWS 2024a). The USFWS extended the 2024 BO (USFWS 2024a) to include 16 additional Falcon 9 launches from SLC-4 between 1 January and 28 February 2025 (USFWS 2024b). The DAF initiated ESA Section 7 consultation to assess the Proposed Action on 9 April 2025.The USFWS issued a BO for the Proposed Action on 21 August 2025 (Appendix B).

As discussed for non-listed species, the increased tempo of launches and landings would increase the frequency at which listed and proposed species and migratory birds could respond behaviorally and physiologically to noise, visual disturbance, and potential vibrations due to C&D activities and launch and landing operations, and artificial lighting at SLC-4 and SLC-6. There could potentially be a corresponding increase in effects such as long-term habitat avoidance and decreased reproductive success. Some individuals may become habituated to increased noise events and vibration and exhibit diminishing responses over time. It is not feasible to predict the number of exposures that would correspond to these types of effects. Given the lack of quantitative thresholds, population monitoring of federally listed species may be used to evaluate long-term noise impacts. Monitoring of western snowy plover, California least-tern, California red-legged frog (CRLF), and other species occurs currently at VSFB under the Programmatic BO, various project-specific BOs, and the INRMP, and is expected to continue.

As discussed in Section 3.4.2, potential sonic booms impacting mainland southeastern Santa Barbara, Ventura, and northwestern Los Angeles Counties during ascent are generally expected to be of low magnitude and infrequent. Due to the lack of any coupled visual stimuli, sonic booms created during missions with easterly trajectories are not expected to have long-term adverse effects on ESA-protected species.

Depending on mission trajectories, ascent sonic boom may occasionally reach approximately 8.0 psf. Sonic boom footprints vary by mission-specific trajectories and weather conditions and the actual number of impacts above 1.0 psf would likely be less than 100 per year. Since the sonic boom would be disassociated from visual stimuli, wildlife resources on the NCI would likely have less intensity than on VSFB but would still be expected to have a brief startle reaction. Reactions would likely be short term and be unlikely to cause any long-term consequences for individuals or populations. Therefore, the Proposed Action would not have a significant impact on special status species due to launch-related noise on NCI.

Increased launch frequency would also increase the occurrence of nighttime lighting at SLC-4 and SLC-6. SpaceX is developing a lighting management plan in coordination with SLD 30 and USFWS to reduce potential impacts due to nighttime lighting.

Although unlikely to be encountered in upland habitats, CRLF may inadvertently occur during removal of vegetation, site grading and contouring, construction, demolition, firebreak and fire establishment, and site maintenance from the operation of heavy equipment, machinery, and vehicles at SLC-6. 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 would be reduced because biologists would monitor construction activities and search for animals trapped in open holes and trenches. Any CRLF or other wildlife detected within the construction area would attempt to be captured and relocated to nearby suitable habitat. In addition, when any demolition, contouring, or construction occurs at SLC-6, the active construction areas would be surrounded by exclusion fence. A USFWS approved biologist would be present to monitor vegetation-clearing activities.

After evaluating the Proposed Action, including the proposed EPMs (Section 3.5.2.5), the DAF has come to the conclusions which are summarized in Table 3.5-13 and Table 3.5-14 (see Appendix B for details).

Table 3.5-13. Federally Listed Species with Potential to Occur Within ROI and Summary of Effects Determinations

Common Name	Scientific Name	Federal Listing	Effects Determinations for the Proposed Action
Tidewater Goby	*Eucyclogobius newberryi*	Endangered	May affect, not likely to adversely affect.
Unarmored Threespine Stickleback	*Gasterosteus aculeatus williamsoni*	Endangered	May affect, not likely to adversely affect.
California Tiger Salamander Santa Barbara DPS	*Ambystoma californiense*	Endangered	May affect, not likely to adversely affect.
California Red-legged Frog	*Rana draytonii*	Threatened	**May affect, likely to adversely affect**.
Arroyo Toad	*Anaxyrus californicus*	Endangered	May affect, not likely to adversely affect.

Common Name	Scientific Name	Federal Listing	Effects Determinations for the Proposed Action
Marbled Murrelet	*Brachyramphus marmoratus*	Threatened	May affect, not likely to adversely affect.
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	Endangered	May affect, not likely to adversely affect.
Least Bell's Vireo	*Vireo bellii pusillus*	Endangered	May affect, not likely to adversely affect.
Western Snowy Plover	*Charadrius nivosus*	Threatened	**May affect, likely to adversely affect.**
California Least Tern	*Sternula antillarum browni*	Endangered	**May affect, likely to adversely affect**.
California Condor	*Gymnogyps californianus*	Endangered	May affect, not likely to adversely affect.
California Gnatcatcher	*Polioptila californica californica*	Threatened	May affect, not likely to adversely affect.
Light-footed Ridgeway's Rail	*Rallus obsoletus levipes*	Endangered	May affect, not likely to adversely affect.
Short-tailed Albatross	*Phoebastria (=Diomedea) albatrus*	Endangered	May affect, not likely to adversely affect.
Hawaiian Petrel	*Pterodroma sandwichensis*	Endangered	May affect, not likely to adversely affect.
Southern Sea Otter	*Enhydra lutris nereis*	Threatened	**May affect, likely to adversely affect**.

Table 3.5-14. Designated Critical Habitat with Potential to Occur Within ROI and Summary of Effects Determinations

Common Name	Scientific Name	Federal Listing	Effects Determinations for the Proposed Action
Tidewater Goby	*Eucyclogobius newberryi*	Endangered	No Effect
California Tiger Salamander	*Ambystoma californiense*	Endangered	No Effect
California Red-legged Frog	*Rana draytonii*	Threatened	No Effect

Common Name	Scientific Name	Federal Listing	Effects Determinations for the Proposed Action
Arroyo Toad	*Anaxyrus californicus*	Endangered	No Effect
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	Endangered	No Effect
Least Bell's Vireo	*Vireo bellii pusillus*	Endangered	No Effect
Western Snowy Plover	*Charadrius nivosus*	Threatened	May affect, not likely to adversely affect.
California Condor	*Gymnogyps californianus*	Endangered	No Effect
California Gnatcatcher	*Polioptila californica californica*	Threatened	No Effect

The terms and conditions and reasonable and prudent measures identified during the Section 7 consultation with the USFWS and the resultant BO (Appendix B) would be implemented. With continued species monitoring and implementation of measures required by the USFWS, modifications to SLC-6 and increased Falcon launches would not be likely to jeopardize the continued existence of a federally listed threatened or endangered species or result in the destruction or adverse modification of federally designated Critical Habitat resources. In addition, these measures would decrease the potential for long-term habitat and species loss, as well as adverse effects on reproductive success, mortality rate, or ability to sustain minimum population levels, such that there would be no significant impact.

3.5.2.2 Alternative 1

Operations under Alternative 1 would be the same as the Proposed Action and would generate the same types and levels of impacts on terrestrial biological resources as discussed in Section 3.5.2.1. The only differences between Alternative 1 and the Proposed Action is the construction of a new hangar, which would have minimal differences in terms of impacts on vegetation communities as a result of different construction footprints. Therefore, Alternative 1 would not result in significant impacts on terrestrial biological resources.

3.5.2.3 No Action Alternative

Under the No Action Alternative, modifications of SLC-6 and increased Falcon launch cadence on VSFB would not occur, resulting in no impacts on terrestrial biological resources, beyond those described in the 2024 EA (DAF 2024a). The analysis of the No Action Alternative includes the potential effects associated with reasonably foreseeable actions (Table 3.2-3) without consideration of the Proposed Action, because these actions would still occur. The potential for noise, sonic boom overpressure, habitat damage, artificial lighting, and general disturbance to wildlife would continue as evaluated in existing NEPA documents and regulatory consultations.

3.5.2.4 Cumulative Effects

Several of the projects listed in Sections 3.2.1 through 3.2.3 include C&D activities in both undisturbed and previously disturbed areas. Disturbance to existing launch areas or other developed and semi-developed sites would have little effect on wildlife because these areas have limited habitat value. The Proposed Action, Alternative 1, and some of the actions listed in Sections 3.2.1 through 3.2.3 involve clearing of native upland habitat and could also potentially involve clearing or filling of a limited amount of wetland habitat. Cumulative loss and fragmentation of native upland and wetland

habitats may cause long-term effects on wildlife breeding, roosting, or foraging, particularly of individuals with limited mobility and those without corridors to another suitable habitat. C&D noise and general disturbance could cause similar impacts, but the effects would be temporary. As described in the USSF Range of the Future initiative to the greatest extent possible development is consistent with sustainable planning and is focused in areas that minimize impacts on wetlands and protected species. All C&D projects would follow BMPs and permit requirements to prevent excess sedimentation and runoff into surrounding habitats. VSFB has large areas of intact habitat where some displaced wildlife species may establish new territories, although the survival rate of displaced individuals is unknown. ESA Section 7 requirements from the USFWS and the requirement to avoid nests of bald eagles, migratory birds, and other protected bird species until they have fledged, which are in place for some past and present actions, reduce the potential for major cumulative effects on these species. Similar requirements are likely for reasonably foreseeable actions that involve substantial habitat disturbance.

For wildlife species with populations that are currently well-distributed and not stressed by other factors, cumulative habitat loss and disturbance impacts are expected to be minimal. However, for protected species, the potential for negative impacts is greater due to the rarity of these animals and their habitats.

The number of annual launch operations on VSFB would not exceed 15 missile and 110 rocket launches per year cumulatively across all launch service providers. Some actions would also include static fire tests. The cumulative launch tempo could result in long-term impacts on wildlife populations. The area of effects for any given launch site would be relatively small and would not be expected to cause detectable impacts on wildlife populations. Acid and particulate deposition in surrounding areas has been noted during operation of some launch vehicles, but neither the Proposed Action nor Alternative 1 would contribute substantially to such effects because of the type of fuels used in Falcon vehicles.

The increased number of launches and landings would correspondingly increase the frequency at which wildlife would be exposed to noise and ground vibration. Behavioral and physiological stress reactions would be expected in some individuals, although habituation could also potentially occur. There is potential for individuals to avoid areas associated with repeated disturbance long-term or to experience chronic stress responses, which could affect health and reproductive success. Such impacts would be of particular concern for protected species. Population-level impacts, and the significance of such impacts, are difficult to predict, but monitoring of representative species may be used to help assess long-term effects. Monitoring is currently conducted for some species at VSFB. Additional monitoring or other management requirements could potentially be identified during consultations with the USFWS for the Proposed Action, Alternative 1, and other future actions.

Increased development and launch tempo would also increase the incidence of nighttime lighting. Lighting may disorient birds and affect the behavior of other wildlife. SpaceX would develop a lighting management plan to incorporate into the construction of SLC-6 and will be provided to the Service. It is expected that exterior lighting measures would be identified during consultations with the USFWS and would be incorporated into applicable lighting management plans.

Overall impacts on vegetation, habitats, wildlife, and protected species would be moderated by the implementation of USFWS and NMFS Section 7 consultation terms and conditions. Increased noise and potential disruption of prescribed burn schedules could cause potentially significant impacts on terrestrial wildlife and protected species (e.g., habitat abandonment and decreased reproductive success). It is expected that requirements developed during Section 7 consultations, which could include actions such as mitigation development based on the results of increased species monitoring, would decrease the potential for effects and that the continued existence of federally listed species would not be jeopardized. It is also expected that burn schedules would be coordinated such that significant habitat impacts would not occur. Impacts on marine species and habitats would likely be minor. With implementation of required management and project design criteria, neither the Proposed Action nor Alternative 1 in combination with other past,

present, and reasonably foreseeable future actions, would result in significant cumulative effects on terrestrial biological resources, including effects on ESA-listed species.

3.5.2.5 Mitigation and Monitoring

The DAF will ensure that the terms and conditions and reasonable and prudent measures identified during Section 7 consultation with the USFWS and in the resultant BO would be implemented (Appendix B). To avoid potential project-related impacts on nesting migratory birds, if exterior building renovations/demolitions and/or vegetation clearing is initiated during avian nesting season (15 February through 15 August), a qualified biologist would conduct nesting bird surveys within 250 ft of the C&D area prior to project initiation and vegetation-clearing activities. If nesting migratory birds are found within the C&D area, a buffer of adequate size to prevent disturbance from project-related activities (to be determined by the biological monitor) would be marked with flagging tape to avoid disturbance. The nest would be monitored to determine impacts, if any, from project-related disturbance. Implementing these measures would avoid or minimize potential adverse effects to terrestrial biological resources during implementation of the Proposed Action. Qualified DAF or SpaceX personnel or contractor staff would oversee fulfilling EPMs.

3.6 Marine Biological Resources

3.6.1 Affected Environment

3.6.1.1 Regulatory Setting

Marine species and habitats are regulated under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), the National Marine Sanctuaries Act (NMSA), and MMPA. Additionally, the ESA of 1973 (16 USC Section 1531 et seq.) established protection over and conservation of threatened and endangered species and the ecosystems upon which they depend. Sensitive and protected biological resources include plant and animal species listed as threatened, endangered, or special status by the USFWS and NMFS. Under the ESA (16 USC Section 1536), an "endangered species" is defined as any species in danger of extinction throughout all or a significant portion of its range. A "threatened species" is defined as any species likely to become an endangered species in the foreseeable future.

Section 7 of the ESA requires all Federal agencies to consult with the USFWS and/or NMFS before initiating any action that may affect a listed species or designated critical habitat. The MSA requires agencies to consult with NMFS on actions that may affect Essential Fish Habitat for managed commercial fisheries. The MMPA prohibits take of marine mammals without a Letter of Authorization requiring formal rulemaking.

Under the NMSA (16 USC Sections 1431 *et seq*.), NOAA (as delegated) designates and manages, as national marine sanctuaries, areas of the marine environment that are of special national significance. Marine species and habitats that occur within or are resources of national marine sanctuaries are subject to management and regulation under the NMSA. The NMSA requires federal agencies whose actions are "likely to destroy, cause the loss of, or injure any sanctuary resource," to consult with NOAA before taking the action (16 USC 1434(d)).

3.6.1.2 Region of Influence

The ROI for marine biological resources encompasses the coastline areas potentially affected by sonic booms and rocket engine noise along VSFB and the surrounding areas, the booster landing and fairing recovery area in the Pacific Ocean (i.e., Recovery Area; Figure 2.1-3), the NCI, the coastline of southeastern Santa Barbara, Ventura, and northwestern Los Angeles Counties, and support vessel routes between the Port of Long Beach, the proposed landing area, and VSFB harbor. Based on over two decades of monitoring pinnipeds during launch-related sonic booms on VSFB and the NCI, the DAF, in collaboration with NMFS, determine that sonic booms of less than 1.0 psf generally do not cause significant behavioral disruptions to pinnipeds. Consequently, the ROI for marine mammals potentially

affected by sonic booms was determined by using the 1.0 psf sonic boom contours from model results. The ROI also includes the proposed landing and fairing recovery area (Figure 2.1-3).

3.6.1.3 Marine Species and Critical Habitat

Fish, sea turtles, and marine mammal species and designated Critical Habitat protected under the ESA or MMPA have the potential to occur in the ROI (Table 3.6-1 through Table 3.6-3). A detailed description of each species is provided in Appendix I. These are the same species that were evaluated in Section 3.4 of the 2024 EA (DAF 2024a). There are no state-listed marine species within the ROI.

Table 3.6-1. ESA-listed Fish Species Occurrence Within the Marine Portion of the ROI

Common Name	Scientific Name	DPS or ESU	Federal Status	California Status	Presence in ROI
Steelhead	*Oncorhynchus mykiss*	Southern California Coast	FE	SSC	Documented in the nearshore and offshore waters.
Chinook salmon	*Oncorhynchus tshawytscha*	5 ESUs[1]	FT	SSC	Specific ESUs present or potentially present in the nearshore and offshore waters.
Coho salmon	*Oncorhynchus kisutch*	4 ESUs[2]	FT	SSC	Documented in the nearshore and offshore waters.
Green sturgeon	*Acipenser medirostris*	Southern	FT	SSC	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

Notes: DPS = Distinct Population Segment; ESU = Evolutionarily Significant Unit; FE = federally endangered; FT = federally 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).

Table 3.6-2. ESA-listed Turtle Species Occurrence Within the Marine Portion of the ROI

Common Name	Scientific Name	DPS or ESU	Federal Status	California Status	Presence in ROI
Green sea turtle	*Chelonia mydas*	East Pacific Central North Pacific	FT	SSC	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

Notes: DPS = Distinct Population Segment; ESU = Evolutionarily Significant Unit; FE = federally endangered; FT = federally threatened

Table 3.6-3. Special Status Marine Mammal Species Occurrence Within the Marine Portion of the ROI

Common Name	Scientific Name	DPS or ESU	Federal Status	California Status	Presence in ROI
Blue whale	*Balaenoptera musculus*	-	FE; MMPA	-	High densities in summer/fall; single individuals in winter/spring
Fin whale	*Balaenoptera physalus*	-	FE; MMPA	-	Higher densities in the summer and fall, present year-round
Gray whale	*Eschrichtius robustus*	Western North Pacific	FE; MMPA	-	Present during seasonal migration in the winter and spring
Humpback whale	*Megaptera novaeangliae*	Mexico	FT; MMPA	-	Individuals present year-round with higher seasonal presence during the summer migrations from Mexico and Central America
		Central America	FE; MMPA	-	
Humpback whale Critical Habitat	*Megaptera novaeangliae*	Mexico/Central America DPS	FE	-	Critical Habitat overlaps the ROI in the Recovery Area northwest of VSFB along coastal California (see Appendix C)
Killer whale	*Orcinus orca*	Southern Resident	FE; MMPA	-	Occasionally present offshore of Central and Southern California
Sei whale	*Balaenoptera borealis*	-	FE; MMPA	-	Present year round with more likely presence in the winter and spring
Sperm whale	*Physeter macrocephalus*	-	FE; MMPA	-	Present year round with a preference for deep waters and the continental shelf break and slope
Steller sea lion	*Eumetopias jubatus*	-	MMPA	SSC	Documented in coastal waters within the noise footprint. Haulouts located on NCI, offshore rocks along California coast north of Point Conception, and occasionally at VSFB.
Northern elephant seal	*Mirounga angustirostris*	-	MMPA	Fully Protected	Documented in coastal waters within the noise footprint. Haulouts located on NCI, along California coast north of Point Conception, and at VSFB.
Pacific harbor seal	*Phoca vitulina richardii*	-	MMPA	-	Documented in coastal waters within the noise footprint. Haulouts located on NCI, along California coast, and at VSFB.
California sea lion	*Zalophus californianus*	-	MMPA	-	Documented in coastal waters within the noise footprint. Haulouts located on NCI, along California coast, and at VSFB.
Guadalupe fur seal	*Arctocephalus townsendi*	-	FT; MMPA	SSC	Primarily present at NCI and between 50 and 300 km offshore seasonally when not at rookeries in Mexican waters. Occasionally observed at haulouts on NCI.
Southern sea otter	*Enhydra lutris nereis*	-	FT; MMPA	SSC	Present along coast of California from Santa Barbara County and north; present along coast of San Nicolas Island

Notes: DPS = Distinct Population Segment; ESU = Evolutionarily Significant Unit; FE = federally endangered; FT = federally threatened; MMPA = Marine Mammal Protection Act

3.6.1.4 Marine Reserves

Pursuant to the National Marine Sanctuaries Act (NMSA; 16 USC Section 1431 et seq.), the NOAA designates and manages, as national marine sanctuaries, marine areas with special conservation, recreational, ecological, historical, cultural, archaeological, scientific, educational, or aesthetic qualities. Management of national marine sanctuaries was delegated by the Secretary of Commerce to the NOAA Office of National Marine Sanctuaries, which issues regulations for each sanctuary and the system as a whole. These regulations specify the types of activities that are prohibited from occurring within the sanctuary and the process and requirements by which NOAA may issue permits, authorizations, or exemptions for otherwise prohibited activities. Under the NMSA, NOAA also prepare management plans for sanctuaries and may assess civil penalties for violations of the NMSA, its implementing regulations, or permits issued under it. Federal agency actions "that are likely to destroy, cause the loss of, or injure any sanctuary resource are subject to consultation," with NOAA.

Channel Islands National Marine Sanctuary (CINMS) was designated in 1980 by NOAA. The CINMS is located in the ROI off the coast of Santa Barbara and Ventura counties in southern California, 350 mi south of San Francisco, 95 mi northwest of Los Angeles, and 40 mi south of SLC-4. The sanctuary encompasses approximately 1,470 square miles of ocean waters around Anacapa, Santa Cruz, Santa Rosa, San Miguel, and Santa Barbara islands, extending from the mean high tide of these islands to six nm offshore, and surrounding the Channel Islands National Park. CINMS regulations may be found at 15 CFR Sections 922.70–922.74. Section 922.72(a)(9) prohibits taking any marine mammal, sea turtle, or seabird within or above CINMS, except as authorized by the MMPA, ESA, or MBTA.

Within the ROI, the coastline from Purisima Point to just south of Point Arguello has been designated as the Vandenberg State Marine Reserve (VSMR) pursuant to California's Marine Managed Areas Improvement Act. The VSMR management objectives include providing for complete protection of a diverse area containing shallow hard and soft habitats, kelp beds, and associated marine life.

The Chumash Heritage National Marine Sanctuary (CHNMS) designation became effective on 30 November 2024. The CHNMS is within the ROI, encompassing an area of the Pacific Ocean from Gaviota Creek to Santa Rosa Creek and out to the western slope of the Santa Lucia Bank. The Final Rule[23] for the sanctuary included an exemption for existing DOD Activities, including commercial space and ballistic launches that originate from VSFB.[24]

For both CINMS and CHNMS, new DoD activities that would not otherwise be prohibited by the sanctuary regulations would not require an amendment to the list of exempted activities. For those new DoD activities that would otherwise be prohibited by the sanctuary regulations, NOAA has included in the regulations a process whereby the ONMS Director, upon consultation with the appropriate counterpart at the DoD, can also exempt such new activities carried out by the DoD.

3.6.2 Environmental Consequences

3.6.2.1 Proposed Action

3.6.2.1.1 ESA-listed Fish

The Proposed Action potentially impacts ESA-listed fishes shown in Table 3.6-1 occurring within the ROI. Section 3.4.2.1.1 of the 2024 EA (DAF 2024a) analyzed the potential effects of physical disturbance and impacts by fallen objects, ship strike, entanglement, and ingestion of expended materials on ESA-listed fish and determined that these would be insignificant. The DAF conducted informal Section 7 consultation with NMFS, which concurred potential impacts ***may affect, but not likely to adversely affect*** ESA-listed fish species through a LOC issued on 17 April 2024 (Appendix C). The DAF would continue to implement all applicable minimization, monitoring, and avoidance measures

[23] https://www.federalregister.gov/documents/2024/10/16/2024-23607/chumash-heritage-national-marine-sanctuary

[24] https://nmssanctuaries.blob.core.windows.net/sanctuaries-prod/media/chumash/2024-chnms-feis-vol-2.pdf

in the LOC and the EPMs included in Section 3.6.2.5. Therefore, the Proposed Action would not result in significant impacts on ESA-listed fish.

3.6.2.1.2 ESA-listed Sea Turtles

The Proposed Action potentially impacts ESA-listed sea turtles shown in Table 3.6-2 occurring within the ROI. Section 3.4.2.1.2 of the 2024 EA (DAF 2024a) analyzed the potential effects of physical disturbance and impacts by fallen objects, ship strike, entanglement, and ingestion of expended materials on ESA-listed sea turtles and determined that these would be discountable. The DAF conducted informal Section 7 consultation with NMFS, which concurred potential impacts ***may affect, but not likely to adversely affect*** ESA-listed sea turtle species through a LOC issued on 17 April 2024 (Appendix C). The DAF would continue to implement all applicable minimization, monitoring, and avoidance measures in the LOC and the EPMs included in Section 3.6.2.5. Therefore, the Proposed Action would not result in significant impacts on ESA-listed sea turtles.

3.6.2.1.3 ESA-listed Cetaceans

The Proposed Action potentially impacts the ESA-listed cetaceans shown in Table 3.6-3 occurring within the ROI. Section 3.4.2.1.3 of the 2024 EA (DAF 2024a) analyzed the potential effects of physical disturbance and impacts by fallen objects, ship strike, entanglement, ingestion of expended materials, and noise on ESA-listed cetaceans and determined that these would be discountable. The DAF conducted informal Section 7 consultation with NMFS, which concurred potential impacts ***may affect, but not likely to adversely affect*** ESA-listed cetacean species through a LOC issued on 17 April 2024 (Appendix C). Humpback whale Critical Habitat overlaps ROI in the Recovery Area northwest of VSFB along coastal California (see Appendix C). No other Critical Habitat for marine species overlaps the Recovery Area (Appendix C). NMFS concurred that the potential impacts ***may affect, but not likely to adversely affect*** humpback whale Critical Habitat on 17 April 2024 (Appendix C). The DAF would continue to implement all applicable minimization, monitoring, and avoidance measures in the LOC and the EPMs included in Section 3.6.2.5. Therefore, the Proposed Action would not result in significant impacts on ESA-listed cetaceans.

3.6.2.1.4 MMPA-Protected Pinnipeds

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. NMFS has previously determined that the only potential stressors associated with the specified activities that could cause harassment of marine mammals (i.e., rocket engine noise, sonic booms) only have the potential to result in harassment of marine mammals that are hauled out of the water (NMFS 2024a). As a result, launches and first stage recoveries are not expected to result in harassment of marine mammals that are at sea.

Pinnipeds at haulouts along the mainland coastline at VSFB, southeastern Santa Barbara, Ventura, northwestern Los Angeles Counties, and on the NCI would be disrupted by noise and visual disturbance associated with up to 100 Falcon launches and up to 24 landing events per year. The DAF has monitored pinnipeds at haulouts on VSFB and the NCI to characterize the effects of noise and visual disturbance during many launches over the past two decades and determined in collaboration with NMFS, there are generally no substantial behavioral disruptions or anything more than temporary affects to the number of pinnipeds hauled out on VSFB and the NCI. Reactions between species are also different. For example, Pacific harbor seals (PHS) and California sea lion tend to be more sensitive to disturbance than northern elephant seals. Normal behavior and numbers of hauled out pinnipeds typically return to normal within two to four hours or less (often within minutes) after a launch event. During monitoring required by NMFS, no observations of injury or mortality to pinnipeds have been attributed to past launches.

Under the MMPA, NMFS issued a Final Rule for taking marine mammals incidental to VSFB launches (NMFS 2024a), and a LOA (NMFS 2024b; Appendix C). The LOA, which will expire on 9 April 2029, allows launch programs to unintentionally take small numbers of marine mammals during launches. The Proposed Action would not result in

exceedance of take thresholds authorized in the 2024 LOA (Level B – behavioral harassment). The DAF is required to comply with the LOA listed conditions and address NMFS concerns regarding marine mammals throughout the ROI.

The DAF assessed acoustic impacts on marine mammals to analyze potential acoustic impacts for pinniped haulouts in southeastern Santa Barbara, Ventura, and northwestern Los Angeles Counties to determine if the increased impact is covered by the estimated take totals in the LOA (NMFS 2024b; Appendix C). Full details of this analysis are provided in Appendix C. Below is a summary of the findings.

Two harbor seal haulouts were identified on the mainland in the geographic noise footprint, the Carpinteria Harbor Seal Rookery and the Point Mugu Lagoon haulout. The DAF applied NMFS thresholds as the best available science to estimate level of take resulting from in-air non-impulsive (rocket engine noise) noise and impulsive (sonic boom) for harbor seals at these haulouts. During missions with easterly trajectories, the received engine noise levels (non-impulsive noise) would be substantially less than the NMFS threshold for behavioral disturbance for harbor seals. Additionally, acoustic monitoring in Ventura County for 11 SpaceX missions with easterly trajectories has not detected engine noise above ambient noise levels. Therefore, engine noise is substantially below NMFS thresholds for behavioral disruption of harbor seals and thus no takes are anticipated at either the Carpinteria Harbor Seal Rookery or the Point Mugu Lagoon haulout.

To analyze the potential for take due to sonic boom (impulsive noise), the sonic boom model outputs were compared to harbor seal haulout locations. Approximately 39 percent of missions with easterly trajectories are predicted to impact the Carpinteria Harbor Seal Rookery. 88 percent of the boom levels were predicted to be less than 1.0 psf, and 98 percent were predicted to be less than 2.0 psf. The highest predicted level was 3.7 psf, although a 4.4 psf sonic boom was detected in Santa Barbara County during one Falcon 9 mission, which is expected to rarely occur. For the Point Mugu Lagoon haulout, approximately 93 percent of missions with easterly trajectories are predicted to impact the site. However, 99.8 percent of the boom levels were predicted to be less than 1.0 psf, and 100 percent were predicted to be less than 1.5 psf. The highest predicted level was 1.6 psf. Sonic booms of approximately 1.0 psf are expected to generally correspond to the NMFS threshold of 100 dB SEL for behavioral disruption for harbor seals. This is supported by over two decades of pinniped monitoring by the DAF during sonic booms caused by numerous launches where the DAF has observed that there are generally no significant behavioral disruptions caused to pinnipeds by sonic booms less than 1.0 psf.

NMFS concurred with the DAF on 7 January 2025 that any marine mammal take from launch noise at haulouts on the south coast of southeastern Santa Barbara, Ventura, and northwestern Los Angeles Counties is not likely to exceed the number of authorized takes in the April 2024 LOA and that modifying the LOA was not warranted (Appendix C). The DAF's LOA permits a total of 11,135 PHS to be incidentally taken by Level B harassment (behavioral disruption) annually due to launch activities (NMFS 2024b). Although this total did not include estimates of take at haulouts on the south coast of southeastern Santa Barbara, Ventura, and northwestern Los Angeles Counties, any increase in annual take by Level B harassment of PHS (estimated to be 2,868 per year total) would be offset by a reduction in take on San Miguel Island (SMI). This is because as the trajectory of the Falcon 9 and resultant sonic boom moves more to the east and approaches 140 to 145 degrees the sonic boom no longer overlaps SMI, where there are large numbers of PHS and other pinnipeds. It is therefore unnecessary to increase the number of permitted takes by Level B harassment of PHS under the LOA, despite the change in geographic area of potential impacts.

MMPA-protected marine mammals have the potential to be disturbed during RORO operations at the VSFB harbor. However, adverse effects are not anticipated because the EPMs in Section 3.6.2.5, including entering the harbor to the extent possible at high tides when pinnipeds are not present, initiating any nighttime activities before dusk, and slowly starting any noisy activities, would help minimize and avoid any behavior disruptions.

Considering the authorizations and EPMs in place, including the required monitoring, the Proposed Action would not result in significant impacts on MMPA protected pinnipeds.

3.6.2.1.5 ESA-listed Guadalupe Fur Seal

The Proposed Action potentially impacts the ESA-listed Guadalupe fur seal. Section 3.4.2.1.5 of the 2024 EA analyzed the potential effects of sonic booms on the NCI on Guadalupe fur seal. In general, 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 if they do flee from a disturbance (Harris 2015). Section 3.4.2.1.5 of the 2024 EA and Appendix C contain more detailed Guadalupe fur seals behavioral reaction discussion. The DAF conducted informal Section 7 consultation with NMFS, which concurred potential impacts ***may affect, but not likely to adversely affect*** the Guadalupe fur seal through a LOC issued on 17 April 2024 (Appendix C). Critical habitat has not been designated for this species. Additionally, the LOA (NMFS 2024b) allows unintentional take of small numbers of Guadalupe fur seals during launches. The Proposed Action would not result in exceedance of take thresholds as identified in the 2024 LOA. The DAF is required to comply with the LOA listed conditions. The DAF would continue to implement all applicable minimization, monitoring, and avoidance measures in the LOC, LOA, and the EPMs included in Section 3.6.2.5. Therefore, the Proposed Action would not result in significant impacts on ESA-listed Guadalupe fur seal.

3.6.2.1.6 ESA-listed Southern Sea Otter

Appendix B includes maps depicting noise model results and the overlap with southern sea otter habitat discussed below. The potential noise exposures from Falcon launches and landings at SLC-4 and SLC-6 are summarized in Table 3.6-4 and Table 3.6-5.

Table 3.6-4. Estimated Maximum Falcon Rocket Engine Noise Levels (dB L_{max}) at Southern Sea Otter Localities

Location	Falcon 9 at SLC-4			Falcon 9 at SLC-6			Falcon Heavy at SLC-6		
	Static Fire	Landing	Launch	Static Fire	Landing	Launch	Static Fire	Landing	Launch
Nearest Coastline	122	130	140	130	120	130	130	110	135
VSFB Harbor	108	108	116	120	119	125	128	118	129
Sudden Ranch	108	108	116	120	119	125	128	118	129

Table 3.6-5. Estimated Maximum Falcon Sonic Boom Levels (psf) During Launches and Landings at Southern Sea Otter Localities

Location	Falcon 9 at SLC-4		Falcon 9 at SLC-6*		Falcon Heavy at SLC-6	
	Launch	Landing	Launch	Landing	Launch	Landing
Nearest Coastline	-	7-8	-	10	-	10
VSFB Harbor	-	3.5-4	-	5-8	-	5-8
Sudden Ranch	-	2-3	-	3	-	3

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 and 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 discountable.

Extensive launch monitoring has been conducted for sea otters on both north and south VSFB. No mortality, or injury of effects on the population has ever been documented for sea otter as a result of launch-related noise and visual disturbance and the same or similar numbers of individuals have been observed at monitoring locations prior to and following launch events (SRS Technologies, Inc. 2006a, 2006b, 2006c, 2006d, 2006e, 2006f, 2006g, 2006h; MSRS 2007a, 2007b, 2008a, 2008b, 2009a; 2009b; 2024a).

Launches and landings and accompanying noise and visual disturbance would be expected to result in minor behavioral response. This has been confirmed by monitoring and recording groups of otters during two Falcon 9 missions which included first stage landing at SLC-4: Transporter 11 and OneWeb-4. During the Transporter 11 mission during the day on 16 August 2024, otters reacted to the launch by alerting and diving and had a similar reaction during the landing and sonic boom with the otters resurfacing within minutes and the entire group completely resettled at approximately 30 minutes after the launch (MSRS 2024b). During the OneWeb-4 mission during the night of 19 October 2024, all otters reacted to the launch by diving, which corresponded to peak visual disturbance and launch noise, but had no reaction to the sonic boom during landing. Individuals began resurfacing within one to two minutes, with all otters resettled within approximately nine minutes of the launch (MSRS 2024c).

As detailed in Appendix B, most of the sonic boom noise energy is less than 250 Hz, well below the region of best hearing sensitivity of the sea otter (2,000 –22,600 Hz). While the sea otter would likely hear the sonic boom, it would only be responding to acoustic energy that is above 250 Hz and total sound levels much less than 135 dB L_{max}. As the sonic boom increases in pressure, it is likely that the sea otter would detect more energy, most notably in frequencies higher than 250 Hz. Appendix B presents a sonic boom spectrum and sea otter hearing sensitivity curve, along with an audiogram used to derive an auditory weighting function. The otter weighting function was applied to a timewave form recording of the June 2022 Falcon 9 SARah-1 launch and resulted in a peak level of approximately 70 dB L_{max} (see Appendix B), which by comparison to human hearing sensitivity is equivalent to the sound level of a household washing machine.

Otters have also been shown to quickly acclimate to disturbances from boats, people, and harassment devices (air horns). A summary of studies related to sea otters and disturbance is included in Appendix B. Extensive launch monitoring of sea otters on VSFB has shown that rocket disturbance is not a primary driver of sea otter behavior or using the habitat along Sudden Flats and has not had any apparent long-term consequences on populations, potentially indicating that this population has acclimated to launch activities. Therefore, impacts from noise or visual disturbance resulting from the Proposed Action is expected to be limited to minor behavioral disruption and insignificant. This has been confirmed by monitoring and recording groups of southern sea otters during two Falcon 9 missions which included first stage landing at SLC-4 (Transporter 11 and OneWeb-4) where otters reacted by diving for short periods of time, as discussed below.

Sea otters are however the smallest marine mammal and lack some of the thermoregulatory adaptations that are seen in cetaceans and pinnipeds, which results in elevated thermal energetic costs for sea otters (Costa & Kooyman 1984; Yeates et al. 2007). As a result, if resting otters are disrupted frequently, there may be energetic consequences that could affect fitness and survival of individuals. Yeates et al. (2007) found that mean metabolic rate for single dives (non-foraging dives), typically lasting one to three minutes, were only 1.3 times as great as resting metabolic rate in the southern sea otter. Most of the reactions documented during the Transporter 11 and OneWeb-4 missions were short dives; however, some individuals swam for approximately nine minutes in addition to diving. Swimming is approximately two times as great as resting metabolic rate (Yeates et al. 2007). Using the metabolic rates, activity budget, and energetic costs for southern sea otter reported in Yeates et al. (2007), the energetic cost of an otter disturbed from rest and swimming for 10 minutes was estimated to be an increase of approximately one percent in energetic cost over one day (Appendix B). There would only be approximately two launch events per week, and because not all otters were observed to react to the degree of the otter described above (most resumed normal behavior within two to three minutes), the effect on energetic expenditure would be insignificant.

Because there is very little overlap in the hearing sensitivity of otters and noise produced during rocket launches, otters would perceive very little noise during launch activities, and that behavioral disruptions would be short and infrequent, the DAF has determined that impacts on southern sea otter would be insignificant as a result of the Proposed Action, including the collective effects of increased launch activities at VSFB. Therefore, the DAF determined that the Proposed Action ***may affect, and is likely to adversely affect,*** the southern sea otter off VSFB's coast. The DAF completed

Section 7 consultation with the USFWS for potential impacts on southern sea otter and would implement all applicable minimization, monitoring, and avoidance measures in the resultant BO (Appendix B). Therefore, the Proposed Action would not result in significant impacts on ESA-listed southern sea otter.

3.6.2.1.7 Marine Reserves

The Proposed Action would not result in significant impacts on existing marine reserves, including CINMS, CHNMS, or the VSMR. As described above, marine biological resources that are sanctuary resources of CHNMS and CINMS include cetaceans, pinnipeds, seabirds, sea turtles, fish, invertebrates, and marine plants and algae, among others. The water column and seabed within CHNMS and CINMS are also sanctuary resources. No physical activities would occur in National Marine Sanctuaries, and any unrecovered marine debris would sink to the floor of the ocean, where it would remain and not drift into or affect a sanctuary resource.

Sonic booms created by the Falcon 9 would reach above 5.0 psf at CINMS on rare occasions. However, these acoustic effects would be infrequent, short in duration, and occur at altitudes that result in a limited acoustic impact at the ocean surface.

Additionally, based on the lack of direct overflight above CHNMS during typical launch trajectories, the Proposed Action would not result in significant impacts to the CHNMS.

At the VSMR, noise levels produced during launch activities at SLC-4 and SLC-6 would be similar to those previously analyzed in Section 3.4.2.1.7 of the 2024 EA. The CDFW and the DAF maintain a MOU for VSMR management. Mission activities, such as those associated with launch operations, are permitted under this agreement. Impacts to marine resources within the VSMR would be limited to temporary acoustic effects from sonic booms or landings and would not result in population-level impacts. Therefore, the Proposed Action would not result in significant impacts on marine reserves.

3.6.2.1.8 Marine Debris

Impacts on marine and coastal resources by marine debris (parachute, parafoils, weather balloons, radiosondes, and residual fuels) under the Proposed Action were analyzed for potential impacts in Sections 4.4 (Marine Biological Resources), 4.5 (Water Resources) and 4.7 (Coastal Zone Management) of the 2023 SEA (DAF 2023). The amount of debris would not increase for each launch and landing, but the frequency at which the launches and landings occur would increase, resulting in a proportional increase in marine debris under the Proposed Action. Additionally, Falcon Heavy launches would typically expend the first stage center core in the recovery area (Figure 2.1-3). These center cores would not perform a reentry burn and would therefore break up upon atmospheric reentry. Any surviving debris would sink to the floor of the ocean where it will remain, like the fate of traditional non-reusable first stage boosters. However, these boosters would not impact water quality and any residual fuel would evaporate such that there is none left when the vehicle debris hits the ocean. Therefore, marine debris would not have a significant impact on marine resources.

3.6.2.2 Alternative 1

Operations under Alternative 1 would be the same as the Proposed Action and would generate the same types and levels of impacts on marine biological resources as discussed in Section 3.6.2.1. The only difference between Alternative 1 and the Proposed Action is the construction of a new hangar, which would have no effect on marine biological resources. Therefore, Alternative 1 would not result in significant impacts on marine biological resources.

3.6.2.3 No Action Alternative

Under the No Action Alternative, modifications of SLC-6 and increased Falcon launch cadence on VSFB would not occur, resulting in no impacts on marine biological resources, beyond those described in the 2024 EA. The potential effects associated with reasonably foreseeable actions (Table 3.2-3) are considered in the effects analysis of the No

Action Alternative without consideration of the Proposed Action, because these actions would still occur. Under the No Action Alternative, the annual launch cadence at VSFB is anticipated to increase over time and local development projects are anticipated to continue. The potential for noise, sonic boom overpressure, habitat damage, artificial lighting, and general disturbance to wildlife would continue as evaluated in existing NEPA documents and regulatory consultations.

3.6.2.4 Cumulative Effects

General threats to marine mammals include water quality degradation (chemical pollution), commercial industries (fisheries bycatch, explosive pest deterrents, and other interactions), noise, hunting, vessel strike, marine debris, disease and parasites, power plant entrainment, and weather stressors. Potential impacts of actions that affect marine mammals include mortality, injury, disturbance, and reduced fitness, including reproductive, foraging, and predator avoidance success. The susceptibility of marine mammals to these outcomes often depends on proximity, severity, or vulnerability to the stressor and vulnerability can be increased as multiple stressors compound on an individual.

Increased launches and landings associated with the Proposed Action, Alternative 1, and other actions in Sections 3.2.1 through 3.2.3 would increase the frequency of impacts on marine species and habitats, including potential noise disturbance, physical strikes, entanglement in or ingestion of mission-related items or debris, and habitat alteration. Sonic booms would affect a small area of ocean surface. Most of the affected area would be exposed to pressure levels of 1.0 psf or less. Sonic booms would not substantially affect marine species beneath the surface. Although frequent launches and landings would increase the potential for an animal at the surface to be within the small area of highest noise levels, the probability would remain low overall. Animals experiencing a sonic boom could exhibit a startle response. Due to the dispersed distribution of marine species and the size of mission-related items and debris relative to the Study Area, physical strikes would likely be unusual and would not cause detectable impacts on populations. Similarly, entanglement in and ingestion of items such as parachutes, parafoils, and other debris is possible, but the number of animals affected would not likely be detectable at the population level. Increased launch operations would generate more debris that would sink to the ocean floor and impact benthic habitats. Because of the small number of unrecovered items relative to the area of available seafloor, impacts on benthic habitats would not affect marine populations. Therefore, the incremental contribution of the Proposed Action or Alternative 1, when added to the impacts of all other past, present, and reasonably foreseeable future actions, would not result in significant cumulative effects on marine mammals in the ROI or beyond.

3.6.2.5 Mitigation and Monitoring

The following EPMs would be implemented to avoid, minimize, or characterize the effects of the Proposed Action on marine biological resources. The DAF and qualified SpaceX personnel or contractor staff would ensure that all non-discretionary measures included in the NMFS LOA (Appendix C) issued for launch activities at VSFB would be implemented during operation of the Falcon launch program at VSFB. In addition, the DAF will ensure that the terms and conditions and reasonable and prudent measures pertaining to the southern sea otter identified during Section 7 consultation with the USFWS and in the resultant BO would be implemented (Appendix B).

- Sonic boom modeling (commercially available modeling software [PCBoom] or an acceptable substitute) would continue to be completed prior to each launch to verify and estimate the overpressure levels and footprint.
- Semi-monthly surveys (two surveys per month) would continue to be conducted to monitor the abundance, distribution, and status of pinnipeds at VSFB. Whenever possible, these surveys will be timed to coincide with the lowest afternoon tides of each month when the greatest numbers of animals are usually hauled out.
- Marine mammal monitoring and acoustic measurements will be conducted at the NCI if the sonic boom model indicates that pressures from a boom will reach or exceed 7 psf from 1 January through 28 February, 5 psf from 1 March through 31. July, or 7 psf from 1 August through 30 September. No monitoring is required on

NCI from 1 October through 31 December. The monitoring methods are described in the LOA included in Appendix B.

- The DAF will continue to submit report detailing results of the monitoring program, to the Office of Protected Resources, NMFS, and the West Coast Regional Administrator, NMFS, in compliance with the requirements of the current LOA.
- Discoveries of injured or dead marine mammals, irrespective of cause, would be reported to the Office of Protected Resources, NMFS, and the West Coast Regional Stranding Coordinator, NMFS. Specific protocol would be followed depending on the cause of the event, if cause is unknown, and whether injury or death was relatively recent.
- To reduce the risk of injury or mortality of ESA-listed species in the marine environment, the following EPMs will continue to be implemented during first stage and fairing recovery operations:
    - The DAF 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 from sea turtles and a minimum distance of 300 ft 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 DAF will immediately report any collision(s), injuries, or mortalities to ESA-listed species to the appropriate NMFS contact.
- To offset the impacts from unrecoverable debris in state waters, SpaceX would make a compensatory donation of $20.00 for every pound of unrecovered debris in state waters. The annual marine debris offset payment would be divided equally and provided to the U.C. Davis Lost Fishing Gear Recovery Project and the National Marine Sanctuary Foundation.
- Vessels will enter the harbor, to the extent possible, only when the tide is too high for pinnipeds to haul-out on the rocks. The vessel will reduce speed to 1.5 to 2 knots once the vessel is within 3 mi of the harbor. The vessel will enter the harbor stern first, approaching the wharf and mooring dolphins at less than 0.75 knots.
- Vessels using the harbor will follow a predetermined route that limits crossing kelp beds.
- No vessels will anchor within kelp beds or hard-bottom habitat outside of the dredge footprint, and no vessel anchors within the dredge footprint will be placed in kelp or hard bottom habitat.
- Activities that could result in the startling of wildlife in the vicinity of the harbor will be allowed so long as they are initiated before dusk and not interrupted by long periods of quiet (in excess of 30 minutes). If such activities cease temporarily during the night, they will not be reinitiated until dawn.
- Starting-up of activities (either initially or if activities have ceased for more than 30 minutes) will include a gradual increase in noise levels if pinnipeds are in the area.
- The restrictions on access to the intertidal area will be included in the personnel orientations provided at project startup and for new employees.
- The tug vessels and barge will be periodically cleaned as necessary to avoid impacts related to the transfer of non-native invasive pests and vegetation to VSFB Harbor.

3.7 Water Resources

3.7.1 Affected Environment

3.7.1.1 Regulatory Setting

The CWA establishes the structure for regulating discharges of pollutants in WOTUS. The CWA includes the NPDES program, which generally requires a permit for the discharge of pollutants to WOTUS from 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 USEPA 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. 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.

3.7.1.2 Region of Influence

VSFB encompasses portions of two major and four minor drainage basins. San Antonio Creek and the Santa Ynez River represent the major basins, while Shuman Creek, Bear Creek, Honda Creek, and Jalama Creek comprise the minor basins on VSFB. The ROI for water resources include Spring Canyon, which is subjected to vegetation management; San Antonio Creek, which may have water extracted from its basin, and the Pacific Ocean, where first stage landings occur and materials may be expended. Surface water in Spring Canyon is entirely on VSFB property, originating at the west end of the Santa Ynez Mountains, north of Honda Canyon. San Antonio Creek drains an area of approximately 154 mi^2 flowing westward and discharging into the Pacific Ocean. Groundwater from the San Antonio Creek basin supplies water for irrigation, domestic, industrial, and municipal purposes through pumping. The GAO identified VSFB as vulnerable to water-scarcity issues in 2019 (GAO 2019).

Potential impacts on the broad ocean area during first stage recovery activities in the Recovery Area (Figure 2.1-3) have been described and analyzed in the previous EAs and SEAs (DAF 2011, 2016a, 2016b, 2018, 2023). The increased cadence would not change the results of any prior analyses. Therefore, surface water resources in the broad ocean area of the Pacific Ocean are not considered further in this EIS.

3.7.1.3 Surface Water

Surface water resources near SLC-4 include Spring Canyon and the Pacific Ocean. There are various unnamed surface water drainages near SLC-6. A description of surface water resources, including Spring Canyon and San Antonio Creek watersheds and associated flow rates is contained in MSRS 2024d. Mean annual rainfall for the region, measured at Surf from 1927 through 2021, is 11.2 inches (28.4 centimeters; County of Santa Barbara Public Works 2022).

Spring Canyon lacks direct connection to the Pacific Ocean and lacks surface flow throughout almost the entire drainage, with flow occurring predominately during and immediately after rainfall (MSRS 2023).

Two surface water drainages occur at SLC-6 (Figure 3.7-1). The north drainage conveys flow from Red Roof Canyon through SLC-6 to Grey Canyon and then the Pacific Ocean. A system of concrete v-ditches, pipes, earthen channels, and rip-rap channels throughout the northern half of the SLC-6 facility also channel stormwater runoff from the facility into the north drainage. The south drainage conveys natural flow from an unnamed drainage west through SLC-6. East of SLC-6 flow through the unnamed drainage is highly ephemeral predominantly subsurface. Through the SLC-6 facility, the south drainage is channeled into a culvert and conveyed west into SLC-6 where it enters the porous riprap lined channel. Flow within the south drainage is intermittent and also collects surface water from a system of concrete v-ditches, pipes, earthen channels, and riprap channels throughout the southern half of the SLC-6 facility and empties into the Pacific Ocean.

3.7.1.4 Ground Water

VSFB includes parts of two groundwater basins and at least two sub-basins. The northern third of VSFB is within the San Antonio Creek Basin and the remaining areas are within the Santa Ynez River Basin and associated Lompoc Terrace and Cañada Honda sub-basins. SLC-4 is located in the Santa Ynez River groundwater basin/Lompoc Terrace sub-basin. Groundwater at SLC-4 was evaluated in Section 3.5.2 of the 2023 SEA (DAF 2023). There is no new construction proposed at SLC-4, therefore, groundwater at SLC-4 is not considered further in this EIS. SLC-6 is south of the Lompoc Terrace sub-basin and outside of a named groundwater basin. Depths to groundwater at SLC-6 were identified at seven to eight ft below grade during a UST removal 1998, 70 to 130 ft below ground surface in 1998, and 55 to 75 ft below ground surface in the vicinity of the boat dock in 2001 (AECOM Technical Services, Inc. 2023).

The current water source for VSFB is via an existing connection between State Water and the VSFB water supply system. VSFB primarily relies on State Water; however, during annual maintenance that lasts two to three weeks, VSFB utilizes four water wells in the San Antonio Creek Basin VSFB receives an allocated amount from the California State Water Project (SWP). To date, VSFB has not exceeded the amount of the allocation. VSFB utilizes groundwater from the San Antonio Creek Basin when the State allocated water is unavailable, which can be for 1) drought; 2) SWP or California Clean Water Act (CCWA) emergency shutdowns; or 3) the annual CCWA system maintenance each November. Annual VSFB water use from 2019 through 2021 has averaged 910,500,000 gallons (2,794 ac-ft) per year. The San Antonio Creek Basin is considered in this EIS due to the proposed water extraction requirements to support the increase in SLC-4 operations and addition of launch activities at SLC-6.

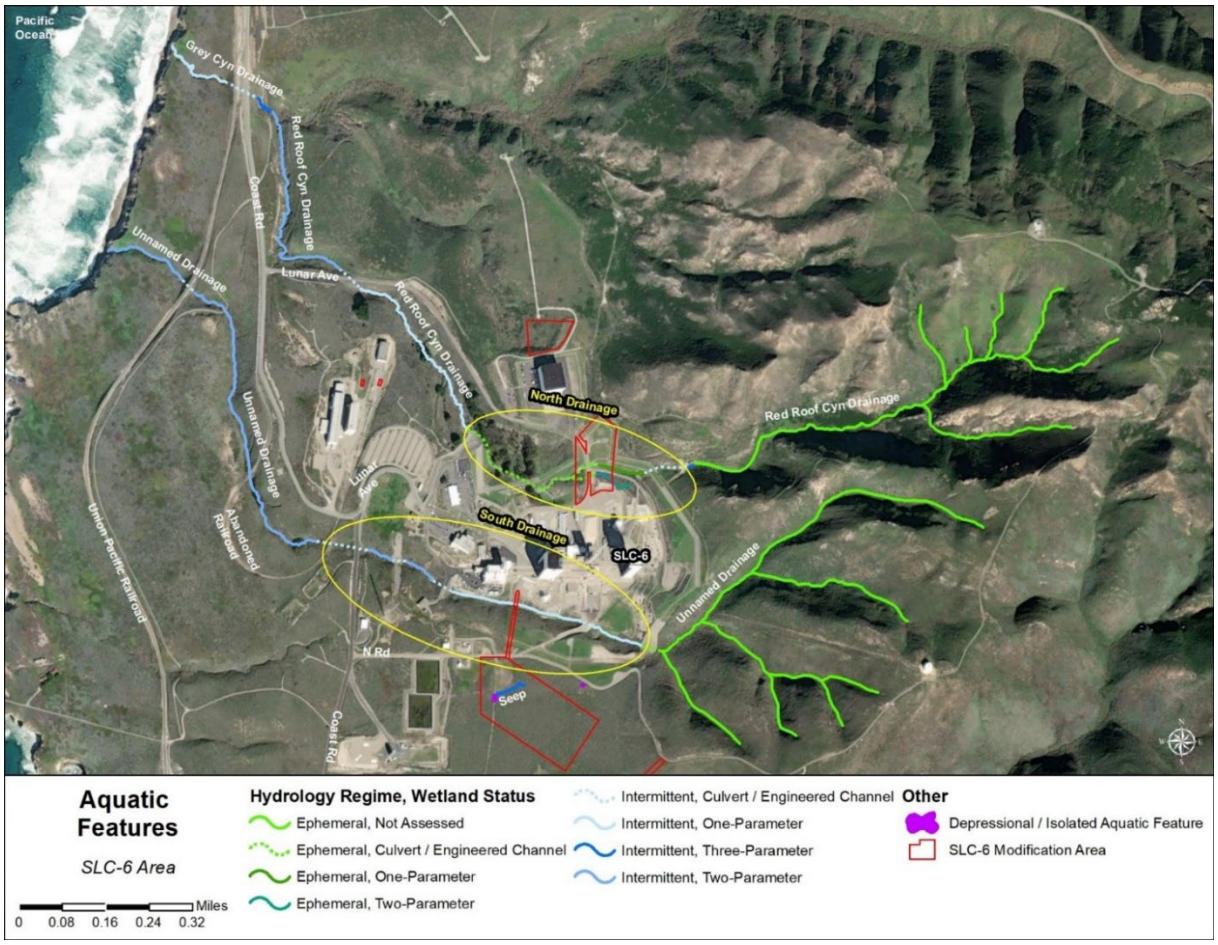

Figure 3.7-1. Surface Waters at SLC-6

3.7.1.5 Waters of the United States and Wetlands

Spring Canyon does not qualify as a WOTUS or jurisdictional wetlands. Spring Canyon originates approximately 1.4 mi inland and flows toward the Pacific Ocean. Spring Canyon has surface waters with flowing or standing water for only a short duration in direct response to significant precipitation (surface flow only occurs during and immediately after rain events and standing water may be present sporadically for hours to days after rainfall events). Surface flow percolates into the groundwater to pass beneath road embankments, but has no connectivity to the navigable waters of the Pacific Ocean; therefore, under the revised 2023 definition (88 FR 61964), it does not qualify as a WOTUS.

A jurisdictional wetland delineation of the north and south drainages at SLC-6 was conducted in 2024 and none of the aquatic features assessed qualify as WOTUS or jurisdictional wetlands (MSRS 2024d). The only connection to WOTUS for the North and South Drainages is the Pacific Ocean via the Red Roof/Grey Canyon Drainages and an unnamed drainage respectively. In order to be considered WOTUS, as tributaries to the Pacific Ocean, these drainages would have to have perennial hydrology to meet the relatively permanent requirement.

A seep occurs south of N Road which consists of a narrow, intermittent, slow-flowing, and shallow surface water that arises within undeveloped land and terminates in a small pool located on an active unpaved access trail (Figure 3.7-1). The pool basin appears to have been created via regular vehicle traffic down the trail during wet soil conditions. The seep is considered a wetland, as defined by EO 11990, *Protection of Wetlands*.

3.7.1.6 Floodplains

Construction areas at SLC-6 overlap the 100-year and 500-year floodplains at SLC-6 (Figure 3.7-2); therefore, the Proposed Action is subject to EO 11988 (*Floodplains Management*). EO 11988 requires federal agencies to reduce the risk of flood loss, minimize the impact of flood on human safety, and to restore and preserve the natural and beneficial values served by floodplains and evaluate alternatives prior to proceeding with federal actions that may affect floodplains.

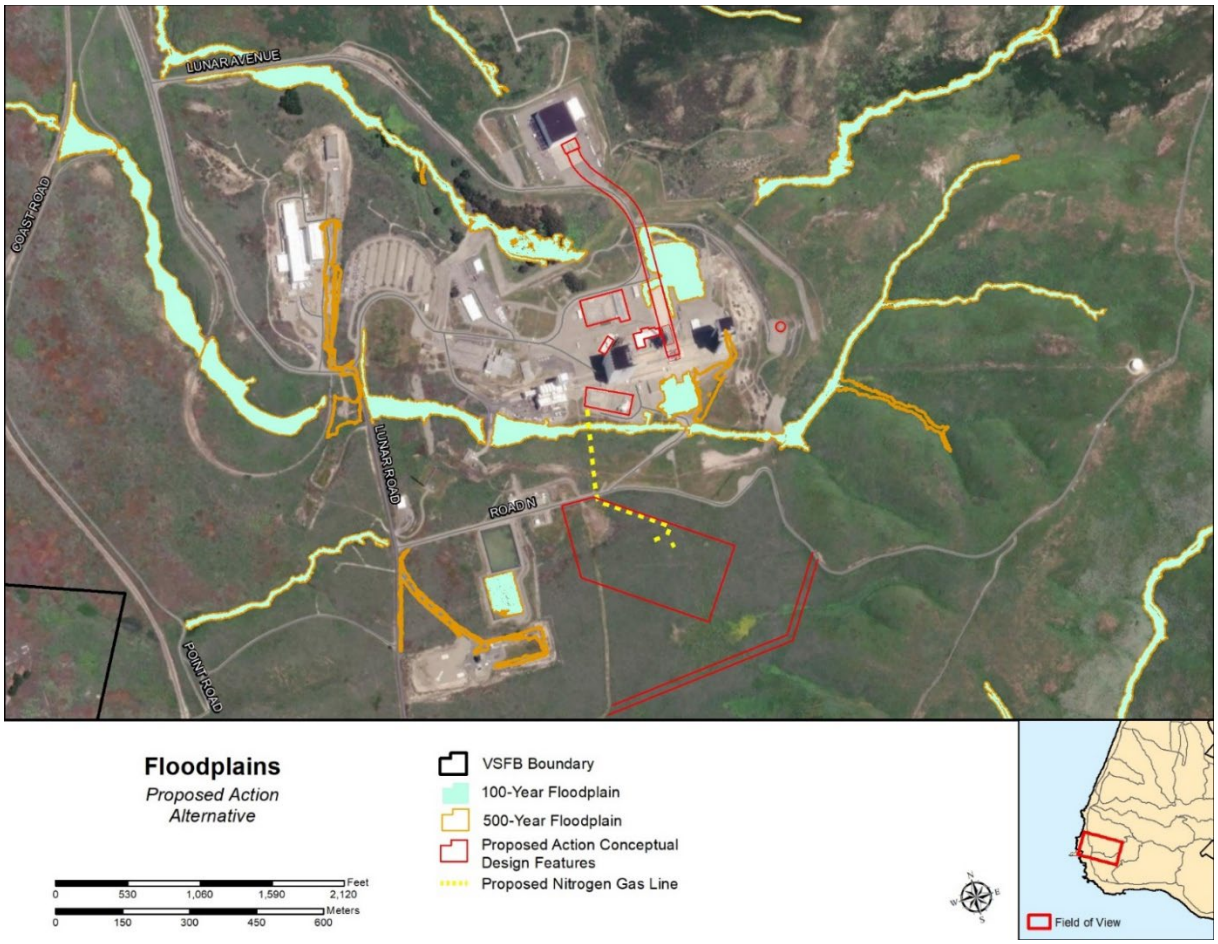

Figure 3.7-2. Floodplain Features in the Vicinity of SLC-6

3.7.2 Environmental Consequences

3.7.2.1 Proposed Action

Determination of water resource effects is based on an analysis of the potential for activities to affect water resources as defined by applicable laws and regulations. Considered in this analysis is activity-related introduction of regulated pollutants into surface water or groundwater resources, and potential effects on floodplains. Under the FAA's significance threshold, a significant impact on surface waters would occur if the action exceeded water quality standards established by Federal, state, local, and Tribal regulatory agencies; or contaminated the public drinking water supply such that public health may be adversely affected. A significant impact to groundwater would occur if the action would exceed groundwater quality standards established by Federal, state, local, and Tribal regulatory agencies; or contaminate an aquifer used for public water supply such that public health may be adversely affected. A significant impact on floodplains would occur if encroachment in the 100-year floodplain would result in a high likelihood of loss of human life, substantial costs or damages, or a notable adverse impact on floodplain natural and beneficial values.

3.7.2.1.1 Surface Water

C&D activities at SLC-6 could adversely affect surface waters in the area (Figure 3.7-1) if sediments in stormwater or non-stormwater runoff from disturbed soil areas exceeded water quality objectives in the NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Construction General Permit). EPMs described in Section 3.7.2.5 would ensure that adequate sediment and erosion control BMPs are implemented

to minimize or prevent any loss of surface soils. In compliance with Section 402 of the CWA, SpaceX will obtain coverage under the NPDES Construction General Permit.

SpaceX would ensure that there is no overland flow reaching the south drainage as a result of water ejected from the flame trench at SLC-6 during launches. Given that the south drainage is in the direct path of the flame trench, the plume would be expected to travel above the south drainage feature but is not anticipated to cause overland sheet-flow into the drainage. Additionally, monitoring of plume temperatures taken in the path of the flame trench at CCSFS has shown that the deluge water (the use of water for acoustic suppression) dramatically lowers the temperature of the plume, returning to ambient temperatures at approximately 530 ft away in the direct path of the flame trench. The flame trench at CCSFS is parallel to grade, whereas the flame trench at SLC-6 is sloped upward. Therefore, the plume at SLC-6 would be directed upward and have significantly more time to cool even further before reaching any features at ground level. Therefore, any vapor reaching the south drainage, approximately 350 ft from the flame trench, is expected to be at ambient temperature. Thus, no adverse impacts on the south drainage are expected as a result of launch at SLC-6.

Activities during launch operations would include using hazardous materials and generating wastewater that if not properly controlled and managed could result in an adverse impact on water resources. SpaceX would obtain coverage under the NPDES General Permit for Storm Water Discharges Associated with Industrial Activity (Industrial General Permit). SpaceX would also prepare and implement a Storm Water Pollution Prevention Plan (SWPPP), including BMPs, employee training, stormwater monitoring and reporting. BMPs would be implemented per the SWPPP and Section 3.7.2.5 to reduce or eliminate pollutants in stormwater and non-stormwater runoff, which reduces the potential for adverse effects on surface water quality.

Wastewater discharges would continue to follow the conditions of the RWQCB letter for Enrollment in the General Waiver of Waste Discharge Requirements for SLC-4E Process Water Discharges to eliminate potential adverse effects on water quality. SpaceX would enroll in RWQCB's General Waiver for Specific Types of Discharges for SLC-6 activities prior to discharging any water accumulated in the flame trench. Any water that remains after launches or stormwater that accumulates within the trench would be tested for regulated pollutants. If regulated pollutants are encountered, the contents would be pumped out and disposed of per the waiver/permit and state and federal regulations.

Potential impacts on Spring Canyon have been described and analyzed in the previous EAs and SEAs (DAF 2011, 2016a, 2016b, 2018, 2023); therefore, surface water resources in Spring Canyon are not considered further in this EIS.

At maximum cadence, the Proposed Action would use up to 65.6 ac-ft of water per year. This would represent an increase of approximately 2.3 percent of the total annual water usage on VSFB. The current water source for VSFB is via an existing connection between State Water and the VSFB water supply system. VSFB primarily relies on State Water; however, during annual maintenance that lasts two to three weeks, VSFB utilizes four water wells in the San Antonio Creek Basin. Even if pumping this entire volume of water from the San Antonio Creek groundwater basin, it would have an indetectable effect of water levels and flow rates in the creek over this short period of time (G. Cromwell, USGS, pers. comm.). VSFB receives an allocated amount from the California State Water Project (SWP). To date, VSFB has not exceeded the amount of the allocation. VSFB utilizes groundwater from the San Antonio Creek Basin when the State allocated water is unavailable, which can be for 1) drought; 2) SWP or California Clean Water Act (CCWA) emergency shutdowns; or 3) the annual CCWA system maintenance each November. Water usage under the Proposed Action would therefore not result in any measurable impacts on flow rates, hydration periods, or water levels in San Antonio Creek. Therefore, the Proposed Action would not have a significant impact on surface water resources.

3.7.2.1.2 Groundwater

Groundwater impacts at SLC-4 were evaluated in Section 3.5.2.1.2 of the 2024 EA (DAF 2024a). The proposed increased cadence at SLC-4 would not change the results of any prior analyses. Although there are currently no active groundwater wells at the site, groundwater depth at SLC-6 was reported to be 70 to 300 feet below ground surface (bgs)

in 1998 (URS Corporation 2000). C&D activities at SLC-6, associated utilities, and Landing Zones would not require substantial excavation activities or require the use of footings at a depth that would interact with groundwater. Exact depths are unknown at this time, but would be substantially less than 70 ft bgs. Any remaining deluge water after launches and stormwater that is collected in the flame trench would be managed per the RWQCB's General Waiver for Specific Types of Discharges enrollment conditions (or other state discharge permit).

Construction of new structures at SLC-6 would increase the extent of impervious areas thus potentially affecting groundwater recharge. Much of SLC-6 where structures would be removed and replaced has existing impervious areas. The Landing Zones would be new impervious structures (Figure 2.1-8). Although this may cause a reduction in groundwater recharge, the affected area would be relatively small and is not expected to have a significant impact on groundwater resources.

Any deluge water that remains after launches or stormwater that accumulates within the basin would be tested for regulated pollutants. If regulated pollutants are encountered, the contents would be pumped out and disposed of per 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. During operation at SLC-6, accidental discharge of regulated pollutants could occur; however, proper handling of hazardous materials and waste management (as described in Section 3.15) would reduce or eliminate potential regulated pollutants in runoff that could infiltrate groundwater. In addition, implementing EPMs to protect water resources (Section 3.7.2.5) would further help protect groundwater resources. Therefore, the Proposed Action would not have significant impacts on groundwater at SLC-6.

At maximum cadence, the Proposed Action would use up to 65.6 ac-ft of water per year. This would represent an increase of approximately 2.3 percent of the total annual water usage on VSFB. The current water source for VSFB is via an existing connection between State Water and the VSFB water supply system. VSFB primarily relies on State Water; however, during annual maintenance that lasts two to three weeks, VSFB utilizes four water wells in the San Antonio Creek Basin. Even if pumping this entire volume of water from the San Antonio Creek groundwater basin, it would have an indetectable effect of water levels and flow rates in the creek over this short period of time (G. Cromwell, USGS, pers. comm.). VSFB receives an allocated amount from the California State Water Project (SWP). To date, VSFB has not exceeded the amount of the allocation. VSFB utilizes groundwater from the San Antonio Creek Basin when the State allocated water is unavailable, which can be for 1) drought; 2) SWP or California Clean Water Act (CCWA) emergency shutdowns; or 3) the annual CCWA system maintenance each November. Since VSFB relies primarily on State Water and the amount of annual usage proposed under the Proposed Action is negligible there would be no measurable impacts on groundwater water levels in San Antonio Creek or exacerbate water scarcity at VSFB or the surrounding area.

Therefore, water usage under the Proposed Action would be negligible and not contribute in any measurable way to the collective effects of water extraction requirements for all VSFB operations. Thus, impacts on groundwater in the San Antonio Creek Basin under the Proposed Action would not be significant.

3.7.2.1.3 Waters of the United States and Wetlands

None of the aquatic features assessed qualify as WOTUS or jurisdictional wetlands; therefore, there would be no impacts on WOTUS as a result of implementation of the Proposed Action. The seep south of N Road is considered a wetland, as defined by EO 11990, *Protection of Wetlands*. The DAF published an NOI to in the FR on 13 December 2024 which served as early public review and requested public comment on the Proposed Action and any practicable alternatives. The DAF evaluated seven alternative landing zones (see Section 2.4.3) in addition to the No Action Alternative, but they were eliminated from further detailed analysis in the EIS because they did not meet the stated purpose and need for the action, were not practicable, or would have led to greater overall environmental impacts. The only practicable alternative is the Proposed Action. For the reasons stated in Section 2.4.3, the dismissed alternatives are not practicable alternatives to avoid potential wetland impacts.

3.7.2.1.4 Floodplains

The potential impacts of the Proposed Action on the 100-year floodplain at Spring Canyon was analyzed in Section 4.5.1 of the 2023 SEA (DAF 2023) was incorporated by reference in the 2024 EA (DAF 2024a); therefore, floodplains in Spring Canyon are not considered further in this EIS. Construction activities at SLC-6 could affect 100-year floodplains in the area (Figure 3.7-2). Development in a floodplain can obstruct or divert floodwater to other areas, alter flood dynamics, flood adjacent areas, and increase flood duration. Measures to minimize floodplain impacts include siting facilities to minimize development within the floodplain, creating compensatory storage (excavating material within or adjacent to the same floodplain to be used as fill), or designing the facilities and related infrastructure to allow for dispersal of floodwaters. Any facilities constructed in the floodplain would be elevated or otherwise floodproofed per DAF floodplain construction requirements. There would be no floodplain or flooding impacts on or off VSFB areas. There are very few upstream/upland facilities.

Alternatives to the construction activities proposed under the Proposed Action were considered, as described in Section 2.4, and it was determined that there is no practicable alternative to implementing the Proposed Action adjacent to SLC-6. Therefore, the Proposed Action is consistent with EO 11988 because the implementation of BMPs and EPMs during construction and operational activities at SLC-6 would ensure that adverse effects on the floodplains are minimized. Therefore, the Proposed Action would not result in significant impacts on floodplains.

3.7.2.2 Alternative 1

Operations under Alternative 1 would be the same as the Proposed Action and would generate the same types and levels of impacts on water resources as discussed in Section 3.7.2.1. The only difference between Alternative 1 and the Proposed Action is the construction of a new hangar, which would have minimal differences in terms of impacts on water resources as a result of different construction footprints. Therefore, Alternative 1 would not result in significant impacts on water resources.

3.7.2.3 No Action Alternative

Under the No Action Alternative, modifications of SLC-6 and increased Falcon launch cadence on VSFB would not occur, resulting in no impacts on water resources beyond those described in the 2024 EA. The effects analysis of the No Action Alternative includes the potential effects of the reasonably foreseeable actions identified in Table 3.2-3 without consideration of the Proposed Action, because these actions would still occur under the No Action Alternative. Discharges would continue to occur in accordance with current permits.

Reasonably foreseeable effects to water resources could occur if the reasonably foreseeable actions were to inadequately address water resources within the study area. Reasonably foreseeable increased impervious surfaces at VSFB and the surrounding areas could increase stormwater runoff, but significant effects would not be expected because projects that involve ground disturbance would have requirements for managing stormwater runoff. These requirements include implementation of a SWPPP and related BMPs (such as silt fences, covering soil stockpiles, using secondary containment for hazardous materials, etc.) Development in floodplains is subject to approval by the local floodplain administrator, thus potential impacts are entirely dependent on the extent of development, adequacy of stormwater management controls, and the stormwater generating events themselves. It is assumed that proper planning and design would ensure any new infrastructure would be designed for the appropriate level of flood risk. Compliance with applicable state and Federal regulations and implementation of proper management of materials and wastes would also serve to minimize effects to water resources.

3.7.2.4 Cumulative Effects

Cumulative effects on water resources could occur if past, present, and reasonably foreseeable future actions were to inadequately address water resources in the ROI. Cumulative effects on water resources would not be expected because projects that contained ground disturbance would have construction requirements for managing stormwater

runoff, such as implementation of a SWPPP and related BMPs (e.g., installing silt fences, covering soil stockpiles, using secondary containment for hazardous materials, and revegetating the site in a timely manner). Cumulative increased impervious surfaces at VSFB could increase stormwater runoff; however, post-construction BMPs (e.g., swales and retention ponds) would be employed to control stormwater runoff.

Compliance with all state and Federal regulations and implementation of proper management of materials and wastes would minimize impacts on water resources. Therefore, implementation of the Proposed Action or Alternative 1 in conjunction with other past, present, or reasonably foreseeable projects would not result in significant cumulative effects on water resources.

3.7.2.5 Mitigation and Monitoring

Implementing the EPMs outlined below would avoid or minimize potential adverse effects to water resources during the Proposed Action. Qualified SpaceX personnel or contractor staff would oversee fulfilling EPMs.

- BMPs will be implemented to minimize sediment, chemicals, debris or other pollutants from entering the stormwater system, natural surface water drainages or groundwater per the latest California Stormwater Quality Association's Stormwater Best Management Practices Handbooks.
- Upon construction completion, disturbed soil areas will be stabilized with effective erosion control per the NPDES Construction General Permit.
- All temporary sediment and erosion control devices including silt fence and wattles with plastic netting shall be removed when disturbed soil areas are stabilized.
- Storm drain inlet protection will be used as needed to minimize pollutant discharge into storm drains.
- Fueling equipment or systems will only occur in pre-designated areas designed to capture runoff or spilled fuel or with portable spill containment devices.
- Hazardous and industrial materials that can be mobilized by contact with stormwater will be stored under cover prior to rain events.
- Trash disposal containers will be covered at all times. Trash that escapes from containers will be collected.
- Concrete materials, curing compounds, waste and washout water will be properly managed to prevent pollution. Washout water will be contained for evaporation.
- SpaceX will employ personnel trained to follow current California stormwater pollution prevention industrial activity BMPs.
- SpaceX would prepare and implement an SWPPP including BMPs, employee training, stormwater monitoring and reporting.
- SpaceX will continue to ensure that water ejected from the flame trench during launches does not result in any overland surface flow reaching Spring Canyon by maintaining current v-ditches within the SLC-4 fence-line and routinely assessing whether any additional diversion structures are necessary.
- Launch related wastewater and stormwater that accumulates within the flame trenches would be tested for contamination and disposed of per Regional Water Quality Control Board waste discharge waiver or permit and federal regulations.

3.8 Cultural Resources

3.8.1 Affected Environment

3.8.1.1 Regulatory Setting

Cultural resources consist of prehistoric and historic sites, structures, artifacts, and any other physical or traditional evidence of human activity considered relevant to a particular culture or community for scientific, traditional, religious, or other reasons. Cultural resources include archaeological resources, historic architectural resources, and American

Indian sacred sites and traditional cultural properties. Cultural resources also include aspects of the physical environment, namely natural features and biota that are a part of traditional ways of life and practices and are associated with community values and institutions.

The NHPA establishes national policy for protecting significant cultural resources that are considered "historic properties." Historic properties are defined as "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in the National Register of Historic Places" (NRHP) (36 CFR Part 800.16). The NHPA is the Nation's primary historic preservation law, which defines the legal responsibilities of Federal agencies for the identification, management, and stewardship of historic properties. Section 106 of the NHPA requires Federal agencies to consider the effects of their undertakings on historic properties. Through consultation with interested parties, the Federal agency identifies historic properties potentially affected by the undertaking, assesses effects, and seeks ways to avoid, minimize, or mitigate any adverse effects on historic properties. The Area of Potential Effects (APE) for cultural resources is the geographic area or areas within which an undertaking (project, activity, program, or practice) may cause changes in the character or use of any historic properties present. The APE is influenced by the scale and nature of the undertaking and may be different for various kinds of effects caused by the undertaking.

As defined under the NHPA at 36 CFR Part 800.16(l)(1), "Historic Property means any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the NRHP maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian Tribe or Native Hawaiian organization and that meet the National Register criteria." A traditional cultural property, as defined by National Register Bulletin 38, "is eligible for listing in the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community" (Parker & King 1990).

The Proposed Action is subject to NHPA Section 106 compliance and DAFMAN 32-7003, *Cultural Resources Management*. Section 106 compliance also satisfies federal agencies' NEPA responsibilities to consider potential project-related effects on historic properties. The NHPA, Section 106, requires federal agencies to consider the effects of proposed federal undertakings on historic properties that are listed in or eligible for listing in the NRHP. If a cultural resource is listed in, or eligible for, the NRHP it is considered a "historic property" for purposes of Section 106. Compliance with Section 106 requires the federal agency to determine either that the undertaking would have no effect, no adverse effect, or an adverse effect on historic properties. The Section 106 implementing regulations (36 CFR Part 800) prescribe the process for making these determinations.

3.8.1.2 Region of Influence

The ROI for cultural resources is the specific APE for the Proposed Action. The cultural resources within the project area are discussed below. The APE of an undertaking is defined as "the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist" (36 CFR Part 800-16(d)). The APE considers any physical, visual, or auditory effects that the Proposed Action may have on cultural resources. The APE for the current project is limited to areas of ground disturbance and auditory effects and was predicated on vibratory impacts. The APE includes the Archeological Study Area (ASA) and a Cultural Resources Study Area (CRSA), described below.

In consultation with the SLD 30 Installation Management Flight, Environmental Conservation (30 CES/CEIEA) and based on the description of the Proposed Action, boundaries of known cultural resources and findings of previously conducted studies, the ASA was investigated for the SLC-6 Landing Zone Area, the Firebreak Area, and the Cypress Ridge and North Fire Access Roads, encompassing the predicted development footprint for the ground disturbing or landscape altering activities including potential grading, launch pad construction and related infrastructure, improvement and maintenance of access roads and firebreaks. A cultural resource inventory, pedestrian survey and subsurface

testing were conducted (Appendix A; Langan 2024). No cultural material was identified within the ASA as a result of any of the investigative approaches (Appendix A).

The CRSA was determined relative to the auditory effects predicated on vibratory impacts based on the Proposed Action and its potential for direct and indirect effects on cultural resources resulting from any related C&D, static fire, launches, and boost-back landings. These auditory effects include noise exceeding 120 dB and sonic booms exceeding 2.0 psf based on previous studies that have determined at which levels structures and archaeological resources could potentially be affected by rocket noise and sonic booms. Sound pressure levels below 120 dB (linear) are considered to have no material effects on structures (Benson 2013; Fenton and Methold 2016; Gibbs 2017; NOAA 2024). These effects are discussed in Section 3.8.2.1.

The APE's physical boundaries, a summary of historical and environmental context, and the historical, architectural, archeological, and cultural resources identified within the APE are described in Appendix A.

3.8.1.3 Existing Conditions

Appendix A provides a detailed description of known historic properties within the affected areas that are potentially eligible for listing on the NRHP and evaluates whether elements of the Proposed Action would potentially affect these resources. The 120 dB launch noise contour would extend only slightly outside and east of the VSFB in an uninhabited area with no reported resources. All but one historic building located on VSFB are associated with launch complexes and supporting infrastructure and are built to withstand concussive forces. The only historic building located on VSFB that is not associated with launch complexes or supporting infrastructure is the former USCG Lifeboat Rescue Station (P-42-040495). The Colonial Revival architectural style, wood-frame structure was built in 1936 as administrative barracks and ancillary structures. The buildings have been subjected to many years of medium and heavy launches and boost-back landings at SLC-4 as well as launches conducted at nearby SLC-6 with no reported and observed effect. Archaeological resources on VSFB, including the Honda Ridge Rock Art Site, have shown no visible effects from rocket engine noise or sonic booms.

The potential 2.0 psf and greater sonic boom impact area encompasses all of Santa Cruz, Santa Rosa, and San Miguel Islands. A reasonable and good-faith effort to identify historic properties within the APE pursuant to 36 CFR 800.4(a)-(d) and 36 CFR 800.5(a)-(d) has been conducted by the DAF. A desktop analysis of archaeological sites and historic-age buildings was performed for the launch noise/sonic boom Study Area. Fieldwork, including intensive pedestrian surveys and subsurface testing, was conducted within the ASA associated with proposed ground-disturbing or landscape-altering activities; and SYBCI Tribal monitors were present for the fieldwork. Identification of all NRHP eligible cultural resources in the CRSA was conducted, and historic properties were assessed for their potential to be affected by the Proposed Action.

There are currently no traditional cultural properties that have been identified within the APE. Archaeological and built environment listed on or eligible for the National Register of Historic Places outside of VSFB are listed in Appendix A.

3.8.2 Environmental Consequences

3.8.2.1 Proposed Action

As noted above, the only historic building located on VSFB that is not associated with launch complexes or supporting infrastructure is the former USCG Lifeboat Rescue Station (P-42-040495). The centerpiece of the Colonial Revival style complex is the wood-frame three-story Administrative Barracks built in 1936. The building, which sports a substantial number of single-pane glass windows, has been subjected to many years of launches and boost-back landings at SLC-4 as well as launches conducted at nearby SLC-6 with no reported or observed effect. Accordingly, there would be no effect to any NRHP eligible resources in the built environment at VSFB from launch noise exceeding 120 dB.

Built environment and archaeological resources located within the CRSA could be subject to sonic booms of up to 4.0 and 5.0 psf. Specifically, the 2.0 psf and greater sonic boom impact area encompasses all of Santa Cruz, Santa Rosa, and San Miguel Islands and may reach an overpressure of as much as 5.0 psf over a very narrow portion of land on the NCI; however, a large portion of the NCI would be exposed to an overpressure no more than of 2.0 to 3.0 psf. Sonic booms are dependent on launch trajectory, inclination, and atmospheric conditions. The Proposed Action is not expected to result in a repeated alignment of the sonic boom overpressure footprint within specific areas of the CRSA and the duration of the overpressure effects are estimated to last less than one second per sonic boom. Previous studies, experimental analysis and observations of archaeological sites located on VSFB have provided good evidence that archaeological sites consisting of only surface artifacts and/or buried archaeological material do not have the potential to be affected by rocket engine noise exceeding 120 dB and sonic booms exceeding 2.0 psf. Mathias et al. (2017) reported that rare minor damage may occur with overpressures between 2.0 and 5.0 psf and that testing has shown structures in good condition undamaged by overpressures up to 11.0 psf. Furthermore, both archaeological and built environment resources within the CRSA have been subjected to many years of launches and boost-back landings at SLC-4 as well as launches conducted at SLC-6 with no reported and observed effect.

NOAA publishes overpressure levels of concern that indicate the typical pressure for glass failure is 21.6 psf, although glass failure could occur at 5.76 psf (NOAA 2024). In 1965, NASA conducted a study of potential structural effects from sonic booms near the White Sands Missile Range and found that there was no structural damage until 8.0 psf (after more than 1,500 tests), but that damage could occur to glass, plaster, tile, and stucco that was already in a vulnerable condition (Benson 2013). Additionally, a NASA commissioned study reported that only rare and minor damage may occur with overpressures between 2.0 and 5.0 psf and that experimental testing of sonic boom effects has shown structures in good condition remain undamaged by overpressures up to 11.0 psf (Gibbs 2017).

Experimental analysis conducted by cultural resources staff at VSFB involving placement and observation of a 12-inch-tall, 45-degree slope sand cone and a 12x12x12-inch midden chunk on a concrete pad located 3,180 ft to the southwest of the SLC-4W pad was conducted to determine if noise vibration resulting from two SpaceX launches/boost-back landings would result in any visual change to the materials. No visual impacts were observed in either the midden chunk or sand cone after the launch/boost-back except a few fine grains of sand shifting down the cone, likely resulting from the samples drying in the wind. Importantly, there was no cracking or crumbling observed on the midden chunk or sand cones from launch vibrations/sonic boom overpressures (Smallwood 2023). As a result, the VSFB cultural resources staff have established that archaeological sites consisting of only surface artifacts and/or buried archaeological material do not have the potential to be affected by rocket engine noise. Additionally, a condition assessment program has occurred continuously on VSFB, assessing impacts on NRHP eligible archaeological resources located above ground as well as an exposed midden deposit. The program has found no evidence of effects on the rock art surfaces or the midden deposit from heavy- and medium-payload rocket launches and boost-back landings at SLC-4 as well as launches conducted at nearby SLC-6. Furthermore, both archaeological and built environment resources within the CRSA have been subjected to many years of rocket noise exceeding 120 dB and sonic booms exceeding 2.0 psf with no reported and observed effect.

Based on thresholds and results of previous experiments and observational assessments (Fenton and Methold 2016; Gibbs 2017; Haber & Nakaki 1989; Mathias et al. 2017; Nocerino et al. 2021; and Smallwood 2023), no NRHP eligible resources with the potential to be adversely effected were identified within the APE, and no eligible or NRHP-listed archaeological resources with the potential to be adversely effected were identified within the ASA as a result of intensive pedestrian surveys and subsurface testing. Therefore, the Proposed Action would have no effect on any known historic properties. The DAF engaged with the SHPO and SYBCI over potentially affected historic properties. The SHPO concurred with the DAF's finding of no historic properties affected on for demolition activities on 16 October 2024 and for construction and operation activities on 6 February 2025 (see Appendix A). The SYBCI responded on 21 January 2025, that the Tribe has concerns the Proposed Action would affect a perceived traditional cultural landscape and

therefore requested a site visit. The ITLO responded on 21 January 2025, requesting the Tribe schedule a site visit. As of certification of the Final EIS, the Tribe had not scheduled a site visit or identified any perceived potential effects. Accordingly, the DAF has completed this consultation, and the Proposed Action would have no significant impact on cultural resources.

3.8.2.2 Alternative 1

Operations under Alternative 1 would be the same as the Proposed Action and would generate the same types and levels of impacts on cultural resources as discussed in Section 3.8.2.1. The only difference between Alternative 1 and the Proposed Action is the construction of a new hangar, which would result in no differences in terms of impacts on cultural resources as a result of different construction footprints. Therefore, Alternative 1 would not result in significant impacts on cultural resources.

3.8.2.3 No Action Alternative

Under the No Action Alternative, modifications of SLC-6 and increased Falcon launch cadence on VSFB would not occur, resulting in no impacts on cultural resources beyond those described in Section 3.6 of the 2024 EA. Under the No Action Alternative, the reasonably foreseeable actions identified in Table 3.2-3 would still occur; therefore, the effects analysis of the No Action Alternative includes the potential effects of these projects without consideration of the Proposed Action. Reasonably foreseeable actions with a federal nexus would require consultation under Section 106 of the NHPA. Those consultations would address any effects on cultural resources resulting from each respective project.

3.8.2.4 Cumulative Effects

General threats to cultural resources in the ROI include construction, infrastructure development, and maintenance projects. Cumulative impacts would result if project activities caused major ground disturbances in areas of high paleontological sensitivity, or that may contain intact subsurface prehistoric or historic archaeological resources, or incremental changes that collectively and over time impact the NRHP eligibility or listing status of a historic property. All projects on VSFB are evaluated for potential cultural resources impacts. Evaluation for NRHP eligibility, Section 106 consultation, and Native American consultation are conducted. These processes stipulate avoidance and minimization measures to protect sensitive archaeological resources. Therefore, the incremental contribution of the Proposed Action or Alternative 1 when added to the impacts of all other past, present, and reasonably foreseeable future actions, would not result in significant cumulative effects on cultural resources.

3.8.2.5 Mitigation and Monitoring

Implementing the EPMs outlined below would avoid or minimize potential adverse effects to cultural resources during the Proposed Action. Qualified SpaceX personnel or contractor staff would oversee fulfilling EPMs.

- If previously undocumented cultural resources are discovered during maintenance or construction and demolition activities, work would stop, and the procedures established in 36 CFR Part 800.13 and the VSFB Integrated Cultural Resources Management Plan shall be followed.

3.9 Coastal Resources

3.9.1 Affected Environment

3.9.1.1 Regulatory Setting

The CZMA (16 USC Section 1451, et seq.) is the primary federal law for managing coastal resources. Federal agency activities that have reasonably foreseeable effects on any coastal use or resource in the coastal zone, regardless of the project's location, are required to be consistent, to the maximum extent practicable, with the enforceable policies of federally approved state coastal management programs (16 USC Section 1456; 15 CFR Part 930). Because launch

activities from VSFB are Federal agency activities, as that term is defined by the CZMA regulations at 15 CFR 930.31(a), the DAF follows the procedures in 15 CFR Part 930, Subpart C.

The NMSA (16 USC Section 1431 et seq.) designates special marine areas for long-term protection, conservation, and management. Compliance with the NMSA is discussed in Section 3.6.

3.9.1.2 Region of Influence

The ROI for coastal zone management extends to those coastal resources off VSFB property that may be affected by the Proposed Action, including natural resources, land uses, water uses, public access, and recreation within the California Coastal Zone (CCZ).The CCZ generally extends 1,000 yards inland and up to three nm seaward, but may extend up to five mi inland for significant coastal estuarine, habitat, and recreational areas and less than 1,000 yards inland in urban areas. 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, its officers or agents." SLC-4 and SLC-6 are located on VSFB, property which is owned by the U.S. and operated by the DAF as the federal agency with full administrative authority and operational management over the federal property, so they are excluded from the coastal zone. However, the DAF recognizes that actions outside the coastal zone may affect land or water uses or natural resources in the coastal zone off VSFB and therefore may be subject to the provisions of the CZMA.

3.9.2 Environmental Consequences

3.9.2.1 Proposed Action

Downrange landings would occur outside of state waters, and would not occur within intertidal areas, salt marshes, estuaries, or coral reefs. The Proposed Action does not include any coastal construction nor seafloor disturbing activities. However, some effects from launch and landing (e.g., noise, public access restrictions) would occur within the CCZ. In addition, increased impervious surfaces could increase stormwater runoff; however, post-construction BMPs and stormwater management would minimize any potential effect. A detailed analysis of the Proposed Action's potential effects on the CCZ is discussed in a CD that addresses the potential impacts of the Proposed Action (see Appendix D). The DAF submitted the CD to the CCC, requesting its concurrence, on 13 June 2025. The CCC voted to object to the DAF's CD on 14 August 2025 and issued a letter of objection to the CD on 26 August 2025 (Appendix D). Under the CZMA and its implementing regulations, the DAF may proceed with the Proposed Action over a CCC objection if it finds the Proposed Action is fully consistent with the enforceable policies of California's approved Coastal Management Program. See 15 CFR Section 930.43(d)(1)-(2). Based on the DAF's review of the CZMA and the CCMP, the DAF has determined that the Proposed Action is fully consistent with the enforceable policies of the CCMP, pursuant to the requirements of the CZMA.

3.9.2.2 Alternative 1

Operations under Alternative 1 would be the same as the Proposed Action and would generate the same types and levels of impacts on coastal resources as discussed in Section 3.9.2.1. The only difference between Alternative 1 and the Proposed Action is the construction of a new hangar, which would result in minimal differences in terms of impacts on vegetation alliances as a result of different construction footprints. Therefore, Alternative 1 would not result in significant impacts on coastal resources.

3.9.2.3 No Action Alternative

Under the No Action Alternative, modifications of SLC-6 and increased Falcon launch cadence on VSFB would not occur, resulting in no impacts on coastal resources beyond those described in the 2024 EA. The No Action Alternative effects analysis includes the potential effects associated with reasonably foreseeable actions listed in Table 3.2-3 without consideration of the Proposed Action, because these actions would still occur. Reasonably foreseeable actions with a

federal nexus affecting the coastal zone would undergo federal consistency review with the CCC. These consultations would serve to avoid or minimize potential effects to coastal resources.

3.9.2.4 Cumulative Effects

The Proposed Action and Alternative 1 would not adversely affect land use or cause significant impacts on coastal uses or resources in the coastal zone, as defined in the CZMA. Past, present, and reasonably foreseeable actions that may have had the potential to affect or may affect coastal uses or resources have been and would be analyzed ensuring such actions were or would be consistent with the enforceable policies of the approved CCMP. Actions would also conform to DAF and DOD planning principes, including BMPs and INRMPs, to ensure no significant impacts on coastal resources. Actions have been and would continue to be assessed pursuant to NEPA and other applicable federal environmental statutes, and any potential effects or impacts would be analyzed and disclosed while simultaneously engaging in coordination and cooperation with the CCC, when required pursuant to the CZMA. Therefore, implementing the Proposed Action or Alternative 1 with other past, present, or reasonably foreseeable projects would not result in significant cumulative effects on the coastal resources, with these requirements and planning processes in place.

3.9.2.5 Mitigation and Monitoring

Implementing the EPMs outlined below would avoid or minimize potential adverse effects to coastal resources during the Proposed Action. Qualified SpaceX personnel or contractor staff would oversee fulfilling EPMs.

- Post-construction BMPs and stormwater management would minimize any potential effect to impervious surfaces and stormwater runoff.

3.10 Department of Transportation Section 4(f)

3.10.1 Affected Environment

3.10.1.1 Regulatory Setting

Section 4(f) of the Department of Transportation (DOT) Act of 1966, now codified at 49 USC Section 303, protects significant publicly owned parks, recreational areas, wildlife and waterfowl refuges, and public and private historic sites listed or eligible for listing on the NRHP. Section 4(f) provides that the Secretary of Transportation may approve a transportation program or project requiring the use of publicly owned land of a public park, recreation area, or wildlife and waterfowl refuge of national, State, or local significance, or land of an historic site of national, State, or local significance, only if there is no feasible and prudent alternative to the use of such land and the program or project includes all possible planning to minimize harm resulting from the use. Procedures requirements for complying with Section 4(f) are set forth in Appendix B-2 of FAA Order 1050.1F.

3.10.1.2 Region of Influence

The ROI for Section 4(f) is defined by launch and landing rocket engine noise of 100 dBA L_{Amax} or greater, sonic booms of 1.0 psf or greater, and potential debris impact corridors associated with launch trajectories. Potential Section 4(f) resources within the ROI would not receive rocket engine noise exceeding 100 dBA L_{Amax} (Figure 3.10-1). However, Point Sal State Park, Wall Beach, Channel Islands, County of Santa Barbara Ocean Beach Park, Surf Beach, La Purisima Mission State Park, Miguelito Park, Jalama Beach County Park, Gaviota State Beach, Refugio State Beach, and El Capitan State Beach may occasionally receive sonic booms of 1.0 psf or greater (Figure 3.10-2 through Figure 3.10-4).

The FAA identified three Section 4(f) resources that might be subject to evacuation for public safety during launch operations: Jalama Beach County Park, Surf Beach, and County of Santa Barbara Ocean Beach Park. These parks offer various recreational options, including picnicking, surfing, whale watching, bird watching, nature photography, and fishing with peak attendance in summer and on holidays. Jalama Beach County Park also offers camping.

3.10.2 Environmental Consequences

Impacts on Section 4(f) resources would be significant if the FAA's Proposed Action involves more than a *de minimis* physical *use* of a Section 4(f) resource or constitutes a *constructive use* based on an FAA determination that the Proposed Action would substantially impair the Section 4(f) resource. The concept of *constructive use* is that a project that does not physically use land in a park, for example, may still, by means of noise, air pollution, water pollution, or other impacts, dissipate its aesthetic value, harm its wildlife, restrict its access, and take it in every practical sense. *Constructive use* occurs when the impacts of a project on a Section 4(f) resource are so severe that the activities, features, or attributes that qualify the property for protection under Section 4(f) are substantially impaired. Substantial impairment occurs only when the protected activities, features, or attributes of the Section 4(f) resource that contribute to its significance or enjoyment are substantially diminished. This means that the value of the Section 4(f) resource, in terms of its prior significance and enjoyment, is substantially reduced or lost. For example, noise would need to be at levels high enough to have negative consequences of a substantial nature that amount to a taking of a park or portion of a park for transportation purposes.

3.10.2.1 Proposed Action

The Proposed Action does not include any construction activities within, or actual physical taking of, a Section 4(f) resource through the purchase of land or a permanent easement, physical occupation of a portion or all of Section 4(f) resource, or alteration of structures or facilities on Section 4(f) resource. Because there would be no physical use of any 4(f) properties and therefore only constructive use is being determined. Impacts on Jalama Beach County Park would result from occasional temporary evacuation of the public during launch/landing events. Surf Beach and County of Santa Barbara Ocean Beach Park would only be closed during SLC-4 and SLC-6 landing events up to 12 times per year (Falcon Heavy landings at SLC-6 are not anticipated to result in closures of Surf Beach and County of Santa Barbara Ocean Beach Park).

SLD 30 Range Safety would individually review launch trajectories for each mission to determine what areas would be affected since the hazard risk analysis is unique to each vehicle, history of reliability, and mission trajectory. If necessary for the safety of park visitors, the County Parks Department and the County Sheriff would evacuate Jalama Beach County Park upon request from SLD 30 and under agreement between DAF and Santa Barbara County. The Proposed Action would comply with these procedures. SpaceX flies a variety of trajectories from VSFB to support a wide range of missions, thus increasing to 100 launches per year does not mean that all 100 launches would be a trajectory that impacts Jalama Beach County Park. In 2024 there were only four evacuations of Jalama Beach County Park despite 46 launches of Falcon 9. One of these evacuations was rescinded and thus the park was not closed during launch but was included in this count. Additionally, as launch vehicles become more reliable (e.g., a proven record of flight), impact limit lines decrease. A launch attempt that could evacuate Jalama Beach County Park could be scrubbed due to weather, an issue with the vehicle, or another reason after an evacuation order has been issued. While some impacts on Jalama Beach County Park are unavoidable due to mission requirements, evacuations would not be issued for more than 12 launches. Given the formal evacuation agreement in place and the temporary nature of the closure, implementation of the Proposed Action would not substantially diminish the protected activities, features, or attributes of any Section 4(f) resources and therefore would not result in substantial impairment of the properties.

All potential Section 4(f) resources in the ROI would experience sound levels less than 100 dBA L_{Amax} during launches, landings, and static fire events (Figure 3.10-1). First stage and booster landings at SLC-4 and SLC-6 could create sonic booms between approximately 1.0 and 3.0 psf at Section 4(f) resources (Figure 3.10-2 through Figure 3.10-4). However, there is no reasonable potential for launch-related noise to impair the majority of the Section 4(f) resources within the ROI because a quiet setting is not part of the significant attributes or features qualifying these properties for protection under Section 4(f).

Peak overpressures in the Channel Islands National Park may peak at 7.0 psf, across a very focused geographic area over the islands, although typical levels are 3.0 psf or less and vary in impact locations with every launch, mostly impacting the ocean (see Section 3.4.2). Although launch trajectories overfly the Channel Islands National Park, impacts would not be so severe that the activities, features, or attributes that qualify the Channel Island National Park for protection under Section 4(f) are substantially impaired.

Both rocket engine noise and sonic booms are classified as short-duration, intermittent events. Given the short duration of increased sound levels during a launch and the small area impacted, the FAA has preliminarily determined that noise generated during launches or landing would not substantially diminish the protected activities, features, or attributes of any of the potential Section 4(f) resources and therefore would not result in a *constructive use* of any potential Section 4(f) resource. Additionally, given the history of beach and park closures for launches at VSFB, the formal evacuation agreement in place, and the temporary nature of the closures, the FAA has determined that the Proposed Action would not substantially diminish the protected activities, features, or attributes of any of the potential Section 4(f) resources and therefore would not result in a constructive use of any Section 4(f) resource.

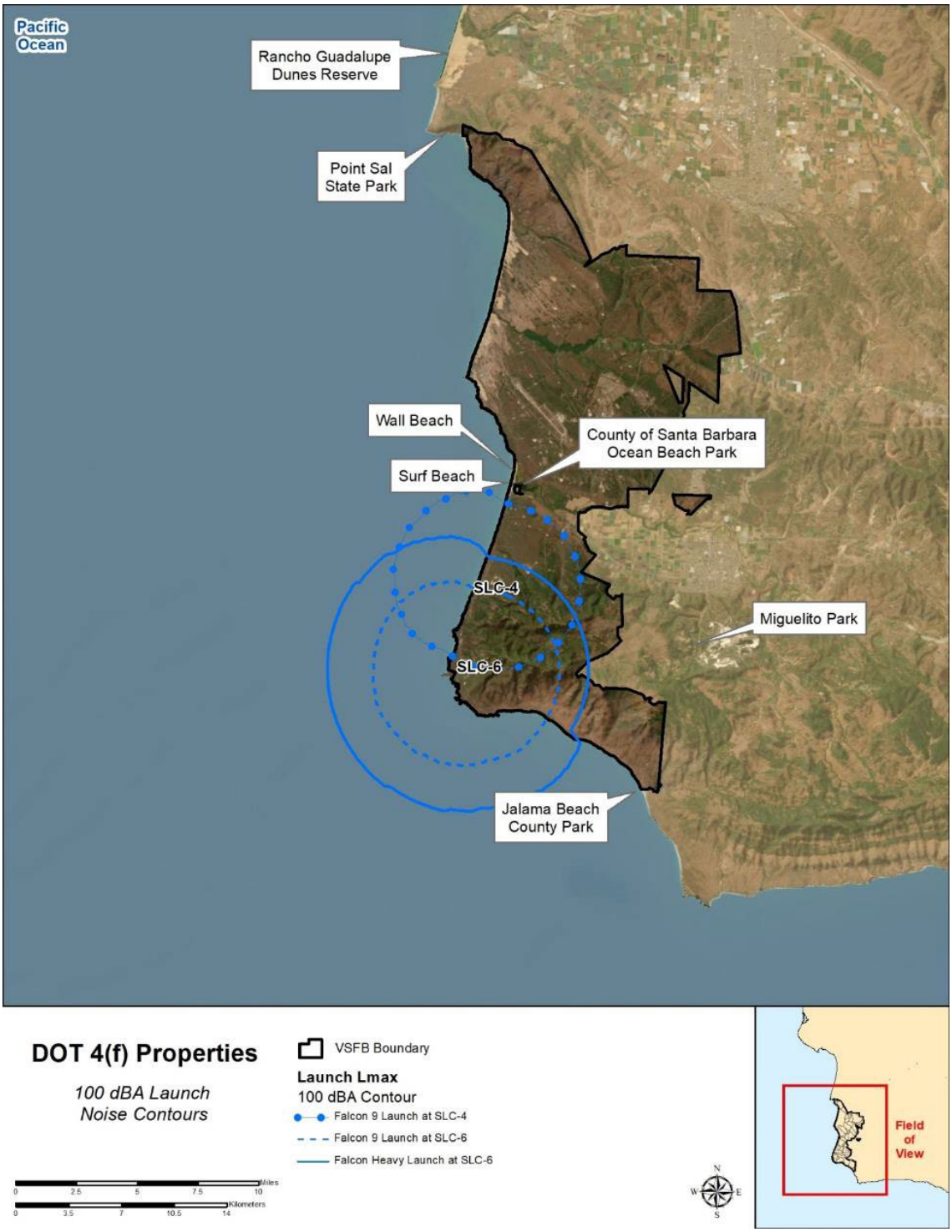

Figure 3.10-1. Potential DOT 4(f) Resources and Launch Engine Noise

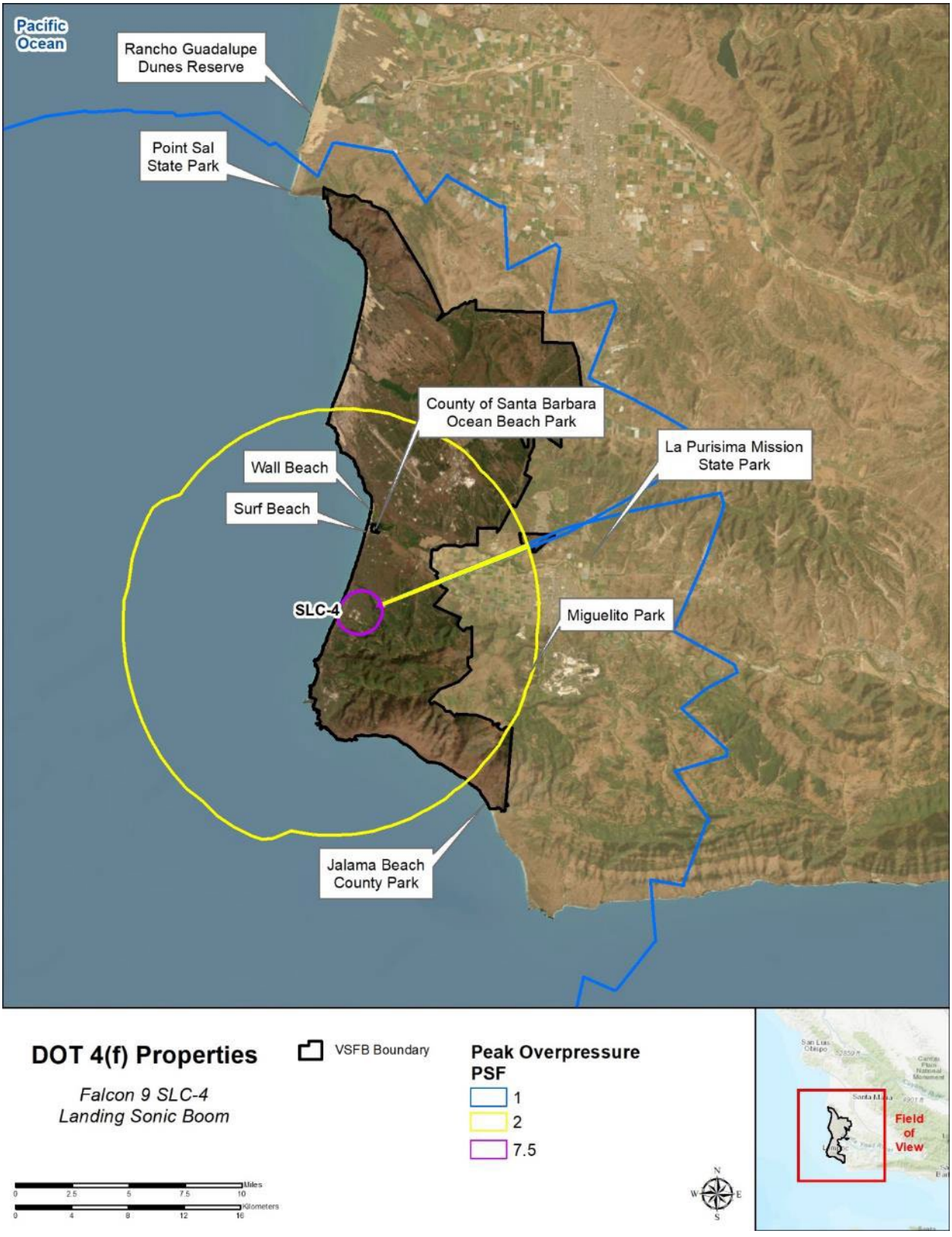

Figure 3.10-2. Potential DOT 4(f) Resource and Sonic Boom for Falcon 9 First Stage Landing at SLC-4

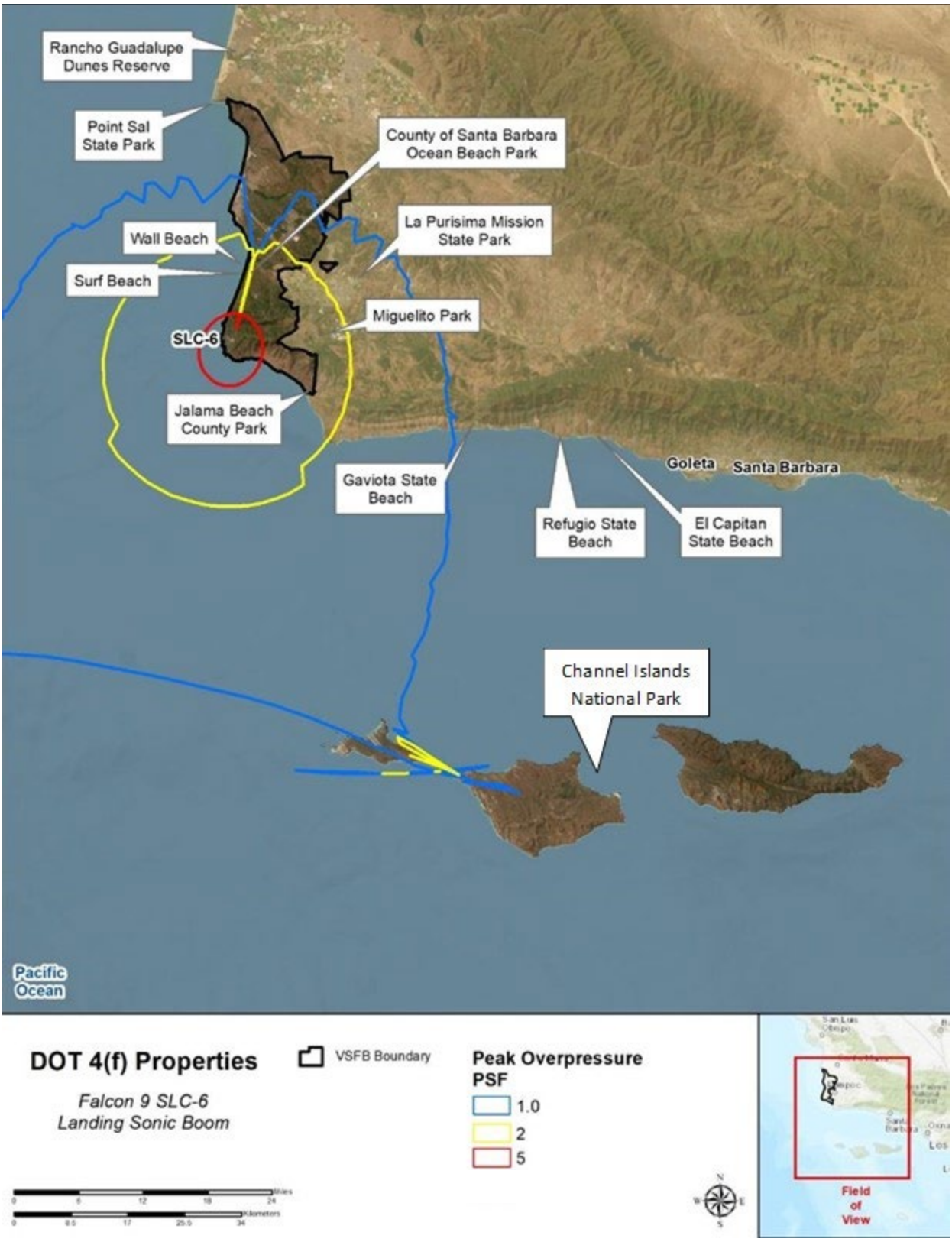

Figure 3.10-3. Potential DOT 4(f) Resource and Sonic Boom for Falcon 9 First Stage Landing at SLC-6

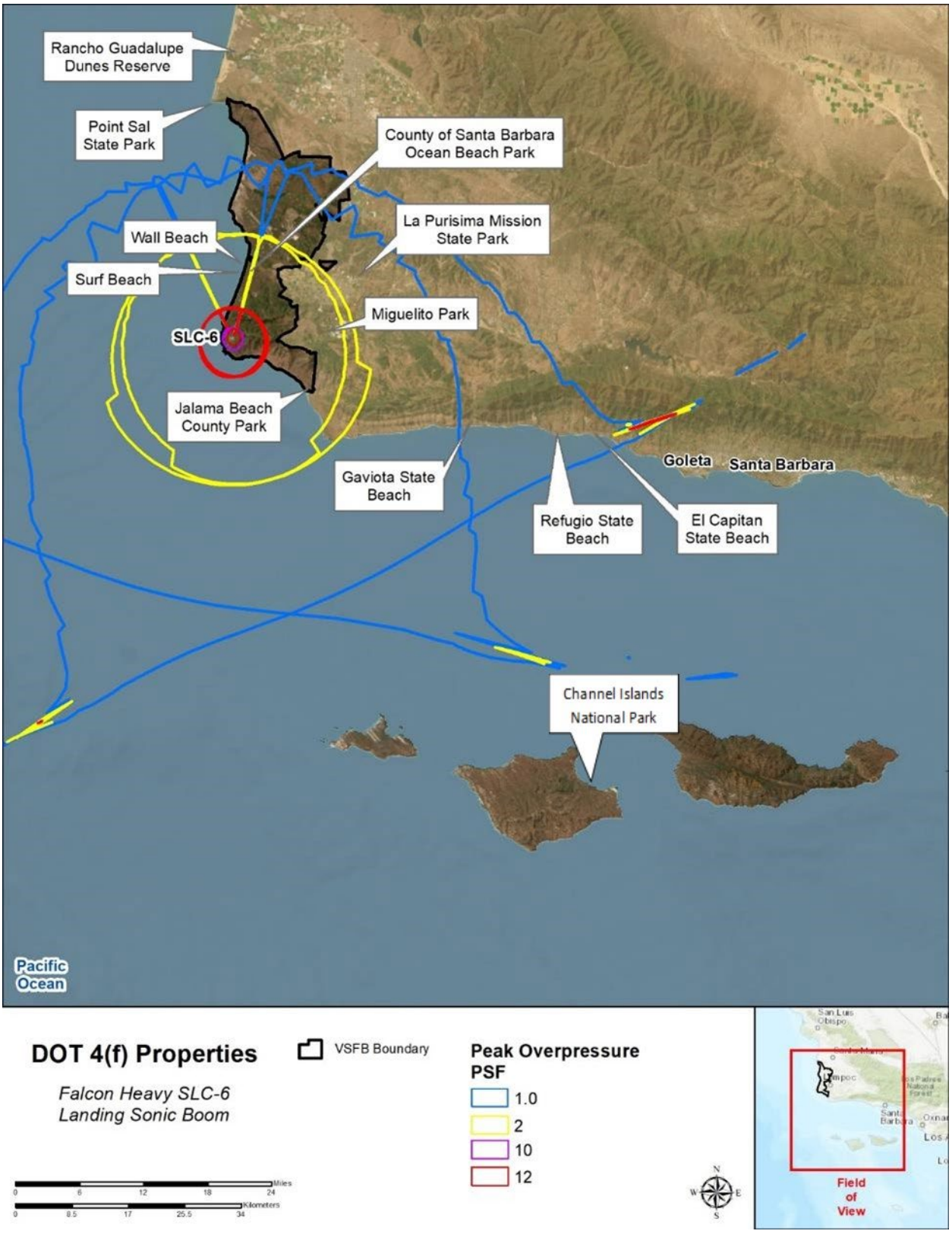

Figure 3.10-4. Potential DOT 4(f) Resource and Sonic Boom for Falcon Heavy Booster Landing at SLC-6 (Note: Image Shows Examples of Sonic Boom Modeling Results for Two Sample Trajectories)

3.10.2.2 Alternative 1

Operations under Alternative 1 would be the same as the Proposed Action and would generate the same types and levels of impacts on DOT 4(f) resources as discussed in Section 3.10.2.1. The only differences between Alternative 1 and the Proposed Action is the construction of a new hangar, which would have no difference in terms of impacts on DOT 4(f) resources as a result of different construction footprints. Therefore, Alternative 1 would not result in significant impacts on DOT 4(f) resources.

3.10.2.3 No Action Alternative

Under the No Action Alternative, modifications of SLC-6 and increased Falcon launch cadence on VSFB would not occur, resulting in no impacts on DOT 4(f) resources beyond those described in the 2024 EA. However, the reasonably foreseeable actions included in Table 3.2-3 would still occur under the No Action Alternative; therefore, the effects analysis considers potential effects associated with these projects without consideration of the Proposed Action. Section 4(f) does not apply to projects without a federal nexus within the DOT, thus is not applicable to many reasonably foreseeable projects. Those projects that do have a federal nexus within DOT would undergo their own Section 4(f) evaluation.

3.10.2.4 Cumulative Effects

The DAF would comply with the closure agreement with Santa Barbara County and would not exceed or increase the current cumulative allowable annual evacuations of Jalama Beach County Park across all present and reasonably foreseeable launch programs on VSFB. SLD 30 Range Safety would individually review future launch programs to determine if additional closures are necessary and what areas would be affected since the hazard risk analysis is unique to each vehicle, launch location, and mission trajectory. SLD 30 is working to avoid restrictions to public access while accounting for risk to human health and safety and has determined there is no need to restrict access to Ocean Beach County Park or Surf Beach for launches with downrange first stage landing on a droneship and launches with first stages expended in the Pacific Ocean that do not fly over or pass within close proximity these locations. Ocean Beach County Park closures would not exceed 12 times per year as previously described in the 2018 SEA (DAF 2018). Therefore, implementing the Proposed Action or Alternative 1 with other past, present, or reasonably foreseeable projects would not result in significant cumulative effects on Section 4(f) resources.

3.10.2.5 Mitigation and Monitoring

In the absence of significant effects, no mitigation or monitoring measures have been identified for this resource.

3.11 Utilities

3.11.1 Affected Environment

3.11.1.1 Regulatory Setting

NEPA requires all federal agencies to assess potential impacts of proposed activities related to utility infrastructure, including electricity, water, wastewater, natural gas, and telecommunications.

3.11.1.2 Region of Influence

The ROI includes SLC-4, SLC-6, and south VSFB utilities (e.g., communications, electricity, domestic water supply, and domestic wastewater). Communications infrastructure at SLC-4 and SLC-6 is provided by existing commercial fiber lines and cell towers at SLC-4 and Building 398. Electrical infrastructure is primarily provided from the Pacific Gas and Electric Company substation north of VSFB, powered by the Diablo Canyon nuclear power plant. In 2023, SpaceX used 6.8 million kilowatt-hour (kW-hr) of electricity at SLC-4 and 1.6 million kW-hr at Building 398. Water is extracted via four water wells from the San Antonio Creek Basin, and VSFB is expected to continue extracting from the Basin into the

foreseeable future. Domestic wastewater at SLC-4 and SLC-6 is managed by existing septic sewer systems. The GAO identified VSFB as vulnerable to water-scarcity issues in 2019 (GAO 2019).

3.11.2 Environmental Consequences

Impacts associated with utilities are related to changes in the supply (also referred to as capacity) or demand for a particular resource. As long as the capacity of a particular utility is higher than the demand for that resource, no impact occurs. However, if the demand exceeds the capacity or if the demand is increased beyond the resource's projected rate of increase, an impact would occur, and the significance of the impact is determined based on the degree to which the capacity is strained.

3.11.2.1 Proposed Action

Existing lines would provide communication and electricity to SpaceX facilities at SLC-4 and SLC-6. The Proposed Action would increase launch cadence at SLC-4, and add launch activities at SLC-6, which would increase the demand for electricity, water, and the septic system. SpaceX estimates that the proposed increase in cadence at SLC-4 and expansion of the Falcon program to SLC-6 would increase annual electricity usage by approximately two-fold to 15,000,000 kW-hr at SLC-4 and 8,000,000 kW-hr at SLC-6. The primary source of VSFB's electricity, Pacific Gas and Electric Company Diablo Canyon nuclear power plant, which generates 18,000 gigawatt-hours of electricity annually. The annual electrical usage needed under the Proposed Action would represent 0.1 percent of the total capacity of the power plant which can therefore adequately support the proposed increase in electricity use. The existing power infrastructure is sufficient to supply this electricity to SLC-4 and SLC-6. During power outages, SpaceX would rely on existing portable backup generators for electricity for SLC-4 and Building 398 and would add five emergency generators for standby power at SLC-6. The existing communication system is sufficient to support increases in launch capacity.

At maximum cadence, the Proposed Action would use up to 65.6 ac-ft of water per year. This would represent an increase of approximately 2.3 percent of the total annual water usage on VSFB. The current water source for VSFB is via an existing connection between State Water and the VSFB water supply system. VSFB primarily relies on State Water; however, during annual maintenance that lasts two to three weeks, VSFB utilizes four water wells in the San Antonio Creek Basin. Even if pumping this entire volume of water from the San Antonio Creek groundwater basin, it would have an indetectable effect of water levels and flow rates in the creek over this short period of time. Therefore, implementation of the Proposed Action would have a discountable effect on water supply and can be met with the current sources and would not exacerbate water scarcity at VSFB or the surrounding area.

To meet water supply needs for launch operations, SpaceX is evaluating constructing additional storage tanks and water reclamation at SLC-6 to reduce potential impacts on the existing water supply network. As cadence increases over time and a greater understanding of per launch water usage as well as available water from state supplies is clearer, SpaceX and other launch service providers would coordinate with American Water to determine if additional common-use infrastructure is needed to support launch operations on south VSFB.

SLD 30 confirmed that the existing septic sewer systems at SLC-4 and SLC-6 have sufficient capacity to support the increase in domestic wastewater associated with the Proposed Action (Pernell 2024). Therefore, there would be no need to upgrade current sewer systems as a result of implementation of the Proposed Action and impacts on the domestic wastewater system would be negligible.

3.11.2.2 Alternative 1

Operations under Alternative 1 would be the same as the Proposed Action and would generate the same types and levels of impacts on utilities as discussed in Section 3.11.2.1. The only difference between Alternative 1 and the Proposed Action is the construction of a new hangar, which would have no difference in terms of impacts on utilities as a result of different construction footprints. Therefore, Alternative 1 would not result in significant impacts on utilities.

3.11.2.3 No Action Alternative

Under the No Action Alternative, modifications of SLC-6 and increased Falcon launch cadence on VSFB would not occur, resulting in no impacts utilities beyond those described in the 2024 EA. The potential effects associated with reasonably foreseeable actions (Table 3.2-3) are considered in the effects analysis of the No Action Alternative without consideration of the Proposed Action, because these actions would still occur. Utilities would continue to be utilized for activities at VSFB and other development in the surrounding areas. Reasonably foreseeable actions are not anticipated to result in exceedances of utility capacity, discussed further in 3.12.2.4.

3.11.2.4 Cumulative Effects

Past, present, and future projects on VSFB would contribute to increases in demand for utility resources; however, utility capacity would be required to be greater than demand. SLD 30 would extend utilities to reach launch facilities, but the existing utility capacity is greater than the anticipated demand to support launch facilities for 110 cumulative launches and supporting infrastructure. The substation that supports south base launch facilities is capable of supporting over 1,000 amps of distribution loads. SLD 30 profiles the loads for every launch, and has not exceeded 100 amps of usage. The existing system can support 10 times the current load, well within the requirements for cumulative launches. If existing utility capacity is not greater than the anticipated demand, SLD 30 would improve utility capacity during infrastructure development for expanded commercial space launch capabilities at VSFB and thus help offset cumulative impacts on utility resources. Additionally, American Water Operations & Maintenance, which operates the water distribution and wastewater collection systems at VSFB, is saving approximately 22 million gallons/year by re-introducing potable water into the system during fire-hydrant flushing instead of disposing of the water in storm drains (Air Force Civil Engineer Center [AFCEC] 2015). Therefore, implementation of the Proposed Action or Alternative 1 in conjunction with other past, present, or reasonably foreseeable projects would not result in significant cumulative effects on utilities in the ROI.

3.11.2.5 Mitigation and Monitoring

In the absence of significant effects, no mitigation or monitoring measures have been identified for this resource.

3.12 Socioeconomics

3.12.1 Affected Environment

3.12.1.1 Regulatory Setting

In NEPA, Congress requires agencies to "utilize a systematic, interdisciplinary approach which will ensure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision making which may have an impact on the human environment" (42 USC 4332(A)).

Economic or social effects by themselves do not require preparation of an environmental impact statement. However, when economic or social and natural or physical environmental effects are interrelated, the environmental impact statement shall discuss these effects on the human environment. Therefore, the requirement to prepare socioeconomic analysis is project specific and is dependent upon the existence of a relationship between natural or physical environmental effects and socioeconomic effects. A socioeconomic analysis was prepared based on the potential economic impact of the Proposed Action, as well as its potential effects on adjacent industries such as commercial fishing.

3.12.1.2 Region of Influence

Socioeconomic resources include the population, income, employment, and housing conditions of a community or affected environment. The ROI for socioeconomics includes Vandenberg Village, the City of Lompoc, CA, the unincorporated area north of Lompoc, CA, the Santa Maria Valley, and portions of the Santa Ynez Valley, in the state

of California; and the recovery area in the Pacific Ocean to assess the extent to which potential impacts on commercial and recreational fishing may occur.

3.12.1.3 Economic Activity

Santa Barbara County's economy is diverse and includes agriculture, tourism, healthcare, education, technology, and commercial fishing. Agriculture is one of the largest sectors, with major crops including strawberries, wine grapes, avocados, and flowers. Tourism is a significant industry, drawing visitors to beaches, wine country, historic sites, and cultural attractions. Educational institutions, including the University of California, Santa Barbara and Santa Barbara City College contribute to education and technological innovation.

VSFB has a large effect on population and employment in northern Santa Barbara County, which encompasses Vandenberg Village, the City of Lompoc, the unincorporated area north of Lompoc, CA, the Santa Maria Valley, and portions of the Santa Ynez Valley. The full economic impact of VSFB on the surrounding communities and the state of California is significant (over $1.75 billion/year). VSFB directly contributes more than $500 million each year to the economies of Santa Barbara County and California and is the second largest employer in Santa Barbara County (6,800 employees as of 2014), including 2,924 military personnel, 1,143 civil servants, and 2,822 non-appropriated fund, contractor, and private business personnel (DAF 2020a).

Southern California's west coast is a leading recreational and commercial fishing area. Commercial fishing off the coast of VSFB is largely conducted by vessels from the Santa Barbara Harbor, Port San Luis, and Morro Bay Harbor. Fishing in areas potentially affected by SpaceX VSFB launches is limited compared to other areas but is valuable for select species. In 2023, area overflown by SpaceX's potential azimuths landed fish with total value of $18,037,773, or 11.2 percent of the value of the state's total landings (CDFW 2025).

3.12.1.4 Employment Population and Income

Population estimates, employment population, unemployment rates, and median household incomes for Santa Barbara County and major cities within the ROI, as of 1 July 2023, and distance of population centers to the project site (SLC-4 and SLC-6) are summarized in Table 3.12-1 (U.S. Census Bureau 2025; Bureau of Labor Statistics 2025; Employment Development Department 2025).

Table 3.12-1. Summary of Employment Population and Income

Geographic Area	Population*	Civilians Employed^	Unemployment Rate^	Median Household Income*	Distance from SLC-4/SLC-6 (mi)
California Statewide	38,965,193	18,320,900	5.2%	$96,334.00	N/A
Santa Barbara County					
Overall	441,257	205,000	4.5%	$95,977.00	N/A
Santa Maria	109,987			$84,627.00	24/28
Santa Barbara	86,499			$101,672.00	55/54
Lompoc	43,305			$70,038.00	8/10

* U.S. Census Bureau 2023 & 2025

^ Employment Development Department 2025

3.12.1.5 Housing

Every eight years the State of California determines the anticipated number of housing units needed in each region across California (Dudek 2024). The methodology for determining the housing need considers factors such as the makeup and condition of the existing housing stock, existing and forecasted jobs, the projected population, and the availability of housing. Specifically, the State allocates the housing need by region and regional agencies work with jurisdictions to develop a methodology for divvying up the allocated housing need per jurisdiction. As determined by the

State, the Santa Barbara County Association of Governments (SBCAG), which is the Metropolitan Planning Organization responsible for regional planning activities for all incorporated and unincorporated areas in Santa Barbara County, has an anticipated housing need of 24,856 additional housing units to be built between 2023-2031. SBCAG's Regional Housing Needs Allocation (RHNA) Plan establishes the methodology for allocating shares of the 24,856 needed housing units between each local government in the region. SBCAG's RHNA Plan relies on SBCAG's Regional Growth Forecast (RGF), which serves as a tool for long range regional planning. Specifically, the RGF provides input for the State Department of Housing and Community Development RHNA for the Santa Barbara County region.

The RGF captures existing and projected population, housing, and job growth for various industries in Santa Barbara County, its eight incorporated cities, and its major economic and demographic regions (e.g., VSFB), through 2050. Because the RGF forms the basis of the RHNA, job growth for the 2023-2031 RHNA projection period in all job industries is reflected in the calculation of the RHNA. Further, the RGF specifically projects anticipated employment at VSFB. In 2017, VSFB supplied an estimated amount of 6,250 jobs, accounting for about three percent of the region's total jobs. The RGF projects a total of 850 new jobs to be added in VSFB between 2017 and 2030, increasing the total to 7,100 jobs by 2030. The increase of 850 new jobs at the VSFB falls within SBCAG's RHNA Plan projection period of 2023-2031. This job growth at VSFB is captured by the SBCAG RGF and has been used to help determine and allocate housing needs in the region through the methodology used in the RHNA Plan. SBCAG's RHNA Plan divides the region into two subareas, the South Coast Housing Market Area and the North County Housing Market Area. The North County Housing Market Area includes the cities of Buellton, Guadalupe, Lompoc, Santa Maria, and Solvang, as well as the unincorporated areas of Orcutt, Guadalupe, Cuyama Valley, Lompoc Valley, and Santa Ynez within the jurisdiction of the County. Given the proximity to VSFB, many off-base employees of VSFB are likely to reside in the North County Housing Market Area. SBCAG's RHNA Plan has allocated portions of the regional housing need to each local jurisdiction in the region, including those in the North County Housing Market Area. Each of these jurisdictions has identified capacity to accommodate their housing need, demonstrating that there are sufficient development opportunities to meet the housing need.

IAW State law, local governments must demonstrate in their General Plan Housing Elements how they will accommodate their share of the regional housing need by identifying sites that are zoned for housing and can reasonably accommodate housing development. It should be noted that jurisdictions are only responsible for creating opportunities for the private market to build units specified in their RHNA and are not responsible for the actual construction of such units. The County's RHNA share is 5,664 total units for the 2023-2031 planning period. The County has divided its housing need of 5,664 into two subregions, the South Coast subregion and the North County subregion. Nearly three-quarters of the housing need (4,142 units) have been allocated to the South Coast subregion of the County, while the rest (1,522) were allocated to the North County subregion. Factoring in all planned and potential housing capacity, the County's Housing Element identifies capacity for 13,986 units, far exceeding the total housing need. Of the County's identified housing capacity, capacity for 4,991 units is identified in the North County subregion. VSFB is located in the County's North County subregion and likely employs more households in the North County subregion than the South Coast subregion.

The City of Lompoc's housing need for the 2023-2031 planning period is 2,248 units. Their Housing Element identifies capacity through planned and approved projects, projected accessory dwelling unit development, and vacant and underutilized sites. Their total identified capacity is 2,407 units, an additional seven percent beyond their housing need. The City of Santa Maria is the most populous city in the North County Housing Market Area and has a housing need of 5,418 units for the 2023-2031 planning period. The City of Santa Maria's Housing Element identifies capacity to accommodate 5,819 new housing units, which is 401 units beyond their housing need. Other cities in the North County Housing Market Area, including Buellton, Guadalupe, and Solvang were allocated much fewer housing units due to their size. Buellton's capacity of 761 units, which includes both built and potential units, exceeds their housing need of 165 new housing units for the 2023-2031 period. Solvang's housing need for the same period is 191 housing units and

their Housing Element identifies capacity for 343 units, which is 128 units beyond their need. The City of Guadalupe's Housing Element identified housing need is 431 new housing units for the same period, but the housing capacity is currently unknown as the City is in process of updating its housing element. If the City of Guadalupe is unable to identify adequate housing capacity, they are required by State law to rezone sites to ensure that adequate capacity is made available to accommodate the entirety of the housing need.

3.12.2 Environmental Consequences

3.12.2.1 Proposed Action

3.12.2.1.1 Economic Activity, Employment Population, and Income

Construction activities under the Proposed Action would result in economic benefits from the use of local labor and supplies. Benefits associated with construction would be local, minor, and temporary, lasting only for the duration of the construction activities, which is estimated to be approximately 18 months. There would be no migration of construction workers as the labor would be filled from the existing local workforce.

Launching and landing operations under the Proposed Action would result in moderate but positive economic benefits from increased demand in the existing workforce, higher revenues, and increased per capita income. SpaceX would continue to use its existing workforce for launching and landing activities. Ongoing commercial space activities at VSFB would continue to be an important economic generator for the local region and nearby counties.

Recreational and commercial vessels transit and operate offshore of VSFB and may be affected by NOTMARs, which are issued to warn maritime vessels of hazardous operations in the area during launch activities. The public's safety during launch operations is of upmost importance to DAF, FAA, USCG, and SpaceX, which includes the protection of maritime users near the launch vehicle's flight trajectory. The USCG notifies the public of the maritime hazard upon request by the range authority or by the launch operator if a Letter of Intent has been signed by USCG and SpaceX. As discussed in detail in Section 3.14.1.4, the USCG issues various types of NOTMARs that notify the public of the time and location of potential hazardous operations and do not explicitly prohibit vessels from entering the identified areas. If the risk, as calculated by SLD 30, within a portion of the maritime hazard area exceeds a threshold determined by the FAA, access to this smaller area, known as the "surveillance area" may be restricted in order for launch to be allowed to proceed.

Due to Falcon's reliability, SpaceX's surveillance areas for launches from VSFB have minimal impacts on maritime activities. For many missions, this closure area does not even leave land. Accordingly, only a small subset of fishing blocks within the vicinity of VSFB have the potential to be closed by each launch and for a relatively short period of time. The area within the hazard area, but not closed to vessel traffic, is approximately two blocks wide along each given trajectory. Temporary closures of these areas for security and safety do not limit commercial or recreational fishing vessel access to or use of adjacent areas. Areas would be closed for the duration of the activity and reopened at the completion of the activity. The temporary hazardous operations area would be lifted as soon as the USCG determines it is safe to do so. The DAF and SpaceX are committed to maintaining communication with fishermen to avoid and minimize any potential impacts on this industry. Therefore, the Proposed Action would not have a significant effect on commercial or recreational fishing activities.

Potential socioeconomic impacts from re-routing aircraft due to commercial space operations would be similar to re-rerouting aircraft for other reasons (e.g., weather, runway closures, wildfires, military exercises). These include additional airline operating costs for increased flight distances and times resulting from re-routing aircraft and increased passenger costs as a result of impacted passenger travel, including time lost from delayed flights, flight cancellations, and missed connections. Alternatively, restricting or preventing a launch event would have socioeconomic impacts on SpaceX, commercial payload providers, and consumers of payload services. Operations would not result in closing any public airport or so severely restrict using surrounding airspace to prevent access to an airport for extended time. Given existing

airspace closures for SpaceX operations are temporary and the FAA's previous analyses related to the NAS have concluded minor or minimal impacts on the NAS from commercial space launches, the FAA does not expect airspace closures would result in significant socioeconomic impacts. Local air traffic controls would coordinate with airports and aircraft operators to minimize launch operations effects on airport traffic flows, as well as traffic flows in en-route airspace. Therefore, the Proposed Action would not generate negative socioeconomic impacts on the region and would generate a small positive impact.

3.12.2.1.2 Housing

SpaceX does not plan to add any additional staff over the increase of 400 permanent staff that were analyzed in Section 3.10.2.1 of the 2024 EA (DAF 2024a). Construction worker positions would primarily be filled from the existing local workforce or would be temporarily based in the region as necessary. The local housing market would not be substantially affected, and no new social services or support facilities would be required during construction activities.

A Housing Impact Study was completed for the 2024 EA (Dudek 2024) assessing the proposed job growth through the lens of regional housing need and available capacity to accommodate needed housing. SpaceX would utilize the same number of personnel analyzed in Section 3.10 of the 2024 EA. Therefore, there would be no additional impacts beyond those already considered in the 2024 EA and the Proposed Action would not significantly affect the demand for local housing and the need for social services and support facilities.

3.12.2.2 Alternative 1

Operations under Alternative 1 would be the same as the Proposed Action and would generate the same types and levels of impacts on socioeconomics as discussed in Section 3.12.2.1. The only difference between Alternative 1 and the Proposed Action is the construction of a new hangar, which would have no difference in terms of impacts on socioeconomics as a result of different construction footprints. Therefore, Alternative 1 would not result in significant impacts on socioeconomics.

3.12.2.3 No Action Alternative

Under the No Action Alternative, modifications of SLC-6 and increased Falcon launch cadence on VSFB would not occur, resulting in no impacts on socioeconomics beyond those described in the 2024 EA. The No Action Alternative effects analysis includes the potential effects resulting from the reasonably foreseeable actions listed in Table 3.2-3 without consideration of the Proposed Action, because these actions would still occur. No significant effects to socioeconomics are anticipated under the No Action Alternative since there would be no incoming personnel associated with this alternative. Regional growth affecting socioeconomics is considered in local and regional long-range planning documents.

3.12.2.4 Cumulative Effects

The long-term employment for personnel supporting the Proposed Action or Alternative 1 would be considered positive and would augment other local community businesses, industries, or housing. SpaceX and VSFB are major employers, and the presence of these employers can cause a chain of economic reactions throughout the local region. VSFB launch operations would not result in closing any public airport or so severely restricting using surrounding airspace to prevent access to an airport for extended time. The need for housing new staff moving into the region from other areas would further decrease. Given existing closed airspace surrounding VSFB and the FAA's previous analyses related to the NAS have concluded minor or minimal impacts on the NAS from commercial space launches, the effects from airspace closures would result in insignificant socioeconomic impacts. The SBCAG RHNA Plan considers an anticipated growth at VSFB of 850 new jobs by 2030 in the determination of the housing need. Further, local jurisdictions surrounding the VSFB have identified adequate housing capacity to meet and far exceed the 2023-2031 housing need. The potential increase of permanent staff associated with past, present, and reasonably foreseeable future actions would not have a housing impact beyond the Santa Barbara County existing and projected housing need, and further

would not create a housing need beyond identified capacity. Additionally, depending on the proportion of local people hired. As a result, the overall cumulative effect of the Proposed Action or Alternative 1 when considered with other past, present, and reasonably foreseeable future actions on socioeconomics is considered beneficial and would not be significant.

3.12.2.5 Mitigation and Monitoring

In the absence of significant effects, no mitigation or monitoring measures have been identified for this resource.

3.13 Transportation

3.13.1 Affected Environment

3.13.1.1 Regulatory Setting

This section addresses existing regional transportation involving the roadway network and other modes of transportation in and around VSFB. Traffic is commonly measured through average annual daily traffic and design capacity. Intersection capacity and traffic operations are evaluated by their level of service, which is a rating system that uses a letter grade from A (free-flowing traffic) to F (stop and go). Level of service is determined by the overall delay a driver may experience at an intersection during peak hour traffic. Intersections and roadway segments are generally considered failing at a level of service F.

Regional growth and its potential effects on the regional multimodal transportation network are considered by the SBCAG in long-range planning documents. The current long-range transportation plan considers future growth to 2050 in the *Connected 2050 Regional Transportation Plan and Sustainable Communities' Strategies* (SBCAG 2021).

3.13.1.2 Region of Influence

The ROI for transportation includes railway, highway (Hwy), arterial, and local roads that provide service to VSFB, the surrounding area. Existing roadway conditions are evaluated based on roadway capacity and traffic volume. The capacity reflects the ability of the network to serve the traffic demand of a roadway and depends on the roadway width, number of lanes, intersection control, and other physical factors.

VSFB is a federal military installation located approximately five mi west of the City of Lompoc. The main access route is Hwy 101, a coastal four-lane divided freeway connecting Northern California to Southern California. Hwy 1, State Route (SR) 135, and SR 246 (Ocean Avenue) connect Hwy 101 to VSFB. When used with Hwy 101, SR 246 provides access to Lompoc to the east, and Santa Barbara to the southeast. SR 135 and SR 246 are primarily two-lane highways with four-lane expressway portions. The California Department of Transportation (Caltrans) traffic count for SR 246 at the western Lompoc city limit, the closest count to south VSFB, indicated an annual average daily traffic volume of 3,100 vehicles per day (Caltrans 2024). SR 246 varies between a two-lane rural unsignalized roadway and a four-lane urban signalized roadway. The generally accepted capacity for this type of rural roadway is approximately 19,000 vehicles per day and the generally accepted capacity for this type of urban roadway is over 40,000 vehicles per day (Federal Highway Administration 2024).

Most of VSFB can only be accessed by authorized military personnel and their families, VSFB civilian employees with approved identification, visitors with pre-approved authorization, and authorized contractors. There is no public access to the roadways within the ROI. South VSFB is accessible by paved roads from the Solvang Gate. Personnel supporting SLC-6 modifications and Falcon program operations would access the location by entering VSFB through the Solvang Gate from West Ocean Avenue, travel south on Arguello Road, west on Bear Creek Road, south on Coast Road, and to the destination on Kelp Road (Figure 3.13-1). There are no readily accessible alternate routes to SLC-4, although Surf Road would be a suitable egress road to the east during emergencies. Oversized transports utilize the Coast Gate rather than Solvang Gate to reduce impacts on vehicular traffic on south VSFB. Some oversized or commercial trucks may require additional inspection at the Lompoc Gate on north VSFB prior to transiting to south VSFB.

The Union Pacific Railroad (UPRR) operates a railway line that runs through VSFB and under the proposed flight path of the Falcon 9 launch vehicle. Up to 12 freight trains and six Amtrak passenger lines travel through VSFB daily (Envicom Corporation 2012; Amtrak 2025). Trains that would pass through a launch vehicle's flight path from VSFB are temporarily stopped at safety hold points during launches to reduce potential risk to people and property. The SPMT's route from the VSFB harbor to SLC-4 and SLC-6 crosses the UPRR railway at the intersection of Tow Road and Coast Road (Figure 3.13-1).

3.13.2 Environmental Consequences

3.13.2.1 Proposed Action

SpaceX does not plan to add any additional staff over the increase of 400 permanent staff that were analyzed for potential impacts on Transportation in Section 3.11.2.1 of the 2024 EA (DAF 2024a). Given the low traffic volumes projected from increased operations, existing capacity of roadways at and near VSFB that would be affected by C&D activities on VSFB and nearby, and the relatively small and temporary increase in daily vehicle traffic that the Proposed Action would generate, no adverse effects on capacity would occur in the ROI roadways.

Increased vehicle activity affects the integrity of roadway sections by increasing the flexures of the pavement. The design life for asphalt pavement, generally selected as either 10 or 20 years, drives engineering specifications for the road based upon the strength of the base soil and estimated number of truck trips that are expected during the design life of the pavement. If the number of truck trips is increased, the life of the pavement is shortened. While the current pavement condition varies on affected roads, added project-related vehicle traffic could cause faster-than-estimated pavement surface deterioration and require additional maintenance. Although an adverse effect, it would not be considered significant given that the number of vehicle trips per day anticipated from the Proposed Action is not high and the speed of pavement deterioration is influenced by more than truck traffic.

Increased oversized load transport is not expected to have a significant impact on operations on south VSFB, as these transports would utilize Coast Gate rather than Solvang Gate. which is the only point of access for routine traffic on south VSFB, and existing daily traffic volumes on south VSFB are low. Some oversized or commercial trucks may require additional inspection at the Lompoc Gate on north VSFB prior to transiting to south VSFB but this is not expected to have a meaningful impact on the operational level of service of VSFB roads. SpaceX will continue to coordinate with SLD 30 to reduce operational impacts on VSFB staff and resources to support and conduct these operations.

Trains that would pass through a launch vehicle flight path from VSFB would be temporarily stopped at safety hold points during launches to reduce potential risk to people and property. SLD 30 2nd Range Operations Squadron (2 ROPS/DON) notifies a dedicated UPRR point of contact (POC) of launch date, times, and train hold point locations, typically 10 days before launch. At approximately three days prior to launch, UPRR's POC provides 2 ROPS/DON a schedule of impacted trains and in collaboration discusses if the trains must hold or can continue through. At three hours before launch, 2 ROPS/DON establishes phone communication with the UPRR POC to provide updates to the train schedule. After a launch has been completed 2 ROPS/DON notifies the UPRR POC that trains may continue on the route. The UPRR POC is on standby during each launch for any notifications needed for a launch anomaly that may impact the railroad track system. UPRR attempts to adjust schedules to avoid train delays due to launches; however, launch windows are typically minimal (typically instantaneous or several minutes) and during longer launch delays 2 ROPS/DON communicates with the UPRR POC to allow trains to move through the affected area; thereby minimizing potential impacts on train schedules.

The SPMT would need to cross the UPRR railway at the Tow Road and Coast Road intersection. The SLD 30 easement to cross the railway (DACA-09-5-82-35) states that crossing "will not obstruct or interfere with the passage of Railroad trains." The UPRR requires a UPRR employee to contact approaching train engineers via radio to alert the engineer of the Tow Road crossing. SpaceX would coordinate with the UPRR to ensure easement proper procedures are followed

for each railway crossing event. Therefore, the Proposed Action would not create any significant impacts on transportation.

3.13.2.2 Alternative 1

Operations under Alternative 1 would be the same as the Proposed Action and would generate the same types and levels of impacts on transportation as discussed in Section 3.13.2.1. The only difference between Alternative 1 and the Proposed Action is the construction of a new hangar, which would result in no differences in terms of impacts on transportation as a result of different construction footprints. Therefore, Alternative 1 would not result in significant impacts on transportation.

3.13.2.3 No Action Alternative

Under the No Action Alternative, modifications of SLC-6 and increased Falcon launch cadence on VSFB would not occur, resulting in no impacts on transportation resources beyond those described in the 2024 EA. The potential effects associated with reasonably foreseeable actions (Table 3.2-3) are considered in the effects analysis of the No Action Alternative, without consideration of the Proposed Action, because these actions would still occur. Local roadways and transportation corridors would continue to be affected by current traffic conditions and ongoing and planned developments. Improvements to transportation networks outside of VSFB are planned by Caltrans, local governments, and regional planning organizations and consider future traffic demand growth, including those from reasonably foreseeable actions.

3.13.2.4 Cumulative Effects

Impacts on the local and regional transportation network due to the Proposed Action or Alternative 1, along with past, present, and reasonably foreseeable projects in the ROI would contribute to increased traffic volumes in the region. However, traffic volumes in the ROI are low and the roadways operate at acceptable levels of service. Both the Proposed Action and Alternative 1 would generate a relatively small and temporary increase in daily vehicle traffic associated with C&D activities at SLC-6 that would not have a cumulative adverse effect on capacity. The DAF anticipates that overall launch frequency on VSFB would not exceed 15 missile and 110 rocket launches per year cumulatively across all launch service providers. Trains that would be stopped at safety hold points for launch activities or railway crossings would only experience minor delays of short duration that are relatively infrequent. Launch windows are typically minimal (typically instantaneous or several minutes but could last a few hours) and during longer launch delays 2 ROPS/DON communicates with the UPRR POC to allow trains to move through the affected area; thereby minimizing potential impacts on train schedules. As a result, the overall cumulative effect of the Proposed Action or Alternative 1 when considered with other past, present, and reasonably foreseeable future actions on transportation would not be significant.

3.13.2.5 Mitigation and Monitoring

In the absence of significant effects, no mitigation or monitoring measures have been identified for this resource.

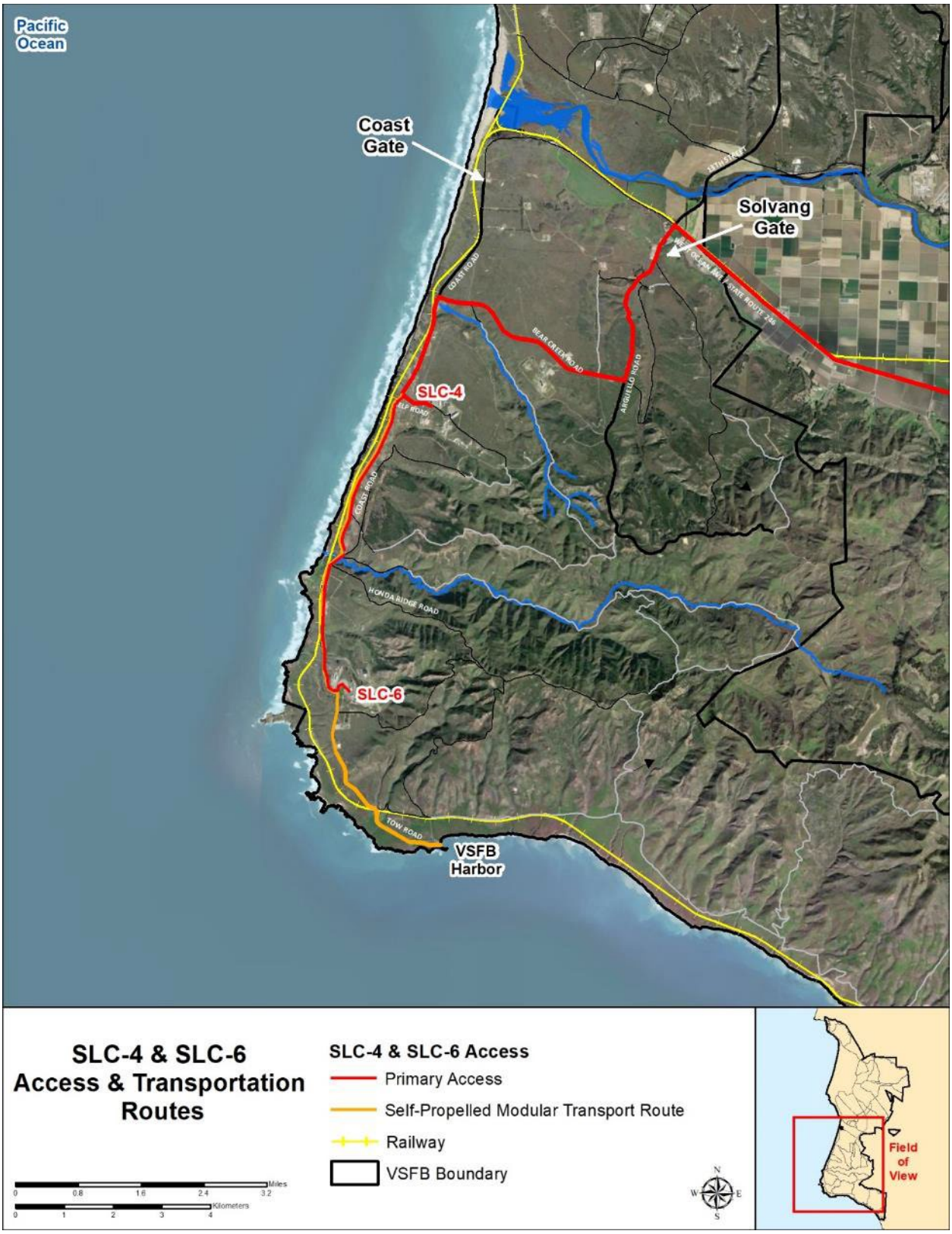

Figure 3.13-1. Main Access and Transportation Routes Associated with the Proposed Action

3.14 Human Health and Safety

3.14.1 Affected Environment

3.14.1.1 Regulatory Setting

All VSFB activities are subject to Federal OSHA, Air Force Occupational Safety and Health (AFOSH), or California OSHA regulations and procedures requirements. SLC-4 and SLC-6 are within a federal exclusive jurisdiction area; however, commercial entities may also comply with California OSHA or AFOSH requirements. The affected environment for Human Health and Safety includes all established regulations to minimize or eliminate potential risk to the general public and personnel involved in the proposed project.

3.14.1.2 Region of Influence

The ROI for Human Health and Safety resources includes all areas where activities associated with the Proposed Action may impact human health and safety. This includes SLC-4, where current launch cadence would increase, the construction area at SLC-6 where workers would potentially be exposed to conditions that could adversely impact their health and safety, and all areas potentially impacted during launch operations, the areas at SLC-6 that would undergo the proposed C&D activities, including the proposed landing zones and firebreak, and Falcon launch and landing activities, including overflight areas and the recovery area.

Personnel at SLC-4 and SLC-6 may be exposed to hazardous conditions, hazardous materials, and hazardous waste. Hazards associated with some past and present mission activities and operations on VSFB can limit locations where projects can be sited to ensure the health and safety of workers. Because of this, the DAF has established hazard zones and areas on VSFB to protect workers from various hazards.

3.14.1.3 General Public and On-Base Personnel Safety

The SLD 30 Safety Office is responsible for ensuring launch support personnel and the general public are safe from all launch operations and potential emergency public health risks as defined in Air Force Instruction (AFI) 91-202 (U.S. Air Force Mishap Prevention Program), Department of Defense Instruction (DODI) 6055.17, and 6200.03. AFI 10-2501 and AFI 10-2519 provide further guidance for DAF emergency management readiness and response to public health and safety issues. The SLD 30 Safety Office personnel would assess proposed mission profiles to ensure public safety criteria are met. Their evaluation would assess hazards associated with debris, toxics, and blast distant focusing overpressure for a normal launch. All launch, high-risk offshore, and airspace areas would be controlled and monitored to ensure public safety during launch operations. Launch day meteorological conditions would also be accounted for to ensure compliance with acceptable risk criteria.

3.14.1.4 Debris Impact Corridors

All launch programs at VSFB are required to establish debris impact corridors as a part of their program's safety review in case of a launch anomaly that requires flight termination (14 USC Section 504, 14 CFR Part 450.147). When any launch is scheduled to take place from VSFB, the SLD 30, Launch Safety (SLD 30/SEL) notifies the 2 ROPS of the associated hazard areas. SpaceX performs a debris analysis for the Falcon 9 and would perform a debris analysis for Falcon Heavy before launching. SLD 30/SEL reviews and approves these analyses prior to authorizing any launch activities. Impact debris corridors would be established off the Santa Barbara County coast to meet security requirements and reduce hazards to persons and property during launch activities. Based on a mission's specific trajectory, specific debris impact areas would be determined for each launch. Once SLD 30/SEL notifies the 2 ROPS of hazard areas, 2 ROPS notifies the FAA so that appropriate airspace restrictions are in place during launches.

In addition, SLD 30 and USCG District Southwest review each SpaceX trajectory IAW the Memorandum of Agreement (Appendix J) to develop risk plots and other materials for 14 CFR Part 450 compliance, including: (1) operating area and impact locations, (2) maritime vessel risk assessment and Ec/Pc plots, and (3) all materials necessary to develop

a NOTMAR. The USCG would be responsible for issuing NOTMARs that provide hazard area locations before each mission event with ocean impacts. A NOTMAR provides notice of temporary changes in conditions or hazards in navigable waterways with maritime traffic to assist in mitigating risks for dangers associated with waterway users. This tool provides both an established and reliable line of communication with the maritime public. The NOTMAR would include the operations dates and times and coordinates of the hazardous operation area. The USCG issues a NOTMARs 30 days before launches from VSFB that defines the times and locations of avoidance areas related to launch activities. Local NOTMARs are broadcast via radio, posted in harbors along the coast, and published weekly by the USCG.

Offshore oil rigs located west of VSFB also have evacuation or shelter-in-place procedures in place for use during launch operations. The 2 ROPS notifies the Bureau of Safety and Environmental Enforcement to notify oil rig personnel of launch operations.

On south VSFB, the UPRR track passes approximately 0.5 mi west of SLC-4 and 0.7 mi west of SLC-6 and would be overflown by the launch vehicles. To reduce potential risk to people and property, railroad schedules and close coordination between train engineers and VSFB personnel would ensure that trains are not on the tracks in the overflight area during launch and landing. SLD 30/SEL defines appropriate railroad mile-markers to 2 ROPS, who coordinates with the Manager Road Operations to ensure trains are kept clear of debris area.

3.14.1.5 Security and Anti-Terrorism

Site security requirements, including those for security lighting and intrusion detection, are part of the requirements integral to launch program safety and detailed in DOD Manual 5220.22-M. Minimum Antiterrorism Standards for Buildings 4-010-01 was issued in July 2022 under the authority of DOD Instruction 2000.16, Antiterrorism Standards. This guidance requires DOD components to adopt and adhere to common definitions, criteria, and minimum construction standards for building to mitigate vulnerabilities and terrorist threats.

3.14.1.6 Existing Noise Environment

As described in Section 3.4 and Appendix G, the existing noise levels on VSFB are generally quite low due to the large areas of undeveloped landscape and sparse noise sources. Background noise levels are primarily driven by wind noise; louder noise levels can be found near industrial facilities and transportation routes, including the railway. Regularly occurring sources of instantaneous noise near the ROI include crashing ocean surf, which generates approximately 78 dBA (6.6 ft tall waves) and can be louder during high surf events (Bolina & Abom 2010).

3.14.2 Environmental Consequences

An impact to Human Health and Safety would be considered significant if it were to create a potential public health hazard or to involve the improper use, production, or disposal of materials that pose a hazard to people in the affected area. An impact would also be considered significant if project activities were to pose a serious risk of fire, especially wildland fires, or were to involve potential obstruction of emergency response or evacuation routes in and around the project area.

3.14.2.1 Proposed Action

3.14.2.1.1 Launch and Landing Operations

Base personnel and general public safety during Falcon 9 launches would be ensured by federal emergency management readiness and response protocols detailed in Sections 2.1.2.1, and 3.14.1.4. USCG District Southwest would evaluate SpaceX 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. The USCG evaluates every launch and reentry activity for risk to waterway users and the environment under this process. Security and anti-terrorism requirements outlined in Section 3.14.1.4 would provide launch program safety compliance. Evacuations, described in

Section 3.10.2.1, would protect public safety of park visitors to Jalama Beach County Park, Surf Beach, and County of Santa Barbara Ocean Beach Park. On-base evacuation areas, implemented for each launch, landing, and static fire event, would protect the safety of personnel from noise exposure and potential anomalies.

To issue a Vehicle Operator License, the FAA requires all launch and reentry operations to comply with the necessary notification requirements, including issuance of NOTAMs, as discussed in Section 2.1.2.1.2. NOTAMs assist general aviation pilots in scheduling around any temporary disruption of flight activities in the area of operation and provide notice of unanticipated or temporary changes to components of, or hazards in, the NAS. The FAA issues a NOTAM at least 24 hours prior to a launch or reentry activity in the airspace to notify pilots and other interested parties of temporary conditions. Advance notice via NOTAMs and the identification of AHAs would assist pilots in scheduling around any temporary disruption of flight activities in the area of operation to reduce risk to human safety.

While adhering to these safety measures and procedures and EPMs described in Section 3.14.2.5, there would not be significant impacts on human health and safety as a result of the Proposed Action due to launch and landing operations.

3.14.2.1.2 SLC-6 Modifications

Modifications to SLC-6 would expose construction workers to hazards associated with C&D activities, including explosives. Potential hazards include the potential for trips, slips, falls, and vehicular accidents. Other potential biological hazards include spider and snake bites, disease vectors, and attacks from wild animals. Construction workers may also be exposed to hazardous materials and hazardous waste. Health and safety guidelines that would be followed in the handling and transportation of hazardous materials and waste are described in Section 3.15.

To minimize potential adverse impacts from biological hazards and physical hazards, awareness training would be incorporated into the worker health and safety protocol. Contractors would be required to develop a site-specific safety plan that would address these potential hazards. Daily safety briefings would be conducted and workers would be expected to comply with federal OSHA and AFOSH regulations. SpaceX would coordinate with SLD 30/SEL to ensure SLD 30 policies are incorporated into the site safety plan. The proposed construction areas are not within a known Military Munitions Response Program (MMRP)/unexploded ordnance (UXO) area; however, UXO may be encountered anywhere on Base. Therefore, the safety program would include coordinating with the AFCEC/Environmental Management Operations MMRP manager and contacting the SLD 30 Weapons Safety Office. Site security requirements detailed in Section 3.14.1.5 would be implemented with any facility modifications.

Prior to start of any renovation or demolition work, an asbestos survey would be completed and a lead survey may be required if existing survey results cannot be used. Prior to project start, all regulatory notifications and abatement plans would be approved by the SLD 30 Installation Environmental Management Office. A copy of the approved SBCAPCD Notification for Renovation and Demolition form ENF-28 would also be provided to the SLD 30 Installation Environmental Management Office.

SpaceX and its contractor(s) would be responsible for industrial hygiene and ground safety during SLC-6 construction and modification operations. Renovation activities require permits and are regulated by 40 CFR Part 61 the National Emission Standards for Hazardous Materials, SBCAPCD, and authorization by the SLD 30 Installation Environmental Management Office. Other regulations affecting projects are 40 CFR Part 763, and OSHA and California OSHA asbestos standards in 29 CFR Parts 1910, 29 CFR 1926, and California Code of Regulations (CCR), Title 8. Industrial hygiene responsibilities include monitoring exposure to workplace chemicals, radiation, and physical hazards; hearing and respiratory protection; medical monitoring of workers subject to chemical exposures; and overseeing all hazardous or potentially hazardous operations. Additional precautions would be taken to provide personnel guidance and appropriate countermeasures on infectious disease containment, planning, and emergency response procedures. Ground safety responsibilities include protection from hazardous situations and hazardous materials.

Because of conditions detailed in Section 3.14, persons participating in SpaceX construction activities at SLC-6 may potentially be exposed to hazardous materials, primarily POLs, which would be used to operate heavy equipment during construction activities under the Proposed Action. Unexpected releases of these POLs would generate hazardous waste. DOT-certified commercial transporters would convey hazardous material used in or resulting from the Proposed Action. Transporting these materials is discussed in Section 3.14.

Explosive safety zones would be established from 75 to 5,000 ft around locations where explosives used for demolition would be stored and an evacuation zone would be established prior to deploying and detonating explosives during the demolition process to protect personnel from potential explosive hazards.

While complying with industrial and ground safety procedures detailed above and in Section 3.14.1 and EPMs described in Section 3.14.2.5, there would be no significant impacts on Human Health and Safety from the construction activities at SLC-6 under the Proposed Action.

3.14.2.2 Alternative 1

Operations under Alternative 1 would be the same as the Proposed Action and would generate the same types and levels of impacts on human health and safety as discussed in Section 3.14.2.1. The only difference between Alternative 1 and the Proposed Action is the construction of a new hangar, which would result in no differences in terms of impacts on human health and safety as a result of different construction footprints. Therefore, Alternative 1 would not result in significant impacts on human health and safety.

3.14.2.3 No Action Alternative

Under the No Action Alternative, modifications of SLC-6 and increased Falcon launch cadence on VSFB would not occur, resulting in no impacts on human health and safety beyond those described in the 2024 EA. The No Action Alternative effects analysis considers the potential effects associated with reasonably foreseeable actions (Table 3.2-3), without consideration of the Proposed Action because these actions would still occur under the No Action Alternative. Increased launches would incrementally increase the potential for health and safety effects given that health and safety risks are an inherent component of launch and landing activities. However, the probability of an off-nominal event is very low. DAF, the FAA, and launch providers conduct robust risk assessments and implement health and safety processes to identify and manage risk. The effects of an off-nominal event are directly related to the size and type of launch vehicle, as well as the trajectory of the vehicle and location of the event. As a result, effects on health and safety are difficult to anticipate considering the different launch providers, associated vehicles, and launch locations. However, implementation of standard health and safety protocols, along with Federal, state, and local agency coordination and emergency response capabilities minimize the risk of health and safety effects.

3.14.2.4 Cumulative Effects

The Proposed Action, Alternative 1, and other concurrent projects on VSFB could result in increased risks to human health and safety. Implementing the Proposed Action or Alternative 1 and other similar actions at VSFB would slightly increase the short-term risk associated with personnel performing work at project locations. SLD 30 has developed hazardous areas that constrain project sites to ensure the health and safety of workers (Section 3.14); these hazard areas have been in use for decades' worth of launch and military activities and applied to many on-base projects. DOD and DAF emergency management readiness and response to public health and safety issues are detailed in DODI 6055.17, DODI 6200.03, AFI 10-2519, and AFI 10-2501. These DOD and DAF instructions have been established for a wide variety of DOD operations and projects and require compliance to mitigate impacts on human health and safety. Any potential contractors would be required to establish and maintain safety programs that would provide protection to their workers and limit the exposure of personnel to work hazards. The safety program would include coordination with the AFCEC MMRP manager and contact with the weapons safety specialist for SLD 30 for information on DAF and SLD 30 policies on UXO safety for construction work at VSFB. Projects on VSFB are regulated by the same policies

and processes to prevent significant impacts on human health and safety from launch activities, weapons testing, and other military actions on VSFB. By implementing the required safety measures, there would be no significant cumulative impacts resulting from the Proposed Action and other anticipated projects. Therefore, implementation of the Proposed Action or Alternative 1 with other past, present, or reasonably foreseeable projects would not result in significant cumulative effects on human health and safety.

3.14.2.5 Mitigation and Monitoring

Implementing the EPMs outlined below would avoid or minimize potential adverse effects to human health and safety during the Proposed Action. Qualified SpaceX personnel or contractor staff would oversee fulfilling EPMs.

- Comply with OSHA, AFOSH, California Division of Occupational Safety and Health regulations, and other recognized standards and applicable DAF regulations or instructions.
- 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 individual to act as safety officer who would be the POC on all problems involving job site safety.
- 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.

3.15 Hazardous Materials and Waste Management

3.15.1 Affected Environment

3.15.1.1 Regulatory Setting

Hazardous materials and wastes are those substances defined as hazardous by the Comprehensive Environmental Response, Compensation, and Liability Act (42 USC Chapter 103), as amended by the Superfund Amendments and Reauthorization Act (26 USC Section 9507); the Environmental Health Standards for the Management of Hazardous Waste (CCR Title 22); the Toxic Substances Control Act (15 USC Sections 2601–2671); the Solid Waste Disposal Act (42 USC Section 6903), as amended by the Resource Conservation and Recovery Act (RCRA; 42 USC Sections 6901-6992); and as defined in Title 8 CCR Section 5161. In addition, federal and state OSHA regulations govern protecting workplace personnel. In general, the definitions within the citations include substances that, because of their quantity, concentration, or physical, chemical, or infectious characteristics, may present substantial danger to public health and welfare, to workers, or to the environment.

3.15.1.2 Region of Influence

The ROI for hazardous materials and waste management resources includes all areas where hazardous materials are used or waste is generated associated with demolition, construction, and launch operations at SLC-4 and SLC-6.

3.15.1.3 Hazardous Materials

Hazardous materials are compounds with the potential to harm human health and the environment through improper use, treatment, transportation, storage, or disposal in commercial, military, and industrial applications. They are harmful to life due to their concentrations and amounts, or physical and chemical attributes. Component hazardous materials, or hazardous constituents, are hazardous materials with low concentrations that would not cause acute adverse effects. Hazardous constituents are present in propellants, batteries, fuels, hydraulic fluids, and munitions, and may harm human and environmental health through water, soil, or air contact.

Operations at VSFB require military personnel and on-Base contractors to use hazardous chemicals in varying quantities throughout the Base. Using hazardous material on VSFB is regulated by the Hazardous Materials

Management Process (HMMP; DAF 2020b), per DAFMAN 32-7002, Environmental Compliance and Pollution Prevention (P2), and 40 CFR Part 112, Spill Prevention, Control, and Countermeasure Plan. Emergency response procedures for hazardous materials spills are established in SLD 30's Installation Management Plan (SLD 30 Plan 10-2). SpaceX has prepared its own Emergency Response Plan per the SLD 30 Installation Management Plan. This Plan ensures that adequate and appropriate guidance, policies, and protocols regarding hazardous material incidents and associated emergency response are available to and followed by all installation personnel and commercial entities. For a spill, SpaceX would also be responsible for completing a Community Awareness and Emergency Response reporting form per local Santa Barbara County hazardous material and hazardous waste spill reporting requirements.

Hazardous materials such as propellants, ordnance, chemicals, and other hazardous material payload components must be transported to and on VSFB per DOT regulations for interstate and intrastate shipment of hazardous materials (Title 49 CFR Parts 100–199).

3.15.1.4 Hazardous Waste

Substantial human and environmental risks may be present when hazardous waste is improperly used, stored, transported, or disposed. Under DAF and SpaceX operations, hazardous waste management complies with RCRA Subtitle C (40 CFR Parts 260-273) and with California Hazardous Waste Control Laws as administered by the California Environmental Protection Agency Department of Toxic Substances Control (22 CCR Section 66260.10; 8 CCR Section 5192). These regulations require that hazardous wastes be handled, stored, transported, disposed of, or recycled according to defined procedures. The SLD 30 Hazardous Waste Management Plan (HWMP; SLD 30 Plan 32-7043-A; DAF 2022b) details hazardous waste packaging, turn-in, transportation, storage, recordkeeping, and emergency procedures. SpaceX follows all federal, state, and local laws regulating generating, storing, transporting, and disposing hazardous waste for current operations at SLC-4 and SLC-6 would continue to do so. SpaceX has also obtained a USEPA Generator identification number to manage and dispose of hazardous waste generated from its site operations on VSFB.

3.15.1.5 Environmental Restoration Program at Vandenberg Space Force Base

In 1975, DOD facilities began implementing the Installation Restoration Program (IRP). The IRP was established under the Defense Environmental Restoration Program (ERP) to identify, characterize, and restore hazardous substance release sites, and provide a method of management under Section 211 of Comprehensive Environmental Response, Compensation, and Liability Act of 1980. The ERP is comprised of three programs: IRP, MMRP, and building demolition and debris removal (AFI 32-7020). Once areas and constituents have been identified, the IRP is tasked to remove or monitor the hazards in an environmentally responsible manner. IRP sites are remediated through the Federal Facilities Site Remediation Agreement, a working agreement between the DAF and the RWQCB Central Coast Region and the Department of Toxic Substances Control Region 3. In addition to IRP sites, there are identified Areas of Concern (AOC), where potential hazardous substances are suspected; and Areas of Interest (AOI), defined as areas with the potential for use or presence of a hazardous substance. To ensure the health and safety of personnel on VSFB, an analysis of MMRP and IRP sites, including AOCs and AOIs, within the ROI at SLC-4 was performed in Sections 3.8.5 and 4.8.1.3 of the 2016 EA (DAF 2016). Four IRP sites (AOC-089, AOC-090, and AOC-203) are associated with SLC-6. Since all AOCs and AOIs within the ROI have been closed, they are not carried forward for analysis.

3.15.1.6 Military Munitions Response Program

The MMRP was established to address UXO, discarded military munitions, and munitions constituents located on current and former defense sites (10 USC Section 2710). No construction activities are proposed at SLC-4 and no MMRP sites are located on or adjacent to SLC-6. Therefore, this resource is not carried forward for analysis.

3.15.1.7 Storage Tanks

Eight above ground storage tanks (ASTs) were identified at SLC-6 during a May 2023 Environmental Baseline Survey (EBS; ULA 2023). At the time of the visual inspection surveys, no oil staining was observed associated with the ASTs. A description and location for each AST is provided in Table 3.15-1.

Table 3.15-1. Existing ASTs at SLC-6

Location	Size/Contents	Function	Containment
B380	600-gallon diesel	backup generator	double-walled belly tank
B399	1,413-gallon diesel	backup generator	double-walled belly tank
B395B	900-gallon diesel	backup generator	double-walled belly tank
B390T	(2) 240-gallon gasoline	fuel storage	concrete double containment
B390T	(2) 200-gallon, (1) 125-gallon diesel	portable tanks for operations	concrete single-walled
B381	800,000-gallon LH2	Propellant	N/A
B382	300,000-gallon LO2	Propellant	N/A
B566	90,000-gallon LOX	Propellant	N/A

One propane underground storage tank (UST) was located at Building 393B. At the time of a 2005 Phase I environmental site assessment, this tank reportedly had been inactive for several years and was the responsibility of the DAF (Geomatrix Consultants, Inc 2005). Based on the nature of propane (i.e., gas at normal temperature and pressure), this UST is not considered a significant environmental concern (ULA 2013). All other USTs at SLC-6 are no longer present (ULA 2013). None of the USTs or ASTs discussed above would be impacted by the Proposed Action, therefore they are not considered further.

3.15.2 Environmental Consequences

Factors considered in determining if implementing an alternative may have significant adverse impacts on hazardous materials and waste management include the extent or degree to which implementing an alternative would result in non-compliance with applicable regulatory requirements; or human exposure to hazardous materials and wastes, or environmental release above permitted limits. The FAA has not established a significance threshold for hazardous materials and P2. Potential impacts resulting from hazardous materials and hazardous waste are evaluated using federal, state, and local regulatory requirements, contract specifications, and Base operating constraints, as outlined in Section 3.14.2. Non-compliance with applicable regulatory requirements, human exposure to hazardous materials and wastes, or environmental release above permitted limits, would be considered adverse impacts.

3.15.2.1 Proposed Action

Compliance with all pertinent federal, state, and local laws and regulations, and applicable DAF and SLD 30 plans would govern all actions associated with implementing the Proposed Action and would minimize the potential for significant impacts. Launch support operations would use a small amount of products containing hazardous materials, including POLs, paints, solvents, oils, lubricants, acids, batteries, and chemicals. SpaceX would also generate a small number of waste tires each year through RORO operations and other pad support equipment during routine launch support. Payload processing would generate a small amount of empty containers, spent solvents, waste oil, spill cleanup materials (if used), and lead-acid batteries.

Fuels (i.e., RP-1) and oxidizers (i.e., LOX) would be the most significant hazardous materials onsite during operations. Propellent (LOX and RP-1) quantities used for launch vehicles would also increase under the Proposed Action. However, most of the hazardous materials would be consumed prior to landing. Although the Proposed Action would increase the number of launches and landings that occur at the site, the probability of a launch anomaly that releases debris and hazardous materials would decrease. Any launch anomalies would be subject to the guidance, policies, and protocols regarding hazardous material incidents and associated emergency response described in SpaceX's Anomaly

Response Plan. SpaceX would respond to any accidental releases of polluting substances quickly and implement appropriate clean-up measures in accordance with applicable laws to minimize impacts on the environment. Loading and unloading operations would take place over appropriately designed and sized containment basins, with spill prevention and emergency response procedures in place. Proper handling practices of liquid fuels would adhere to 14 CFR Section 420.67 (*Separation distance requirements for handling incompatible energetic liquids that are co-located*) for liquid fuels and limit the risk of hazardous material releases due to leaking storage tanks, tanker trucks, delivery lines, or other infrastructure.

SpaceX would continue to identify, label, and accumulate any hazardous wastes IAW all applicable federal, state, and local regulations. Hazardous materials and wastes would be properly contained, manifested, and managed per applicable federal, state, and local regulations, AFIs, DAFMANs, DOD Directives, the site-specific health and safety plan, and associated EPMs. Accidental releases of POLs from vehicles, equipment, and transformer leaks would generate hazardous wastes, resulting in potential adverse impacts on the ROI. All hazardous wastes and spills would be properly managed and disposed of per applicable federal, state, and local hazardous waste regulations and the HWMP (DAF 2022b). Hazardous materials and waste management regulations would follow procedures outlined in the HMMP (DAF 2020b) and the HWMP DAF (2022b). SpaceX and any contractors working at the site would make all reasonable and safe efforts to contain and control any spills or releases that may occur. For a spill or accidental release, SpaceX would implement an Emergency Response Plan and complete a Community Awareness and Emergency Response reporting form per local Santa Barbara County hazardous material and hazardous waste spill reporting requirements.

To protect water resources, any potentially contaminated wastewater would be collected, analyzed, and disposed of per CCR Title 22 & Title 27, Division 2, and the RWQCB General Waiver for Specific Discharges. Additional EPMs described in Section 3.15.2.5 would further ensure that the Proposed Action would not have a significant impact on water resources. During construction at SLC-6 human sewage would be collected in temporary on-site portable toilets subject to spill-prevention EPMs and serviced by a commercial contractor. The amount of hazardous materials needed and the waste generated by the Proposed Action would have little to no impact on waste processing capacity. An array of operations occur on VSFB and multiple contractors are available to handle and dispose of hazardous wastes at permitted facilities. Before implementing the construction or operations at SLC-6, SpaceX would prepare a hazardous material Spill Prevention and Response Plan and obtain 30 CES/CEI concurrence.

The relatively small amounts of hazardous materials needed and the waste generated by the Proposed Action would have little to no impact on waste processing capacity. The EPMs described in Section 3.15.2.5 would be implemented. Therefore, the Proposed Action would not have a significant impact due to using and generating hazardous materials and hazardous wastes. With adherence to existing policies and procedures as outlined in the applicable federal, state, and local regulations, as well as the EPMs described in Section 3.15.2.5, impacts from using hazardous materials associated with the Proposed Action would not be significant.

3.15.2.2 Alternative 1

Operations under Alternative 1 would be the same as the Proposed Action and would generate the same types and levels of impacts on hazardous materials and waste management as discussed in Section 3.15.2.1. The only difference between Alternative 1 and the Proposed Action is the construction of a new hangar, which would result in no differences in terms of impacts on hazardous materials and waste management as a result of different construction footprints. Therefore, Alternative 1 would not result in significant impacts on hazardous materials and waste management.

3.15.2.3 No Action Alternative

Under the No Action Alternative, modifications of SLC-6 and increased Falcon launch cadence on VSFB would not occur, resulting in no impacts on hazardous materials and waste management beyond those described in the 2024 EA. Under the No Action Alternative, the reasonably foreseeable actions listed in Table 3.2-3 would still occur. Therefore,

these potential effects of these actions are considered in the effects analysis of the No Action Alternative, without consideration of the Proposed Action. Numerous types of hazardous materials are used to support operations across VSFB. Management of hazardous materials and the resultant hazardous waste is the responsibility of each individual or organization and is regulated under RCRA. Outside of VSFB, hazardous waste generating facilities are regulated by the California Department of Toxic Substances Control and Certified Unified Program Agencies to ensure that environmental effects are minimized to the extent practicable.

3.15.2.4 Cumulative Effects

Past, present, and future projects on VSFB are subject to the same protocols and procedures for the management of hazardous materials and waste. In addition to federal, state, and local rules, installation management of any hazardous materials would occur by complying with Base-specific manuals and protocols such as the HMMP, the Hazardous Materials Emergency Response Plan, and the Integrated Solid Waste Management Plan (ISWMP). Slight variances in protocols may occur in contractors' or project proponents' project-specific Emergency Response Plan as it pertains to the unique requirements and processes of individual proposed actions. Additionally, EPMs described in Section 3.15.2.5 would be implemented to minimize impacts on hazardous materials or hazardous waste management from similar proposed actions. Impacts on hazardous materials and waste management from launch activities, weapons testing, and other military actions on VSFB are closely monitored and controlled by the same policies and procedures to ensure impacts are mitigated or minimized and do not result in significant cumulative detrimental effects on hazardous materials and waste management resources. Therefore, implementing the Proposed Action or Alternative 1 with other past, present, or reasonably foreseeable projects would not result in significant cumulative effects on hazardous materials and waste management.

3.15.2.5 Mitigation and Monitoring

Implementing the EPMs outlined below would avoid or minimize potential adverse effects to hazardous materials and waste management during the Proposed Action. Qualified SpaceX personnel or contractor staff would oversee fulfilling EPMs.

- 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 IAW manufacturer's specifications to avoid accidental exposure to or release of hazardous materials required to operate and maintain equipment.
- All equipment would be properly maintained and free of leaks during operation 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.
- SpaceX would ensure employees and contractor staff are trained in proper prevention and cleanup procedures.
- SpaceX 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.
- Per 40 CFR Part 112, Spill Prevention, Control, and Countermeasure Plan, SpaceX would place chemicals, drums, or bagged materials on a pallet and, when necessary, secondary containment.
- All aboveground oil or fuel tanks and containers 55 gallons or greater shall be reported to the tank manager at (805) 605-0342. All tanks and containers must be doubled-walled or constructed with secondary containment at minimum of 110 percent of the total capacity. Please contact SLD 30 Tank Manager at 605-0342 for questions.

3.16 Solid Waste Management

3.16.1 Affected Environment

3.16.1.1 Regulatory Setting

Solid waste management on VSFB is directed by DODI 4715.23, Integrated Recycling and Solid Waste Management, and implemented in SLD 30's ISWMP (USSF 2022). AFMAN 32-7002, Environmental Compliance and Pollution Prevention, details requirements and programs that installations must comply with to successfully divert as much solid waste as economically feasible. The SLD 30 ISWMP requires source segregation of recyclable materials to the greatest extent possible. In 1989, the California Integrated Waste Management Act (Assembly Bill [AB] 939) has a policy goal of a 50 percent reduction of the quantity of solid waste disposed of in California landfills from a 1990 baseline, to be accomplished by 1 January 2000. To bolster the positive effects of AB 939, the Mandatory Commercial Recycling Regulation (AB 341) became law in 2012 and has a policy goal of CalRecycle to increase statewide solid waste diversions to 75 percent by 2020. The DOD Strategic Sustainability and Performance Plan listed a solid waste diversion goal of 50 percent and a C&D debris diversion rate of 60 percent. The DAF is committed to achieving these goals.

3.16.1.2 Region of Influence

The ROI for solid waste management is VSFB. The regulatory environment for solid waste management establishes control of solid waste and promotes P2 associated with the Proposed Action. Solid waste is generally defined as any discarded material that is not characterized by other specific regulatory requirements detailed in the RCRA (40 CFR Part 261.2). Solid waste is subject to corrective action under RCRA (42 USC Section 6901 et seq.). The regulatory environment for solid waste management reflects comprehensive federal, state, and local approaches to minimize waste generation and increase reuse and recycling.

3.16.1.3 Construction and Demolition Debris

The State of California passed Senate Bill 1374 on 12 September 2002, amending the Public Resources Code, Section 42912, which addresses the issue of C&D debris, diversion requirements, and the development of a model ordinance to be implemented by local jurisdictions (e.g., Santa Barbara County). Santa Barbara County Code of Ordinances stipulates that 50 percent of C&D debris must be recycled (Ordinance No. 4689, Section 1). EO 13693 Section 3(j)(iii) mandates the diversion of at least 50 percent of non-hazardous C&D materials and debris by Federal agencies.

3.16.1.4 Pollution Prevention

The Pollution Prevention Act of 1990 (42 USC Sections 13101-13109) focused the national approach to environmental protection toward P2. Implementing the DAF Environmental Management System (EMS; DODI 4715.17) carries P2 a step further toward mission sustainability principles. The P2 program is detailed in the SLD 30 HMMP and is aimed at achieving SLD 30 EMS objectives and targets, through documented practices, procedures, and operational requirements. SLD 30 implements EMS and its associated P2 program elements by the P2 hierarchy: 1) Reduce (source reduction to prevent the creation of wastes); 2) Reuse (keep item or material for its intended purpose); 3) Recycle (use item or material for some other beneficial purpose); and 4) Disposal (in an environmentally compliant manner, only as a last resort).

3.16.2 Environmental Consequences

Solid waste impacts are evaluated using federal, state, and local laws and regulations; permit conditions; and contract specifications. Adverse impacts would occur from noncompliance with applicable regulatory requirements or an increase in the amount of waste disposal that would exceed available waste management capacities. The FAA has not established a significance threshold for solid waste and pollution prevention.

3.16.2.1 Proposed Action

Solid waste generated during demolition would primarily include concrete, asphalt, and metal, much of which is recyclable. Construction wastes would include packing materials (cardboard and plastic), scrap materials (rebar, wood, pipes, wiring), and miscellaneous waste generated by onsite construction workers. Contractors would be responsible for the disposal or recycling of all waste generated during the scope of the construction. During launch operations and facilities maintenance, solid waste (e.g., cardboard packaging, wood, rags, plastic and aluminum bottles and cans) would be disposed of on a routine basis. Solid waste would be collected in on-site refuse containers and transported to the Santa Maria Transfer Station for waste disposal, diversion, and recycling. Solid waste would be minimized by strict compliance with VSFB's ISWMP. All materials that are disposed of off-base would be reported to the CEI Solid Waste Manager. The Santa Maria Regional Landfill would receive waste for disposal. Under the Proposed Action construction would cause a temporary increase in the quantity of solid waste generated on VSFB. However, the current remaining capacity of the landfill is 1,477,580 tons with a weekly throughput limit of 6,006 tons (CalRecycle 2023). The City of Santa Maria has also initiated development of a new landfill, the Santa Maria Integrated Waste Management Facility (Facility No. 42-AA-0076), located approximately eight mi southwest of the City of Santa Maria. The new facility would have a design capacity of approximately 131 million cubic yards of waste with an estimated closure date of 2105 (City of Santa Maria 2021). Therefore, there is adequate capacity to accommodate a temporary increase in solid waste generated during C&D associated with the Proposed Action, as well as the solid waste that would be generated during launch operations.

During C&D at SLC-6, sewage would be collected in temporary on-site portable toilets subject to spill-prevention EPMs and serviced by a commercial contractor. Before implementing the Proposed Action, the contractor would prepare a hazardous material Spill Prevention and Response Plan.

Compliance with all applicable federal, state, local laws, and regulations, applicable SLD 30 plans and policies, and EPMs (Section 3.16.2.5), would govern all aspects of the Proposed Action, and would avoid or minimize potential impacts related to solid waste or pollution prevention. Therefore, the Proposed Action would not have a significant impact on solid waste management.

3.16.2.2 Alternative 1

Operations at SLC-4 and SLC-6 and C&D activities at SLC-6 under Alternative 1 would be the same or similar as the Proposed Action and would generate the same types and amounts of solid wastes as discussed Section 3.16.2.1. The only differences between Alternative 1 and the Proposed Action would be the use of the existing HIF versus construction of a new hangar. These alternatives would generate similar amounts of solid wastes. Therefore, impacts associated with solid waste from the Proposed Action under Alternative 1 would not be significant.

3.16.2.3 No Action Alternative

Under the No Action Alternative, modifications of SLC-6 and increased Falcon launch cadence on VSFB would not occur, resulting in no impacts on solid waste management beyond those described in the 2024 EA. Reasonably foreseeable actions (Table 3.2-3) would still occur under the No Action Alternative. These actions are therefore considered without the Proposed Action in the effects analysis of the No Action Alternative. As discussed further in Section 3.16.2.4, local landfills are anticipated to have adequate capacity to process potential increases in solid waste. It is expected that reasonably foreseeable actions would comply with all Federal, state, and local regulations regarding solid waste management.

3.16.2.4 Cumulative Effects

The cumulative projects listed above, including the Proposed Action and Alternative 1, would result in an overall increase in solid waste generation produced during the increased launch operations. All operations and activities on VSFB are required to comply with all applicable federal, state, local laws, and regulations, and applicable SLD 30 plans. Local

landfills have adequate capacity to process the projected temporary increases in solid waste, especially with the development of the Santa Maria Integrated Waste Management Facility. Therefore, with adhering to disposal and recycling requirements and EPMs described in Section 3.16.2.5, implementation of the Proposed Action or Alternative 1 would not have a significant cumulative effect on solid waste management.

3.16.2.5 Mitigation and Monitoring

Implementing the EPMs outlined below would avoid or minimize potential adverse effects to solid waste during the Proposed Action. Qualified SpaceX personnel or contractor staff would oversee fulfilling EPMs. Solid waste would be minimized by strict compliance with SLD 30's Integrated Solid Waste Management Plan (DAF 2015).

- All materials that are disposed of off Base would be reported to the SLD 30 Solid Waste Manager.

3.17 Geology and Soils

3.17.1 Affected Environment

3.17.1.1 Regulatory Setting

Geological resources include the geology, soils, and seismicity of a particular area. The following federal regulations and policies are relevant to the analysis of geological resources: Farmland Protection Policy Act (7 USC Section 4201); Earthquake Hazards Reduction Act of 1977 (42 USC Section 7701 et seq.); and the Unified Facilities Criteria (UFC) (e.g., UFC 3-220-01, *Geotechnical Engineering*, UFC 3-310-04, *Seismic Design of Buildings*, and UFC 3-220-10N, *Soil Mechanics*).

3.17.1.2 Region of Influence

The ROI for geology and soils is any area where ground-disturbing activities would take place. Here, this would be where construction activities would occur at SLC-6 (Figure 2.1-7) and within the adjacent proposed site of the landing zones (Figure 2.1-8).

3.17.1.3 Geology

VSFB is located in a geologically complex area in the transition zone between the Southern Coast Range and Western Transverse Range Geomorphic Provinces. Marine sedimentary rocks of the Late Mesozoic age (140 to 70 million years before present [BP]) and Cenozoic age (70 million years BP to the present) underlie VSFB (Dibblee 1950).

VSFB is in Seismic Hazard Zone 4, as defined by the Uniform Building Code, which is the most severe seismic region and is characterized by areas likely to experience earthquakes of a magnitude of seven or higher on the Modified Mercalli Scale and to consequently sustain major damage from earthquakes. Numerous onshore and offshore faults have been mapped in the vicinity of VSFB Four major faults have been mapped on VSFB: the late quaternary Lion's Head fault on north VSFB and the quaternary Hosgri fault zone, late quaternary Santa Ynez River, and late quaternary Honda Fault on south VSFB. Other potential geologic hazards at VSFB may include surface erosion, landslides, seacliff retreat, streambank erosion, tsunamis, and liquefaction, although the California Geological Survey has not assessed the area for risk of earthquake-induced landslides or liquefaction at this time. The fault closest to SLC-6 is the east-west–trending Honda Fault, approximately 1.5 mi north of SLC-6(California Department of Conservation 2025).

3.17.1.4 Soils

The primary soils underlying SLC-6 identified by the United States Department of Agriculture Soil Conservation Service are Marina soil with deep to moderately deep, moderately well to well drained, and moderate infiltration rates. Marina soils have high hydraulic conductivity and low water holding capacity, with a depth to water generally greater than six ft bgs. These soils are not classified as hydric and have a low corrosion potential on uncoated steel.

3.17.2 Environmental Consequences

3.17.2.1 Proposed Action

The Proposed Action would increase the extent of impervious areas at SLC-6 and the adjacent proposed Landing Zones. Activities with the potential to impact geology and soils would largely be associated with the removal of existing structures and construction of new structures (Figure 2.1-7). However, this area is largely previously disturbed from past construction activities and proposed soil disturbance is anticipated to be shallow. Vegetation would be removed and impervious structures installed at the site of the proposed Landing Zones (Figure 2.1-8). Vegetation would also be removed from the proposed firebreaks (Figure 2.1-9).

Coverage under the NPDES Construction General Permit is required, and the DAF would prepare a SWPPP in accordance with this permit. The SWPPP would include erosion control measures. BMPs would also be implemented during ground-disturbing activities, and the EPMs detailed in Section 3.7.2.5 would be implemented. Project C&D would be designed to comply with seismic design standards as specified in AFSPCMAN 91-710, Range Safety Requirements. The 1998 Boeing EELV Phase I Environmental Baseline Survey reported that groundwater in the vicinity of SLC-6 was 70 to 130 ft bgs, with shallower perched groundwater units above these zones (URS Corporation 2002). Since the area has a deep water table and Marina soil does not retain water, potential hazards due to liquefaction are not anticipated. As a result, no long-term or significant impacts on geological resources from the Proposed Action are anticipated.

3.17.2.2 Alternative 1

C&D activities at SLC-6 under Alternative 1 would be the same or similar as the Proposed Action and would generate the same types of disturbance to geological resources as discussed in Section 3.17.2.1. The only differences between Alternative 1 and the Proposed Action would be the use of the existing HIF versus the construction of a new hangar. The construction of a new hangar would also implement a SWPPP, BMPs, and EPMs listed in Section 3.7.2.5 to reduce erosion and impacts on geology and soil resources during construction. The new hangar would also be designed to comply with seismic design standards as specified in AFSPCMAN 91-710, Range Safety Requirements. Therefore, potential impacts on geological resources under Alternative 1 would not be significant.

3.17.2.3 No Action Alternative

Under the No Action Alternative, modifications of SLC-6 and increased Falcon launch cadence on VSFB would not occur, requiring no C&D activities and therefore resulting in no impacts on geological resources. No Action effects analysis considers potential effects associated with reasonably foreseeable actions (Table 3.2-3) without consideration of the Proposed Action, because these actions would still occur under the No Action Alternative. The No Action Alternative would not result in effects to geological resources outside of those experienced routinely by development projects and general seismic activity within California.

3.17.2.4 Cumulative Effects

Cumulative projects within the ROI that involve grading, excavations, construction, or demolition could result in erosion-induced sedimentation of adjacent drainages and water bodies. The soils in the ROI have been altered over time and much of the project site is permanently disturbed with existing infrastructure and paved surfaces. Potential cumulative effects would include an increase in soil disturbance associated with construction, substantially increased erosion, landslides, soil creep, mudslides, and unstable slopes. These impacts would be minimized by the use of BMPs to minimize soil erosion and reduce fugitive dust. Erosion-induced sedimentation of surface drainages could occur as a result of cumulative projects at VSFB.

All projects located in the ROI are subject to seismically induced ground shaking due to frequent earthquakes on local or regional faults. By incorporating modern construction engineering and safety standards, all adverse seismic-related impacts at the project site, as well as the projects in the region should be avoided. Therefore, implementation of the

Proposed Action or Alternative 1 in conjunction with other past, present, or reasonably foreseeable projects would not result in cumulative effects on geological resources.

3.17.2.5 Mitigation and Monitoring

In the absence of significant effects, no mitigation or monitoring measures have been identified for this resource. However, the EPMs that would be implemented for water resources, described in Section 3.7.2.5 would reduce erosion and impacts on geology and soil resources during construction.

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