CALIFORNIA COASTAL COMMISSION
455 MARKET STREET, SUITE 300
SAN FRANCISCO, CA 94105-2219
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Th9a

CD-0007-24 (United States Space Force)

October 10, 2024

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Figure 1-1: Regional Location of Proposed Action Area

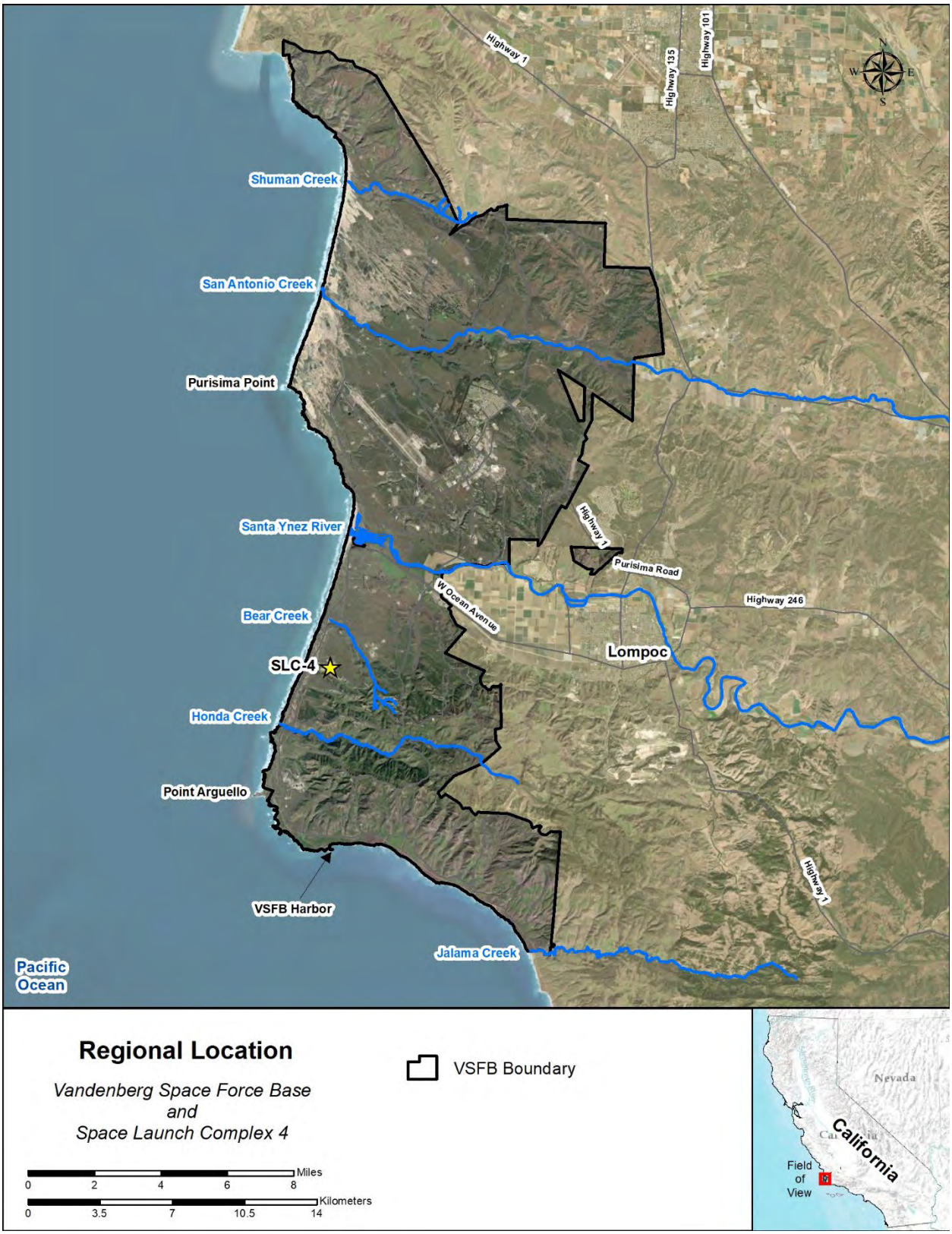


Exhibit 1
CD-0007-24

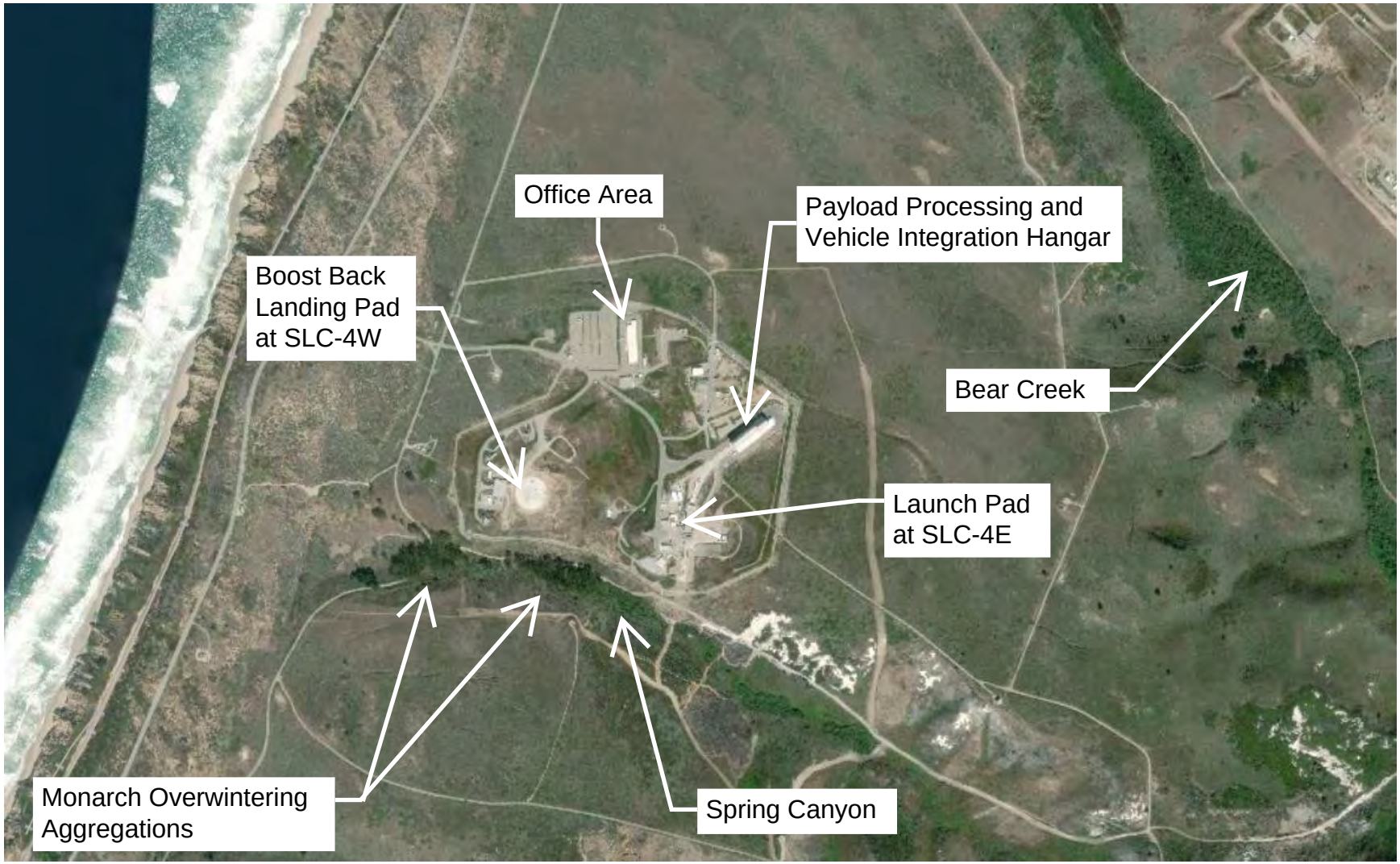


Exhibit 2
CD-0007-24

SPACEX

Cassidy Teufel
Deputy Director
California Coastal Commission
455 Market Street, Suite 228
San Francisco, CA 94105

Dear Mr. Teufel:

SpaceX is in receipt of your August 28, 2024, email directing SpaceX to move forward with a coastal development permit (CDP) application.

SpaceX is committed to working with the Department of Air Force (DAF) and the Commission on the protection of coastal resources. However, consistent with the DAF's longstanding and statutorily based determination that Vandenberg Space Force Base's (VSFB) space launch program is federal agency activity that is not subject to the Coastal Management Program's CDP requirement, it would not be proper for SpaceX to seek a CDP for Falcon 9 launches from VSFB.

As you are aware, the DAF determined that the proposal to increase the launch cadence out of VSFB of Falcon's launch program to 36 launches a year is fully consistent with the enforceable policies of the California Coastal Management Program. Since August 8, 2024, when the Commission adopted a staff report that concurred in DAF's consistency determination subject to all seven additional conditions, it is our understanding that DAF continues to engage with the Commission to discuss potential alternative mitigation measures that could be implemented from those objected to by DAF. Additionally, on August 28, 2024, the U.S. Fish and Wildlife Service issued a Biological Opinion that requires further robust monitoring related to this federal activity. Given these developments, and to address the Commission's concerns, SpaceX is currently consulting with DAF regarding next steps, including measures SpaceX would help DAF implement.

But SpaceX agrees with DAF that commercial space launches from VSFB are federal agency activities that are not subject to the California Coastal Management Program's CDP requirement. The Commission's attempt to prohibit Falcon 9 launches from VSFB absent a CDP issued under state law conflicts with the limited role the CZMA provides the Commission with respect to review of federal agency activity. The CZMA requires federal agencies to consult with coastal states in making determinations that a proposed federal agency activity is consistent with enforceable policies of the states' coastal management programs. But the CZMA allows a federal agency to proceed with a federal agency activity—here, VSFB's Falcon launch program—over a state's objections, provided the agency determines the activity is "consistent to the maximum extent practicable" with the enforceable policies of that state's coastal management program. 16 U.S.C. § 1456(c)(1)(A); 15 C.F.R. § 930.43. Here, DAF has determined that the Falcon launch program is consistent with the enforceable policies of the California Coastal Management Program.

Falcon 9 is the most reliable, reusable, economical rocket ever created, and is the workhorse of the national space program. A robust Falcon 9 launch schedule at VSFB is integral to ensuring "the availability of rapid, responsive, and reliable space launches for national security space programs" as required under the 2002 National Defense Authorization Act. We sincerely hope that the parties can find an amicable resolution that allows for continued protection to coastal resources while ensuring that DAF can maintain a robust launch program at VSFB that is capable of rapidly serving U.S. national security interests and meeting national space policies.

Respectfully,

Sheila McCorkle

Sheila McCorkle
Vice President, Launch Legal and Regulatory Affairs

Exhibit 3
CD-0007-24

CALIFORNIA COASTAL COMMISSION
455 MARKET STREET, SUITE 300
SAN FRANCISCO, CA 94105-2421
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SENT BY ELECTRONIC MAIL

September 27, 2024

Sheila McCorkle
SpaceX
VP, Starship Legal and Regulatory
1 Rocket Road
Brownsville TX 78521
Sheila.McCorkle@spacex.com

Dear Ms. McCorkle,

California Coastal Commission (Commission) staff would like to thank SpaceX for taking time to meet with us about SpaceX's Falcon 9 launch and landing activities. We also acknowledge receipt of your undated letter, sent via email on September 10, 2024, responding to the Commission's request that SpaceX apply for a Coastal Development Permit (CDP) for SpaceX's Falcon 9 launch and landing activities. Commission staff would like to take this opportunity to formally respond to SpaceX's position that its Falcon 9 launch and landing activities are a federal agency activity and that it does not need to obtain a CDP these activities.

The Commission disagrees with SpaceX's and the Department of Air Force's characterization that the launch of SpaceX rockets from a leased portion of VSFB and associated activities and development outside of VSFB are federal agency activities subject to Subpart C[1] of the Coastal Zone Management Act (CZMA) regulations. As explained in the Commission's staff report[2] for SpaceX's 36-launches and associated landings per year proposal for the June 2024 Commission hearing (June 2024 Staff Report), there is no scenario in which a federal agency contracts for a small fraction of a private business's overall business activities, in this case about 12 known launch services out of a total of 394 launches (as of May 2024) by SpaceX over the past several years, and can claim that all of the private business's activities are, by extension, federal agency activities. Therefore, as further laid out in the June 2024 Staff Report, SpaceX's rocket launch and landing activities are not federal agency activities subject to Subpart C of the CZMA regulations.

The Commission continues to take the position that its CDP authority extends to SpaceX's Falcon 9 launches and landings and associated activities and development within and

[1] https://www.ecfr.gov/current/title-15/part-930/subpart-C.
[2] w10a-6-2024-report.pdf (ca.gov).

outside of VSFB. As further explained in the June 2024 Staff Report, Supreme Court precedent[3] supports the Commission's position that it may require private parties operating on federal land to obtain a CDP for its development activities to ensure that, consistent with the California Coastal Act, the private party commences development in a manner that protects the coastal environment. The Commission has no intention of determining the basic uses of VSFB and neither the CZMA nor other existing applicable laws and regulations preempt the Commission's CDP authority over SpaceX's launch and landing activities within and outside of VSFB.

The June 2024 Staff Report further explained that SpaceX is engaging in development, as defined in section 30106[4] of the Coastal Act, including rocket launch and landing activities which change the intensity of use of land, discharge and dispose of gaseous, thermal, liquid, and solid waste and change the intensity of use of water, or of access thereto. First, rocket launch and landing activities increase the intensity of use of the land at and around SpaceX's launch facilities as well as the use of coastal waters as rocket stages are transported by barge back to VSFB. Second, the Falcon 9 launches, landings and associated activities discharge gaseous, thermal and liquid waste as well as solid waste, including through the discharge into the ocean of weather balloons and associated equipment and battery materials. Finally, SpaceX's launches change the intensity of use of water and of access to water due to evacuations and closures of public beaches and recreational sites, including Jalama Beach, a highly used day and overnight lower cost recreational facility that is part of the Santa Barbara County Park system.

Given the foregoing, the Commission requests that SpaceX submit a CDP application seeking after-the-fact and continuing authorization for its Falcon 9 launches, landings and associated activities. Additionally, the Commission requests that Space X participate, in person, at the upcoming October 10, 2024, Commission hearing on DAF's Consistency Determination for SpaceX's 50-launches per year proposal.

Sincerely,

Cassidy Teufel

Cassidy Teufel
Deputy Director, Energy, Ocean Resources, and Federal Consistency Division

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[3] *California Coastal Commission v. Granite Rock Company* (1987) 480 U.S. 572.

[4] "Development" means, on land, in or under water, the placement or erection of any solid material or structure; discharge or disposal of any dredged material or of any gaseous, liquid, solid, or thermal waste; grading, removing, dredging, mining, or extraction of any materials; change in the density or intensity of use of land, including, but not limited to, subdivision pursuant to the Subdivision Map Act (commencing with Section 66410 of the Government Code), and any other division of land, including lot splits, except where the land division is brought about in connection with the purchase of such land by a public agency for public recreational use; change in the intensity of use of water, or of access thereto; construction, reconstruction, demolition, or alteration of the size of any structure, including any facility of any private, public, or municipal utility; and the removal or harvesting of major vegetation other than for agricultural purposes, kelp harvesting, and timber operations which are in accordance with a timber harvesting plan submitted pursuant to the provisions of the Z'berg-Nejedly Forest Practice Act of 1973 (commencing with Section 4511).
As used in this section, "structure" includes, but is not limited to, any building, road, pipe, flume, conduit, siphon, aqueduct, telephone line, and electrical power transmission and distribution line.

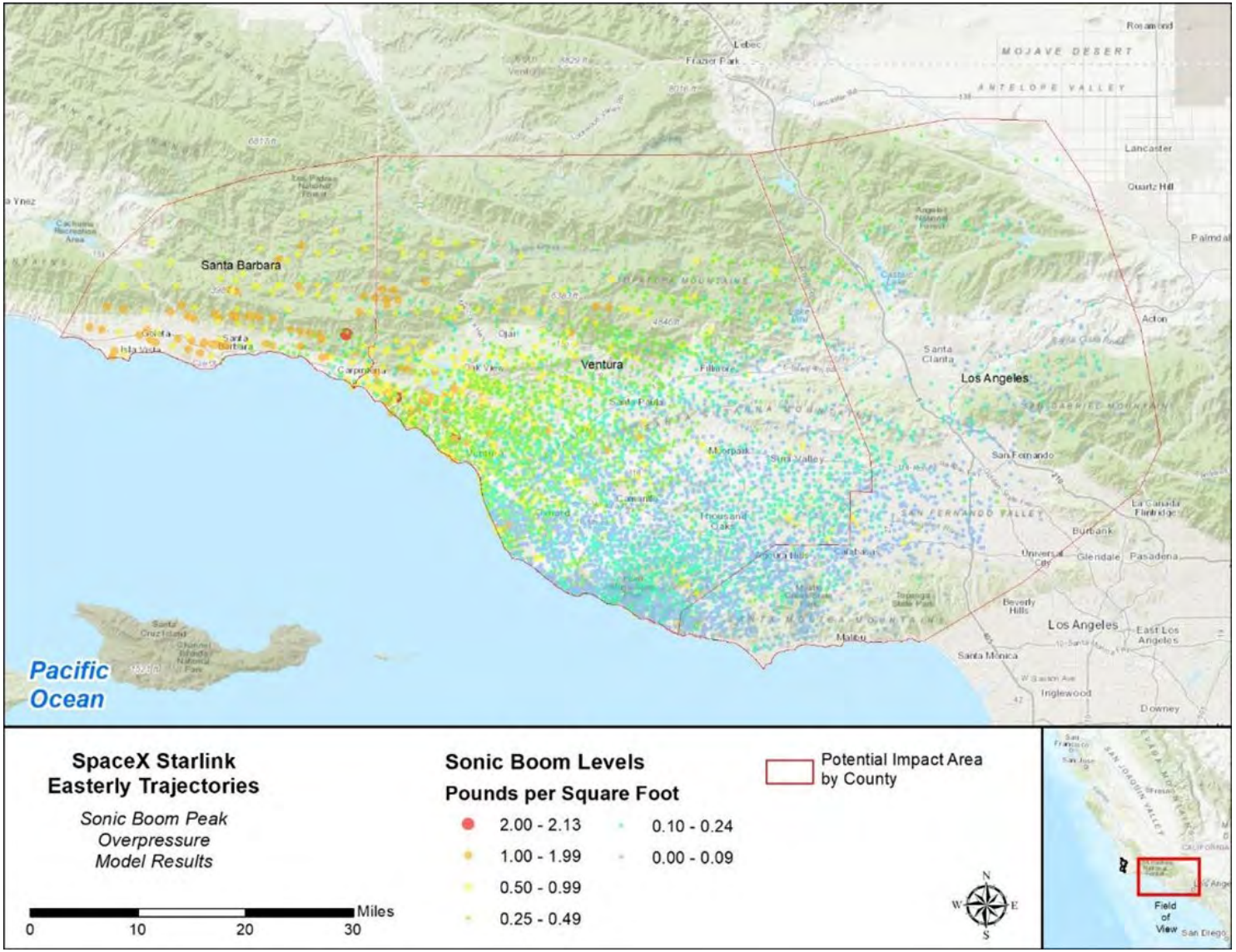
EXHIBIT 4

OFF-BASE SONIC BOOM MODELING

EXHIBIT 4a (SONIC BOOM MODELING FOR AREAS OUTSIDE OF VSFB AND NCI, OVERVIEW).....8

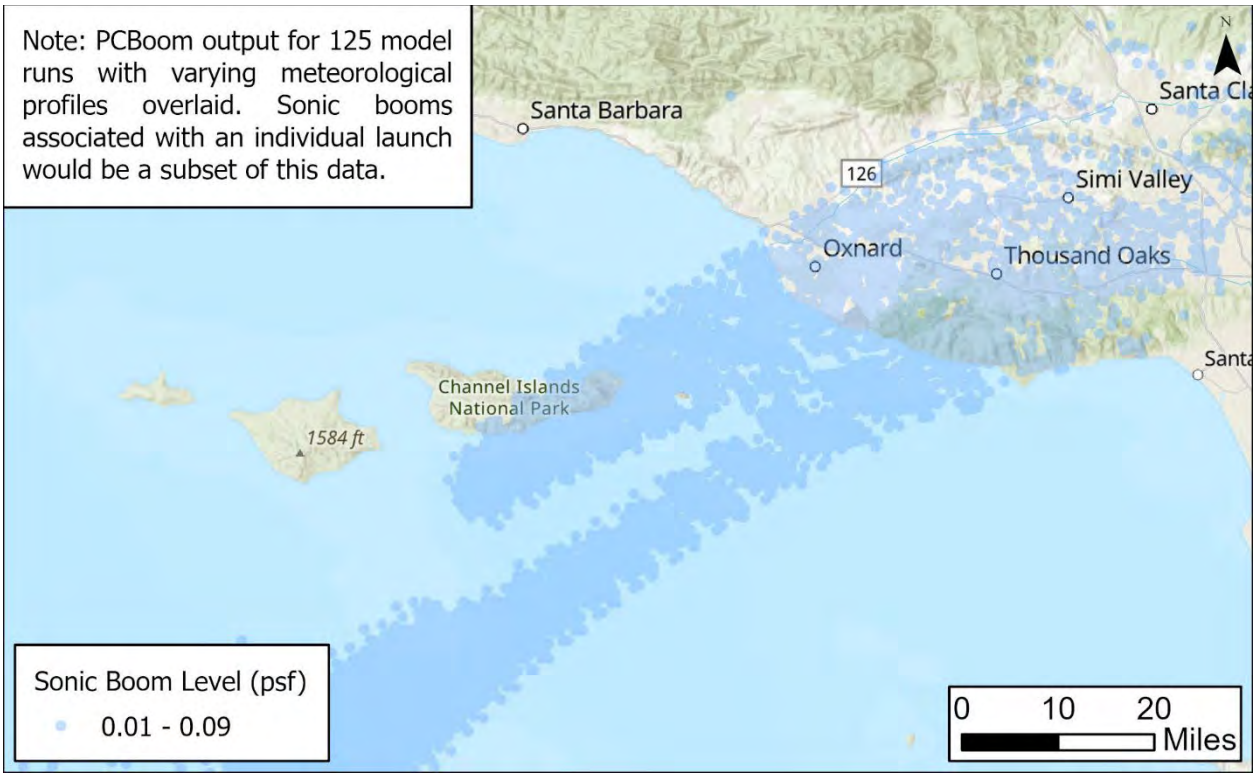
EXHIBIT 4b (SONIC BOOM LAUNCH MODELING, BY OVERPRESSURE RANGE).....9

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PCBoom model for potential sonic boom effect areas in eastern Santa Barbara, Ventura, and Western Los Angeles Counties for launches with easterly trajectories

Exhibit 4a
CD-0007-24



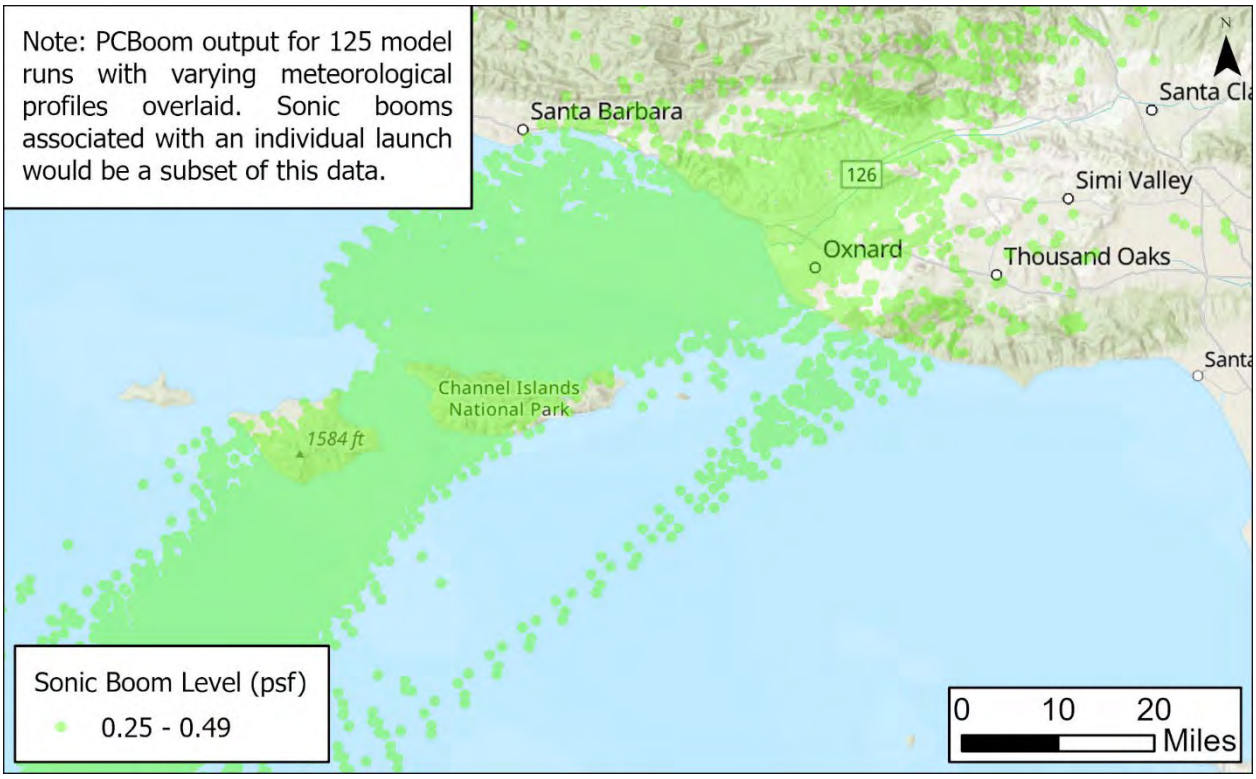
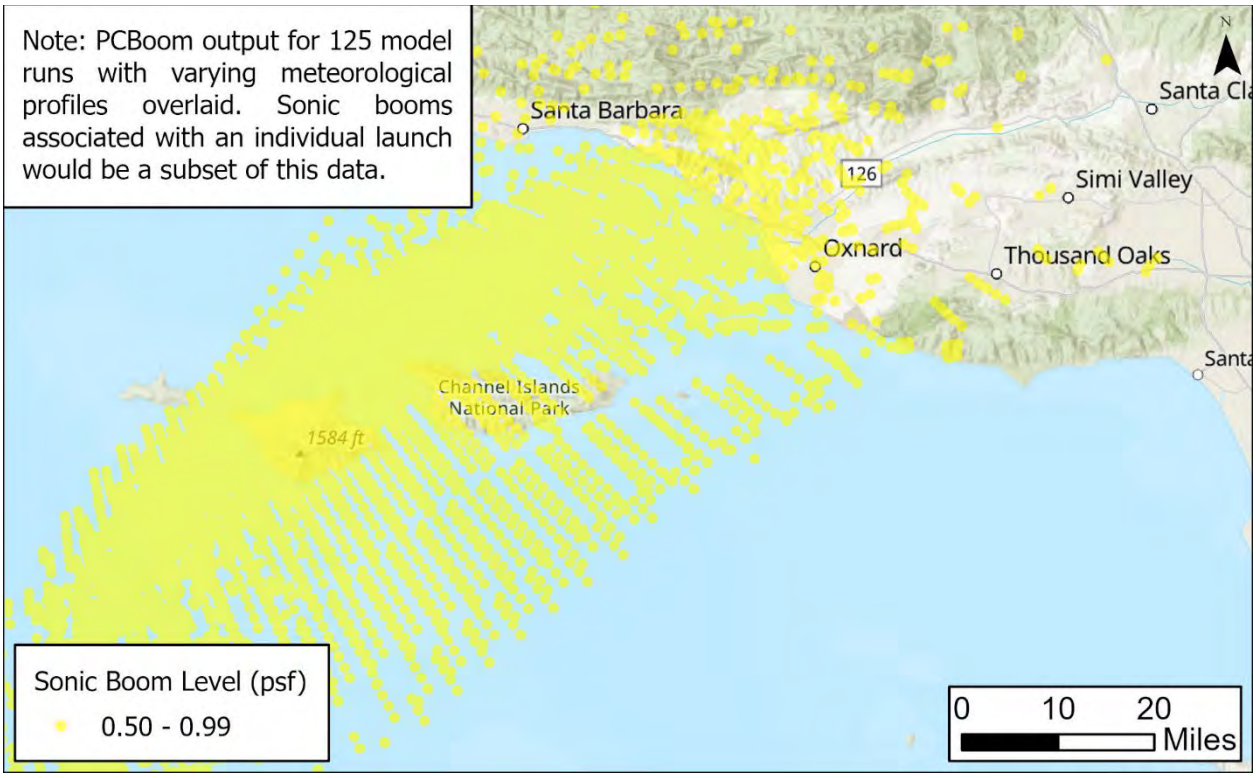
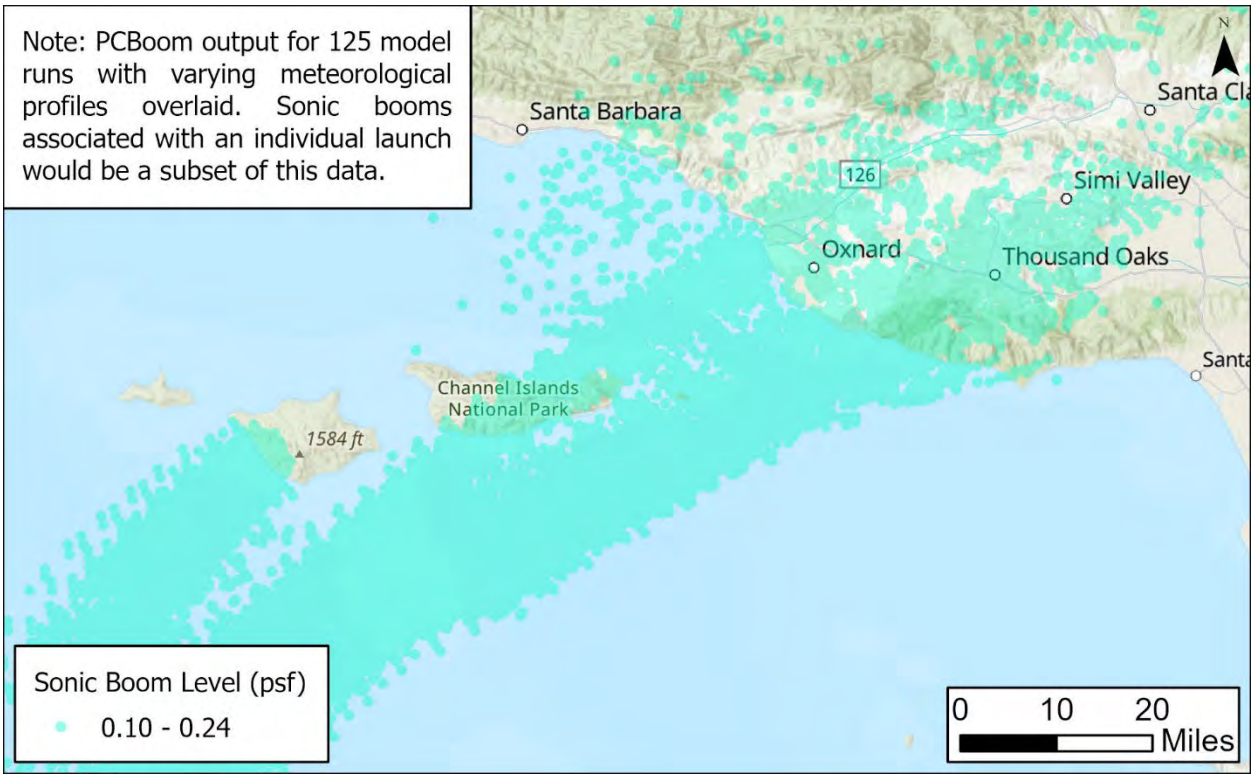
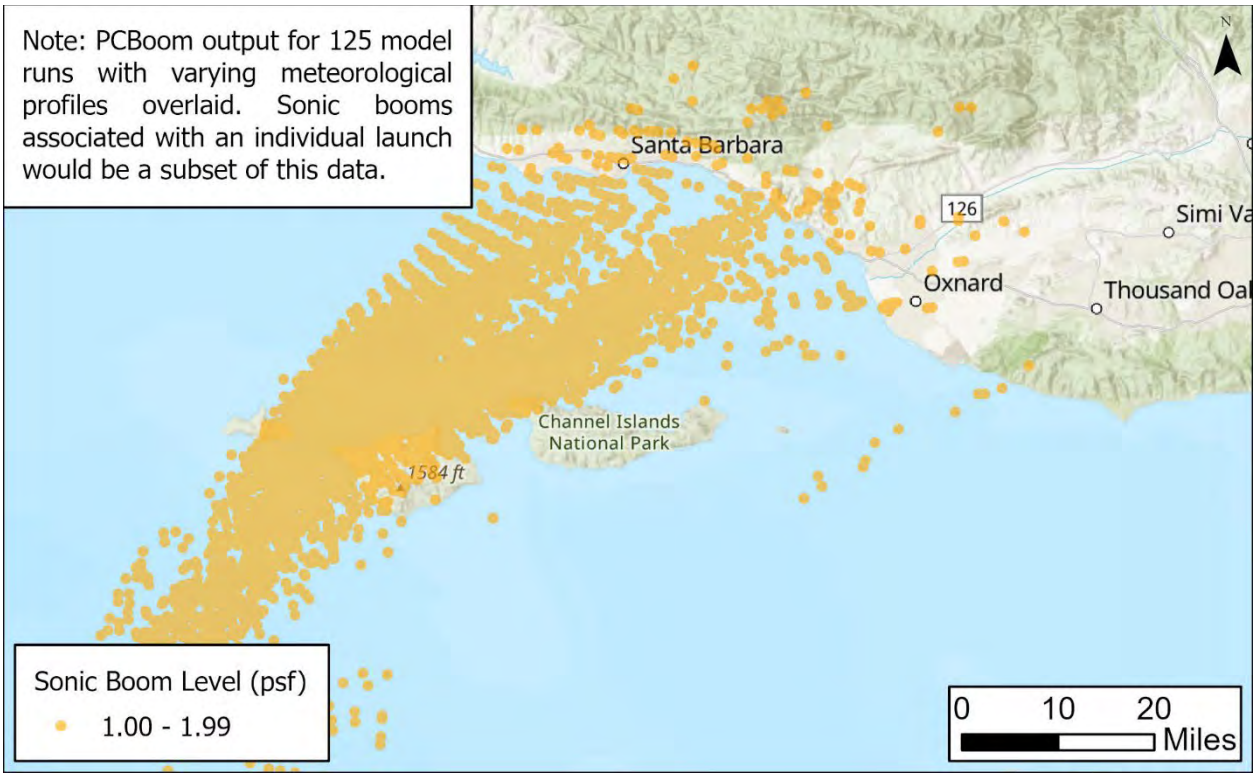
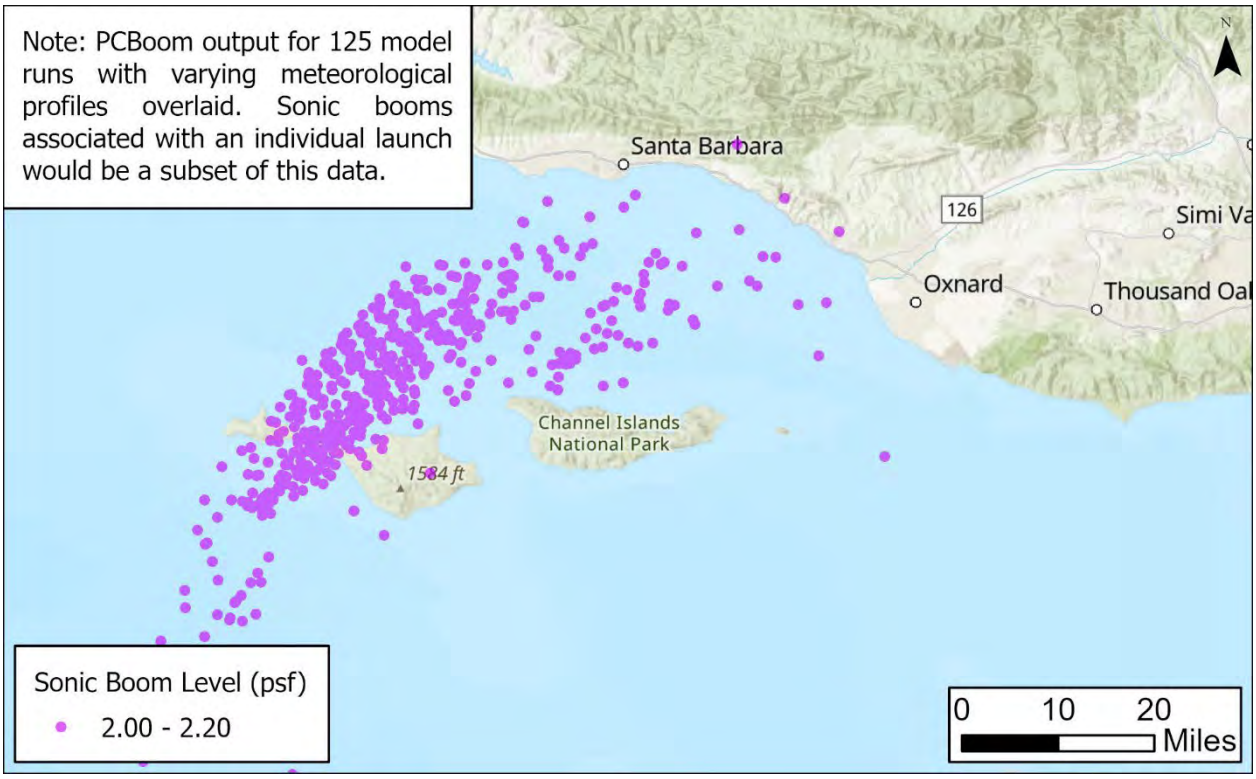


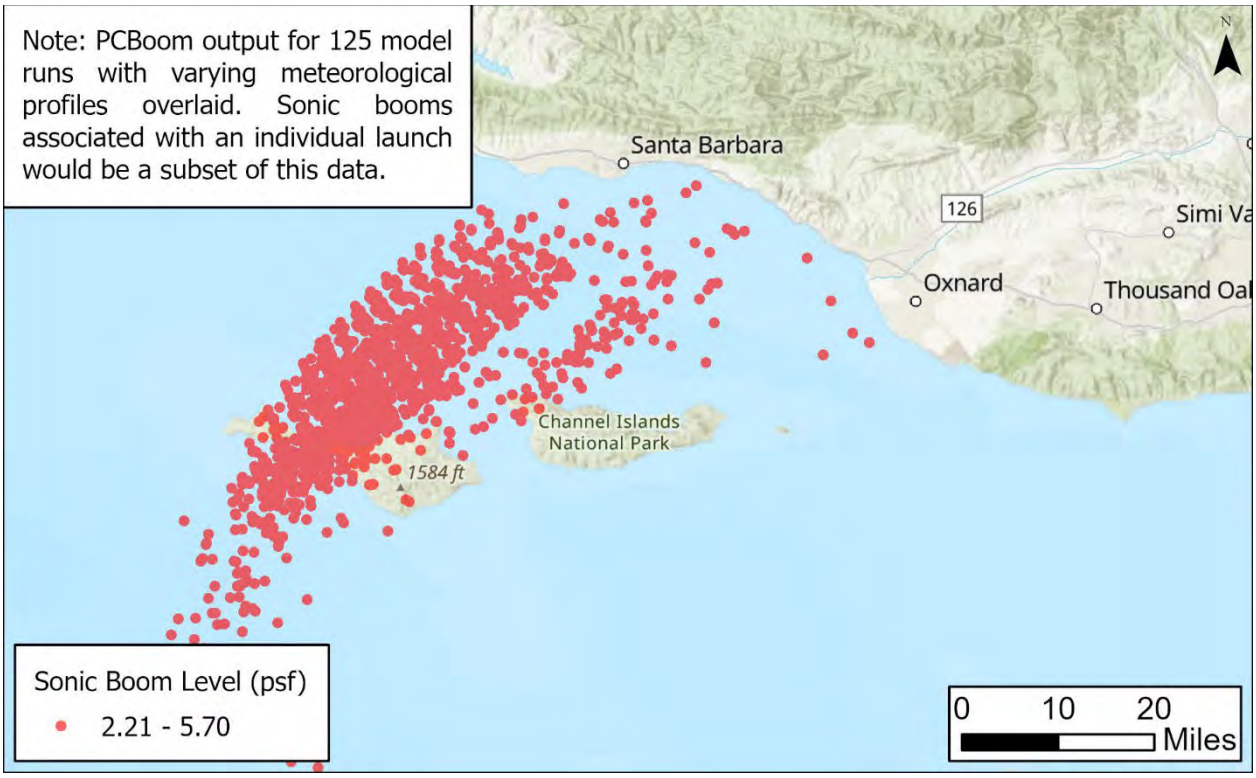
Exhibit 4b
CD-0007-24


Note: PCBoom output for 125 model runs with varying meteorological profiles overlaid. Sonic booms associated with an individual launch would be a subset of this data.
Santa Barbara
Santa Cl
126
Simi Valley
Oxnard
Thousand Oaks
Santa
Channel Islands National Park
1584 ft
Sonic Boom Level (psf)
0.50 - 0.99
0 10 20
Miles


Note: PCBoom output for 125 model runs with varying meteorological profiles overlaid. Sonic booms associated with an individual launch would be a subset of this data.
Santa Barbara
Santa Cl
126
Simi Valley
Oxnard
Thousand Oaks
Santa
Channel Islands National Park
1584 ft
Sonic Boom Level (psf)
0.10 - 0.24
0 10 20
Miles


Note: PCBoom output for 125 model runs with varying meteorological profiles overlaid. Sonic booms associated with an individual launch would be a subset of this data.
Santa Barbara
126
Oxnard
Channel Islands National Park
1584 ft
Sonic Boom Level (psf)
1.00 - 1.99
0 10 20
Miles


Note: PCBoom output for 125 model runs with varying meteorological profiles overlaid. Sonic booms associated with an individual launch would be a subset of this data.
Santa Barbara
126
Oxnard
Channel Islands National Park
1584 ft
Sonic Boom Level (psf)
2.00 - 2.20
0 10 20
Miles


Note: PCBoom output for 125 model runs with varying meteorological profiles overlaid. Sonic booms associated with an individual launch would be a subset of this data.
Santa Barbara
126
Simi Va
Oxnard
Thousand Oak
Channel Islands National Park
1584 ft
Sonic Boom Level (psf)
2.21 - 5.70
0 10 20
Miles
N

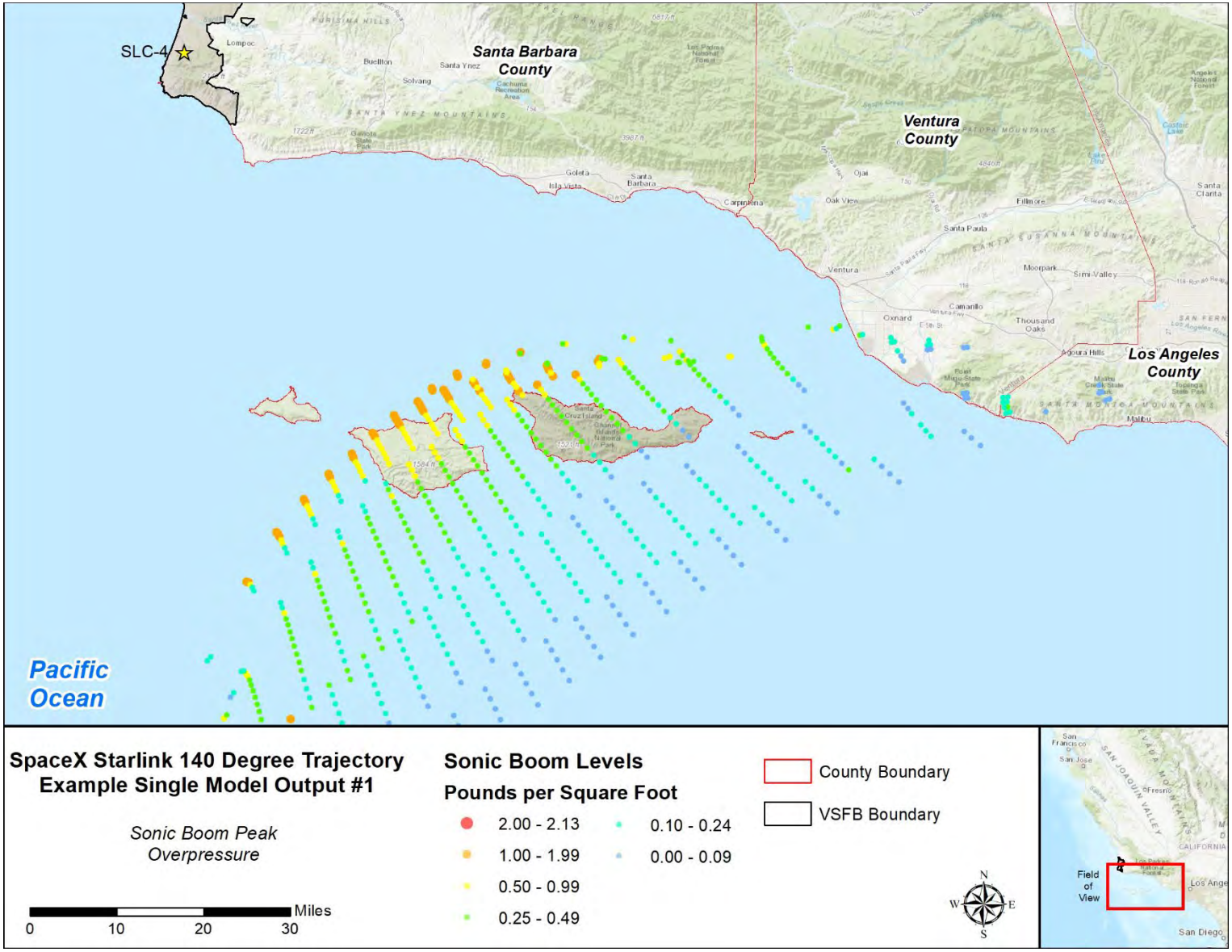


Figure 1. PCBoom sonic boom model output for Starlink Trajectory of 140 degrees – meteorological profile example 1.

Exhibit 4c
CD-0007-24

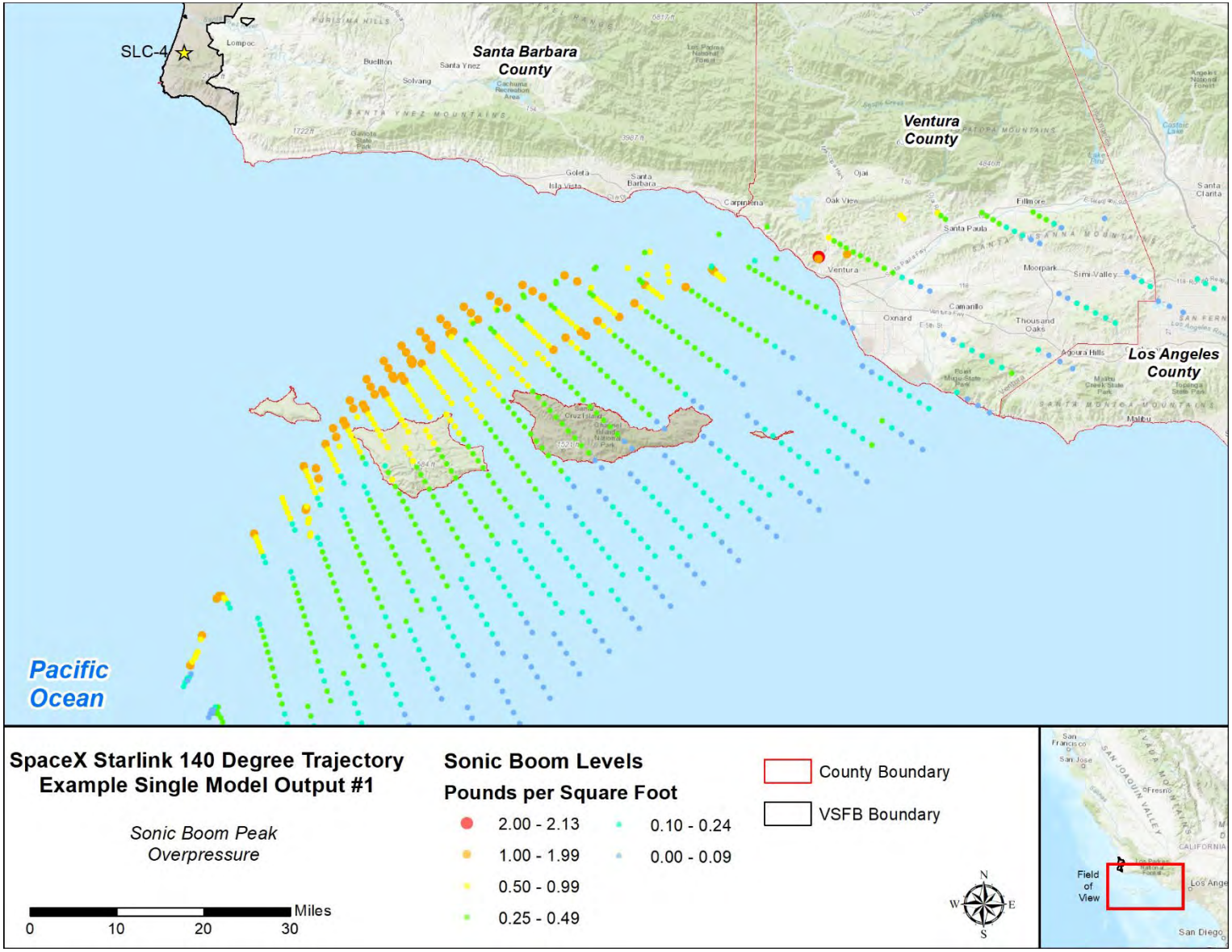


Figure 2. PCBoom sonic boom model output for Starlink Trajectory of 140 degrees – meteorological profile example 2.

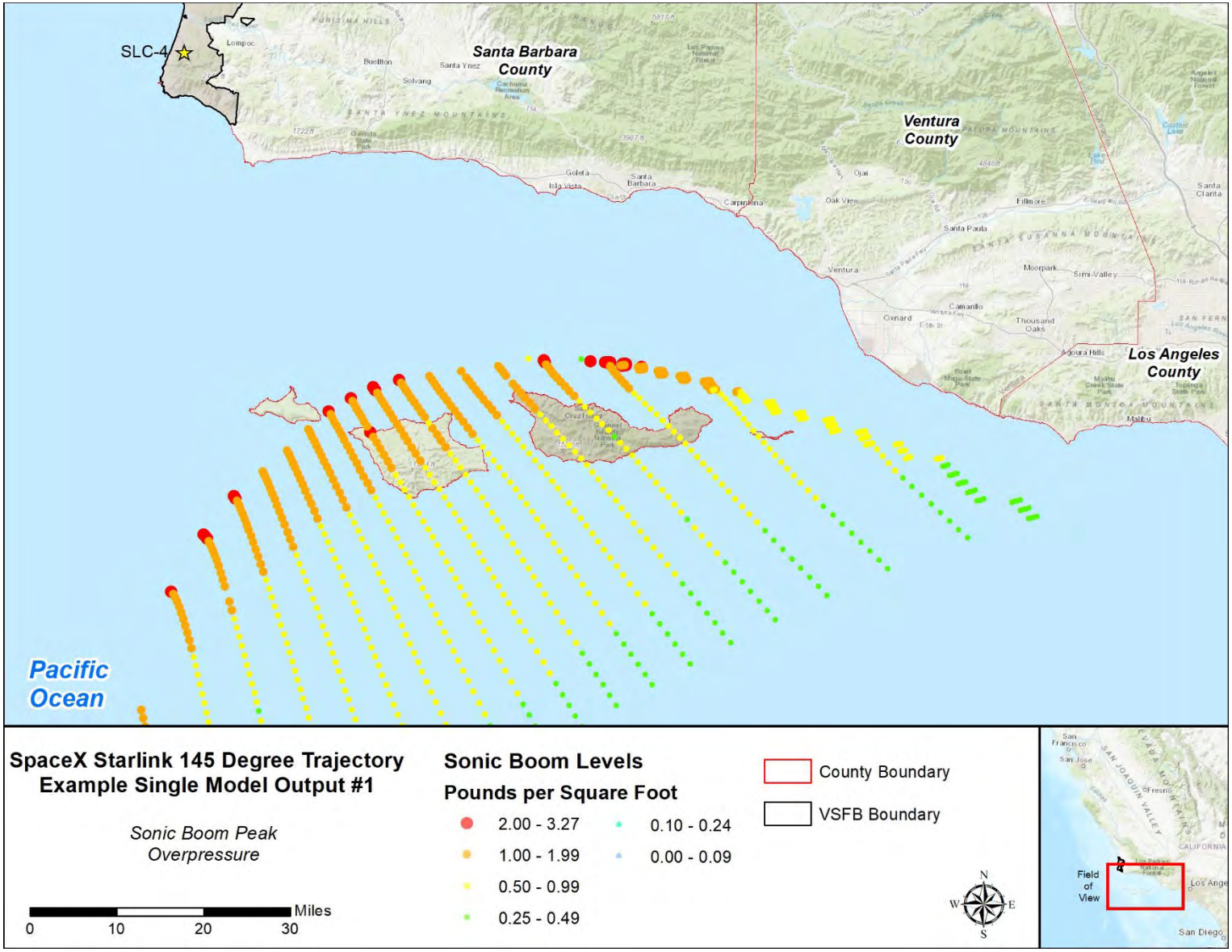


Figure 3. PCBoom sonic boom model output for Starlink Trajectory of 145 degrees – meteorological profile example 1.

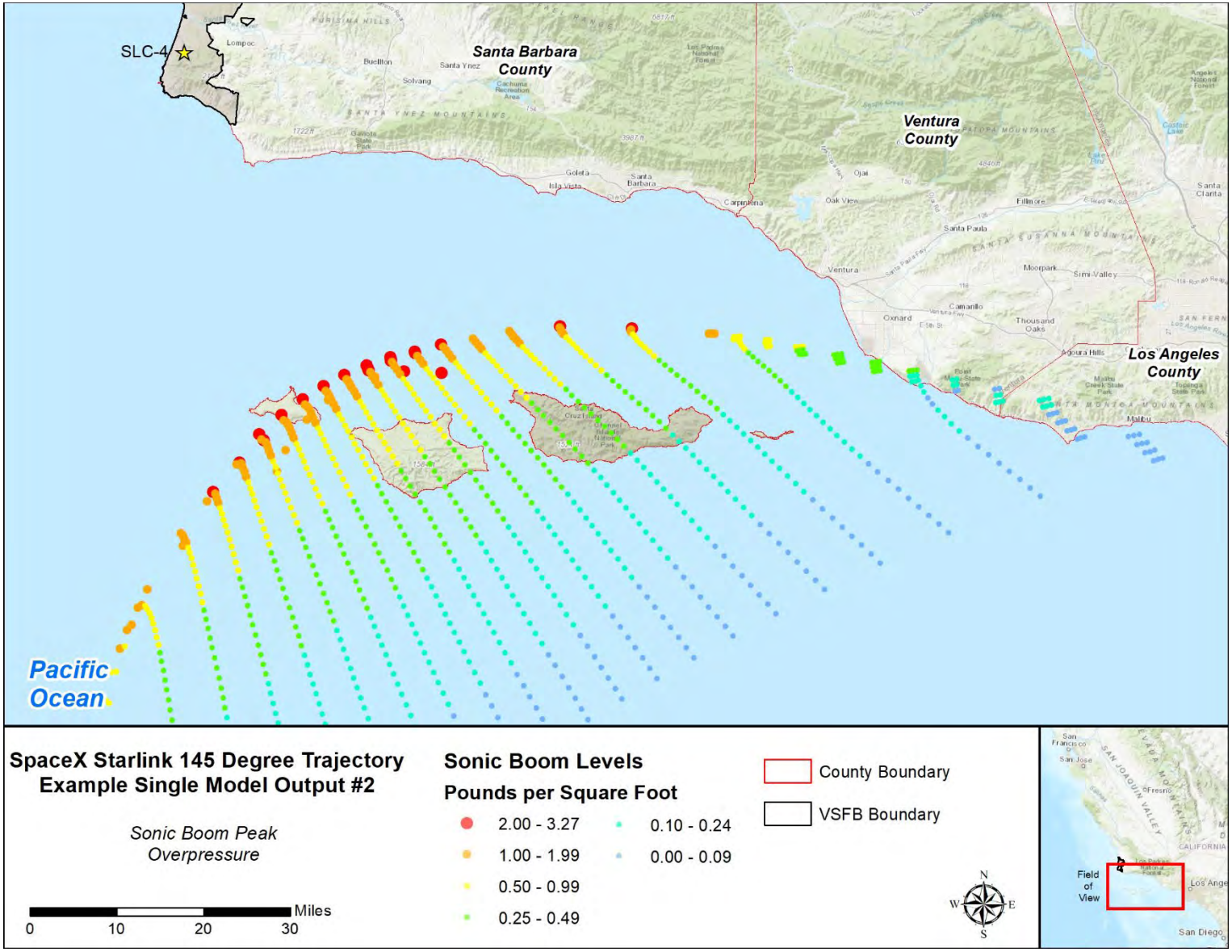


Figure 4. PCBoom sonic boom model output for Starlink Trajectory of 145 degrees – meteorological profile example 2.

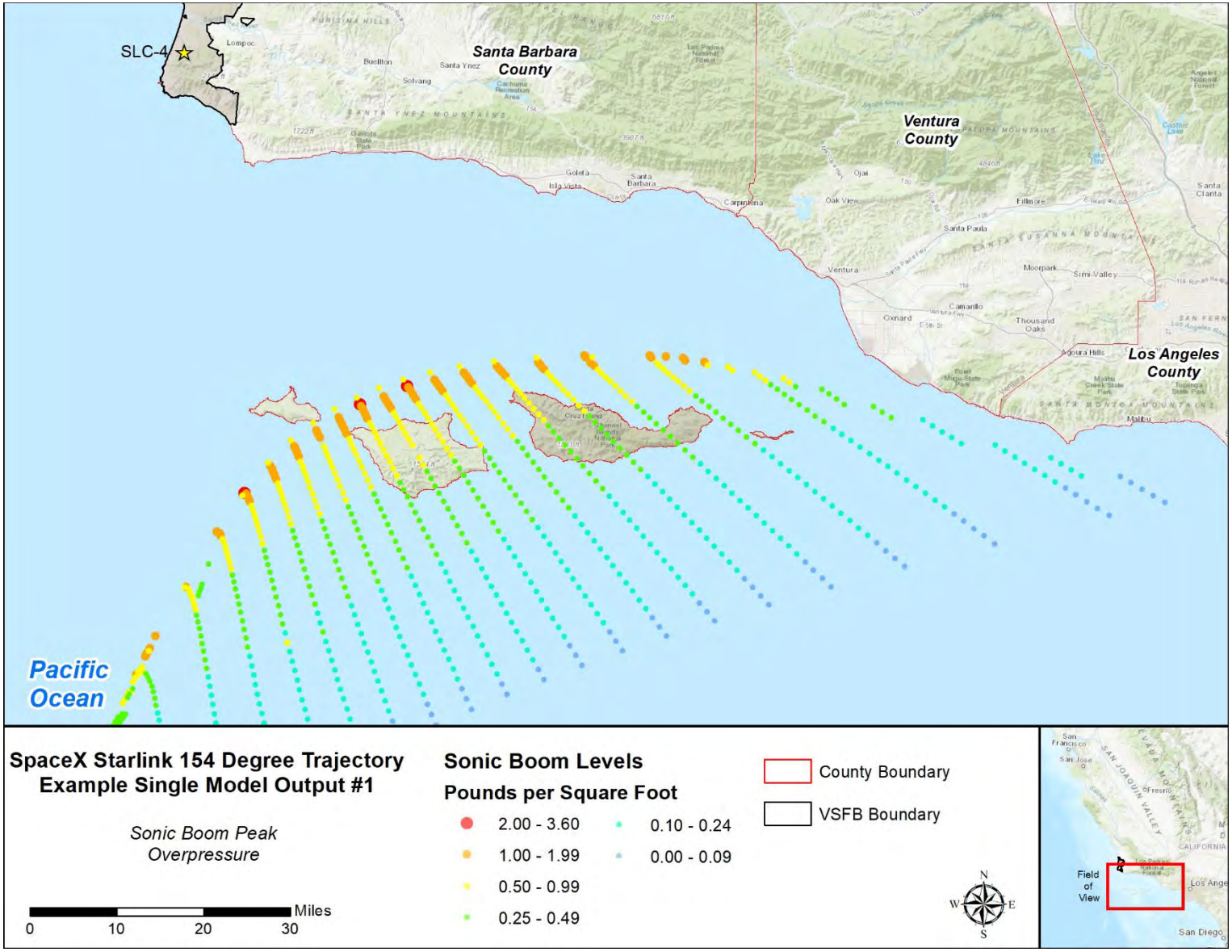


Figure 5. PCBoom sonic boom model output for Starlink Trajectory of 154 degrees – meteorological profile example 1.

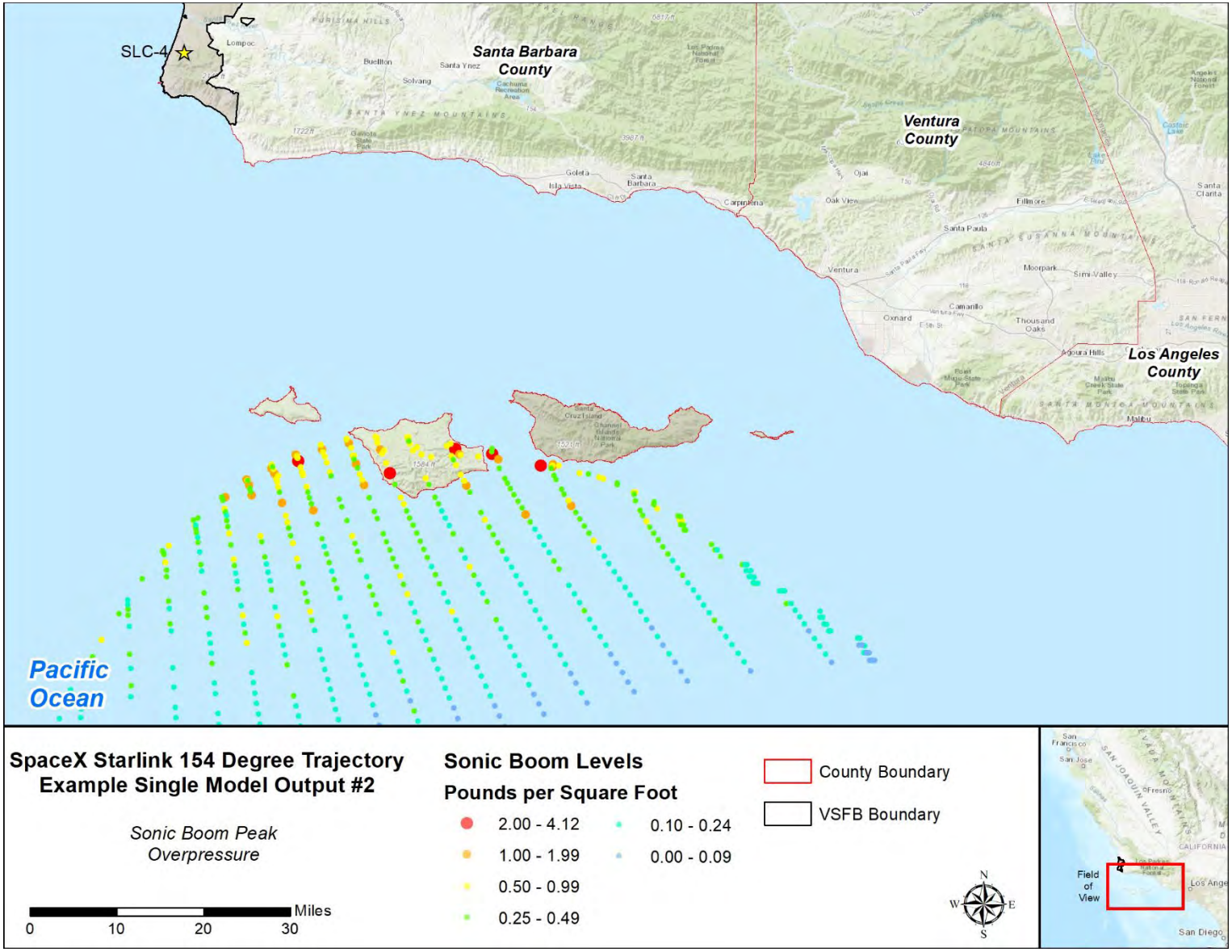


Figure 6. PCBoom sonic boom model output for Starlink Trajectory of 154 degrees – meteorological profile example 2.

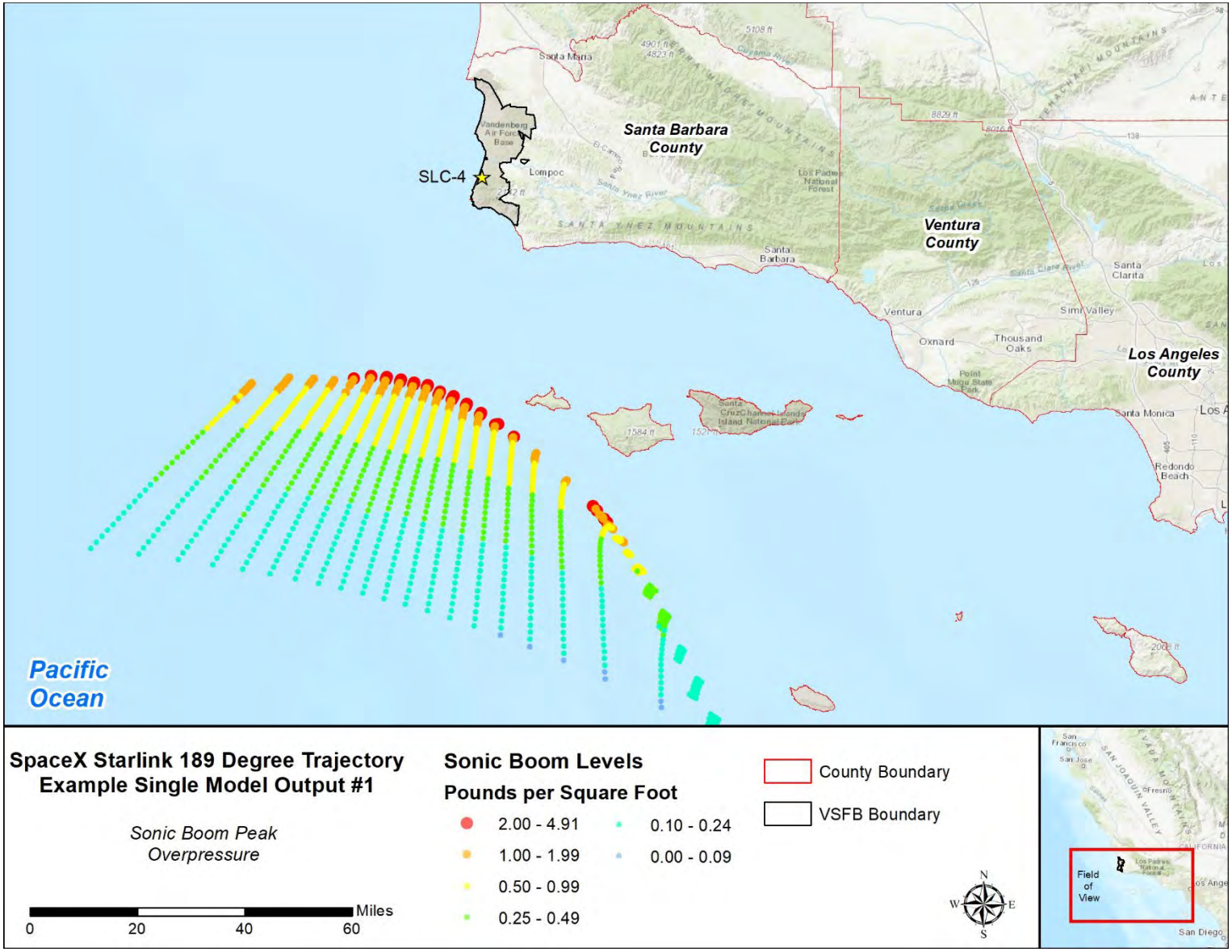


Figure 7. PCBoom sonic boom model output for Starlink Trajectory of 189 degrees – meteorological profile example 1.

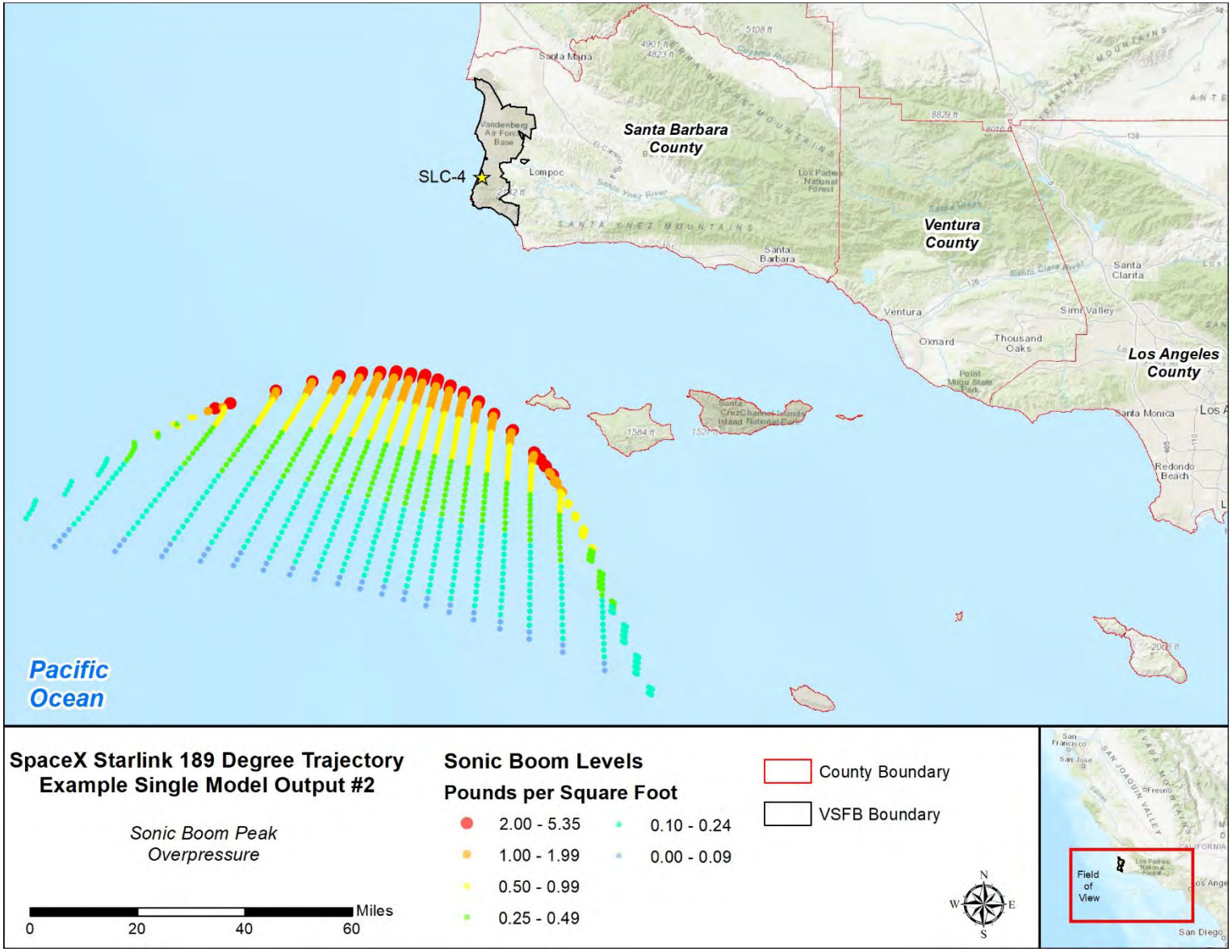


Figure 8. PCBoom sonic boom model output for Starlink Trajectory of 189 degrees – meteorological profile example 2.

EXHIBIT 5

NOISE AND OVERPRESSURE MODELING ON VSFB

EXHIBIT 5a (NOISE AND OVERPRESSURE MODELING ON VSFB FROM CONSISTENCY DETERMINATION FOR 50 LAUNCHES PER YEAR) 22

EXHIBIT 5b (NOISE AND OVERPRESSURE MODELING ON VSFB FROM DRAFT ENVIRONMENTAL ASSESSMENT FOR 50 LAUNCHES PER YEAR) 28

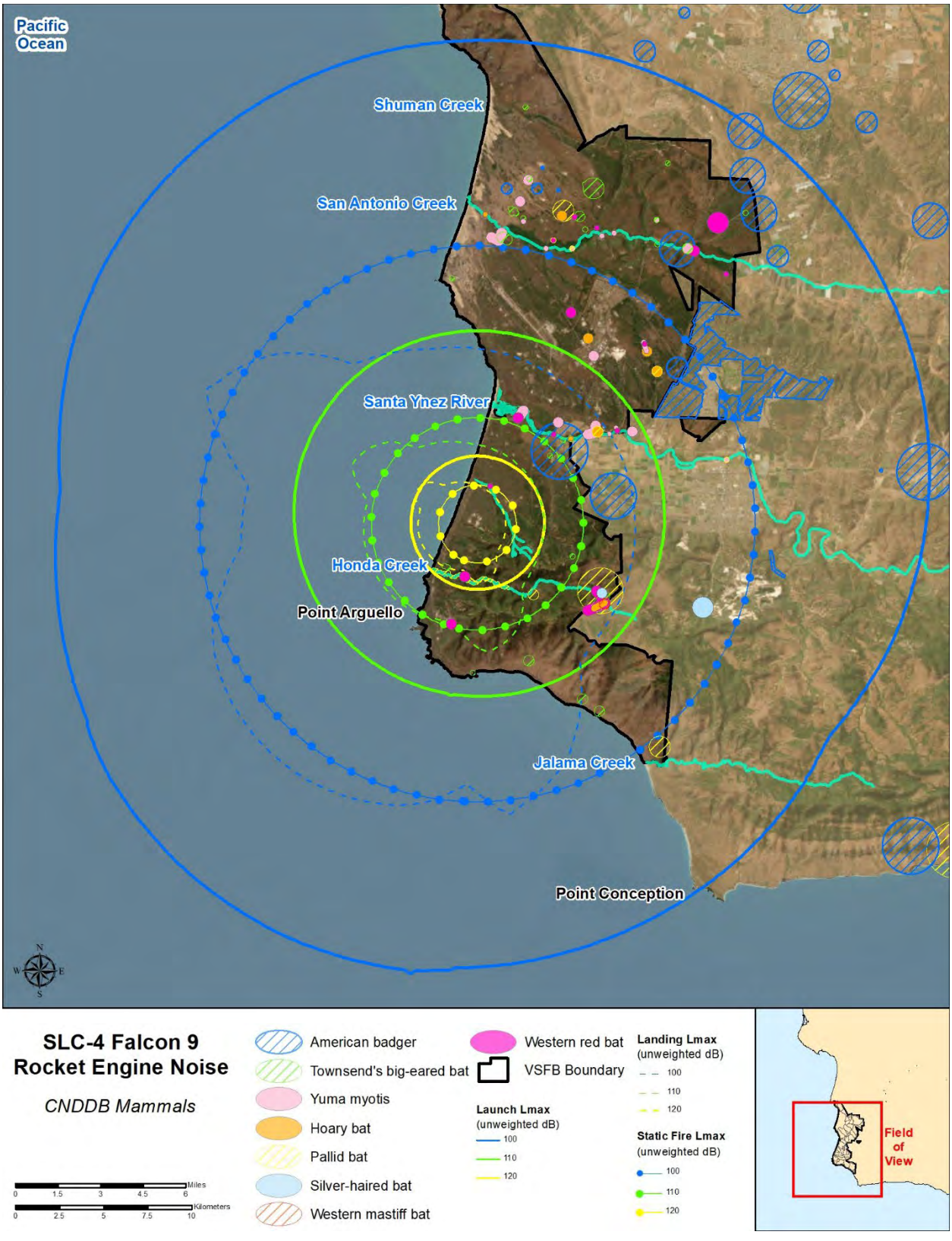


Figure B.0-1. Special status mammal CNDDB localities and Falcon 9 SLC-4 static fire, launch, and landing rocket engine noise model results.

Exhibit 5a
CD-0007-24

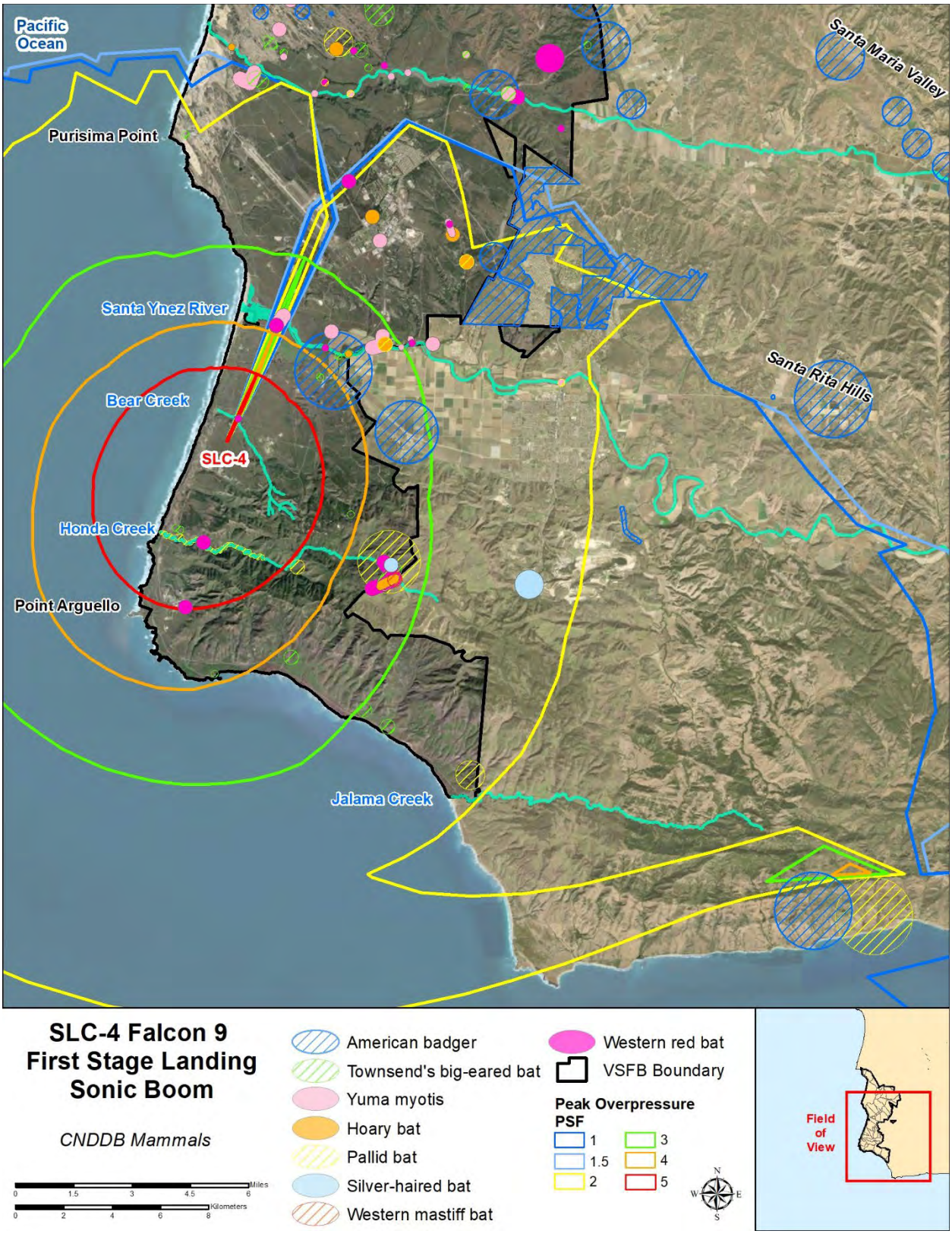


Figure B.0-2. Special status mammal CNDDB localities and example SLC-4 landing sonic boom contours.

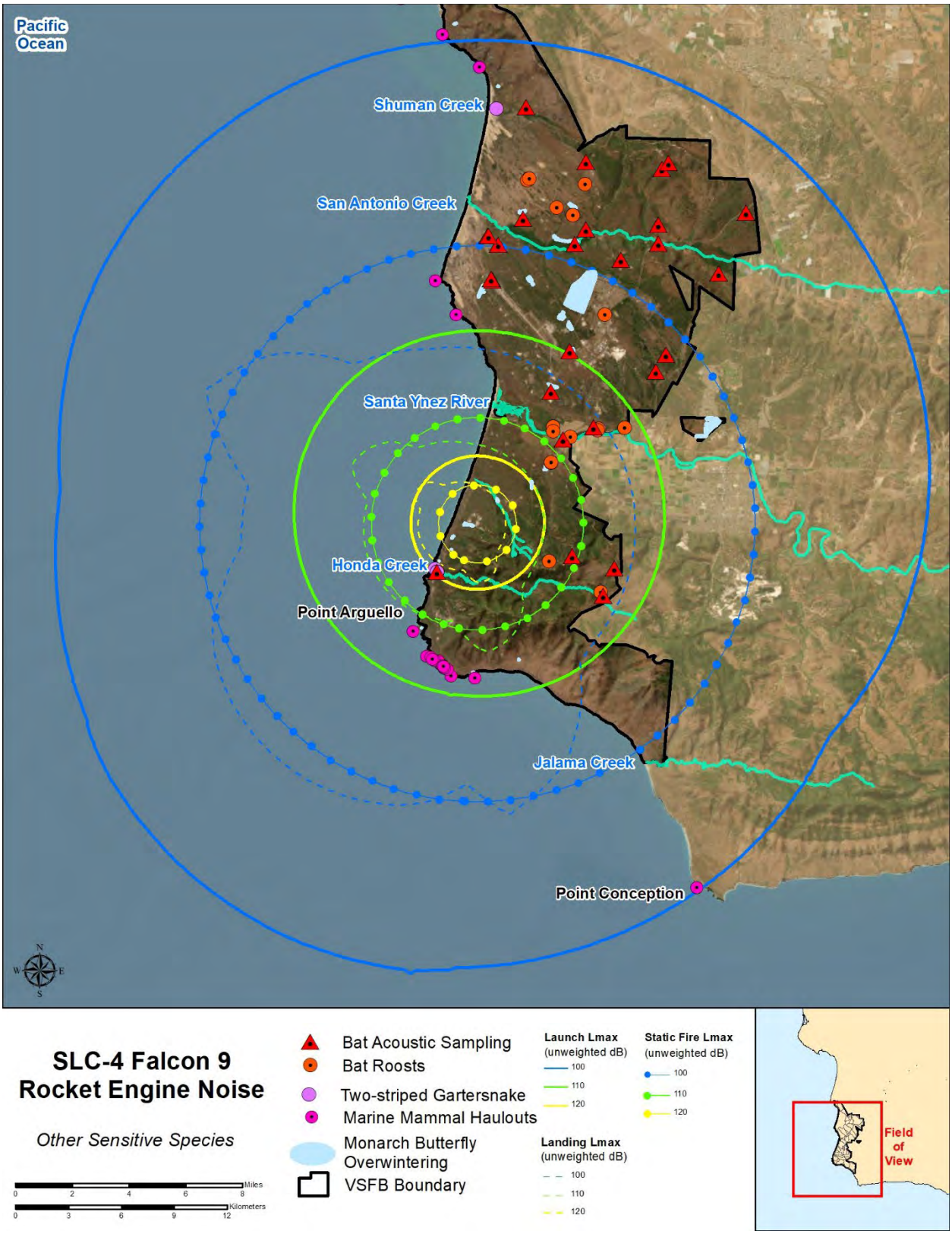


Figure B.0-5. Other sensitive species and Falcon 9 SLC-4 static fire, launch, and landing rocket engine noise model results.

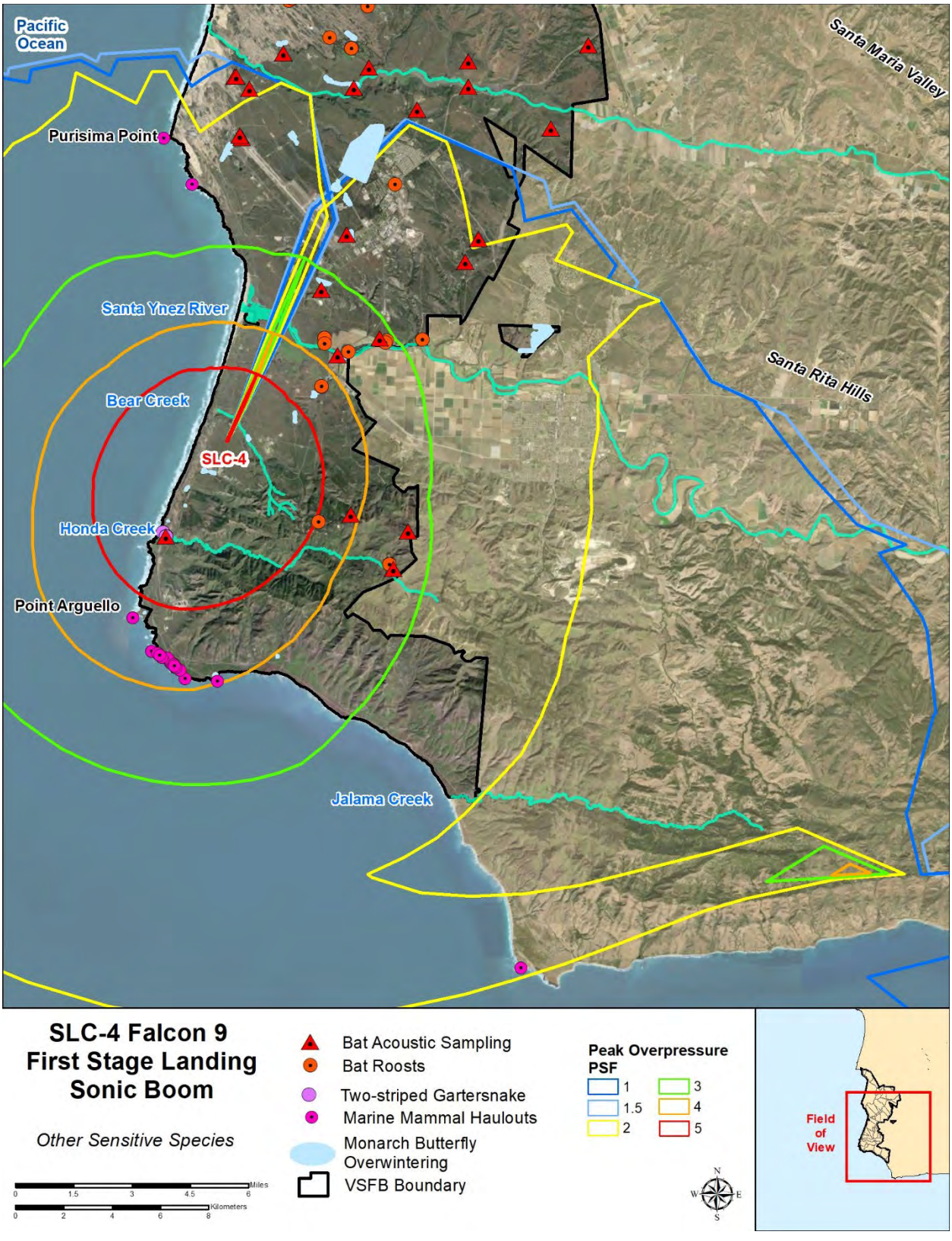


Figure B.0-6. Other sensitive species and example SLC-4 landing sonic boom contours.

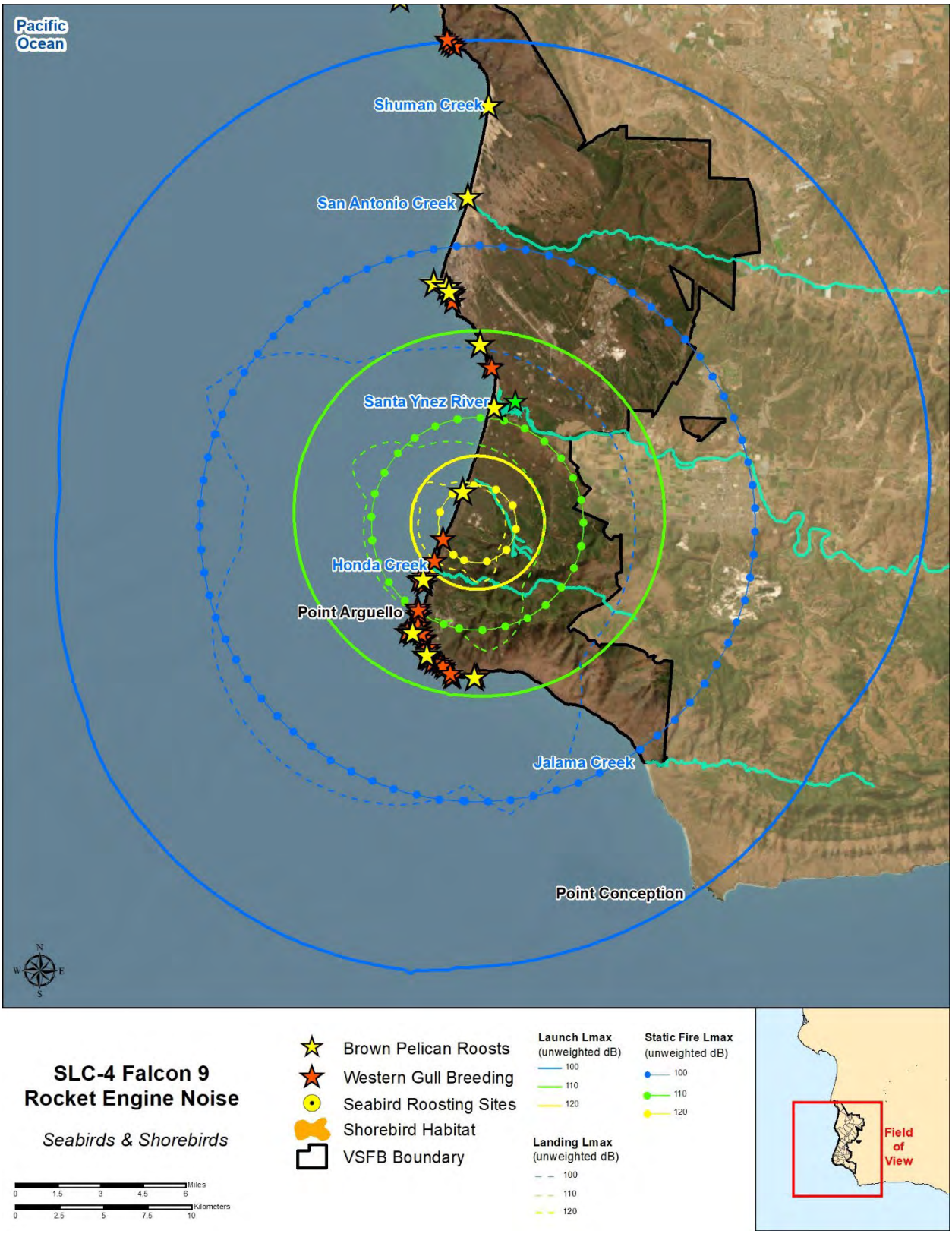


Figure B.0-7. Seabirds, shorebirds, and Falcon 9 SLC-4 static fire, launch, and landing rocket engine noise model results.

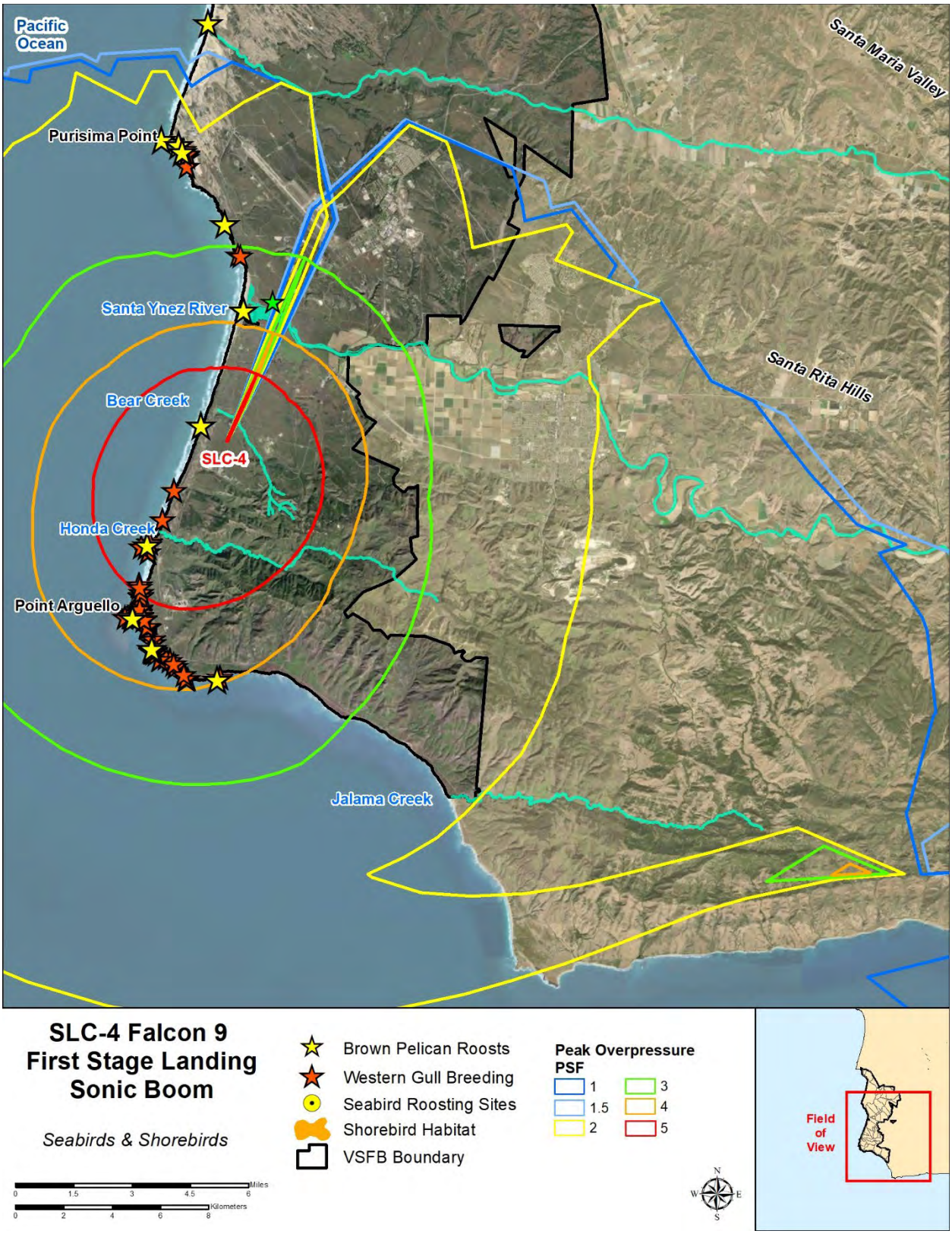


Figure B.0-8. Seabirds, shorebirds, and example SLC-4 landing sonic boom contours.

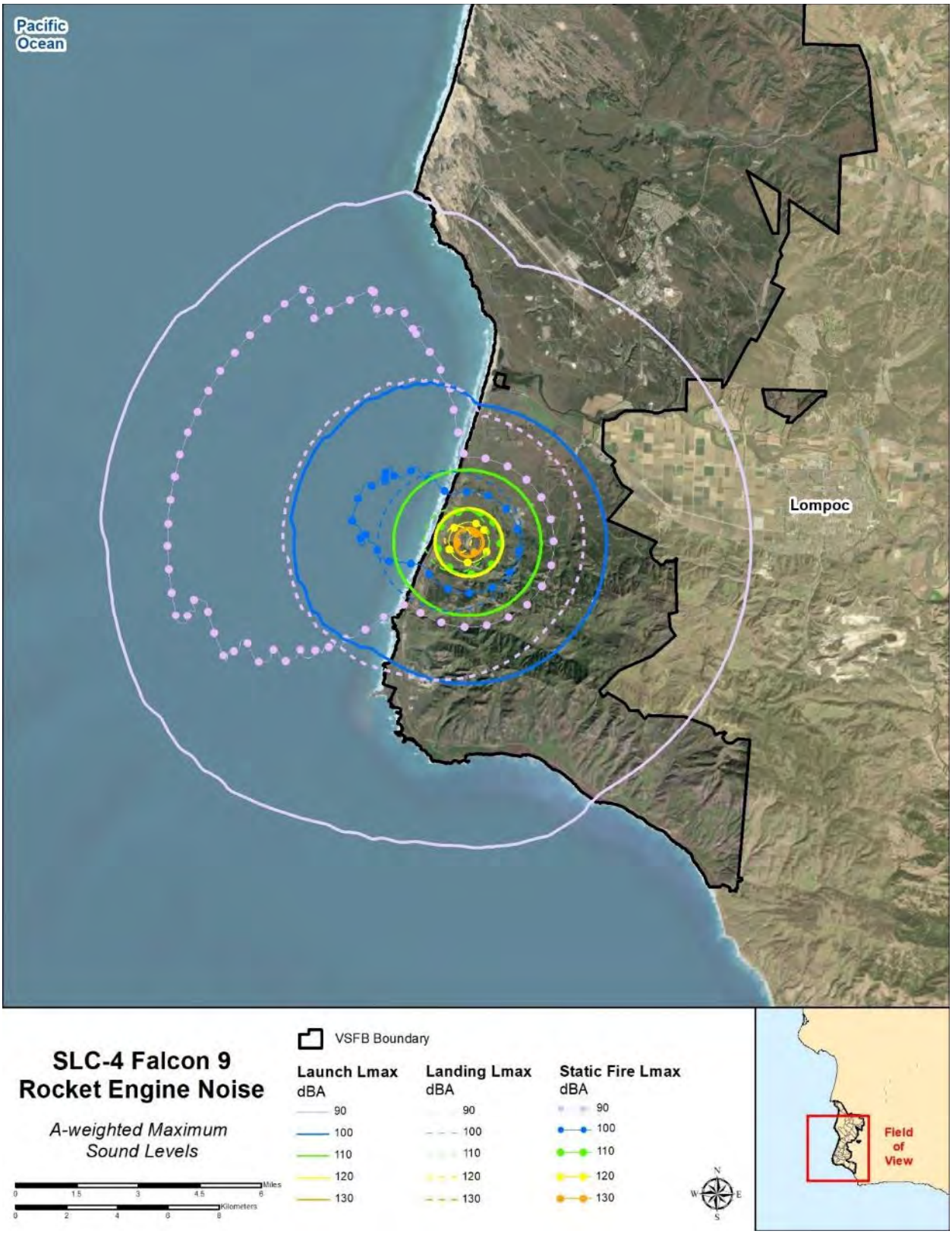


Figure 3.2-1. Falcon 9 static fire, launch, and landing rocket engine noise model results at SLC-4

Exhibit 5b
CD-0007-24

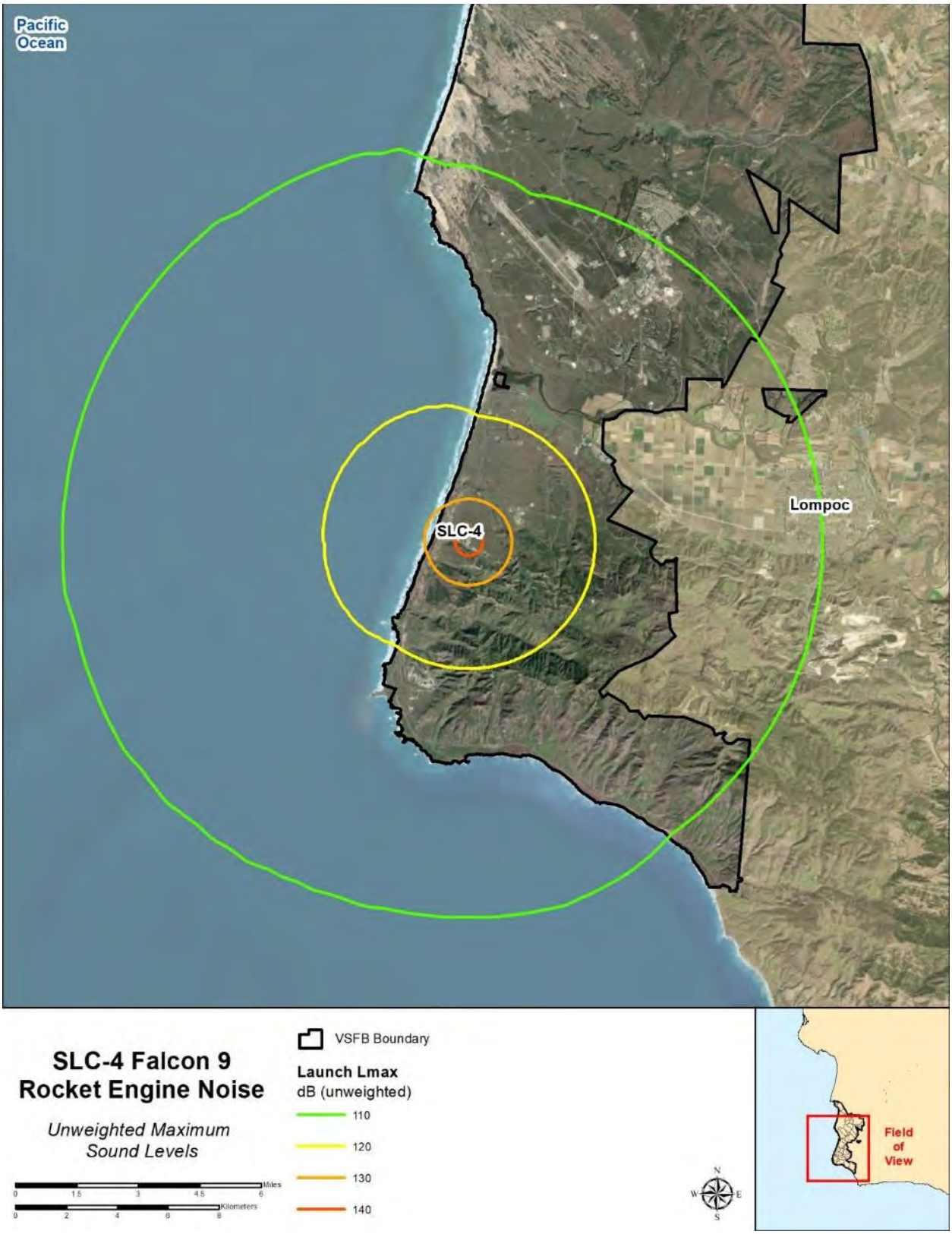


Figure 3.2-2. Unweighted L_{max} contours for Falcon 9 launch at SLC-4

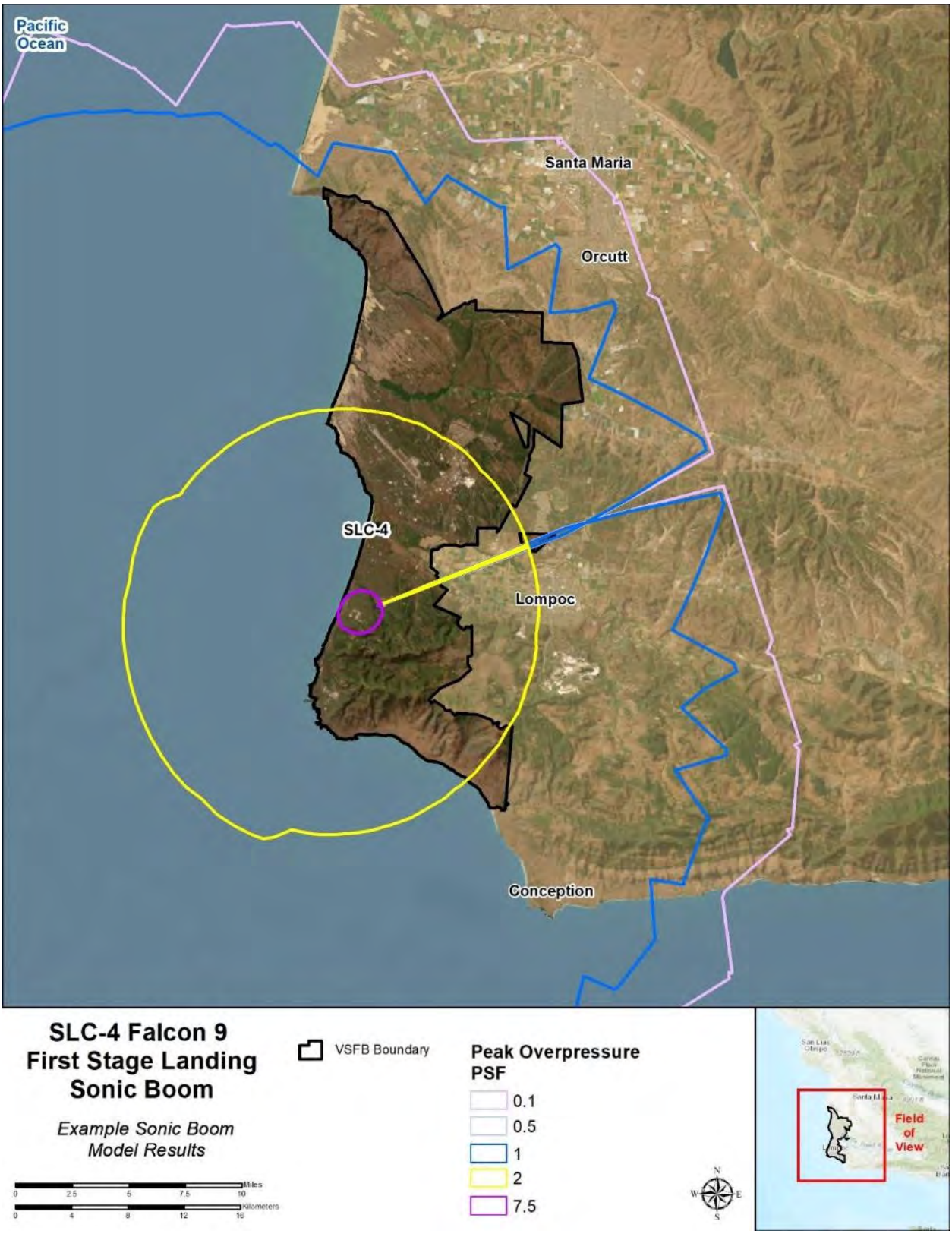


Figure 3.2-4. Example sonic boom model results for Falcon 9 first stage landing at SLC-4W

Ascent Sonic Booms from Falcon-9 Launches

Kent L. Gee, Lucas K. Hall, Mark C. Anderson, Makayle S. Kellison, Bradley McLaughlin, Marcus O. Perkins, and Levi T. Moats

Brigham Young University and California State University Bakersfield

BYU Acoustics

Exhibit 6
CD-0007-24

Launches and Measurements

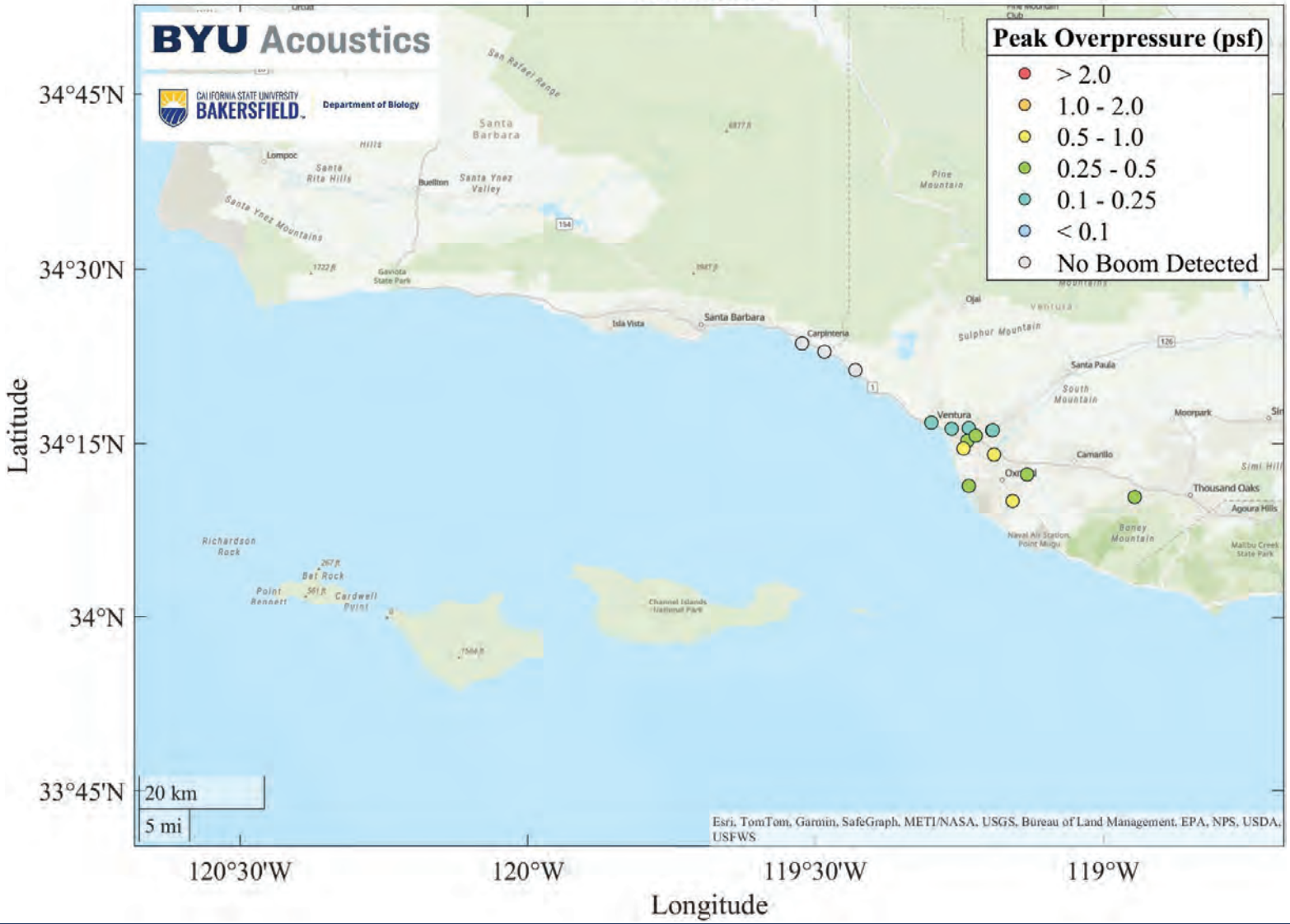
Launch	Measurement Locations
Starlink 9-1	16
Starlink 9-2	23
Starlink 9-3	23
Starlink 9-4	25
Starlink 11-1	22
NROL-186	23

Launches and Measurements

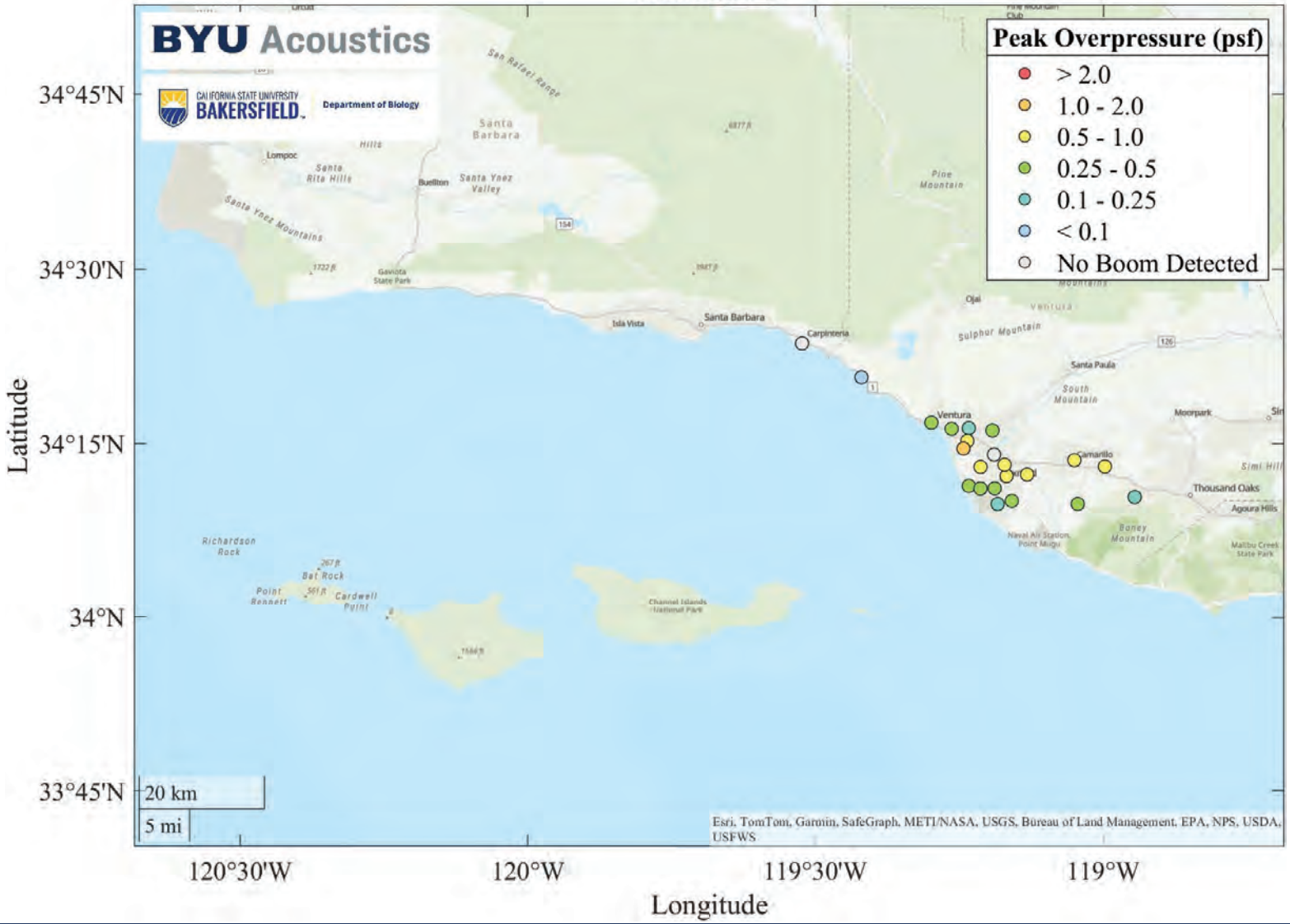
Launch	Time (PDT) and Date	Measurement Locations
Starlink 9-1	8:40 pm 18 June	16
Starlink 9-2	8:47 pm 23 June	23
Starlink 9-3	7:35 pm 11 July	23
Starlink 9-4	2:22 am 28 July	25
Starlink 11-1	12:24 am 04 August	22
NROL-186	8:14 pm 28 June	23

Large Maps

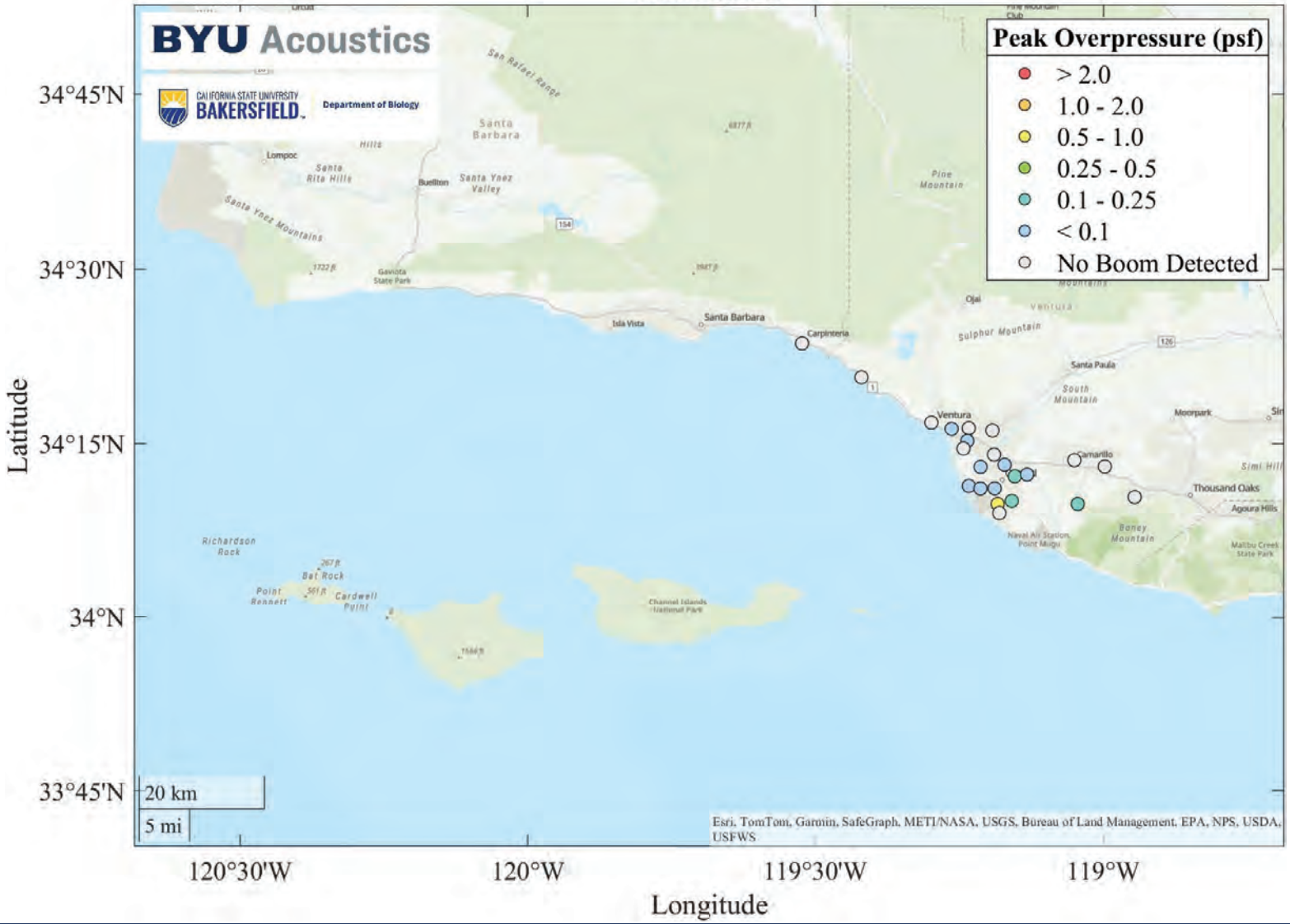
Starlink 9-1


BYU Acoustics
CALIFORNIA STATE UNIVERSITY BAKERSFIELD
Department of Biology
Peak Overpressure (psf)
> 2.0
1.0 - 2.0
0.5 - 1.0
0.25 - 0.5
0.1 - 0.25
< 0.1
No Boom Detected
34°45'N
34°30'N
34°15'N
34°N
33°45'N
Latitude
120°30'W
120°W
119°30'W
119°W
Longitude
20 km
5 mi
Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS
Santa Barbara
Carpinteria
Ventura
Oxnard
Thousand Oaks
Camarillo
Santa Paula
Ojai
Lompoc
Buellton
Isla Vista
Gaviota State Park
Point Bennett
Cardwell Point
Bel Rock
Richardson Rock
Naval Air Station Point Mugu
Channel Islands National Park
Santa Ynez Mountains
Santa Ynez Valley
Santa Rita Hills
Sulphur Mountain
South Mountain
Boney Mountain
Pine Mountain
San Rafael Range
Moorpark
Agoura Hills
Malibu Creek State Park

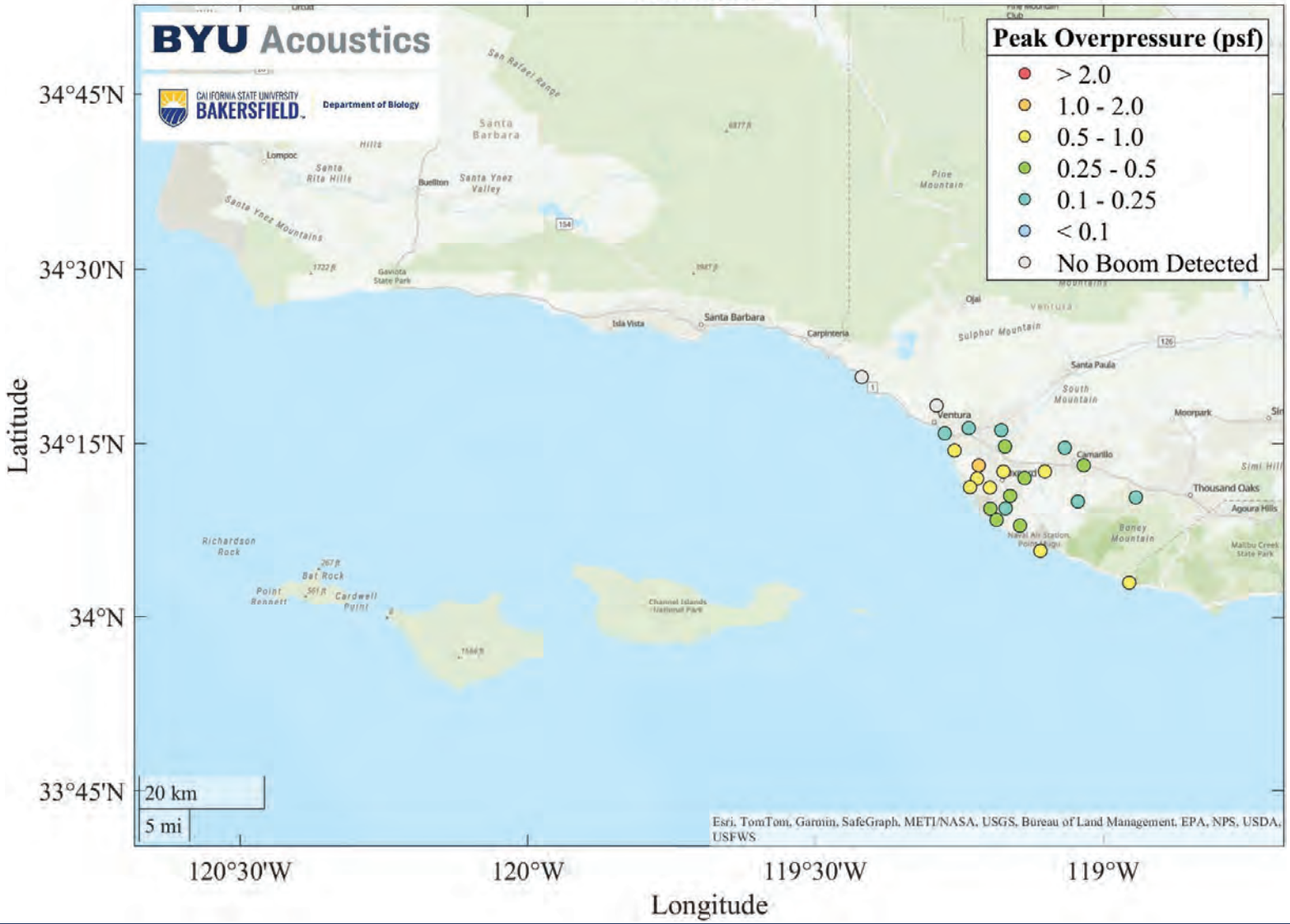
Starlink 9-2


BYU Acoustics
CALIFORNIA STATE UNIVERSITY BAKERSFIELD
Department of Biology
Peak Overpressure (psf)
> 2.0
1.0 - 2.0
0.5 - 1.0
0.25 - 0.5
0.1 - 0.25
< 0.1
No Boom Detected
34°45'N
34°30'N
34°15'N
34°N
33°45'N
Latitude
120°30'W
120°W
119°30'W
119°W
Longitude
20 km
5 mi
Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS
Santa Barbara
Carpinteria
Ventura
Thousand Oaks
Agoura Hills
Santa Paula
Ojai
Moorpark
Camarillo
Isla Vista
Lompoc
Buellton
Gaviota State Park
Point Bennett
Cardwell Point
Bat Rock
Richardson Rock
Naval Air Station Point Mugu
Channel Islands National Park
Santa Ynez Mountains
Santa Ynez Valley
Santa Rita Hills
San Rafael Range
Pine Mountain
Sulphur Mountain
South Mountain
Boney Mountain
Malibu Creek State Park

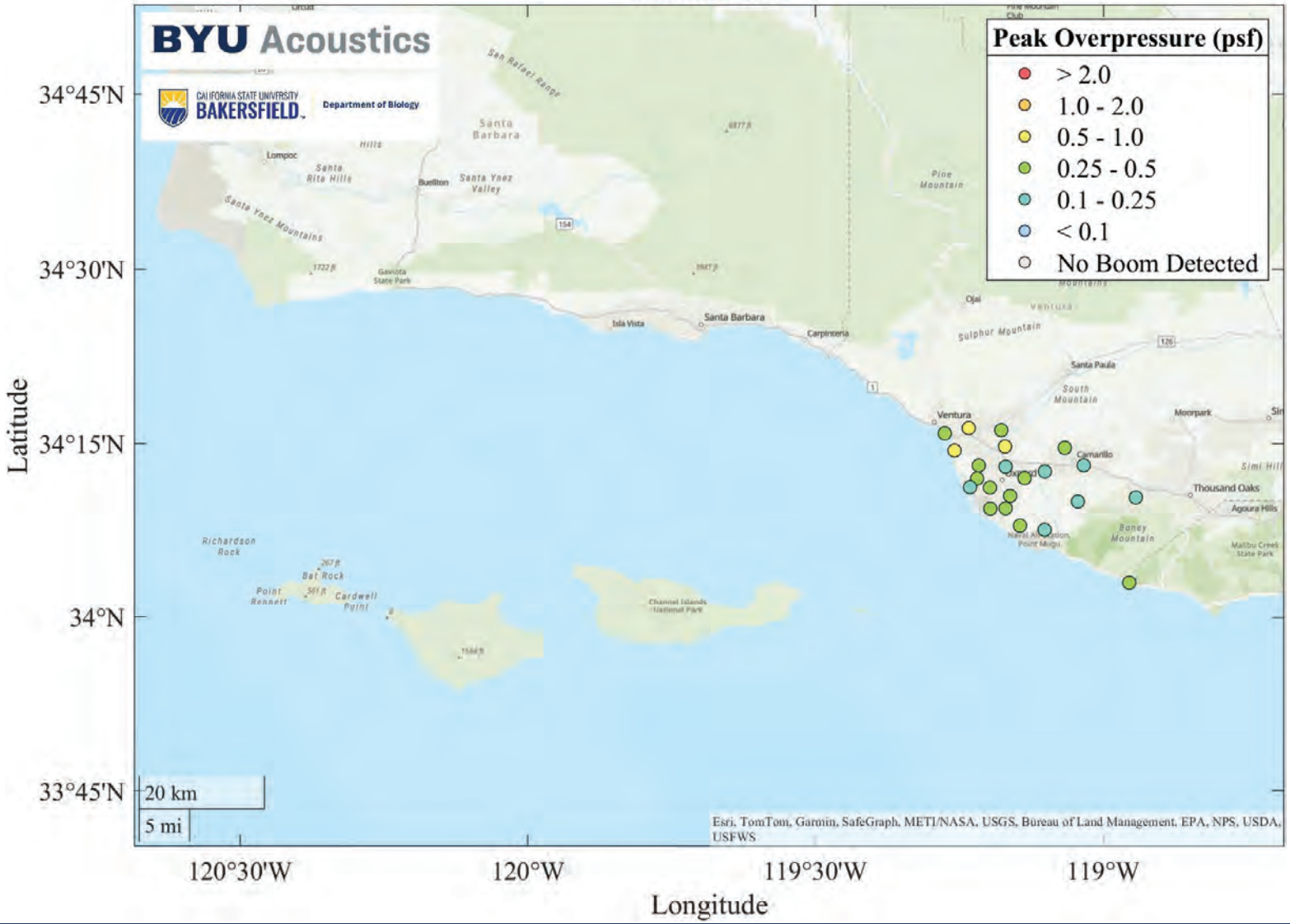
Starlink 9-3


BYU Acoustics
CALIFORNIA STATE UNIVERSITY BAKERSFIELD
Department of Biology
Peak Overpressure (psf)
> 2.0
1.0 - 2.0
0.5 - 1.0
0.25 - 0.5
0.1 - 0.25
< 0.1
No Boom Detected
34°45'N
34°30'N
34°15'N
34°N
33°45'N
Latitude
120°30'W
120°W
119°30'W
119°W
Longitude
20 km
5 mi
Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS
Santa Barbara
Carpinteria
Ventura
Camarillo
Thousand Oaks
Agoura Hills
Moorpark
Santa Paula
Ojai
Lompoc
Buellton
Isla Vista
Gaviota State Park
Point Bennett
Cardwell Point
Richardson Rock
Bat Rock
Naval Air Station Point Mugu
Channel Islands National Park
Santa Ynez Mountains
Santa Ynez Valley
Santa Rita Hills
Sulphur Mountain
South Mountain
Boney Mountain
Pine Mountain
San Rafael Range
Malibu Creek State Park

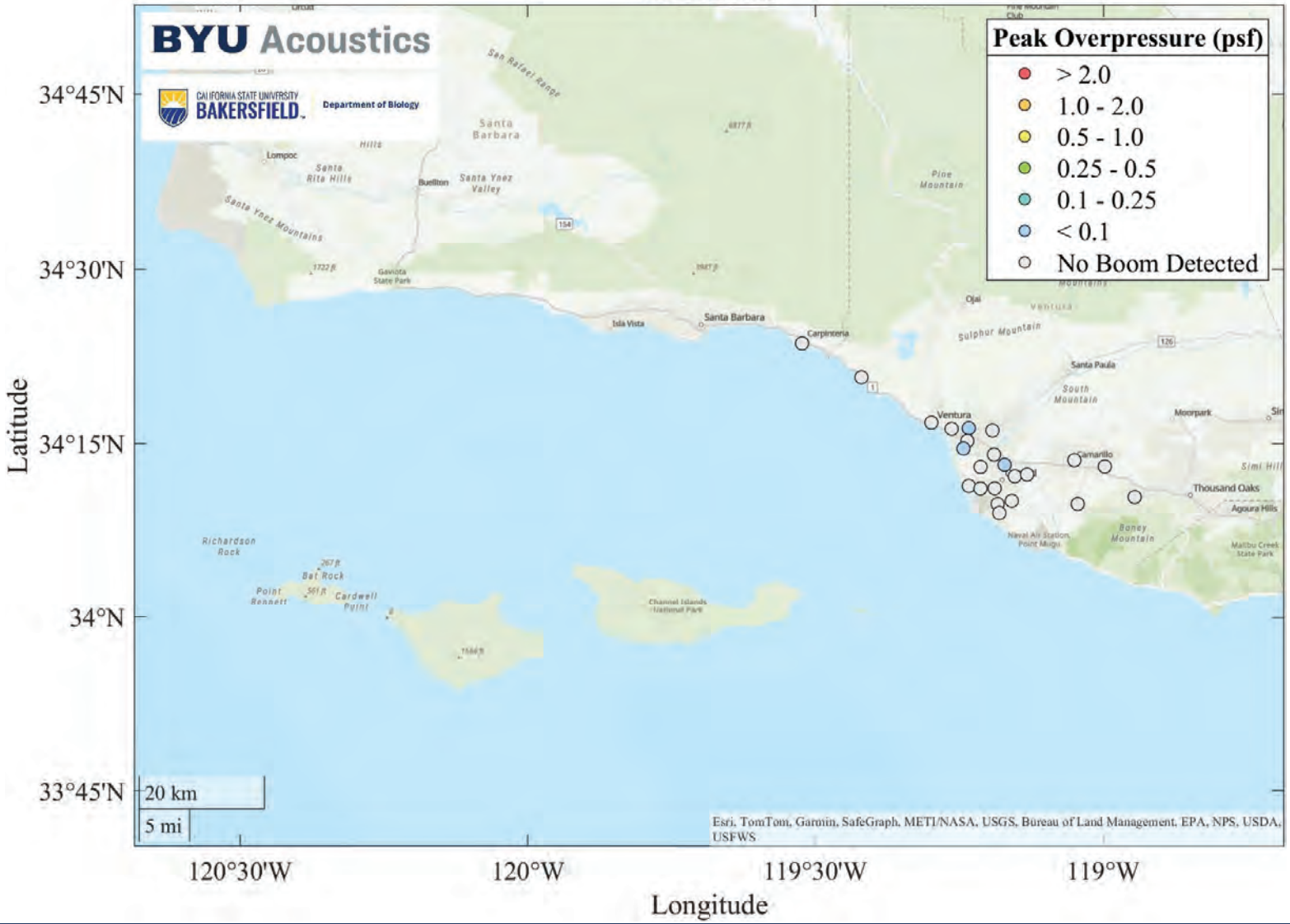
Starlink 9-4


BYU Acoustics
CALIFORNIA STATE UNIVERSITY BAKERSFIELD
Department of Biology
Peak Overpressure (psf)
> 2.0
1.0 - 2.0
0.5 - 1.0
0.25 - 0.5
0.1 - 0.25
< 0.1
No Boom Detected
34°45'N
34°30'N
34°15'N
34°N
33°45'N
Latitude
120°30'W
120°W
119°30'W
119°W
Longitude
20 km
5 mi
Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS
Santa Barbara
Ventura
Carpinteria
Isla Vista
Santa Paula
Camarillo
Thousand Oaks
Agoura Hills
Moorpark
Ojai
Lompoc
Buellton
Gaviota State Park
Point Bennett
Cardwell Point
Richardson Rock
Bat Rock
Channel Islands National Park
Santa Ynez Valley
Santa Rita Hills
Sulphur Mountain
Pine Mountain
Boney Mountain
South Mountain
Malibu Creek State Park

Starlink 11-1

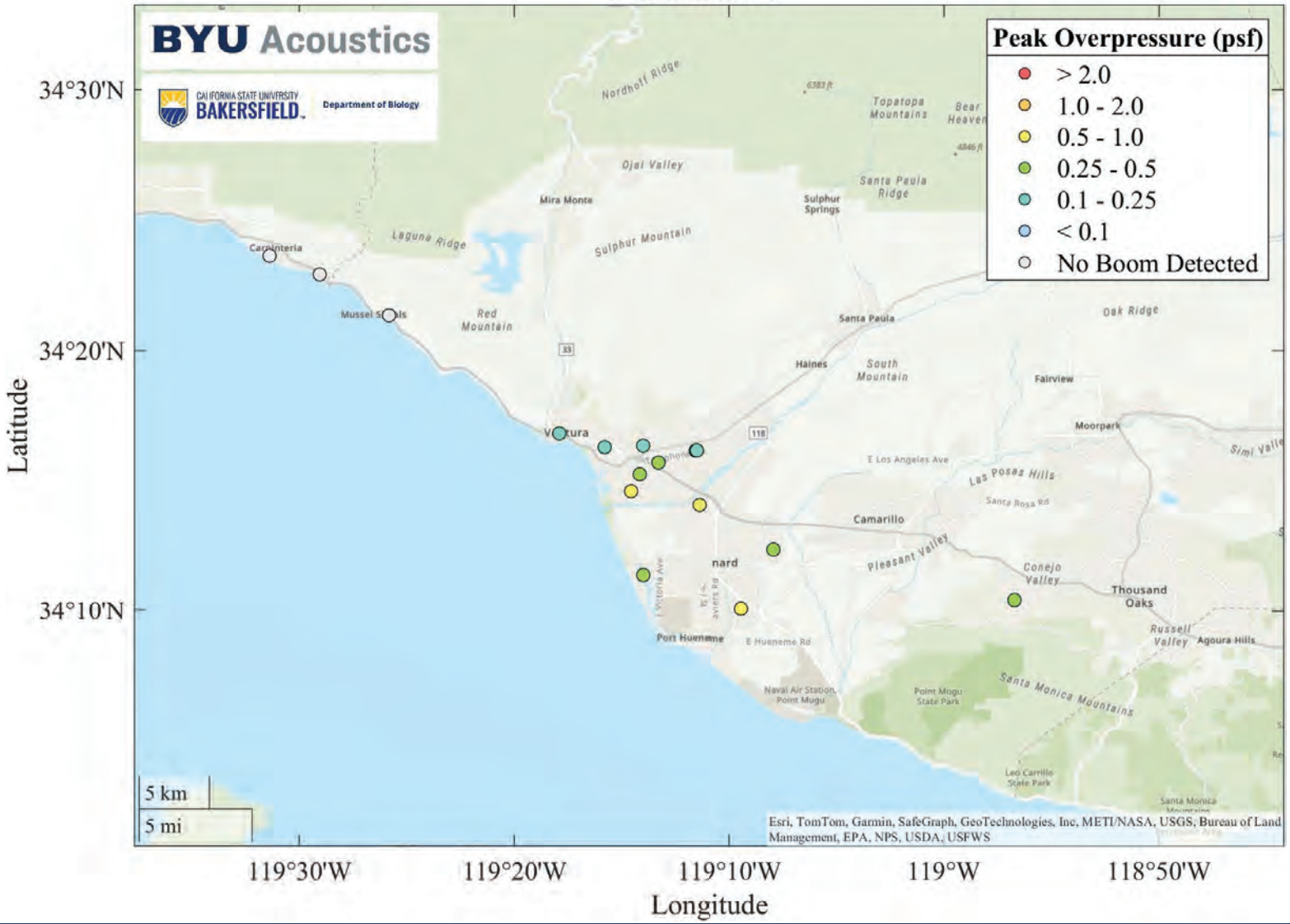


NROL-186

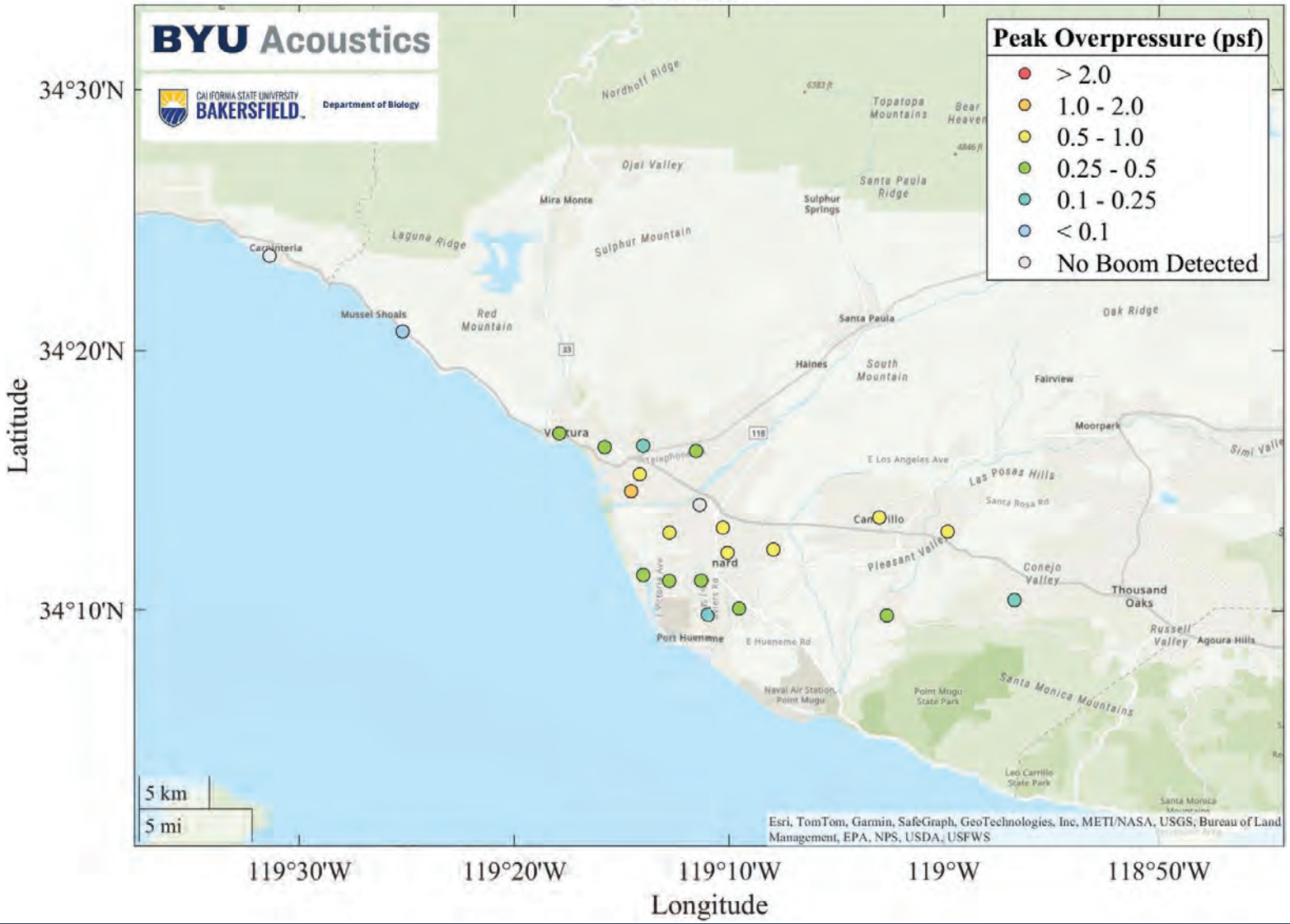

BYU Acoustics
CALIFORNIA STATE UNIVERSITY BAKERSFIELD
Department of Biology
Peak Overpressure (psf)
> 2.0
1.0 - 2.0
0.5 - 1.0
0.25 - 0.5
0.1 - 0.25
< 0.1
No Boom Detected
34°45'N
34°30'N
34°15'N
34°N
33°45'N
Latitude
120°30'W
120°W
119°30'W
119°W
Longitude
20 km
5 mi
Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS
Santa Barbara
Lompoc
Santa Rita Hills
Buellton
Santa Ynez Valley
Santa Ynez Mountains
Gaviota State Park
Isla Vista
Carpinteria
Ojai
Sulphur Mountain
Santa Paula
South Mountain
Ventura
Moorpark
Camarillo
Thousand Oaks
Agoura Hills
Boney Mountain
Pine Mountain
Richardson Rock
Bat Rock
Point Bennett
Cardwell Point
Channel Islands National Park
Naval Air Station Point Mugu
Malibu Creek State Park

Zoomed Maps

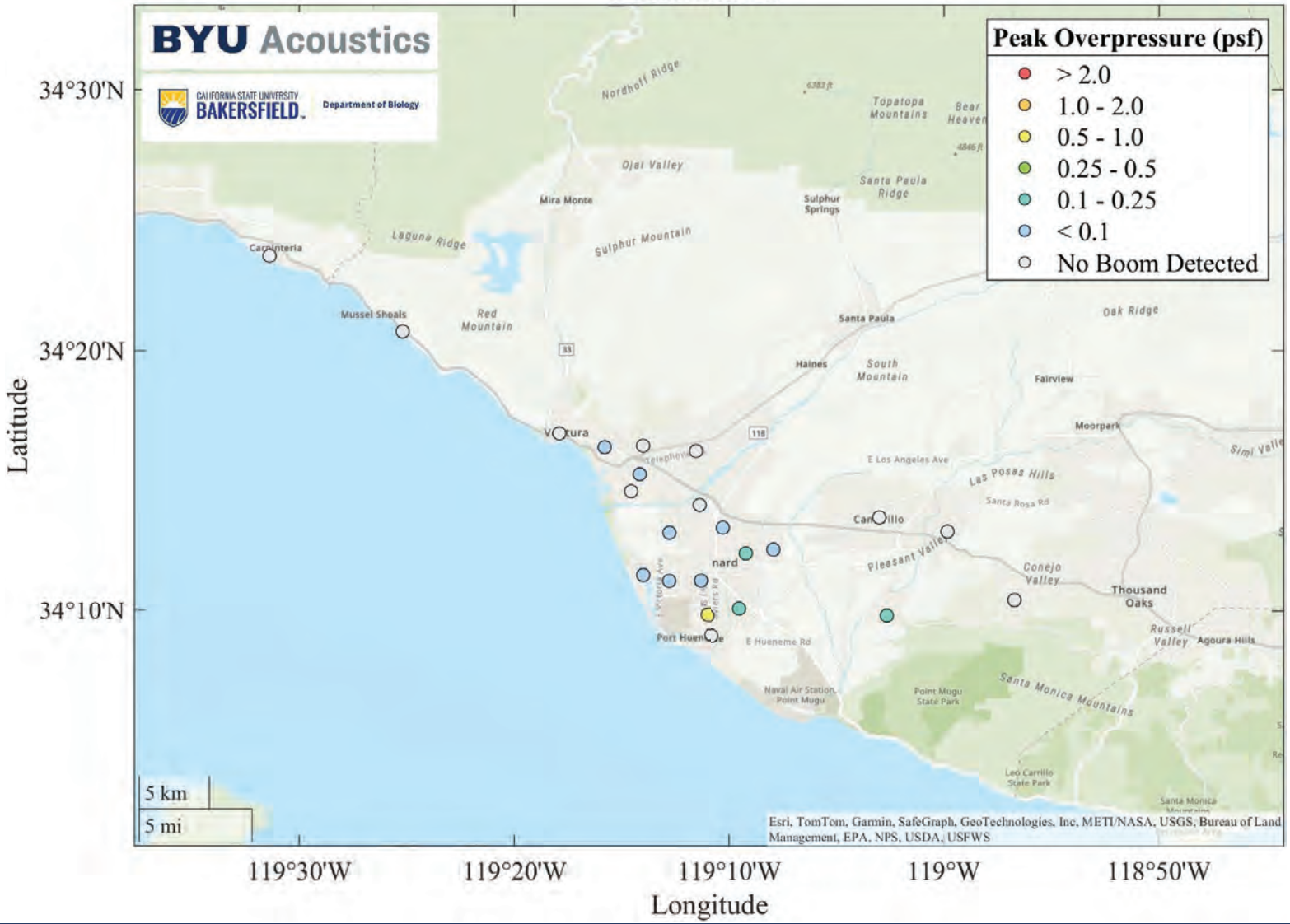
Starlink 9-1


BYU Acoustics
CALIFORNIA STATE UNIVERSITY BAKERSFIELD
Department of Biology
Peak Overpressure (psf)
> 2.0
1.0 - 2.0
0.5 - 1.0
0.25 - 0.5
0.1 - 0.25
< 0.1
No Boom Detected
34°30'N
34°20'N
34°10'N
Latitude
119°30'W
119°20'W
119°10'W
119°W
118°50'W
Longitude
Nordhoff Ridge
Topatopa Mountains
Bear Heaven
Ojai Valley
Santa Paula Ridge
Mira Monte
Sulphur Springs
Laguna Ridge
Sulphur Mountain
Carpinteria
Red Mountain
Santa Paula
Oak Ridge
Haines
South Mountain
Fairview
Moorpark
Las Posas Hills
Santa Rosa Rd
Camarillo
Pleasant Valley
Conejo Valley
Thousand Oaks
Russell Valley
Agoura Hills
Port Hueneme
E Hueneme Rd
Naval Air Station Point Mugu
Point Mugu State Park
Santa Monica Mountains
Leo Carrillo State Park
5 km
5 mi
Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS

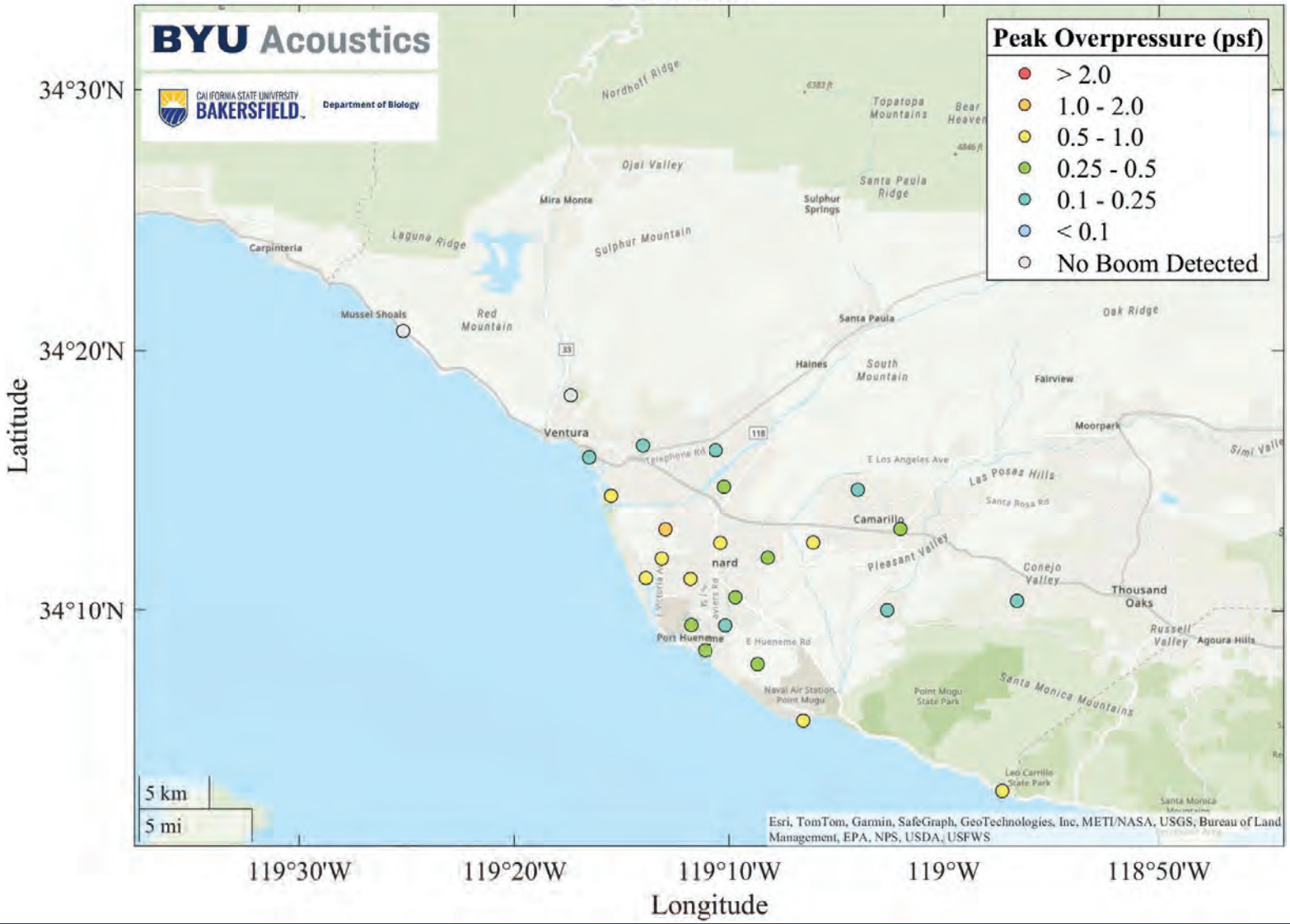
Starlink 9-2


BYU Acoustics
CALIFORNIA STATE UNIVERSITY BAKERSFIELD
Department of Biology
Peak Overpressure (psf)
> 2.0
1.0 - 2.0
0.5 - 1.0
0.25 - 0.5
0.1 - 0.25
< 0.1
No Boom Detected
34°30'N
34°20'N
34°10'N
Latitude
119°30'W
119°20'W
119°10'W
119°W
118°50'W
Longitude
Nordhoff Ridge
Topatopa Mountains
Bear Heaven
Ojai Valley
Santa Paula Ridge
Mira Monte
Sulphur Springs
Laguna Ridge
Sulphur Mountain
Carpinteria
Mussel Shoals
Red Mountain
Santa Paula
Oak Ridge
Haines
South Mountain
Fairview
Moorpark
E Los Angeles Ave
Las Posas Hills
Santa Rosa Rd
Pleasant Valley
Conejo Valley
Thousand Oaks
Russell Valley
Agoura Hills
Port Hueneme
E Hueneme Rd
Naval Air Station Point Mugu
Point Mugu State Park
Santa Monica Mountains
Leo Carrillo State Park
5 km
5 mi
Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS

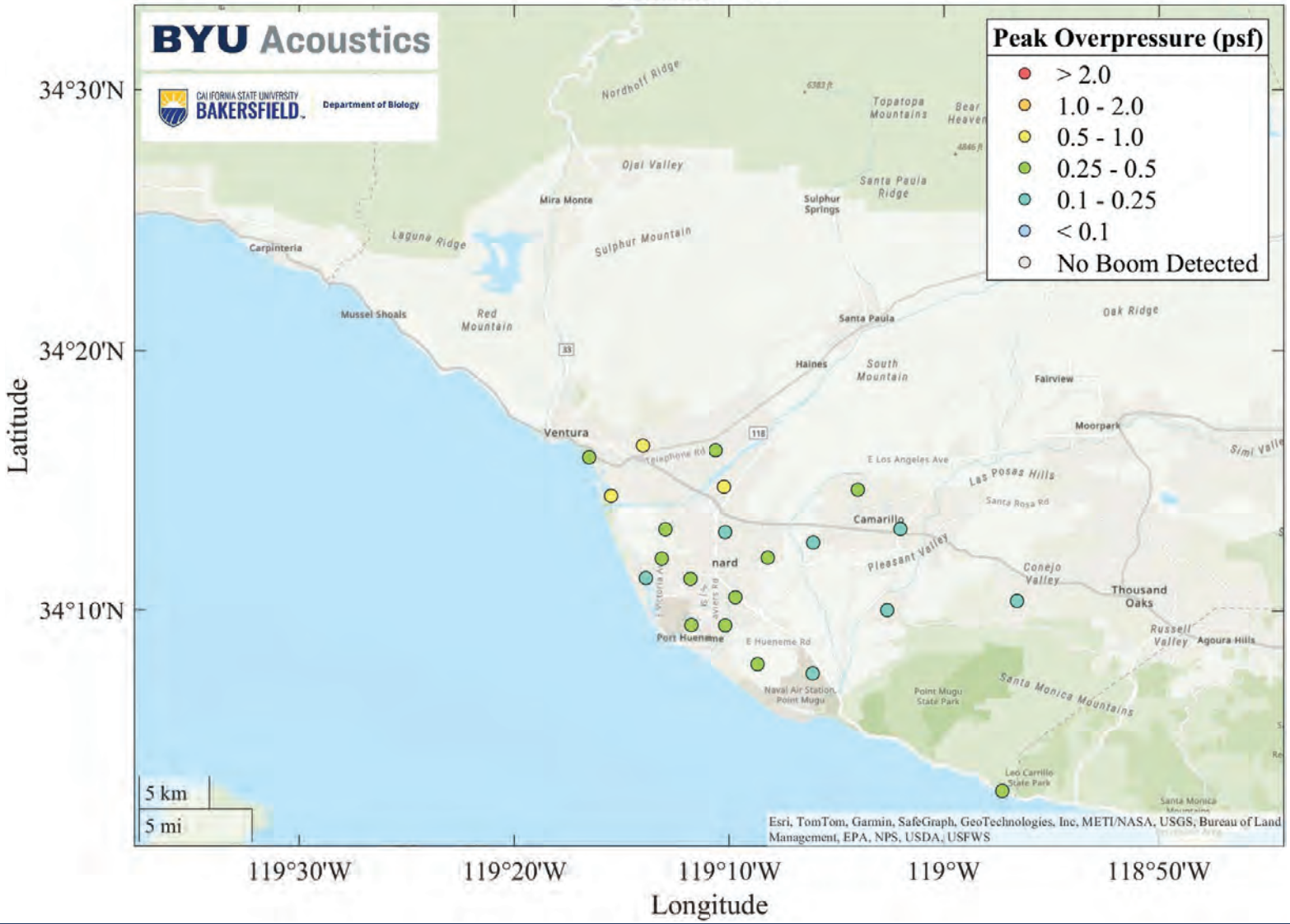
Starlink 9-3


BYU Acoustics
CALIFORNIA STATE UNIVERSITY BAKERSFIELD
Department of Biology
Peak Overpressure (psf)
> 2.0
1.0 - 2.0
0.5 - 1.0
0.25 - 0.5
0.1 - 0.25
< 0.1
No Boom Detected
Nordhoff Ridge
Topatopa Mountains
Bear Heaven
Ojai Valley
Santa Paula Ridge
Mira Monte
Sulphur Springs
Laguna Ridge
Sulphur Mountain
Carpinteria
Mussel Shoals
Red Mountain
Santa Paula
Oak Ridge
Haines
South Mountain
Fairview
Moorpark
Ventura
E Los Angeles Ave
Las Posas Hills
Santa Rosa Rd
Camarillo
Pleasant Valley
Conejo Valley
Thousand Oaks
Port Hueneme
E Hueneme Rd
Russell Valley
Agoura Hills
Naval Air Station Point Mugu
Point Mugu State Park
Santa Monica Mountains
Leo Carrillo State Park
5 km
5 mi
Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS
34°30'N
34°20'N
34°10'N
Latitude
119°30'W
119°20'W
119°10'W
119°W
118°50'W
Longitude

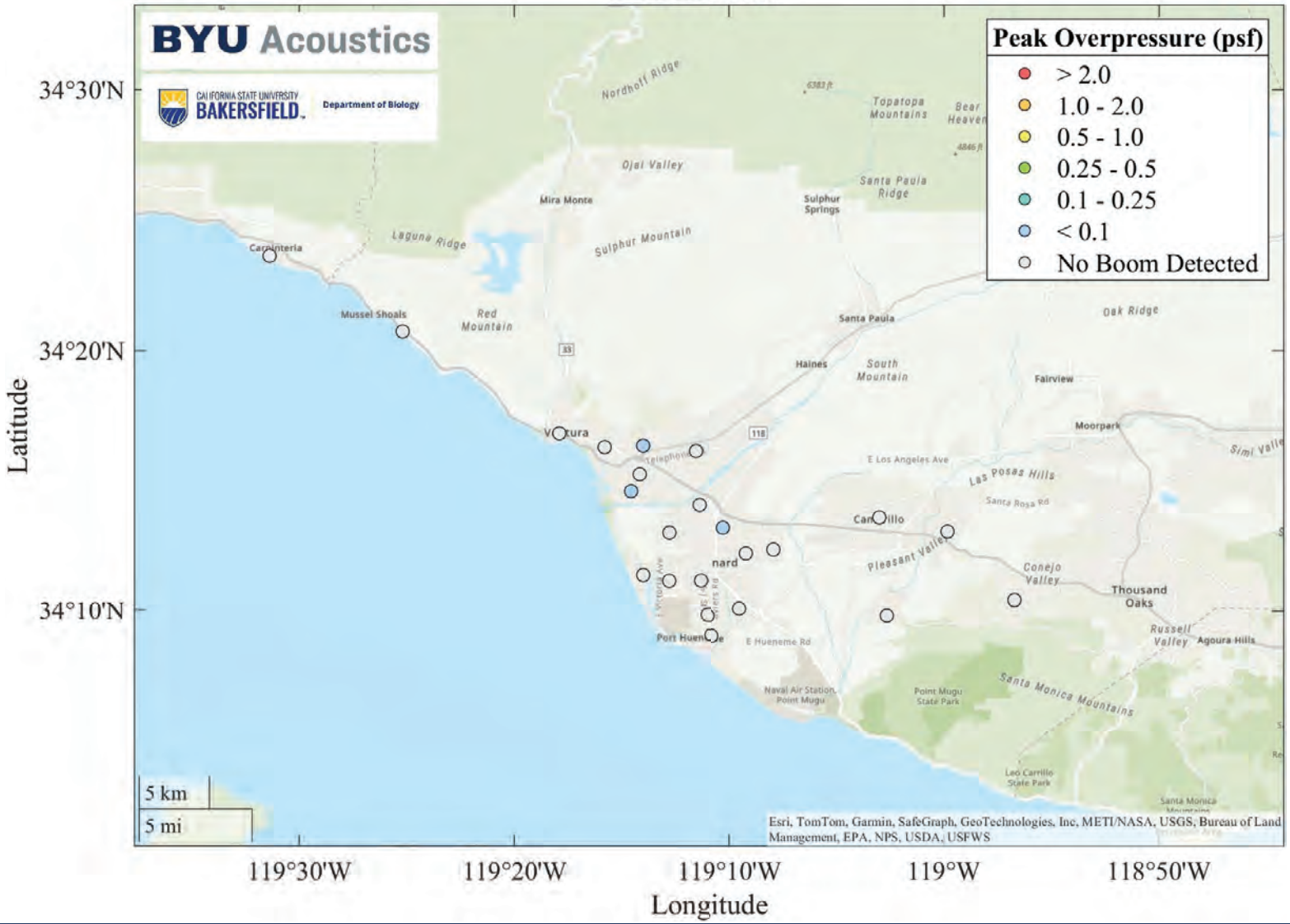
Starlink 9-4


BYU Acoustics
California State University Bakersfield
Department of Biology
Peak Overpressure (psf)
> 2.0
1.0 - 2.0
0.5 - 1.0
0.25 - 0.5
0.1 - 0.25
< 0.1
No Boom Detected
34°30'N
34°20'N
34°10'N
Latitude
119°30'W
119°20'W
119°10'W
119°W
118°50'W
Longitude
Nordhoff Ridge
Topatopa Mountains
Bear Heaven
Ojai Valley
Mira Monte
Sulphur Springs
Santa Paula Ridge
Carpinteria
Laguna Ridge
Sulphur Mountain
Mussel Shoals
Red Mountain
Santa Paula
Oak Ridge
Haines
South Mountain
Fairview
Ventura
Moorpark
Las Posas Hills
Camarillo
Pleasant Valley
Conejo Valley
Thousand Oaks
Port Hueneme
E Hueneme Rd
Naval Air Station Point Mugu
Point Mugu State Park
Santa Monica Mountains
Russell Valley
Agoura Hills
Leo Carrillo State Park
5 km
5 mi
Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS

Starlink 11-1

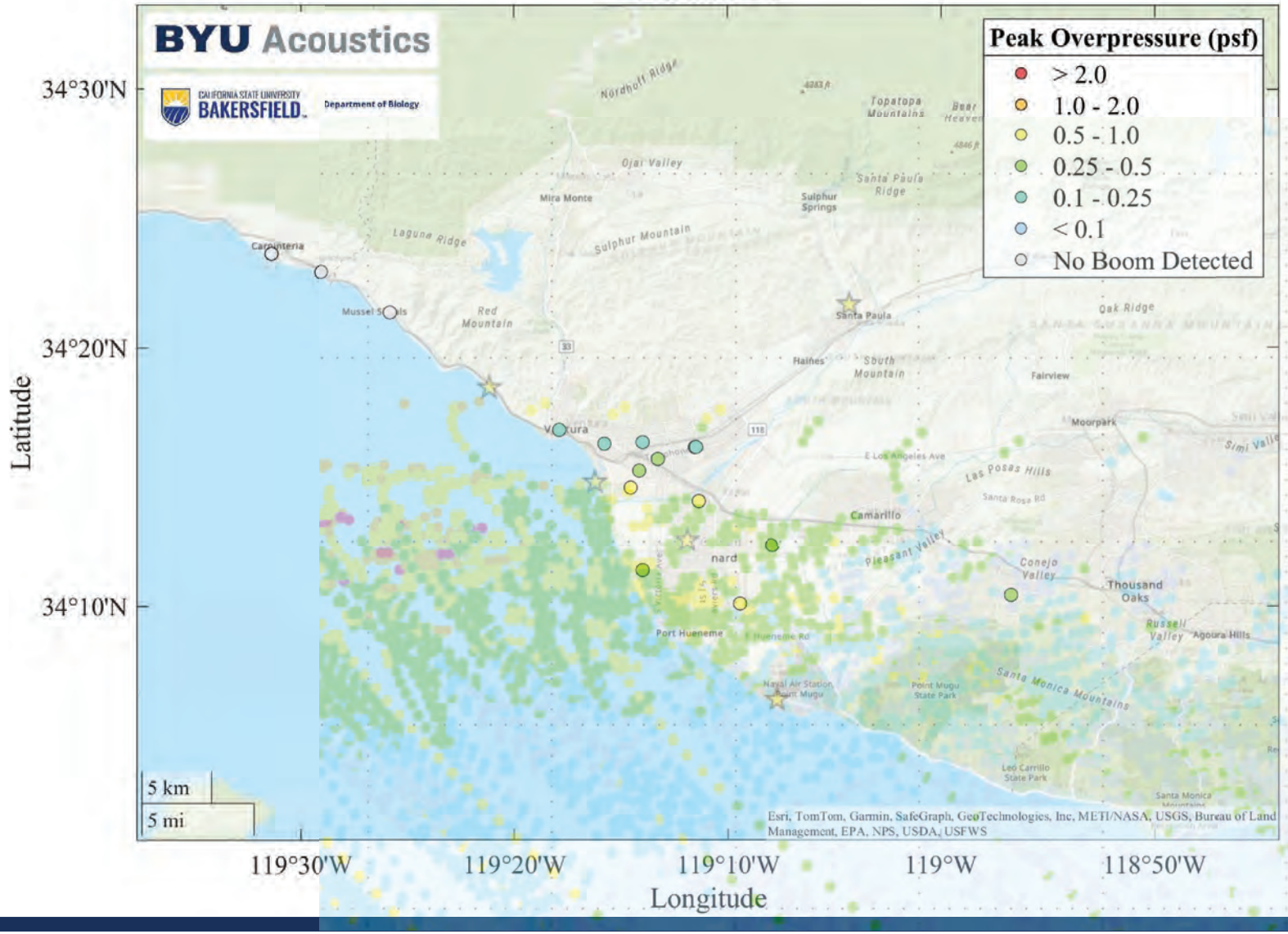


NROL-186

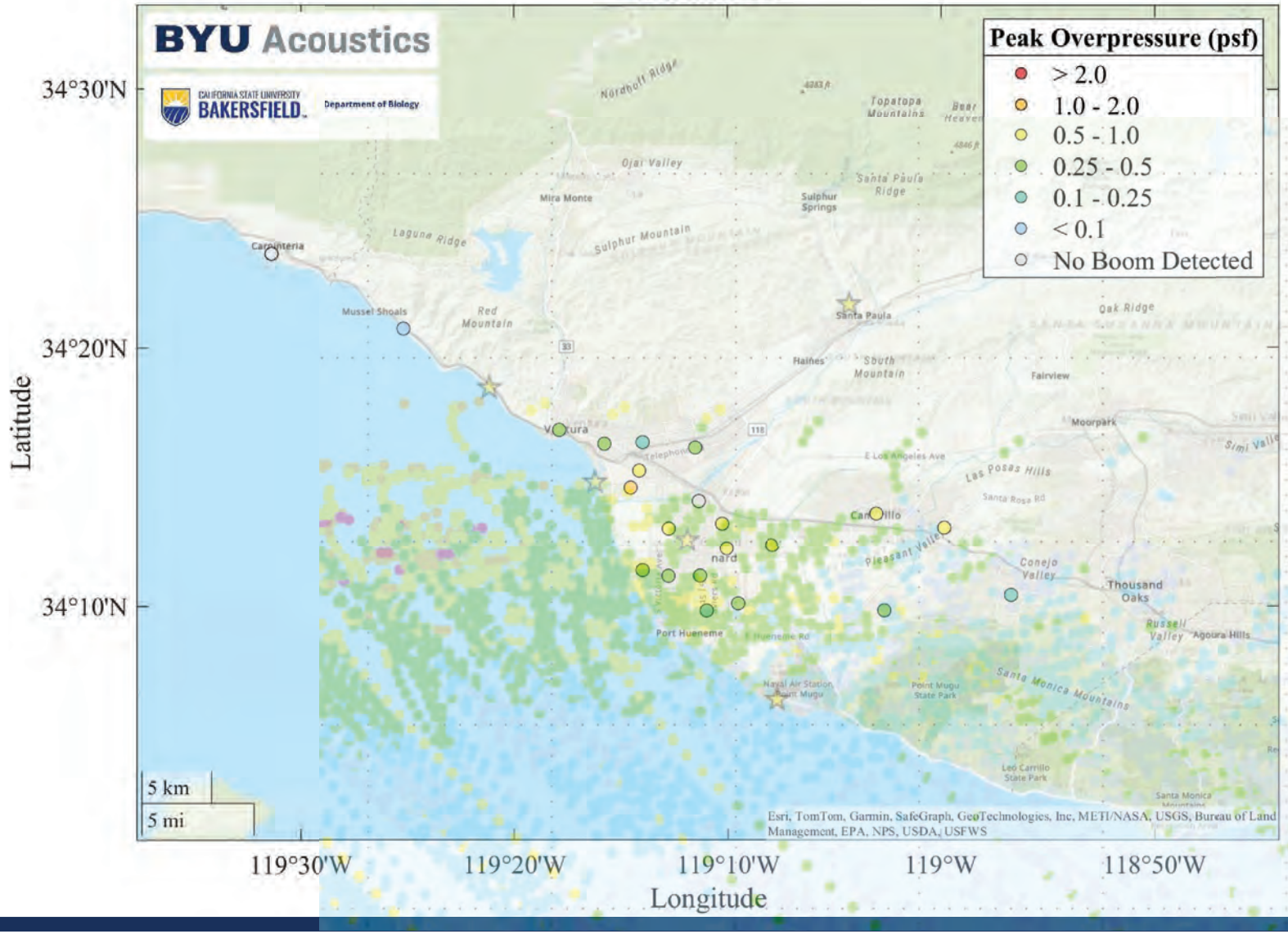

BYU Acoustics
CALIFORNIA STATE UNIVERSITY BAKERSFIELD
Department of Biology
Peak Overpressure (psf)
> 2.0
1.0 - 2.0
0.5 - 1.0
0.25 - 0.5
0.1 - 0.25
< 0.1
No Boom Detected
34°30'N
34°20'N
34°10'N
Latitude
119°30'W
119°20'W
119°10'W
119°W
118°50'W
Longitude
Nordhoff Ridge
Topatopa Mountains
Bear Heaven
Ojai Valley
Mira Monte
Sulphur Springs
Santa Paula Ridge
Laguna Ridge
Sulphur Mountain
Carpinteria
Mussel Shoals
Red Mountain
Santa Paula
Oak Ridge
Haines
South Mountain
Fairview
Moorpark
Las Posas Hills
Santa Rosa Rd
E Los Angeles Ave
Pleasant Valley
Conejo Valley
Thousand Oaks
Russell Valley
Agoura Hills
E Hueneme Rd
Naval Air Station Point Mugu
Point Mugu State Park
Santa Monica Mountains
Leo Carrillo State Park
5 km
5 mi
Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS

Zoomed Maps with Predicted Overlay

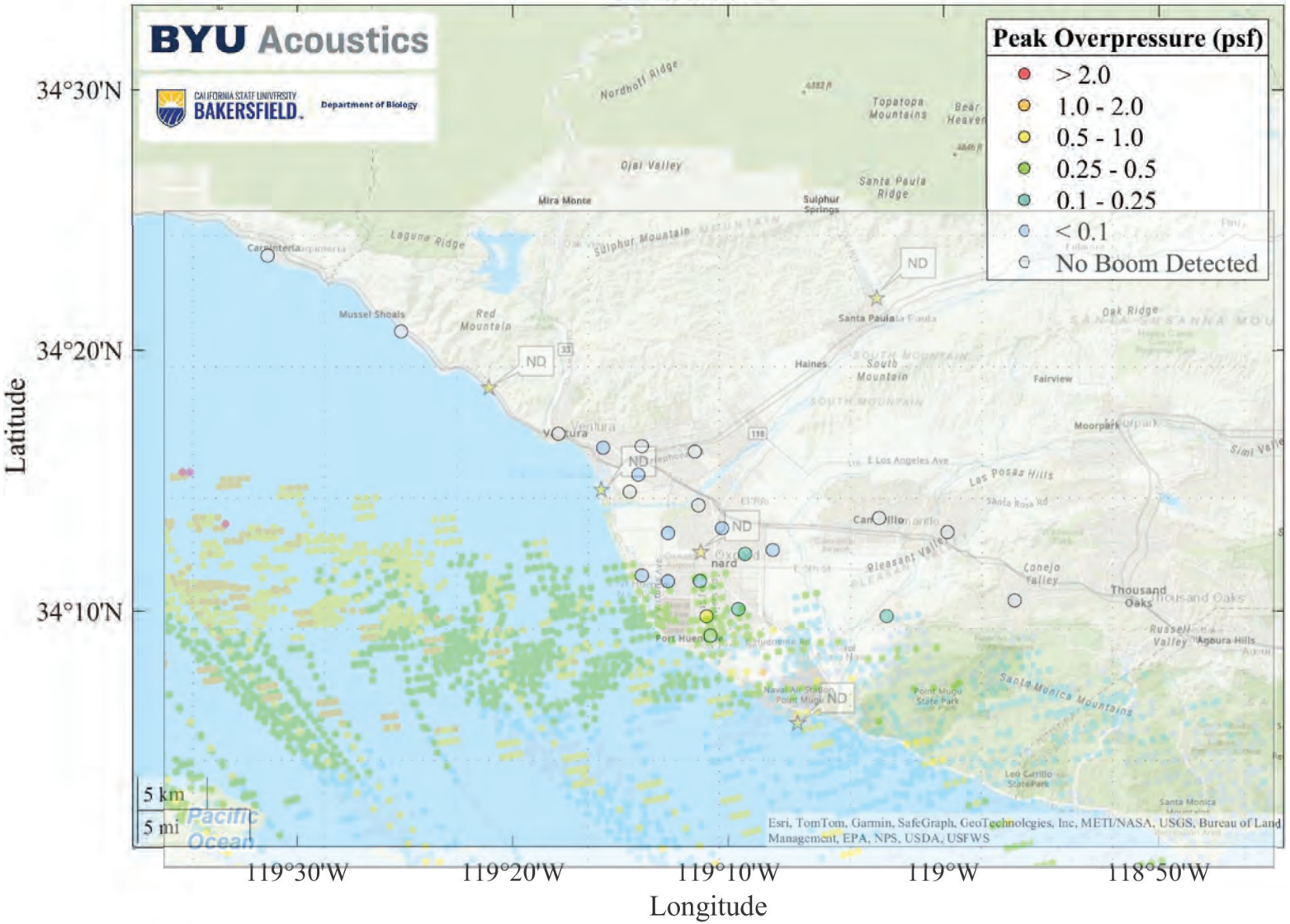
Starlink 9-1


BYU Acoustics
California State University Bakersfield
Department of Biology
Peak Overpressure (psf)
> 2.0
1.0 - 2.0
0.5 - 1.0
0.25 - 0.5
0.1 - 0.25
< 0.1
No Boom Detected
34°30'N
34°20'N
34°10'N
Latitude
119°30'W
119°20'W
119°10'W
119°W
118°50'W
Longitude
Carpinteria
Mussel Shoals
Ventura
Santa Paula
Camarillo
Port Hueneme
Naval Air Station Point Mugu
Point Mugu State Park
Leo Carrillo State Park
Thousand Oaks
Moorpark
Fairview
Oak Ridge
Simi Valley
Las Posas Hills
Conejo Valley
Russell Valley
Agoura Hills
Santa Monica Mountains
Pleasant Valley
Mira Monte
Sulphur Springs
Santa Paula Ridge
Topatopa Mountains
Ojai Valley
Nordhoff Ridge
Laguna Ridge
Sulphur Mountain
Red Mountain
South Mountain
Haines
5 km
5 mi
Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS

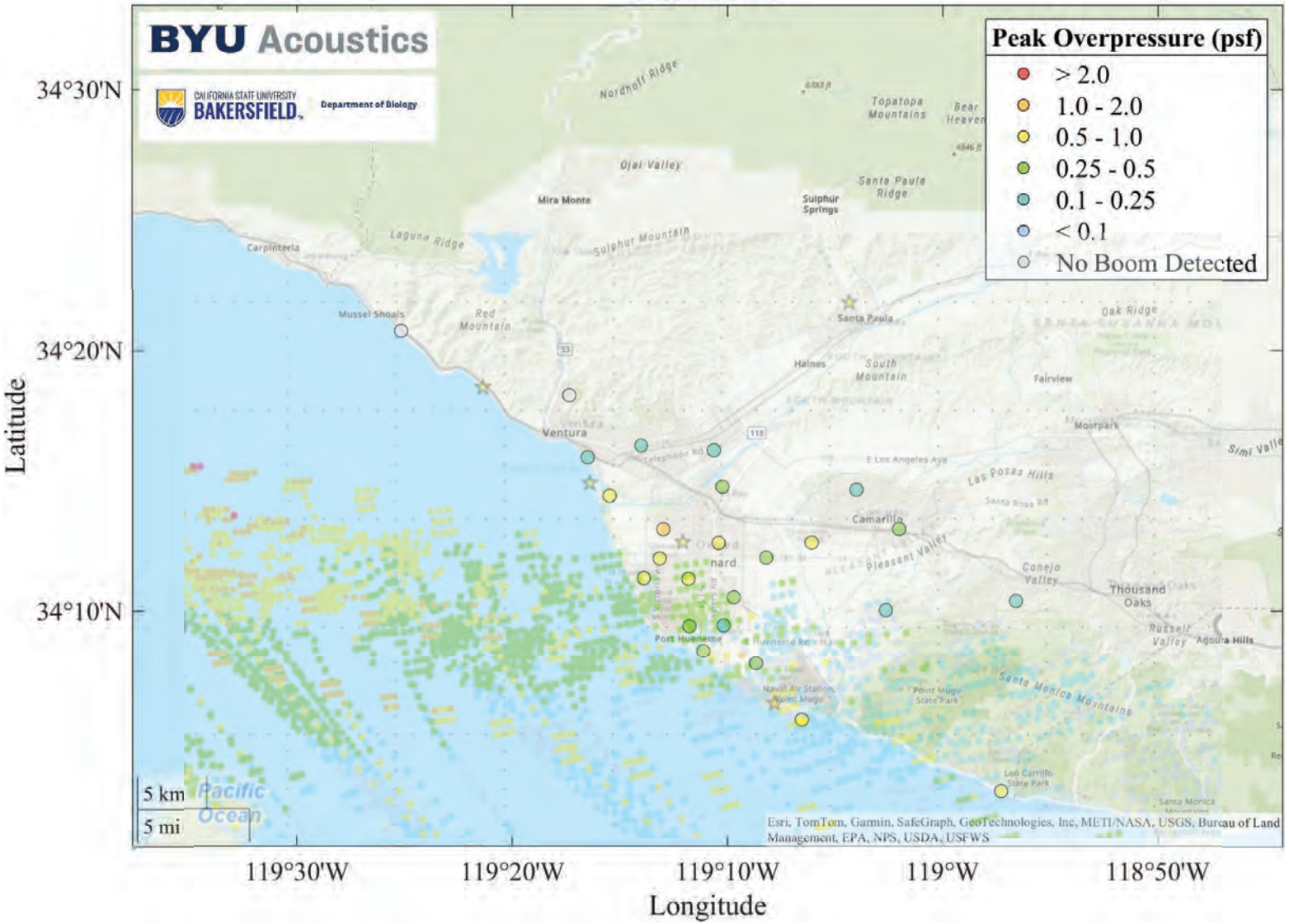
Starlink 9-2


BYU Acoustics
CALIFORNIA STATE UNIVERSITY BAKERSFIELD
Department of Biology
Peak Overpressure (psf)
> 2.0
1.0 - 2.0
0.5 - 1.0
0.25 - 0.5
0.1 - 0.25
< 0.1
No Boom Detected
34°30'N
34°20'N
34°10'N
Latitude
119°30'W
119°20'W
119°10'W
119°W
118°50'W
Longitude
5 km
5 mi
Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS
Carpinteria
Mussel Shoals
Ventura
Santa Paula
Oak Ridge
Fairview
Moorpark
Simi Valley
Las Posas Hills
Conejo Valley
Thousand Oaks
Russell Valley
Agoura Hills
Port Hueneme
Point Mugu State Park
Santa Monica Mountains
Leo Carrillo State Park
Mira Monte
Sulphur Springs
Santa Paula Ridge
Topatopa Mountains
Ojai Valley
Laguna Ridge
Sulphur Mountain
Red Mountain
Haines
South Mountain
Pleasant Valley
Santa Rosa Rd
E Los Angeles Ave
Nordhoff Ridge

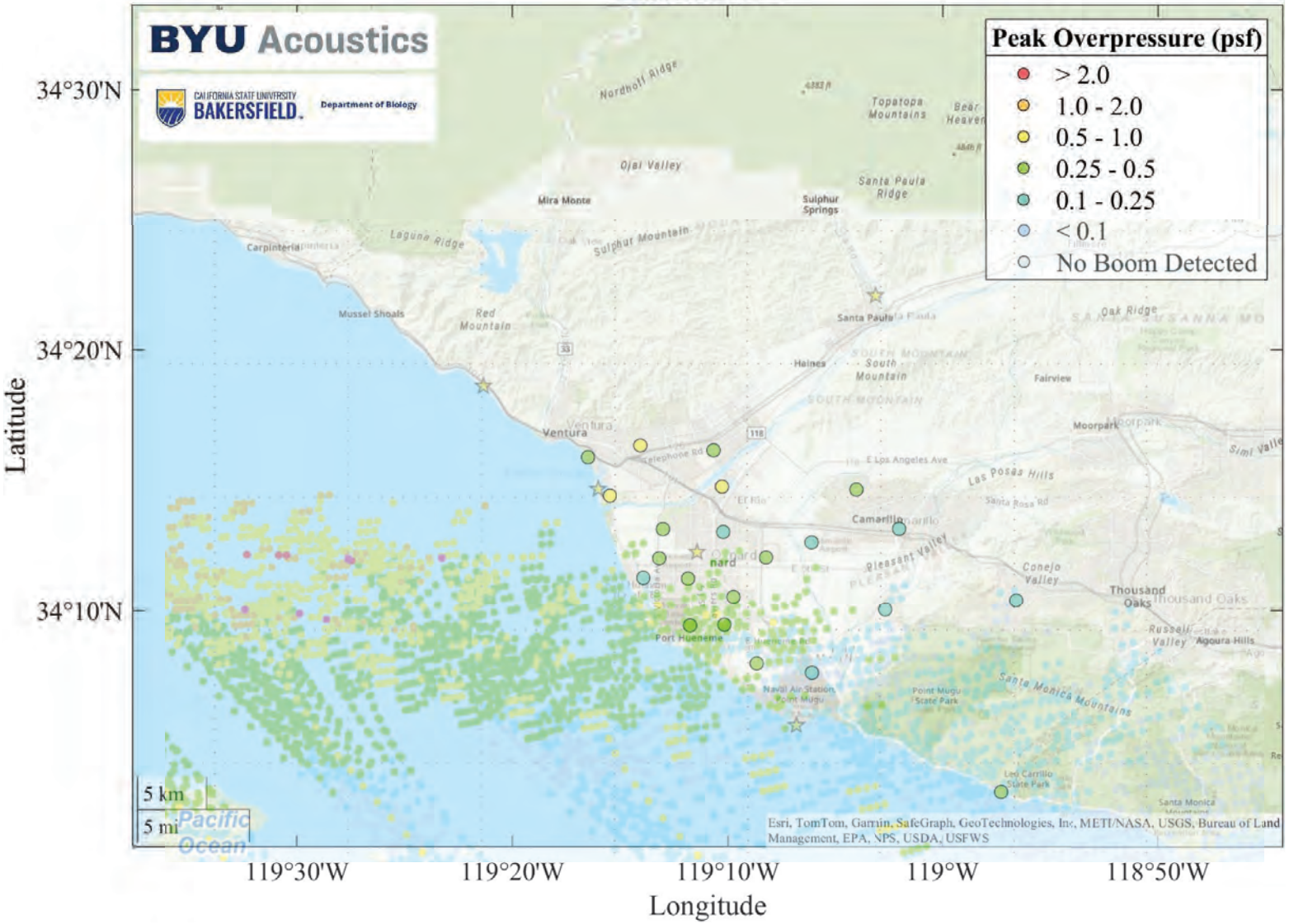
Starlink 9-3


BYU Acoustics
CALIFORNIA STATE UNIVERSITY BAKERSFIELD. Department of Biology
Peak Overpressure (psf)
> 2.0
1.0 - 2.0
0.5 - 1.0
0.25 - 0.5
0.1 - 0.25
< 0.1
No Boom Detected
ND
34°30'N
34°20'N
34°10'N
Latitude
119°30'W
119°20'W
119°10'W
119°W
118°50'W
Longitude
5 km
5 mi
Pacific Ocean
Esri, TomTom, Garmin, SafeGraph, GeoTechnolgies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS

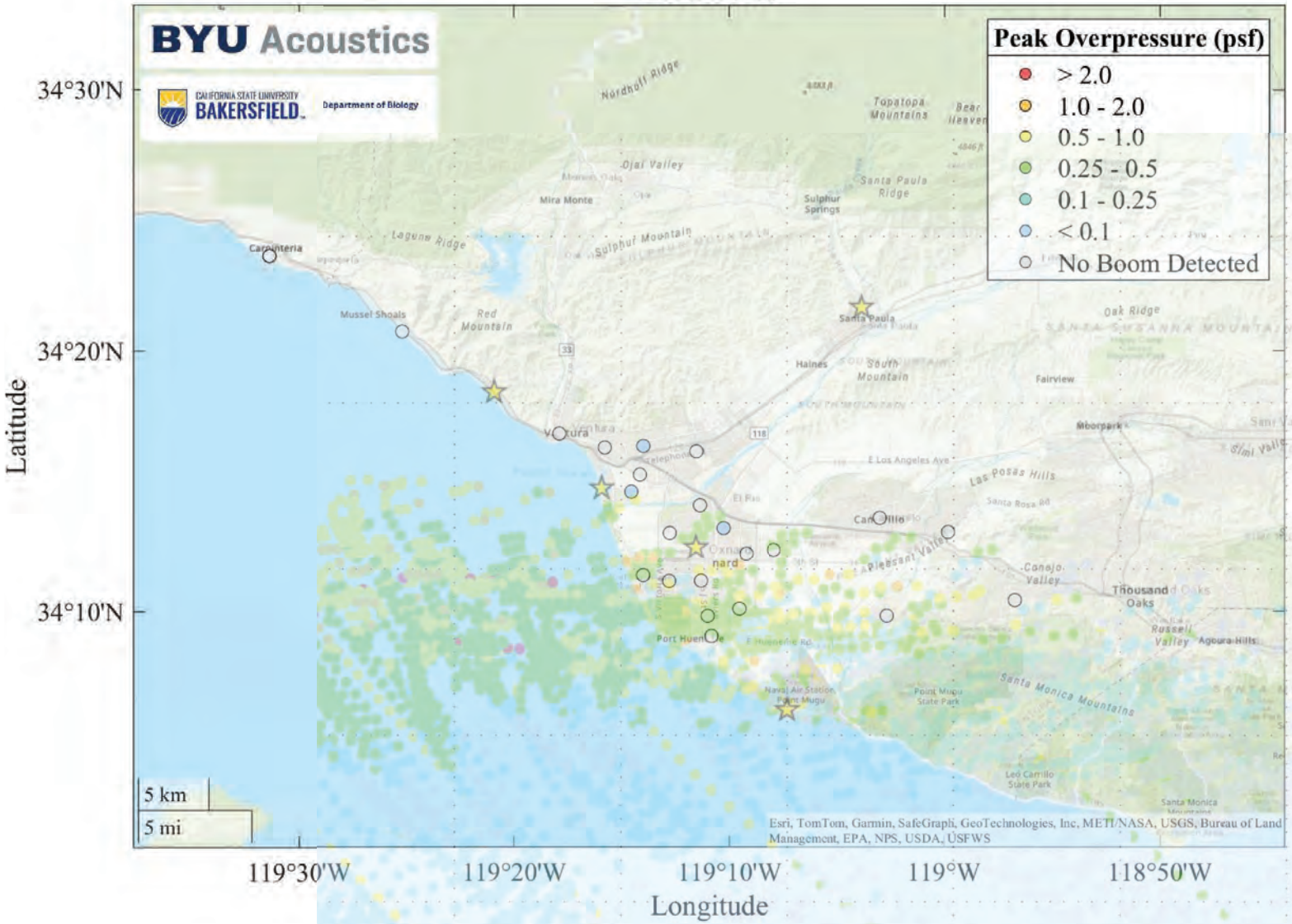
Starlink 9-4


BYU Acoustics
California State University Bakersfield
Department of Biology
Peak Overpressure (psf)
> 2.0
1.0 - 2.0
0.5 - 1.0
0.25 - 0.5
0.1 - 0.25
< 0.1
No Boom Detected
34°30'N
34°20'N
34°10'N
Latitude
119°30'W
119°20'W
119°10'W
119°W
118°50'W
Longitude
Nordhoff Ridge
Topatopa Mountains
Bear Heaven
Ojai Valley
Mira Monte
Sulphur Springs
Santa Paula Ridge
Carpinteria
Laguna Ridge
Sulphur Mountain
Mussel Shoals
Red Mountain
Santa Paula
Oak Ridge
Haines
South Mountain
Fairview
Ventura
Moorpark
Simi Valley
Las Posas Hills
Camarillo
Pleasant Valley
Conejo Valley
Thousand Oaks
Port Hueneme
Russell Valley
Agoura Hills
Santa Monica Mountains
Point Mugu State Park
Leo Carrillo State Park
Pacific Ocean
5 km
5 mi
Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS

Starlink 11-1



NROL-186

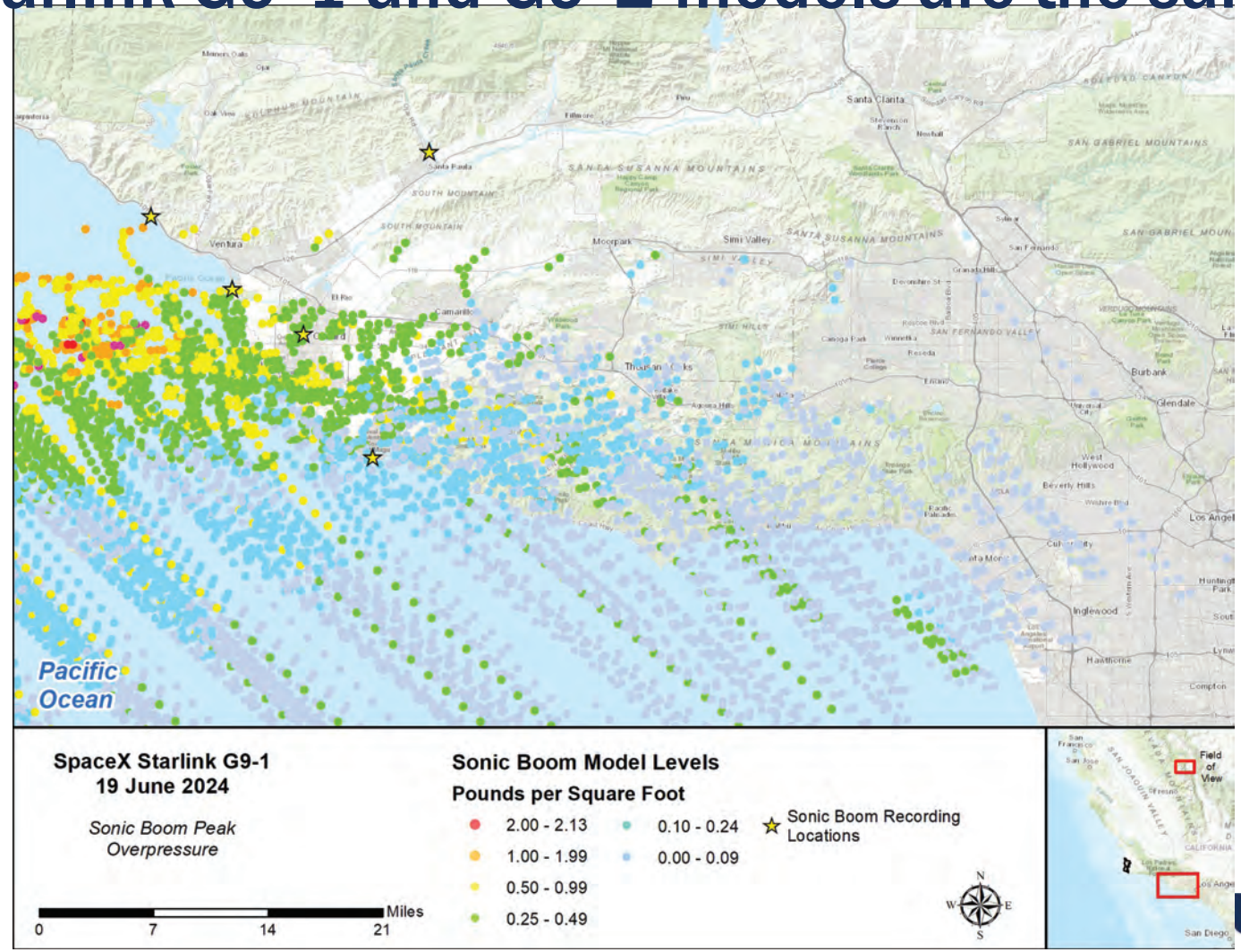

BYU Acoustics
CALIFORNIA STATE UNIVERSITY BAKERSFIELD
Department of Biology
Peak Overpressure (psf)
> 2.0
1.0 - 2.0
0.5 - 1.0
0.25 - 0.5
0.1 - 0.25
< 0.1
No Boom Detected
34°30'N
34°20'N
34°10'N
Latitude
119°30'W
119°20'W
119°10'W
119°W
118°50'W
Longitude
5 km
5 mi
Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS
Carpinteria
Mussel Shoals
Red Mountain
Laguna Ridge
Sulphur Mountain
Mira Monte
Ojai Valley
Nordhoff Ridge
Topatopa Mountains
Santa Paula Ridge
Sulphur Springs
Santa Paula
Oak Ridge
Haines
South Mountain
Fairview
Moorpark
Simi Valley
Las Posas Hills
Santa Rosa Rd
E Los Angeles Ave
El Rio
Camarillo
Oxnard
Pleasant Valley
Canejo Valley
Thousand Oaks
Russell Valley
Agoura Hills
Port Hueneme
E Hueneme Rd
Naval Air Station Point Mugu
Point Mugu State Park
Santa Monica Mountains
Leo Carrillo State Park
Santa Monica
Santa Clarita
SANTA SUSANNA MOUNTAINS
SAN FERNANDO VALLEY
SANTA MONICA MOUNTAINS
BYU Acoustics

Predictions Only

Maps represent models to predict ascent sonic boom overpressures from launches of the Falcon 9 rocket from Space Launch Complex 4 at VSFB

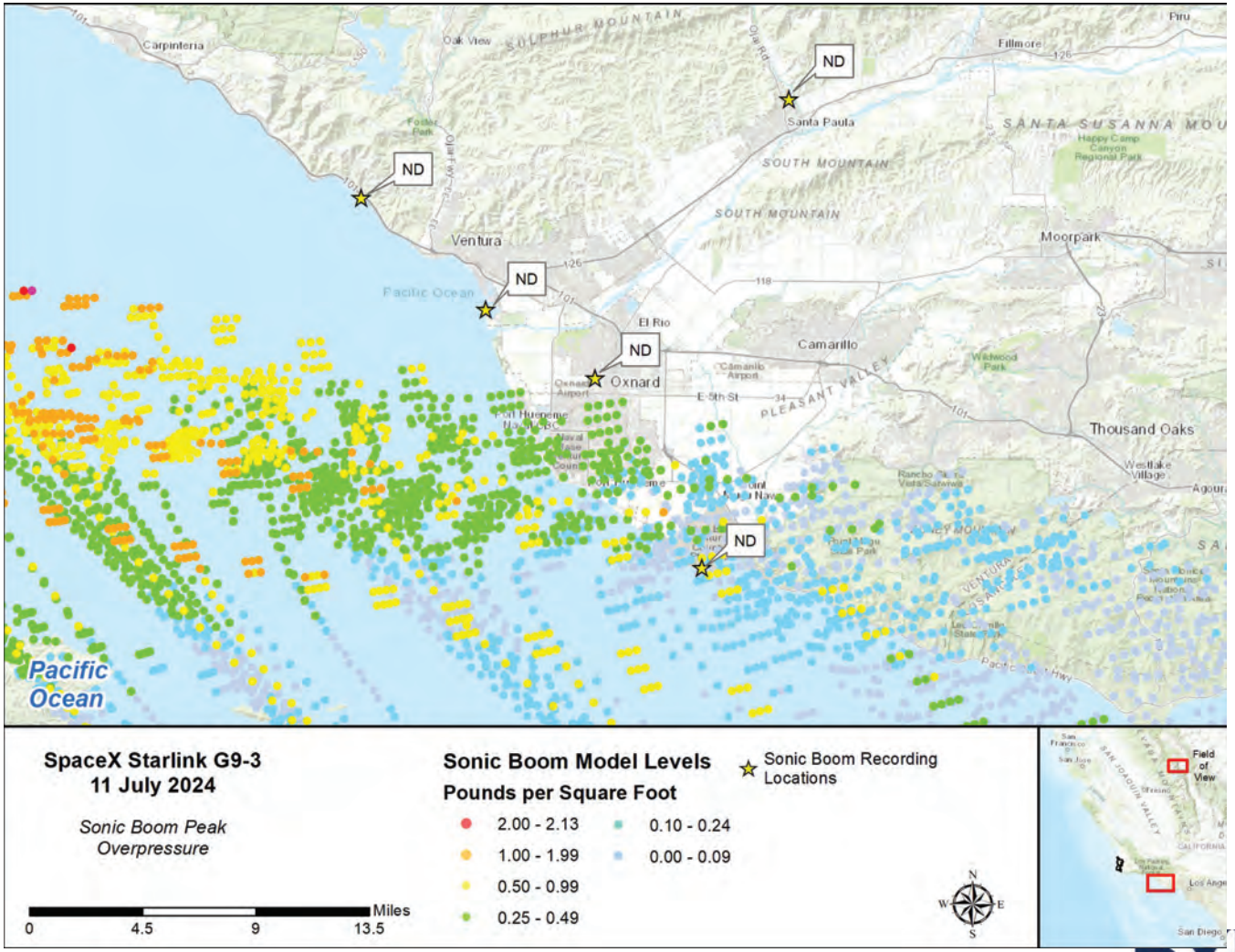
- Stars on the following 5 maps represent locations ManTech collected data from, they do not include BYU locations.

Starlink G9-1 and G9-2 models are the same



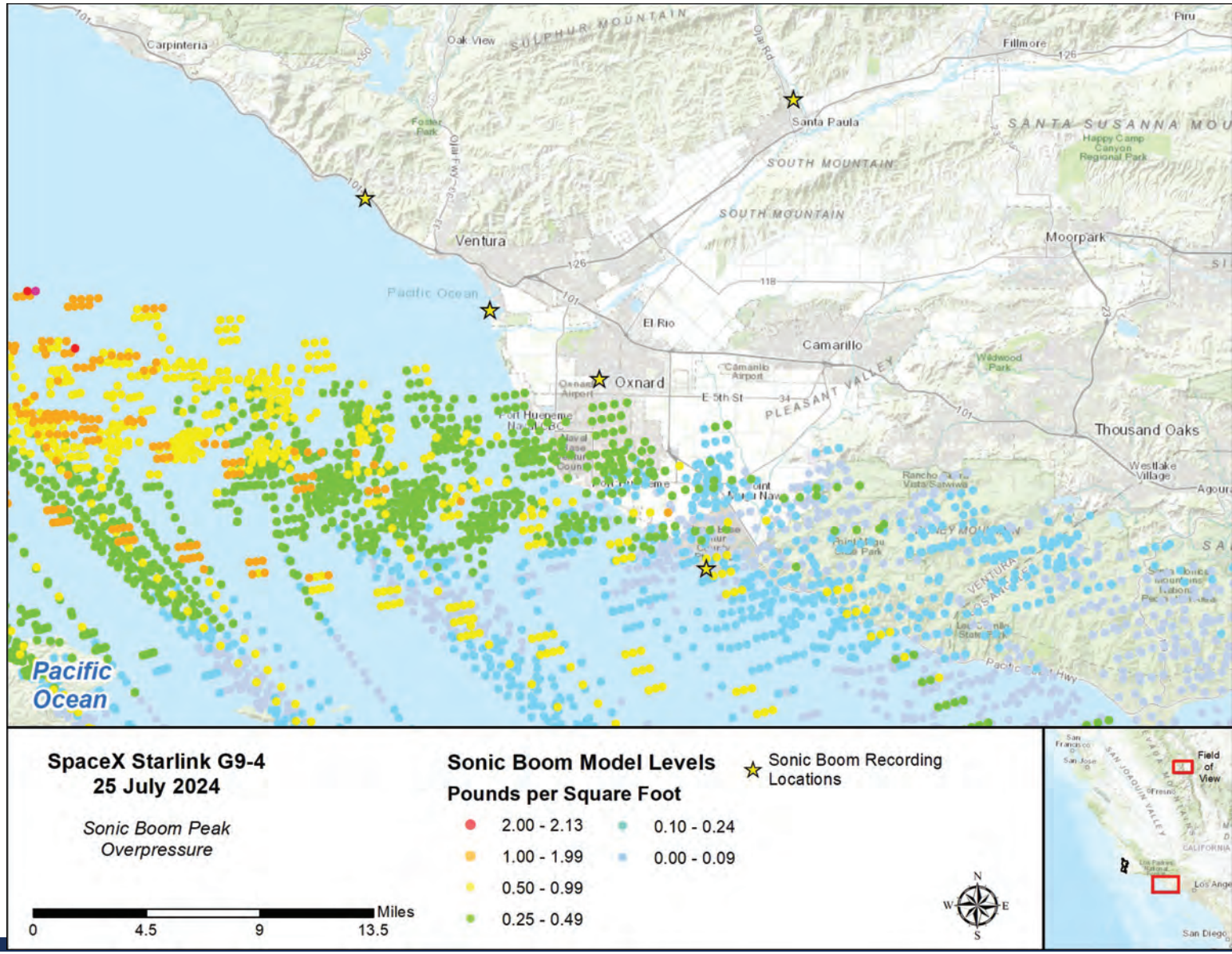
U Acoustics

This map shows the results of the ManTech data. ND = Non-detect

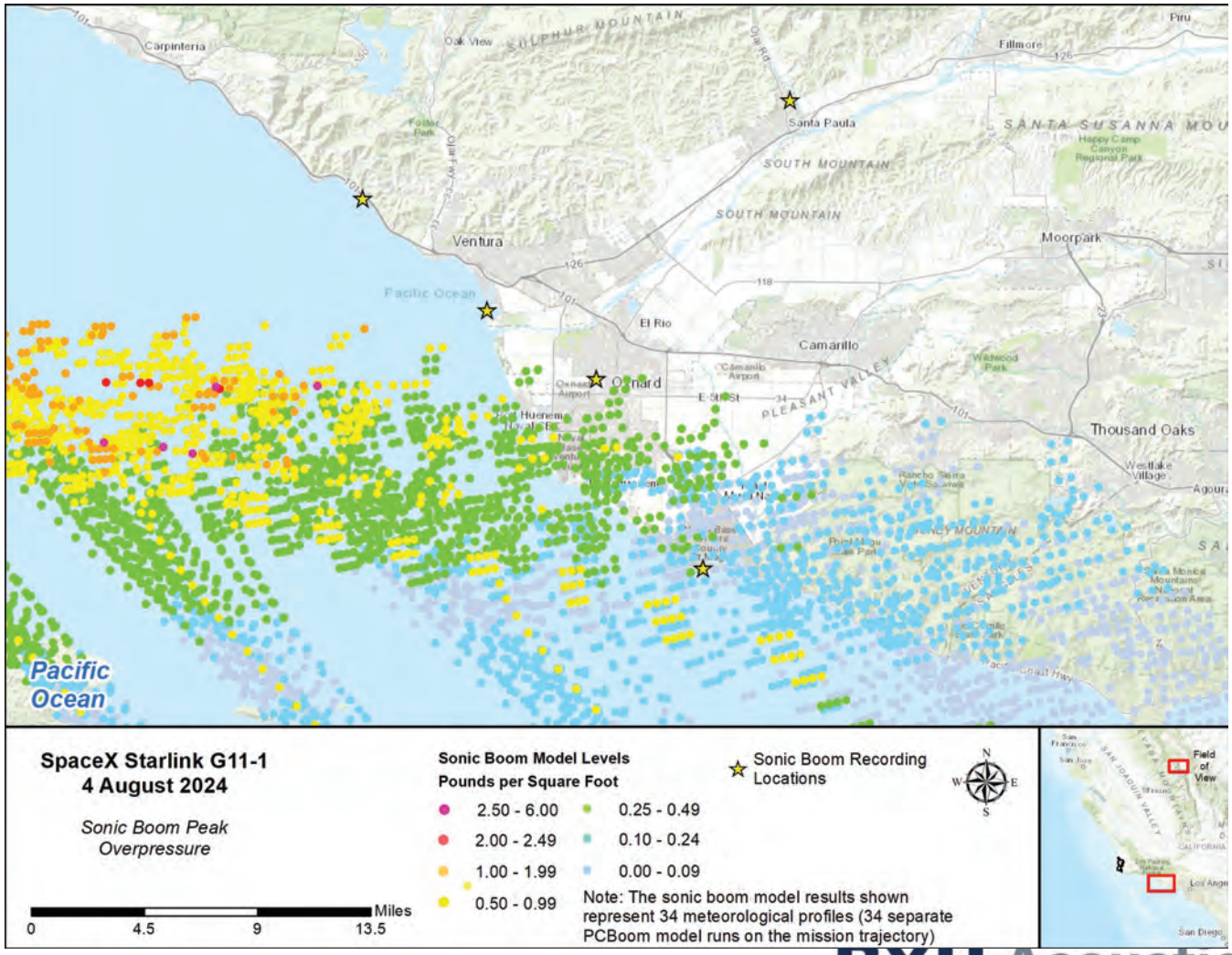


BYU Acoustics

G9-4

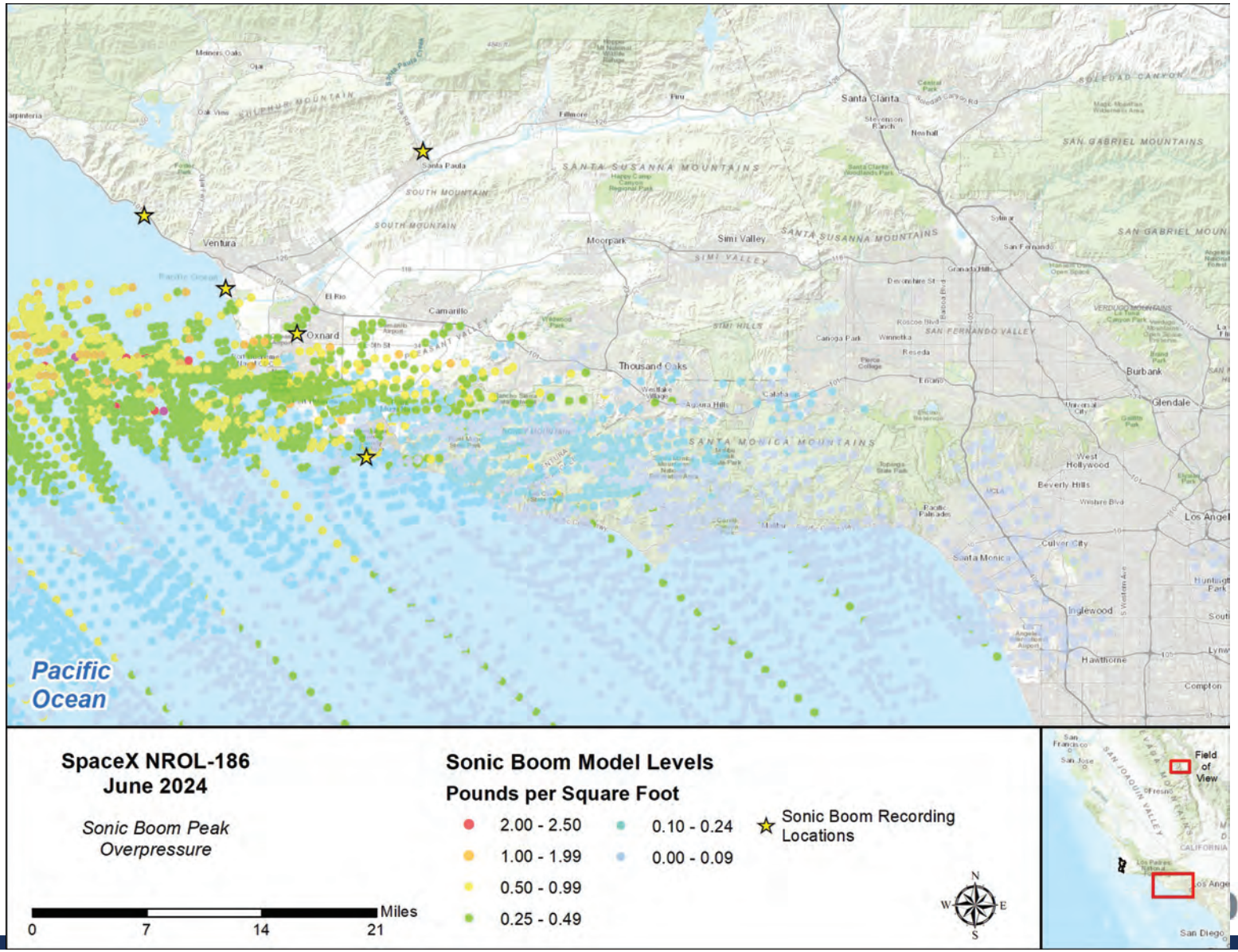

Carpinteria
Oak View
SULPHUR MOUNTAIN
Santa Paula
Fillmore
SOUTH MOUNTAIN
SOUTH MOUNTAIN
Ventura
Moorpark
Pacific Ocean
El Rio
Camarillo
Oxnard
E 5th St
PLEASANT VALLEY
Thousand Oaks
Westlake Village
Pacific Ocean
SpaceX Starlink G9-4
25 July 2024
Sonic Boom Peak Overpressure
Sonic Boom Model Levels
Pounds per Square Foot
2.00 - 2.13
1.00 - 1.99
0.50 - 0.99
0.25 - 0.49
0.10 - 0.24
0.00 - 0.09
Sonic Boom Recording Locations
Miles
0
4.5
9
13.5
N
W
E
S
Field of View

G11-1



BYU Acoustics

NROL -186



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EXHIBIT 7

DAF RESPONSE LETTERS FOR CONDITIONS

EXHIBIT 7a (SEPTEMBER 13, 2024, DAF RESPONSE LETTER).....63

EXHIBIT 7b (SEPTEMBER 17, 2024, DAF RESPONSE LETTER).....69

DEPARTMENT OF THE AIR FORCE
UNITED STATES SPACE FORCE
SPACE LAUNCH DELTA 30

September 13, 2024

Colonel Mark A. Shoemaker, USSF
Commander
Space Launch Delta 30
747 Nebraska Ave, Ste A302
Vandenberg SFB CA 93437-6261

Kate Huckelbridge, PhD
Executive Director
California Coastal Commission
455 Market Street, Suite 300
San Francisco, California 94105-2219
Phone: (415) 904-5203
Email: Kate.Huckelbridge@coastal.ca.gov

Dear Dr. Huckelbridge,

This letter is in response to the California Coastal Commission's (CCC) conditional concurrence letter regarding Consistency Determination (CD), CD-0003-24, (Increase in Space Exploration Technologies Corporation's Falcon 9 launch and landing activities at VSFB to 36 and 12 per year, respectively, as well as the addition of offshore barge landing locations in the Pacific Ocean), received by the Department of the Air Force (DAF) on 15 August 2024 and to provide information discussed during associated conversations between Dr. Ravi I. Chaudhary, Assistant Secretary of the Air Force for Energy, Installations, and Environment and the Commission. The DAF recognizes the intent and importance of the Commission's feedback and looks forward to partnering collaboratively with our federal partners and the Commission to preserve California's coastal uses and resources.

The DAF appreciates the mutual coordination of the CCC's Commissioners and staff that has occurred through ongoing reciprocal communications since before the DAF's May 2023 submission of a negative determination (ND-0009-23) for the 36-Launch Increase and receipt of concurrence on ND-0009-23 through DAF's submission of CD-0003-24 in March 2024 and the Commission's August 15, 2025, written decision providing for conditional concurrence. The DAF has cooperated with the Commission by providing documents and information to address questions or concerns raised throughout the process, including participation in hearings on 15 December 2023, 11 April 2024, 10 May 2024 (informational meeting with the Commission, the public, and VSFB), and 8 August 2024. We are committed to collaboration and coordination with the CCC as demonstrated as recently as the 6 September 2024 meeting between you and Dr. Chaudhary, and we look forward to continuing our dialogue when CCC joins Dr. Chaudhary and VSFB team at the base on 17 September.

Exhibit 7a
CD-0007-24

Specifically, the DAF has provided or made available the following environmental analysis documents and additional information: 2023 Draft Supplemental Environmental Assessment (SEA), Falcon 9 Cadence Increase at VSFB, California (CA) and Offshore Landing Locations; 2023 Final SEA, Falcon 9 Cadence Increase at VSFB, CA and Offshore Landing Locations; US Fish and Wildlife Service (USFWS) Biological Opinions (BOs) for the Launch, Boost-Back, and Landing activities of the Falcon 9 First Stage at Space Launch Complex 4 (SLC-4) at VSFB, Santa Barbara County, CA (2017, 2023, 2024); National Marine Fisheries Service (NMFS) Letter of Authorization (LOA) to 30th Space Wing dated 10 April 2019 and LOA to SLD 30 dated 9 April 2024; Space Launch Delta 30 (SLD 30) Response to California Coastal Commission Request for Information dated June 28 2024 (including sonic boom modeling and real time data for 2 launches' analysis of effects in Santa Barbara, Ventura, and western Los Angeles counties).

Prior to the 8 August 2024 hearing, the Commission staff and the DAF came to agreement on conditions 4 through 7 for this 36-launch cadence. At that time, the DAF and Commission staff were unable to reach mutual agreement on requested conditions 1 through 3. While considerable written and verbal communications have occurred to address the Commission's repeated or developing questions and requested conditions related to the CD, the DAF is providing you with a more detailed plan that we believe not only meets the intent of conditions 1 through 3, but also demonstrates DAF's commitment to protecting natural resources at and around VSFB and coordinating with the CCC on these efforts that will address potential adverse impacts from space launch activities from VSFB.

Condition 1. The DAF implementation plan to meet the intent of the Condition 1 is as follows.

The DAF is developing and executing monitoring management plans required for compliance with the March 2023 and August 2024 USFWS BOs and the April NMFS 2024 LOA (2024 LOA) and will provide these plans to the Executive Director and Commission staff for review and input on the draft monitoring management plans as an active stakeholder. The DAF intends to provide the Commission staff 14 calendar days of review opportunity for each plan or report. All input will be carefully considered and shared with USFWS and NMFS. The DAF will deliver to the Executive Director and Commission staff the draft reports required by USFWS annually by 31 December, and NMFS annually by 1 February, prior to the date the final reports are due to USFWS (30 January) and NMFS (1 March). The DAF will provide the Executive Director and Commission staff the final reports by 1 July annually, unless an extension is granted by USFWS or NMFS. The 2024 BO requires enhanced conservation measures and monitoring, and the DAF will also share this information in the draft reports for Executive Director and Commission staff input.

Condition 1.a.i.

The DAF will conduct ongoing marine mammal monitoring in accordance with the 2024 LOA requirements. For over 20 years (in accordance with prior NMFS LOAs), DAF conducted launch specific monitoring at haul out sites nearest to SLC-4. The significant data gathered over this time was analyzed and used to establish requirements for the 2024 LOA. In accordance with the 2024 LOA, among other launch specific requirements, DAF will conduct monitoring of population distribution to detect any population level declines or changes in distribution. Launch specific monitoring and acoustic measurements at VSFB are still required under certain conditions (e.g.

louder/larger vehicles or new locations, if sonic boom thresholds are modeled at a certain level). The DAF will conduct monitoring twice a month to monitor the abundance, distribution, and status of pinnipeds on VSFB, plus launch specific monitoring under conditions set forth in the 2024 LOA. While NMFS has scientifically determined that certain individual pinniped monitoring is no longer required under the 2024 LOA, DAF invites the Executive Director and Commission staff to provide input regarding monitoring concerns and DAF will assess the input and coordinate with NMFS. When providing its feedback, the Commission staff will provide specific concerns regarding any population of a coastal resource they believe will be adversely impacted on VSFB by launch activities beyond what is currently being addressed by the 2024 BO and 2024 LOA requirements. The scientific data in support of the concerns will be evaluated by wildlife experts, in consultation with USFWS and NMFS, to determine appropriate measures the DAF will pursue. The DAF will also provide the Executive Director and Commission staff the Air Force Research Lab (AFRL) study which records rocket launches and reentries and will result in a publicly releasable dataset when finalized, anticipated approximately October 2025.

Condition 1.a.ii.

The DAF currently monitors and collects information on many bat species, including those identified in Condition 1.a.ii, in accordance with the Sikes Act and VSFB's associated Integrated Natural Resources Management Plan (INRMP) which is coordinated not only with the USFWS but with the California Department of Fish and Wildlife (CDFW). The DAF will provide the Executive Director and Commission staff with the information.

Condition 1.a.iii.

The DAF also monitors and collects information on the monarch butterfly in accordance with the Sikes Act and VSFB's associated INRMP. The DAF will provide the Executive Director and Commission staff with the information.

Condition 1.a.iv.

The DAF will identify and analyze data for off-base reference site populations for the Western Snowy Plover (WSP) and the California Red Legged Frog (CRLF), which the USFWS has required in the 2024 BO. The DAF, in coordination with USFWS, will select 2 reference sites for monitoring the WSP and CRLF by 1 January 2025: one site to the north and one to the south of VSFB. This data will be incorporated into base-wide monitoring data and reports. If deemed appropriate and subject to necessary funding authorization, the DAF will fund off-base recovery work for the WSP and its habitat. DAF will provide draft reports generated from these projects to the Commission staff for review and input prior to any final reports due to USFWS and will provide a final report by 1 July annually. The link to the USFWS website for WSP reports throughout the range is at https://www.fws.gov/species/western-snowy-plover-charadrius-nivosus-nivos.

Condition 1.a.v.

The DAF will conduct ongoing marine mammal monitoring on the Northern Channel Islands (NCI) in accordance with the 2024 LOA requirements. As noted above in section 1.a.i., for over 20 years DA completed launch specific monitoring at haul out sites nearest to SLC-4 in accordance with prior NMFS LOAs. The information gained from an analysis of this data was used to determine necessary measures contained within the 2024 LOA. DAF will conduct monitoring in accordance with the 2024 LOA. The DAF invites the Executive Director and Commission staff to review the 2024 LOA and provide input regarding any remaining concerns. The DAF will assess input and coordinate with NMFS. Draft reports required by the 2024 LOA will also be provided to the Commission staff for review and input by 1 February annually and input will be considered by the DAF in coordination with NMFS prior to the DAF finalizing the report due to NMFS by 1 March. The DAF will provide the Executive Director and Commission staff final reports by 1 July annually.

Condition 1.a.vi.

The following actions have been taken to address equipment and data handling improvements: biological monitors have been trained to check for malfunctions in equipment; batteries have been set up with power saving measures; duplicates of images and videos are saved on separate hard drives; and higher quality batteries and larger capacity memory cards have been purchased. The entire launch window is now recorded. CA Least Terns and WSPs have been successfully monitored since 1 March 2024 when DAF implemented these changes. DAF will continue to monitor and implement any equipment and data-handling improvements as needed.

Condition 1.b.

The DAF shall conduct analysis of monitoring data in accordance with the 2023 and 2024 BOs and 2024 LOA requirements by 1 July annually. The DAF will prepare a multivariate statistical analysis of the potential changes in species populations by 1 July annually. The DAF will fund a qualified, experienced independent third party to conduct the analysis that will provide (a) available historical population data (b) frequency of launches and on-base boost-back landings over different time scales; (c) seasonality of launches and sensitive times of year for respective species; (d) geospatial variability; (e) off-base control reference site data in accordance with USFWS requirements; (f) climatic and oceanographic patterns (g) realized levels of acoustic and lighting monitoring data in accordance with USFWS requirements; (h) and patterns of other variables (as relevant to the respective species).

Condition 1.c.

The DAF will invite the Executive Director and Commission staff to convene to review results from annual reports, after DAF has submitted annual reports to USFWS (30 January) and NMFS (1 March), by 1 July. The DAF will also include the annual monarch butterfly report by 1 July. If these results indicate significant effects found to be attributed to launch related activities, then additional monitoring, minimization and mitigation measures will be discussed and considered for implementation.

Condition 2. The DAF implementation plan to meet the intent of Condition 2 is as follows.

The DAF will provide the Executive Director/Commission staff with a Sonic Boom Assessment Plan. Based upon ongoing data collection and research of sonic boom noise from launch vehicles, an assessment plan is most appropriate. This plan will be based on data collected during different launch times, times of year, and launch azimuths in order to better characterize the phenomenon. This process will allow a data-informed approach to develop appropriate minimization without presupposing that adjusting or canceling launches is a necessary response. Further, the DAF will assess through its launch schedule review board processes which launches, if any, may be available for replanning, which may drive the need to increase the total launches to account for reductions in the number of satellites that can be included in each mission due to reduced launch vehicle performance.

The plan will require an expert's collection of real time data, assessments of the modeling, and study of related research. While implementation of a minimization plan is premature, a minimization plan could be an end state goal if/when the thorough assessment of this expert work provides science-based minimization recommendations and measures that align with national requirements and existing approaches to noise mitigation. Concurrent to this ongoing assessment, to reduce surprise and concerns from unexpected sonic boom noise, the DAF will advertise launch details with the public at least 2-12 hours prior to launch, although some launches require protection of the exact time for security purposes. As part of the assessment(s), the DAF is collecting sonic boom and noise data based on modeling data over the course of the next year. The DAF, in addition to providing ongoing Sonic Boom Assessment Report(s), will provide a summary brief to the Executive Director and Commission staff on the results of the data collection by 1 July annually. This summary brief will provide information on whether a Sonic Boom Minimization Plan would be appropriate, based upon such data and assessments.

The DAF will maintain its authority on approving trajectories based upon these reports and the Sonic Boom Assessment Plan. The DAF recognizes Commission's intent of minimizing potential adverse impacts on coastal resources from sonic boom trajectories and looks forward to collaborating on solutions that will address our shared goal of ensuring protection of coastal resources while allowing essential military missions to be accomplished. The Executive Director and Commission staff will provide the DAF with any specific concerns regarding off-base coastal resources they believe to be adversely impacted by VSFB launch activities beyond what is being assessed. The DAF will share sonic boom analysis findings throughout the year as the DAF conducts its seasonal data collection in addition to its comprehensive annual report. Any concerns will be evaluated by wildlife experts to determine what further monitoring may be required. The DAF will review the Executive Director and Commission staff input on the Sonic Boom Assessment Reports and coordinate with USFWS and NMFS. The DAF will provide the Executive Director and Commission staff the AFRL study which will record rocket launches and reentries and will result in a publicly releasable dataset when finalized, anticipated by approximately October 2025.

Condition 3. The DAF implementation plan to meet the intent of Condition 3 is as follows.

The DAF will collect sonic boom and noise data along the coast from VSFB to LA County based on modeling over the course of the next year. The DAF, in addition to providing ongoing Sonic Boom Assessment Report(s), will brief the Executive Director and Commission staff on the results of the data collection by 1 July annually. The DAF is considering sonic boom predictions when making launch decisions/approvals and will share updates on its ongoing Sonic Boom Assessment Report by 1 July annually. Again, the DAF recognizes Commission's intent of minimizing potential adverse impacts on coastal resources from sonic boom trajectories and looks forward to collaborating on solutions that will address our shared goal of ensuring the protection of coastal resources while allowing essential military missions to be accomplished. The Executive Director and Commission staff will provide specific concerns regarding off-base coastal resources they believe to be adversely impacted by VSFB launch activities beyond what is being assessed. These concerns will be evaluated by wildlife experts to determine what further monitoring may be required. The DAF will review input provided by the Executive Director/Commission staff related to the Sonic Boom Assessment Reports and coordinate with USFWS and NMFS.

The DAF continues to view its partnership with the State of California as important to meeting the nation's security objectives and looks forward to further coordination and collaboration with the Commission and its staff.

Sincerely,

MARK A. SHOEMAKER, Colonel, USSF
Commander

Copy to:
Mr. Cassidy Teufel, Deputy Director and Federal Consistency Coordinator, California Coastal Commission, 455 Market Street, Suite 228, San Francisco, CA 94105-2219.

DEPARTMENT OF THE AIR FORCE
UNITED STATES SPACE FORCE
SPACE LAUNCH DELTA 30

September 17, 2024

Colonel Mark A. Shoemaker, USSF
Commander
Space Launch Delta 30
747 Nebraska Ave, Ste A302
Vandenberg SFB CA 93437-6261

Cassidy Teufel
Deputy Director
California Coastal Commission
455 Market Street, Suite 228
San Francisco CA 94105

Dear Mr. Teufel,

This letter is in response to the California Coastal Commission's (CCC) emailed response (Atch 1) sent on 16 September 2024 of 19 critical issues in response to the Department of the Air Force's (DAF's) 13 September 2024 letter. The DAF recognizes the intent and importance of the Commission's feedback and looks forward to partnering collaboratively with our federal partners and the Commission to preserve California's coastal uses and resources.

As offered in the 16 September 2024 conference call, DAF is committed to convening a Working Group with key stakeholders to share information, review and discuss data and reports related to coastal resources impacts, and collaborate in support of conservation objectives and National Security requirements. DAF invites the CCC to take part in this new forum and anticipates other participants to include, but not limited to, the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and the Federal Aviation Administration (FAA). The Working Group is expected to be held quarterly, or as needed, with the intent to schedule the first meeting prior to the end of calendar year 2024. We believe this forum will provide an interactive process to discuss feedback and concerns from the CCC and other Working Group members.

General

Response to Item 1: DAF appreciates the additional input and is committed to resolving the specific concerns as described in responses to Items 7-15 below.

Response to Item 2: DAF will use collected data to assess potential adverse impacts and determine adaptive management measures where necessary to address those adverse impacts to sensitive coastal

resources and allow the DAF to meet National Security requirements. DAF is committed to discussing specific concerns on any adaptive management measures during the Working Group meetings.

Response to Item 3: As noted above, DAF will convene a Working Group to meet and collaborate. This will allow for any specific concerns that are not clear to be openly discussed and resolved in a transparent manner.

Response to Item 4: The monitoring requirements established in the 2023 Biological Opinion (BO) will remain in effect until a new BO is issued by the USFWS for an increased launch cadence in 2025. The 2024 USFWS BO addresses additional measures for the increase of 36 launches to 50 as a transition between the 36 and consistency determination (CD) for the 100 launches. The additional measures in the August 2024 USFWS BO have ongoing benefits.

Response to Item 5: The DAF commits to implementing the protective measures agreed to for the 36 launch CD in its implementation of the 50 launch CD.

Response to Item 6: The DAF will convene a Working Group with invited stakeholders consisting of, but not limited to, the DAF, CCC, USFWS, NMFS, and FAA. This Working Group will meet to collaborate and discuss monitoring programs, provide progress updates, and potential adaptive management measures.

Specific Recommendations for California Coastal Management Program (CCMP) Consistency

Condition 1
Response to Item 7: DAF will extend the review period to 21 days for CCC staff to review to better facilitate meaningful review and comments.

Response to Item 8: DAF agrees to conduct additional monitoring at haul-out sites during launches, as was required in the 2019 NMFS Letter of Authorization (LOA), though not required under the 2024 LOA. DAF will coordinate with the Working Group to evaluate the data annually to determine if these additional monitoring efforts should continue.

Response to Item 9: DAF provided the requested bat and monarch butterfly monitoring plans and information on 16 September 2024. DAF is receptive to discussing specific concerns or re-evaluating monitoring efforts during the Working Group.

Response to Item 10: DAF confirms that the intent is to select reference sites outside the modeled affects area. Selection of reference sites will be determined using the best available scientific data for suitability. DAF will provide CCC staff the proposed selection of referenced sites and welcomes feedback.

Response to Item 11: DAF confirms we will select reference sites outside the modeled affects area for the California least tern and will continue to use the reference sites beyond the expiration of the 2024 USFWS BO. Selection of reference sites will be determined using the best available scientific

data for suitability. DAF will provide CCC staff the proposed selection of reference sites and welcomes feedback. The additional measures in the August 2024 USFWS BO have ongoing benefits. The monitoring requirements established in the 2023 BO will remain in effect until a new BO is issued by the USFWS for an increased launch cadence in 2025.

Response to Item 12: DAF agrees to conduct additional monitoring at the Northern Channel Islands during launches, as was required in the 2019 NMFS LOA, though not required under the 2024 LOA. DAF will coordinate with the Working Group to evaluate the data annually to determine if these additional monitoring efforts should continue.

Response to Item 13: The DAF reaffirms we will continue to implement further measures if additional issues arise with regards to data loss and/or equipment failures.

Response to Item 14: DAF confirms we will conduct analysis of monitoring data collected in accordance with the terms of the 2023 and 2024 USFWS BOs. We note that the additional monitoring called for in CCC's Condition 1.b. mirrors the language of the 2024 BO. Additionally, we will include data collected from the reference site for the California least tern as part of the data analysis.

Response to Item 15: DAF will provide reports, convene a Working Group as described above, and commit to reviewing the monitoring efforts and data during the Working Group. If these results include adverse effects found to be attributed to launch related activities substantially different than previously identified, then the Working Group will have an opportunity to recommend additional monitoring, minimization and mitigation measures.

Condition 2

Response to Item 16: DAF will provide the current Sonic Boom Assessment Plan based upon comments received about human impacts by 27 September 2024. During the conference call on 16 September 2024, CCC clarified the focus of the concern was potential impacts to sensitive coastal resources rather than human receptors. Therefore, DAF commits to updating the Sonic Boom Assessment Plan with renewed focus on addressing species of special biological and economical significance and providing the draft updated plan to CCC for inputs by 25 October 2024. Additionally, DAF requests additional CCC input (e.g., potentially impacted species and locations) during Working Group meetings. Once developed, DAF will provide an update by 1 July annually as new data is collected.

Response to Item 17: DAF believes the response above to Item 16 addresses CCC's critical concerns to meet Condition 2. Additionally, DAF is currently working on establishing measures for evaluating modeling for specific atmospheric conditions and will provide status updates during Working Group meetings and ad hoc as additional information becomes available. DAF recognizes the importance of taking action in real time, when necessary, as informed by collected data and Working Group analysis. DAF will use collected sonic boom data to assess potential adverse impacts and determine adaptive management measures necessary to address such adverse impacts to sensitive coastal resources and allow the DAF to meet National Security requirements.

DAF will evaluate inputs from the Working Group when considering launch times and trajectory to minimize the spatial extent and severity of sonic booms experienced in those off-base areas to the greatest extent practicable. The DAF will carry these inputs into its Current Launch Schedule Review Board process when considering decisions on adjustments to launch times and trajectories.

Condition 3

Response to Items 18 and 19: Given the dependency of Condition 3 on the results of Condition 2, and in accordance with your guidance provided on 16 September 2024, the DAF is committed to working with the CCC towards addressing Condition 2.

The DAF continues to view its partnership with the State of California as important to meeting the nation's security objectives and the State of California's coastal preservation efforts. We look forward to further coordination and collaboration with the Commission and its staff.

Sincerely,

MARK A. SHOEMAKER, Colonel, USSF
Commander

Attachment:
1. RE: DAF Response Letter to CCC Conditions for CD-0003-24

Copy to:
Dr. Kate Huckelbridge, Executive Director California Coastal Commission, 455 Market Street, Suite 300, San Francisco, CA 94105-2219

SHOEMAKER, MARK A Col USSF SSC SLD 30/CC

From: Teufel, Cassidy@Coastal <Cassidy.Teufel@coastal.ca.gov>
Sent: Monday, September 16, 2024 6:39 PM
To: SHOEMAKER, MARK A Col USSF SSC SLD 30/CC; Huckelbridge, Kate@Coastal
Cc: CONNER, JOHN P Col USAF SAF/IE; HATCHER, DORIAN C Col USAF SSC SLD 30/CV; KEPHART, BEATRICE L CIV USSF SSC 30 CES/CEI; YATES, LAURA E CIV USAF HAF SAF/IEIP
Subject: RE: [Non-DoD Source] RE: DAF Response Letter to CCC Conditions for CD-0003-24

Colonel Shoemaker –
Thank you again for providing this response to the Commission's August 8th conditional concurrence. In the interest of moving our discussions forward quickly, we have prepared this initial response in a number of hours and are transmitting it via email. Although we have done our best to highlight the critical issues, please also note that we may have additional points to raise following a more detailed review.

General

1. The language and intent of Condition 1 as we drafted it is for a biological monitoring program to be developed and implemented that builds off of what NMFS and USFWS have required and includes additional measures to ensure CCMP compliance. However, the approach taken by USAF in the response letter would carry out monitoring required by NMFS and USFWS only and assume those activities satisfy consistency with the CCMP . While the regulations those agencies implement (such as the Endangered Species Act and Marine Mammal Protection Act) have some overlap with CCMP enforceable policies, this overlap is not complete and the CCMP policies differ in a variety of important respects. For example, while the MMPA allows for marine mammals to be protected and managed at a population level, Policy 30230 of the CCMP requires that "special protection shall be given to areas and species of special biological or economic significance." The Commission has interpreted this to mean that special protection must be provided for areas such as marine mammal haul-outs and marine protected areas. Thus, we continue to hold the position that the most recent monitoring requirements developed to ensure ESA and MMPA compliance (i.e., 2024 USFW BO and 2024 NMFS LOA) are not sufficient to also ensure CCMP consistency. Specific suggestions to bring the program into CCMP consistency are detailed in Condition 1 and included below.
2. While the commitment to continue sonic boom acoustic monitoring and data collection is appreciated, this effort alone does not meet the language and intent of Condition 2. We suggest that the response to Condition 2 be augmented to commit to using the collected data on an ongoing basis to implement adaptive management measures that will result in reductions in sonic boom intensity and spatial extent.
3. Several statements in the response invite the Commission staff to provide specific concerns and scientific justification for coastal resource protection. We have provided this information as part of the Commission's adopted findings included with the Commission's 8/15 conditional concurrence letter. As we receive additional information through monitoring reports and other sources, we will make any needed adjustments.
4. The 9/13 response refers to implementation of some improved and enhanced biological monitoring measures established through the August 2024 BO. While these monitoring measures would improve the existing monitoring program, it is Commission staff's understanding that they would only be implemented from October through December of 2024, only three months of the indefinite period proposed for 50 launches per year in the Consistency Determination. Further, because the August 2024 BO only covers a short period in 2024, it does not consider the full range of species and life stages that would be affected by the project proposed in the CD. To resolve this, we again reiterate our request that the CD be revised to only propose an increase to 50 launches for 2024 to match our review timeline with that of the USFWS. If

that Is unacceptable, please provide clarification on DAF's implementation of the measures outlined in the 2024 BO beyond the end of 2024.

5. As currently written, the CD for 50 launches does not include a commitment to implement the various protective measures established through the Commission's review of the 36 launch CD and the Commission's conditional concurrence with it. This adds uncertainty to the implementation of those protective measures once the Commission considers the 50 launch CD. To resolve this, we request that DAF confirm, in writing, that the CD for 50 launches includes a commitment to implement the protective measures described in the Commission's conditional concurrence for 36 launches for year.
6. In its response, DAF has provided for a feedback process whereas the Commission can provide comment on monitoring components included in plans developed by NMFS and USFWS. To increase efficiency and ensure the Commission's and Commission staff's input is understood and adequately addressed, we suggest that Commission staff be included in ongoing coordination with NMFS and USFWS. It is the Commission staff's strong preference that a monitoring program be developed and implemented that can meet the needs of NMFS, USFWS and the Commission. In order to accomplish this, all agencies need to be involved in the development of the program. We therefore suggest a more integrated interagency process rather than the proposed process that limits the Commission to only a peripheral role.

Specific Recommendations for CCMP Consistency

Condition 1

7. Extend the time period for CCC staff to review the NMFS LOA and USFWS BO to at least 21 days to better facilitate meaningful review and comments.
8. Continue to conduct monitoring at haul-out sites during launches – as was required in the NMFS 2019 LOA.
9. Condition 1, subpart a(ii) and (iii) call for monitoring of bat and monarch butterfly populations on VSFB, "in a manner sufficient to assess potential changes in habitat use patterns and population levels." The 9/13 response noted that bat and monarch butterfly monitoring is occurring but does not include these monitoring programs or detailed descriptions of them. To resolve this, please share the referenced bat and monarch butterfly monitoring plans so Commission staff can evaluate them and determine if they meet the standard of being "sufficient to assess potential changes in habitat use patterns and population levels." We also suggest a feedback process be included in case the existing programs do not meet CCMP consistency objectives.
10. Condition 1, subparts (a)(iv) and (v) refer to monitoring of off-base reference sites. Please confirm that the reference sites north and south or VSFB and on the Northern Channel Islands (NCI) will be outside of the modeled affects area for engine noise and sonic booms. Please also consider providing Commission staff with an opportunity to provide feedback on the selection of reference sites to help ensure agreement that they would not be affected by the proposed launches.
11. Condition 1, subpart (a)(iv) refers to three species, California least tern, western snowy plover and red-legged frog. The 9/13 response letter proposes only to identify and analyze reference site data for two of these species, plovers and frogs. In addition, it references the requirements of the August 2024 BO, which does not appear to apply after December 2024. Please confirm that reference sites will also be established for California least terns and that the use of reference sites would persist for the full duration proposed in the 50 launch CD.
12. Condition 1, subpart (a)(v) refers to NCI monitoring carried out under the 2024 NMFS LOA. However, the 2024 LOA now would only require semi-monthly surveys at on-base haul out sites while no-such semi-monthly surveys are required at the northern Channel Islands (NCI). Also, the 2024 LOA no longer requires by-launch monitoring of on-base haul out sites and significantly raised the thresholds for initiating monitoring by launches on the NCI such that while past data may have been collected, future data collection is uncertain and data sets may not be comparable. Please revise the response to ensure that comparable monitoring activities will occur at the reference sites and areas of anticipated effects.

13. Condition 1, subpart (a)(vi). Thank you for this response and the proposed improvements to data collection and retention. Please also consider implementing further measures if additional issues arise with regards to data loss and/or equipment failures.
14. Condition 1, subpart (b): DAF's proposal appears to be generally consistent with this condition subpart. As noted above, however, the relaxing of monitoring requirements in the 2024 NMFS LOA and limited duration of the August 2024 USFWS BO means that data analysis carried out purely to satisfy the LOA and BO will not be adequate to meet the additional monitoring called for in Condition 1 of the Commission's conditional concurrence. To resolve this, please clarify that data collected per the terms of the conditional concurrence will be evaluated consistent with the elements of Condition 1, subpart (b).
15. Condition 1, subpart (c) – monitoring reports. This subpart includes a variety of specific details and elements to be included in the annual reports, as well as an interagency review of results every three years and a process for Commission review of avoidance, minimization, mitigation measures if monitoring demonstrates that adverse impacts have occurred. The 9/13 response does not address these elements of subpart (c). To resolve this, please confirm that the reporting process described in subpart (c) will be followed.

Condition 2

16. While Commission staff appreciates DAF's commitment to continue the ongoing acoustic monitoring efforts and use of data from these efforts to inform next steps, it is not clear when this plan would be provided to the Executive Director, if feedback will be accepted on it and if it is focused on areas of sensitive coastal resources or sensitive human receptors. To resolve this, please commit to a submittal date and process for consideration of feedback from Commission staff on the sonic boom assessment plan to help ensure that sensitive coastal resource sites are adequately represented.
17. The response provided to Condition 2 falls short of the language and intent of Condition 2. To resolve this, please provide (1) a description of efforts that will be taken to limit the spatial extent and severity (in terms of overpressure levels) of sonic booms caused by launches; (2) measures for evaluating modeling for specific atmospheric conditions to anticipate sonic boom effects on the Northern Channel Islands and off-base areas of the mainland coast of Santa Barbara, Ventura, and Los Angeles Counties; (3) measures for making decisions on launch time and trajectory based on an analysis to minimize the spatial extent and severity of sonic booms experienced in those off-base areas.

Condition 3

18. The response to this condition calls for Commission staff to provide specific concerns regarding off-base coastal resources that may be adversely affected by sonic booms. Please refer to the Commission's adopted findings in support of its August 8th conditional concurrence decision for this information. These adopted findings were provided with the Commission's 8/15 conditional concurrence letter.
19. The response provided to this condition also does not meet the intent or language of the condition. However, this condition is a contingency that only applies if avoidance of sonic boom effects through implementation of Condition 2 is not effective. We hope to work with DAF to ensure that implementation of Condition 2 is effective and that Condition 3 is unnecessary. However, as noted above, we believe that revisions to the response for Condition 2 are necessary. If those requested revisions will not be implemented by DAF, please carefully consider the language of Condition 3 and provide the referenced monitoring plan for Executive Director review.

Thanks again for the call this afternoon and for your consideration of this feedback. We stand ready to answer any question you may have and to discuss further.

-Cassidy

Cassidy Teufel
Deputy Director
California Coastal Commission
455 Market Street, Suite 228
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http://www.coastal.ca.gov/

From: SHOEMAKER, MARK A Col USSF SSC SLD 30/CC <mark.shoemaker@spaceforce.mil>
Sent: Friday, September 13, 2024 4:18 PM
To: Teufel, Cassidy@Coastal <Cassidy.Teufel@coastal.ca.gov>; Huckelbridge, Kate@Coastal <Kate.Huckelbridge@coastal.ca.gov>
Cc: CONNER, JOHN P Col USAF SAF/IE <john.conner@us.af.mil>; HATCHER, DORIAN C Col USAF SSC SLD 30/CV <dorian.hatcher@spaceforce.mil>; KEPHART, BEATRICE L CIV USSF SSC 30 CES/CEI <beatrice.kephart@spaceforce.mil>; YATES, LAURA E CIV USAF HAF SAF/IEIP <laura.yates.1@us.af.mil>
Subject: RE: [Non-DoD Source] RE: DAF Response Letter to CCC Conditions for CD-0003-24

Cassidy - Yes, please provide feedback and we will discuss it with Dr. Chaudhary and Department of the Air Force leadership, as this product was fully coordinated with them prior to sending. We definitely want your thoughts and inputs as we collaborate on a solution.

Very Respectfully,

Mark A. Shoemaker, Col, USSF
Commander, Space Launch Delta 30
805-606-3000 (office)
805-588-8150 (cell)

From: Teufel, Cassidy@Coastal <Cassidy.Teufel@coastal.ca.gov>
Date: Friday, Sep 13, 2024 at 4:00 PM
To: SHOEMAKER, MARK A Col USSF SSC SLD 30/CC <mark.shoemaker@spaceforce.mil>, Huckelbridge, Kate@Coastal <Kate.Huckelbridge@coastal.ca.gov>
Cc: CONNER, JOHN P Col USAF SAF/IE <john.conner@us.af.mil>, HATCHER, DORIAN C Col USAF SSC SLD 30/CV <dorian.hatcher@spaceforce.mil>, KEPHART, BEATRICE L CIV USSF SSC 30 CES/CEI <beatrice.kephart@spaceforce.mil>, YATES, LAURA E CIV USAF HAF SAF/IEIP <laura.yates.1@us.af.mil>
Subject: [Non-DoD Source] RE: DAF Response Letter to CCC Conditions for CD-0003-24

Colonel Shoemaker –
Thank you very much for providing this response and for all the work that went into preparing it. Unfortunately, we feel it does not adequately meet the intent of the conditions. Please let us know if you are open to receiving feedback and taking another shot at it or if we should consider this as a final response to the conditional concurrence and proceed from there.

Thank you also for sharing Tuesday's itinerary, it looks like a good plan and I'm sure the Commissioners will appreciate seeing those locations.

Thanks again,
Cassidy

From: SHOEMAKER, MARK A Col USSF SSC SLD 30/CC <mark.shoemaker@spaceforce.mil>
Sent: Friday, September 13, 2024 12:14 PM
To: Huckelbridge, Kate@Coastal <Kate.Huckelbridge@coastal.ca.gov>; Teufel, Cassidy@Coastal <Cassidy.Teufel@coastal.ca.gov>
Cc: CONNER, JOHN P Col USAF SAF/IE <john.conner@us.af.mil>; HATCHER, DORIAN C Col USAF SSC SLD 30/CV <dorian.hatcher@spaceforce.mil>; KEPHART, BEATRICE L CIV USSF SSC 30 CES/CEI <beatrice.kephart@spaceforce.mil>; YATES, LAURA E CIV USAF HAF SAF/IEIP <laura.yates.1@us.af.mil>
Subject: DAF Response Letter to CCC Conditions for CD-0003-24

Dr. Huckelbridge / Mr. Teufel –

Please find attached the Department of the Air Force's (DAF) response to the CCC's conditional concurrence on CD-0003-24. The DAF continues to view its partnership with the State of California as important to meeting the nation's security objectives and looks forward to further coordination and collaboration with the Commission and its staff.

I have also attached the itinerary for the CCC's visit next week to Vandenberg SFB. We look forward to hosting next week's engagement with you and Dr. Chaudhary.

Very Respectfully,

Mark A. Shoemaker, Col, USSF
Commander, Space Launch Delta 30
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EXHIBIT 8

DAF PLAN SUBMITTALS FOR CONDITIONS

EXHIBIT 8a (BAT MONITORING FOR CONDITION 1).....79

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Introduction

In accordance with Consistency Determination CD-0003-24, the Department of the Air Force (DAF) has provided the below information regarding Measure 1.a.ii:

> **ii.** Monitoring of the on-base pallid and western red bat populations in a manner sufficient to assess potential changes in habitat use patterns and population levels;

VSFB Bat Monitoring

Since 2023, the DAF has monitored 23 locations within 8 cells per the Bat Conservation International (BCI) North American Bat (NABat) Monitoring Program protocol available here: gtr_srs208.pdf (usda.gov). The DAF at VSFB is participating in this program through acoustic surveys at stationary points per established protocol. The Attachment below provides the protocol for how 23 locations on Vandenberg Space Force Base (VSFB) were determined.

The following is taken directly from the NABat website available here: Methods and Sample Design | NABat (nabatmonitoring.org).

> *NABat monitoring follows a master sample approach in which North America is divided into a series of 10 x 10 km (100 km) grid cell frameworks. The generalized random tessellation stratified (GRTS) survey design algorithm then assigns a spatially balanced and randomized ordering (GRTS order) to each cell within its respective framework. Grid cells are prioritized numerically; the lower the number, the higher the sampling priority. Cells can then be selected for monitoring following the GRTS order, ensuring both randomization and spatial balance. Monitoring within this standardized framework allows statistical inference to non-surveyed locations and ensures the validity of analysis at regional and range-wide scales using data collected by dozens of partners across the continent.*

Results from the 2023 surveys are attached below. The DAF's intent is to continue this monitoring effort to assess bat populations at VSFB.

Attachments:

North American Bat Monitoring Program Regional Protocol for Surveying with Stationary Deployments of Echolocation Recording Devices Standard Operating Procedure 4: Locating and Establishing Detector Locations Version 1.0

North American Bat Monitoring Program (NABat) 2023 Acoustic Survey Results

Exhibit 8a
CD-0007-24

National Park Service
U.S. Department of the Interior

North American Bat Monitoring Program Regional Protocol for Surveying with Stationary Deployments of Echolocation Recording Devices

Standard Operating Procedure 4: Locating and Establishing Detector Locations

Version 1.0

Please cite this publication as:

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Revision History Log

Original Version #	Date of Revision	Revised By	Changes	Justification	Page #'s Affected	New Version #

1. Version numbers increase incrementally by tenths (e.g., version 1.1, version 1.2 …etc.) for minor changes. Major revisions should be designated with the next whole number (e.g., version 2.0, 3.0, 4.0 …). Record the previous version number, date of revision, author of the revision, identify paragraphs and pages where changes are made, and the reason for making the changes along with the new version number.
2. Notify the Bat Hub Coordinator of any changes to the SOP so that the new version number can be incorporated in the Metadata of the project database.
3. Post new versions on the internet and forward copies to all individuals with a previous version of the SOP.

This Standard Operating Procedure is available in digital format from the NPS Data Store at: [https://irma.nps.gov/DataStore/Reference/Profile/2265548].

Purpose

The purpose of this SOP is to describe the step-by-step procedures for establishing detector locations for acoustic monitoring surveys of bat populations. This SOP begins where SOPs 1, 2, and 3 leave off, with field preparations complete, crews trained and ready to hit the field with detector equipment, GPS units, and field reference maps.

Legacy Bat Grid Sample Units

From 2003 to 2010, the interagency Bat Grid Program was conducted to monitor bat populations and distributions. The Bat Grid established the sampling frame of 10 × 10 km grid cells used by the NABat program. At the initiation of the NABat program in 2016 in Oregon, it was determined that a proportion of sample units (those with ≥ 3 surveys) to be surveyed would come from the legacy Bat Grid program. As of 2018, only 38 Legacy Bat Grid Sample Units are being surveyed. If future legacy grid cells are to be surveyed (whether specifically selected because they are legacy grid cells or are NABat GRTS-ordered grid cells that have legacy Bat Grid data), the Hub Coordinator should be contacted for coordinates and site descriptions of legacy Bat Grid survey locations. Note that these locations need to be assessed for accessibility and suitability for detector placement as these locations were selected primarily for mist netting and surveyors would be at the location the entire time. Thus, the locations could be close to a high public use area (e.g., road), in which case selection of a new location might be considered. If legacy detector locations are not resurveyed, then new detector locations need to be established following the guidance herein.

Found (Non- GRTS-ordered) Sample Units

Contact the NW Bat Hub Coordinator to confer on selection of non-probability grid cell surveys that are selected for convenience (proximity to work or home) or as part of a local-scale project.

NABat GRTS-ordered Sample Units

If a NABat GRTS-ordered Sample Unit was previously surveyed in recent years (i.e., during the Oregon NABat pilot study of 2016 and 2017), confer with the Hub Coordinator to ensure the same detector locations will be used in subsequent years or to coordinate selection of one or more new detector locations where needed. If the grid cell is new in the current year, initial site selection for all four detector locations is required. This can be accomplished by following the desktop guidance provided below or by the field staff's own knowledge of the area. The NW Bat Hub is available to assist field contributors by conducting the desktop selection of possible detector locations, yet, it will be the responsibility of the field contributors to ground-truth these locations as to their suitability for monitoring (e.g., does the pond actually have water in it?).

Spatial Guidance within Sample Unit

Detectors should be placed to maintain spatial balance within the sample unit, that is, detectors are dispersed somewhat evenly and not clustered within a single portion of the sample unit. Therefore, one detector should be placed in each **5 × 5 km quadrant** of the sample unit for a total of four (4) detector locations per grid cell. If this is not possible due to access issues (e.g., private landowner refuses access) or environmental conditions (e.g., wildfire), then place the detector **at least 1.5 km (~1 mile)** from other detectors. If conditions prevent establishing more than one detector location

within a sample unit, then the sample unit should be skipped until additional detector locations can be established. **Always ensure detector locations are within the targeted sample unit**. A number of measures can be enacted to ensure detector locations are not unintentionally selected outside of the targeted sample unit. For instance, detector locations can be selected by desktop (e.g., GIS) prior to entering the field (see below) or by importing the sample unit boundaries into a format that is useful in a handheld device (e.g., smartphone or GPS unit) for use in the field. These methods are described in subsequent sections.

Habitat within Sample Unit

The overall objective of monitoring is that the potential to record all species that possibly occur in a sample unit should be maximized at each detector location in order to determine occurrence probabilities for the sample unit based on the four spatial replicates, that is, the selected detector locations. Possible species composition should be determined by overlapping the sampling frame with the best-known range map data (see SOP 7 for sources of range map data). Maximizing the detection of all possible species within a given sample unit is accomplished by increasing the chances of obtaining high quality calls (e.g., in open low-clutter environments) by establishing detector locations at or near habitat features (or detection targets), such as waterbodies, where bats often are most active (Figure SOP4-1).

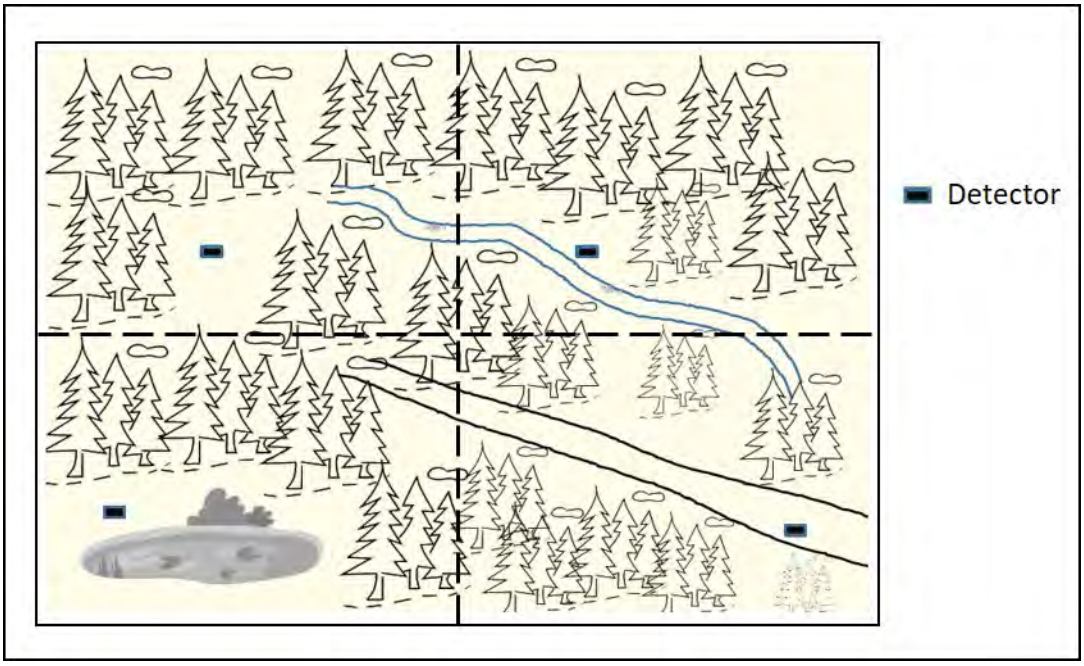


Figure SOP 4-1. An example of detectors placed within a sample unit at habitat features where bats are more likely to be active and thus maximize the detection of all possible species that may occur within the specific sample unit. Image adapted from Loeb et al. (2015).

Detection Targets

For guidance in selecting detector locations, below is a list of detection targets in order of highest to lowest priority based on the degree to which bats may be more likely active. Note that the availability of these will depend on sample unit-specific conditions.

- Pools, open guzzlers, water tanks, troughs, oxbows, sewage ponds, pump chances, seeps with standing water, or ponds
- Small streams, canals, or springs
- Wetlands
- Small bays or inlets of larger ponds or lakes
- Side channels or flat rivers
- Edge habitats – old/young forest, forest/open land (shrub-steppe, agriculture, grassland), riparian, and rock cliffs
- Forest openings – small gaps, along trails and forest roads
- Roosting sites – mature trees, snags, rock crevices, anthropogenic structures (e.g., bridges, homes, barns, and log cabins), caves, and mines
- Wetlands with dense surrounding vegetation
- Large bodies of water (lakes and reservoirs)
- Fast flowing streams or rivers
- Dry water features – large canyon bottom, large canyon top, small arroyo/dry gulch bottom, small arroyo/dry gulch top
- Rock features – ridge top, cliff bottom, cliff top
- Wide-open places, such as within a cultivated field

Consider the following when selecting detection targets:

- Reliable perennial water sources compared to ephemeral water sources.
- Small areas (1-20 sq. m.) of slow, open water where vegetation does not inhibit bats drinking or feeding or interfere with detector recording calls.
- Points along suspected commuting routes or foraging areas where bat activity is somewhat restricted to a narrow area such as stand edges, waterways, dry arroyos, roads, and where detectors can be placed to avoid echoes off of water, walls, or rock features.
- **If suitable bat habitat appears to be none to limited, then select the most appropriate habitat feature to set up the detector within the SU (and following the guidance provided above) because four (4) detector locations are still needed and absence data are also beneficial.**

Desktop Evaluation of Detector Locations

Evaluating grid cells for possible detector locations in the office assists the field staff in efficiently surveying more targeted grid cells for the season. That is, this process can save them a substantial amount of time in the field because it can reduce the time they have to perform field reconnaissance of detector locations.

The selection and review process begins with acquiring files for use in a GIS program (e.g., ArcGIS) (Table SOP4-1). Although the list provided below is not exhaustive of every possible GIS layer that can be helpful, these layers provide basic information to effectively select possible detector locations.

Table SOP 4-1. List of GIS files for selecting possible detector locations.

Name	Link
NABat Master Sample 10 × 10 km Grid Cells	https://www.sciencebase.gov/catalog/item/5b7b563ae4b0f5d57884615b
NABat Master Sample 5 × 5 km Grid Cell Quadrants	https://www.sciencebase.gov/catalog/item/5b5a164ce4b0610d7f4dcb8c
State and County Boundaries	https://www.census.gov/geo/maps-data/data/tiger-line.html
Base Maps: USGS National Map, National Geographic, Imagery	All are accessible within ArcMap by selecting the dropdown arrow next to the Add Data icon, then selecting Add Basemap.
Protected Areas Database of the United States (PAD-US)	https://gapanalysis.usgs.gov/padus/data/download/
Oregon Transportation Network	http://spatialdata.oregonexplorer.info/geoportal/
Washington All Public Roads (WAPR)	http://www.wsdot.wa.gov/mapsdata/geodatacatalog/
Road Transportation of Idaho	http://cloud.insideidaho.org/index.html
Motor Vehicle Use Map: Roads	https://data.fs.usda.gov/geodata/edw/datasets.php
National Forest System Trails	https://data.fs.usda.gov/geodata/edw/datasets.php
National Hydrography Dataset (NHD)	https://nhd.usgs.gov/data.html

With a GIS project setup, the first step is to create a point shapefile to store the potential detector locations. The following three fields ‘LocationID’, ‘Target’, and ‘Notes’, helps to document information about the detector location and possible detection target for the field staff. The field ‘LocationID’ provides a suggested Location ID (i.e., Sample Unit ID + Quad + Quad No., e.g., 12345_NW1) for the field staff to use for the specific location. It is good practice to establish these Location IDs ahead of time to avoid any duplication with previously established detector locations. The field ‘Target’ provides a description of the intended detection target (i.e., as previously defined as the habitat feature at which to record acoustic bat activity). After zooming in on the target grid cell, a good start is to have a waterbody layer (i.e., obtained from the National Hydrography Dataset,

e.g., NHDWaterbody.shp) turned on and with symbology color (e.g., light blue) that makes the waterbodies stand out. This allows one to quickly scan the entire grid cell or at least one quadrant at a time and easily find a waterbody. With editing turned on for the point layer, points can be added for possible detector locations and the three fields mentioned previously can be completed. Turning on linear hydrology and transportation layers can help to locate potential flyways. Scanning each quad with the aerial imagery layer turned on will help to find forest features (i.e., edges, gaps). When searching for these detection targets, it is always more advantageous to keep the focus on public lands for access purposes, yet, detection targets on private lands should not be immediately overlooked as they could provide valuable information on bat species composition and distribution not entirely captured by public lands. It is helpful to the field staff to have multiple possible detector locations per grid cell to provide options in the event access is difficult to one or more detector locations or these locations are not as suitable as they appeared from the desktop evaluation. Field staff should be informed that the desktop-selected locations are for informational and navigational purposes only and do not represent the actual point location where the detector should be placed. Field staff should evaluate site-specific conditions in the field for exact placement of the detector following guidance provided in SOP 5.

After all possible detector locations are selected, reference maps should be created for the field staff. One useful tool for distributing maps is by creating geo-referenced pdf maps from the GIS program that can be used by an app such as Avenza Maps (accessible from Google Play or the Apple App Store) on a mobile device (e.g., phone or tablet). Although this is an easy method for generating portable maps, it can be time consuming creating multiple maps for several areas and sample units. An alternative method is to create a web map from within a GIS program that is distributed to an app on a mobile device. This method produces a single map source for an entire region (e.g., a state or multiple states) that provides the field staff with the freedom to select the extent of the map they want. Because of Oregon State University's established license, the NW Bat Hub uses the ArcGIS software suite to perform this process. The general process is to prepare your desired layers in ArcGIS Desktop, publish these layers to your ArcGIS Online (AGOL) account, create the web map and share it to a group that includes field staff who have AGOL accounts. The field staff then access the map via the Collector for ArcGIS app (see SOP 7 for directions on use by field staff). An additional step is to create a web app based on the web map that the field staff can use to perform pre-trip planning.

1 **Executive Summary**

2 **Methods**

3 **Map of Stationary Locations**

4 **Potential Species**

5 **Stationary Acoustic Results**

6 **Metadata**

7 **Select Spectrograms**

8 **Noise Recordings**

9 **Learn More**

North American Bat Monitoring Program (NABat) 2023 Acoustic Survey Results

National Data Processing Lab

Report produced December 13, 2023

(https://sciencebase.usgs.gov/nabat/#/results)

Report prepared for: Vandenberg Air Force Base

U.S. AIR FORCE

1 Executive Summary

In 2023, the Vandenberg Air Force Base implemented stationary acoustic bat monitoring within 8 10 x 10 km grid cells (3.1). These data were collected following protocols in *A Plan for the North American Bat Monitoring Program (NABat)* (https://www.fs.usda.gov/research/treesearch/48442). Over the stationary monitoring nights this year, 12 species were confirmed, 12 were confirmed for the first time.

2 Methods

Acoustic recordings were sent to the National Data Processing Lab (NDPL) for processing. Acoustic recordings were scrubbed of noise using Kaleidoscope Pro 5.3.9 (Wildlife Acoustics, Maynard, MD). Files not scrubbed out as noise were then automatically identified using Kaleidoscope Pro set to the California region and SonoBat 4.4 (SonoBat, Arcata, CA) with the SonoBatch auto-classifier set to the CA swCA classifier region.

Based on species range maps from Bat Conservation International (https://www.batcon.org/about-bats/bat-profiles) and BatAMP (https://visualize.batamp.databasin.org/presence), the Kaleidoscope Pro species list was customized to exclude the following species: Lesser Long-nosed Bat, Californian Leaf-nosed Bat, Arizona Myotis, Cave Myotis.

The resulting species list included 20 species that could potentially be present in the project location(s) (Section 4).

We used results from both Kaleidoscope and SonoBat auto-identification algorithms to inform our manual vetting process. We used SonoBat 4.4 to manually review the first four nights of stationary monitoring in an attempt to confirm the identification of at least one acoustic file per species, per site by visually inspecting the species ID proposed by the programs. Up to five files per species-site-night were reviewed in an attempt to confirm the species ID if a species was present.

Results of manual review options included: 1) confirming species ID as assigned by the programs; 2) assigning the file to a species couplet, or frequency category based on the frequency and call shape (region-specific table available upon request); 3) assigning the file as noise, i.e., not a recording of bat echolocation calls; or 4) rarely, and when species aren't included in the auto-classification programs, assigning the file to a species other than what was assigned by the programs.

We reviewed files in order of confidence in identification as expressed by the program(s). A confirmed identification of a species in one or more files on a given night at a given site resulted in a designation of species presence for that site-night. When we could not assign any files recorded on a site-night to species, that species was considered "not detected."

3 Map of Stationary Locations

This map shows the survey locations monitored in all years and the NABat cell(s) they fall within. Hover your cursor over the map to see the NABat GRTS cell number(s) and survey location name(s).

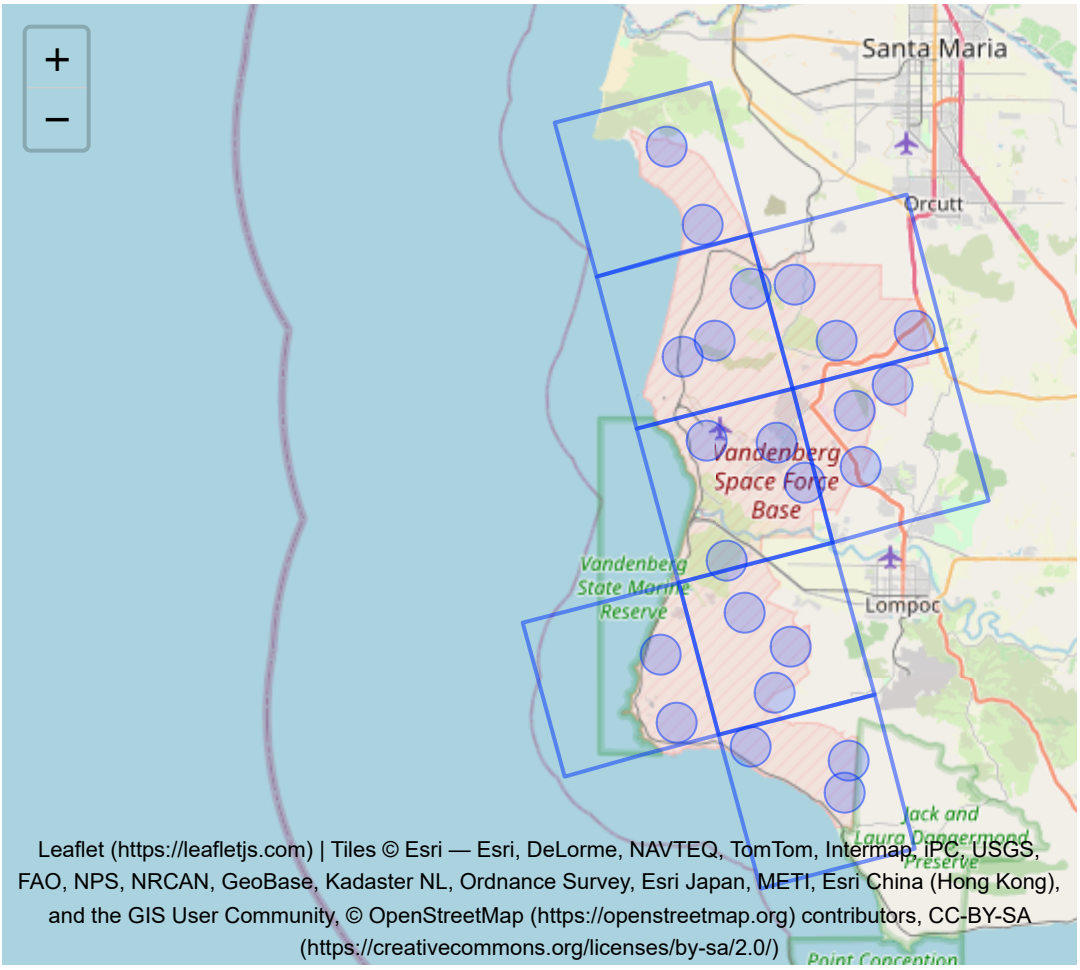


Figure 3.1: Map of surveyed locations

4 Potential Species

The species that may occur in the surveyed area of the Vandenberg Air Force Base, their characteristic frequency range, and a range map. Click on the arrows to view an example spectrogram for each species. Click on the links to learn more about that species. Species of greatest conservation need (SGCN), designated by the state's wildlife action plan, are indicated where applicable.

▶ *Antrozous pallidus* (SGCN in California) - Pallid Bat (https://www.batcon.org/bat/antrozous-pallidus)- ANPA: 24-34 kHz - Range Map (https://visualize.batamp.databasin.org/species/anpa)
▶ *Corynorhinus townsendii* (SGCN in California) - Townsend's Big-eared Bat (https://www.batcon.org/bat/corynorhinus-townsendii)- COTO: 18-32 kHz - Range Map (https://visualize.batamp.databasin.org/species/coto)
▶ *Eptesicus fuscus* - Big Brown Bat (https://www.batcon.org/bat/eptesicus-fuscus/)- EPFU: 24-34 kHz - Range Map (https://visualize.batamp.databasin.org/species/epfu)
▶ *Euderma maculatum* - Spotted Bat (https://www.batcon.org/bat/euderma-maculatum)- EUMA: 12-Sep kHz - Range Map (https://visualize.batamp.databasin.org/species/euma)

▶ *Eumops perotis* - Western Mastiff Bat (https://www.batcon.org/bat/eumops-perotis)- EUPE: 16-Jul kHz - Range Map (https://visualize.batamp.databasin.org/species/eupe)
▶ *Lasionycteris noctivagans* - Silver-haired Bat (https://www.batcon.org/bat/lasionycteris-noctivagans)- LANO: 25-28 kHz - Range Map (https://visualize.batamp.databasin.org/species/lano)
▶ *Lasiurus blossevillii* - Western Red Bat (https://www.batcon.org/bat/lasiurus-blossevillii)- LABL: 36-53 kHz - Range Map (https://visualize.batamp.databasin.org/species/labl)
▶ *Lasiurus cinereus* - Hoary Bat (https://www.batcon.org/bat/lasiurus-cinereus)- LACI: 16-32 kHz - Range Map (https://visualize.batamp.databasin.org/species/laci)
▶ *Lasiurus xanthinus* - Western Yellow Bat (https://www.batcon.org/bat/lasiurus-xanthinus)- LAXA: 27-40 kHz - Range Map (https://visualize.batamp.databasin.org/species/laxa)
▶ *Myotis californicus* - Californian Myotis (https://www.batcon.org/bat/myotis-californicus)- MYCA: 47-52 kHz - Range Map (https://visualize.batamp.databasin.org/species/myca)
▶ *Myotis ciliolabrum* - Western Small-footed Myotis (https://www.batcon.org/bat/myotis-ciliolabrum)- MYCI: 38-46 kHz - Range Map (https://visualize.batamp.databasin.org/species/myci)
▶ *Myotis evotis* (SGCN in California) - Long-eared Myotis (https://www.batcon.org/bat/myotis-evotis)- MYEV: 32-46 kHz - Range Map (https://visualize.batamp.databasin.org/species/myev)
▶ *Myotis lucifugus* - Little Brown Myotis (https://www.batcon.org/bat/myotis-lucifugus)- MYLU: 35-41 kHz - Range Map (https://visualize.batamp.databasin.org/species/mylu)
▶ *Myotis thysanodes* (SGCN in California) - Fringed Myotis (https://www.batcon.org/bat/myotis-thysanodes)- MYTH: 23-32 kHz - Range Map (https://visualize.batamp.databasin.org/species/myth)
▶ *Myotis volans* (SGCN in California) - Long-legged Myotis (https://www.batcon.org/bat/myotis-volans)- MYVO: 39-45 kHz - Range Map (https://visualize.batamp.databasin.org/species/myvo)
▶ *Myotis yumanensis* - Yuma Myotis (https://www.batcon.org/bat/myotis-yumanensis)- MYYU: 47-51 kHz - Range Map (https://visualize.batamp.databasin.org/species/myyu)
▶ *Nyctinomops femorosaccus* - Pocketed Free-tailed Bat (https://www.batcon.org/bat/nyctinomops-femorosaccus)- NYFE: 14-19 kHz - Range Map (https://visualize.batamp.databasin.org/species/nyfe)
▶ *Nyctinomops macrotis* (SGCN in California) - Big Free-tailed Bat (https://www.batcon.org/bat/nyctinomops-macrotis)- NYMA: 15-Nov kHz - Range Map (https://visualize.batamp.databasin.org/species/nyma)
▶ *Parastrellus hesperus* - Canyon Bat (https://www.batcon.org/bat/parastrellus-hesperus)- PAHE: 41-47 kHz - Range Map (https://visualize.batamp.databasin.org/species/pahe)
▶ *Tadarida brasiliensis* - Brazilian Free-tailed Bat (https://www.batcon.org/bat/tadarida-brasiliensis)- TABR: 18-33 kHz - Range Map (https://visualize.batamp.databasin.org/species/tabr)

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5 Stationary Acoustic Results

12 bat species have been confirmed over all years of monitoring (Table 5.1):

- 12 species in 2023

Multiple factors contribute to a decrease or increase in the number of bat species confirmed with acoustic monitoring over multiple years. Many bat species are declining throughout the United States due to climate change, wind energy, white nose syndrome, and habitat loss. However, yearly variation can also be due to a difference in survey effort, the timing of acoustic monitoring, weather events, and the quality of recorded echolocation files. Differences in these parameters are captured in the survey metadata (Section 6).

Recording quality is essential for identifying bats to the species level, especially in areas with species that overlap in their echolocation call characteristics. The ratio of recordings of noise to non-noise (i.e., bat echolocation) can be an indication of recording quality (Section 8).

In 2023, we confirmed the presence of 12 bat species (see Table 5.2):

Eptesicus fuscus, Lasionycteris noctivagans, Lasiurus xanthinus, Myotis californicus, Myotis yumanensis, Tadarida brasiliensis, Corynorhinus townsendii, Antrozous pallidus, Lasiurus blossevillii, Lasiurus cinereus, Eumops perotis, Myotis ciliolabrum were confirmed for the first time this year.

- 6 species in GRTS 24566
- 9 species in GRTS 31990
- 8 species in GRTS 35830
- 4 species in GRTS 40950
- 8 species in GRTS 108913
- 7 species in GRTS 109437
- 7 species in GRTS 119891
- 7 species in GRTS 128515

5.1 Bat species confirmed all years

Table 5.1: Bat species presence (X) or undetected (blank cell) of bat species recorded at stationary sites in all years of monitoring.

Species	2023							
	24566	31990	35830	40950	108913	109437	119891	128515
ANPA		X				X		
COTO		X	X		X		X	X
EPFU	X	X	X	X	X	X	X	X
EUPE			X					
LABL		X					X	
LACI		X	X		X	X	X	X
LANO	X	X	X	X	X	X	X	X
LAXA	X				X			
MYCA	X	X	X	X	X	X	X	X
MYCI				X				
MYYU	X	X	X		X	X		X
TABR	X	X	X		X	X	X	X

5.2 Files confirmed per species in 2023

Table 5.2: Number of files manually confirmed for each species detected per site and night at stationary sites in 2023.

GRTS Cell	Location Name	Monitoring Night	ANPA	COTO	EPFU	EUPE	LABL	LACI	LANO	LAXA	MYCA	MYCI	MYYU	TA
24566	NE_1	2023-07-20			1						1		1	
		2023-07-21			1				1		1			
		2023-07-22			1				1	1	1		1	
		2023-07-23			1				1	1	1			
	NW_1	2023-07-20												
		2023-07-21											1	
		2023-07-22			1				1				1	
		2023-07-23			1									
	SE_1	2023-07-20							1		1			
		2023-07-21							2					
		2023-07-22			1				1		1			
		2023-07-23			1				1				1	
	SW_1	2023-07-20			1						1			
		2023-07-21							1		1			
		2023-07-22									1			
		2023-07-23			1						1			
31990	NE_1	2023-07-28									1			
		2023-07-29									1			
		2023-07-30									1			
		2023-07-31												
	NW_1	2023-07-24			1				1		1		1	
		2023-07-25		1	1				1		1			
		2023-07-26			1								1	
		2023-07-27			1						1			
	SE_1	2023-08-25	1	1	1			1	1		1		1	
		2023-08-26	1	1	1		1	1	1		1		1	
		2023-08-27			1			1	1		1		1	
		2023-08-28			1			1	1		1		1	

GRTS Cell	Location Name	Monitoring Night	ANPA	COTO	EPFU	EUPE	LABL	LACI	LANO	LAXA	MYCA	MYCI	MYYU	TA
35830	NE_1	2023-08-11												
		2023-08-12						1			1			
		2023-08-13		2	1				1		1			
		2023-08-14		1		1		1			1		1	
	SE_1	2023-08-03									1			
		2023-08-04			1						1			
		2023-08-05												
		2023-08-06												
40950	NE_1	2023-07-10							1		1			
		2023-07-11									1			
		2023-07-12			1									
		2023-07-13							1		1			
	SE_1	2023-07-20												
		2023-07-21												
		2023-07-22			1						1	1		
		2023-07-23												
108913	NE_1	2023-07-28			1								1	
		2023-07-29												
		2023-07-30			1								1	
		2023-07-31									1			
	SE_1	2023-07-28		2	1				1	1	1		1	
		2023-07-29		1	1			1	1		1		1	
		2023-07-30		1	1				1		1		1	
		2023-07-31			1				1		1		1	
	SW_1	2023-07-28			1						1		1	
		2023-07-29		1							1		1	
		2023-07-30			1				1		1		1	
		2023-07-31												
109437	NE_1	2023-07-14												
		2023-07-15			1				1		1			
		2023-07-16			1			1			1		1	
		2023-07-17	2		1						1			
	NW_1	2023-07-10			1						1			

GRTS Cell	Location Name	Monitoring Night	ANPA	COTO	EPFU	EUPE	LABL	LACI	LANO	LAXA	MYCA	MYCI	MYYU	TA
		2023-07-11	1								1			
		2023-07-12	1		1									
		2023-07-13												
	SE_1	2023-07-14												
		2023-07-15												
		2023-07-16												
		2023-07-17												
119891	NW_1	2023-08-03			1						1			
		2023-08-04			1				1					
		2023-08-05			1									
		2023-08-06			1						1			
	SE_1	2023-08-24						1	1		1			
		2023-08-25			1			1			1			
		2023-08-26						1						
		2023-08-27												
	SW_1	2023-08-24			1			1			1			
		2023-08-25			1			1			1			
		2023-08-26		3	1			1	1					
		2023-08-27		1	1		1	1	1		1			
128515	NW_1	2023-08-07			1				1		1			
		2023-08-08			1				1					
		2023-08-09			1						1			
		2023-08-10			1				1					
	SE_1	2023-08-11			1			1	1		1		1	
		2023-08-12			1						1		1	
		2023-08-13		1	1				1		1		1	
		2023-08-14		1	1						1			
	SW_1	2023-08-11			1									
		2023-08-12		1	1			1	1		1			
		2023-08-13			1				1					

6 **Metadata**

6.1 Stationary Acoustic Survey Metadata

Table 6.1: Metadata for the stationary acoustic surveys in 2023

GRTS Cell	Location Name	Detector Type	Detector Serial #	Microphone Type	Latitude	Longitude
24566	NE_1	WILDLIFE ACOUSTICS SM4BAT-FS	S4U01861	Wildlife Acoustics SMM-U1	34.73055	-120.5451
	NW_1	WILDLIFE ACOUSTICS SM4BAT-FS	S4U01819	Wildlife Acoustics SMM-U1	34.73152	-120.5923
	SE_1	WILDLIFE ACOUSTICS SM4BAT-FS	S4U00653	Wildlife Acoustics SMM-U1	34.70730	-120.5250
	SW_1	WILDLIFE ACOUSTICS SM4BAT-FS	S4U01905	Wildlife Acoustics SMM-U1	34.66355	-120.5787
31990	NE_1	WILDLIFE ACOUSTICS SM4BAT-FS	S4U01905	Wildlife Acoustics SMM-U1	34.76287	-120.4649
	NW_1	WILDLIFE ACOUSTICS SM4BAT-FS	S4U01861	Wildlife Acoustics SMM-U1	34.74788	-120.4917
	SE_1	WILDLIFE ACOUSTICS SM4BAT-FS	S4U00653	Wildlife Acoustics SMM-U1	34.71633	-120.4872
35830	NE_1	WILDLIFE ACOUSTICS SM4BAT-FS	S4U00653	Wildlife Acoustics SMM-U1	34.89680	-120.6205
	SE_1	WILDLIFE ACOUSTICS SM4BAT-FS	S4U00653	Wildlife Acoustics SMM-U1	34.85321	-120.5949
40950	NE_1	WILDLIFE ACOUSTICS SM4BAT-FS	S4U01905	Wildlife Acoustics SMM-U1	34.61047	-120.6242
	SE_1	WILDLIFE ACOUSTICS SM4BAT-FS	S4U01803	Wildlife Acoustics SM3-U1	34.57171	-120.6127
108913	NE_1	WILDLIFE ACOUSTICS SM4BAT-FS	S4U00653	Wildlife Acoustics SMM-U1	34.81711	-120.5629
	SE_1	WILDLIFE ACOUSTICS	S4U01803	Wildlife Acoustics SMM-	34.78831	-120.5870

GRTS Cell	Location Name	Detector Type	Detector Serial #	Microphone Type	Latitude	Longitude
		SM4BAT-FS		U1		
	SW_1	WILDLIFE ACOUSTICS SM4BAT-FS	S4U01861	Wildlife Acoustics SMM-U1	34.77919	-120.6087
109437	NE_1	WILDLIFE ACOUSTICS SM4BAT-FS	S4U01819	Wildlife Acoustics SMM-U1	34.55068	-120.4956
	NW_1	WILDLIFE ACOUSTICS SM4BAT-FS	S4U01803	Wildlife Acoustics SMM-U1	34.55880	-120.5620
	SE_1	WILDLIFE ACOUSTICS SM4BAT-FS	S4U01803	Wildlife Acoustics SMM-U1	34.53284	-120.4974
119891	NW_1	WILDLIFE ACOUSTICS SM4BAT-FS	S4U01905	Wildlife Acoustics SMM-U1	34.63382	-120.5669
	SE_1	WILDLIFE ACOUSTICS SM4BAT-FS	S4U01819	Wildlife Acoustics SMM-U1	34.61533	-120.5350
	SW_1	WILDLIFE ACOUSTICS SM4BAT-FS	S4U01803	Wildlife Acoustics SMM-U1	34.58909	-120.5464
128515	NW_1	WILDLIFE ACOUSTICS SM4BAT-FS	S4U01905	Wildlife Acoustics SMM-U1	34.81975	-120.5319
	SE_1	WILDLIFE ACOUSTICS SM4BAT-FS	S4U01861	Wildlife Acoustics SMM-U1	34.79383	-120.4495
	SW_1	WILDLIFE ACOUSTICS SM4BAT-FS	S4U01905	Wildlife Acoustics SMM-U1	34.78753	-120.5039

6.2 Stationary Survey Dates

Ideally, surveys are repeated annually at the same week of the year. Variation in survey dates could contribute to differences in species detections from year to year.

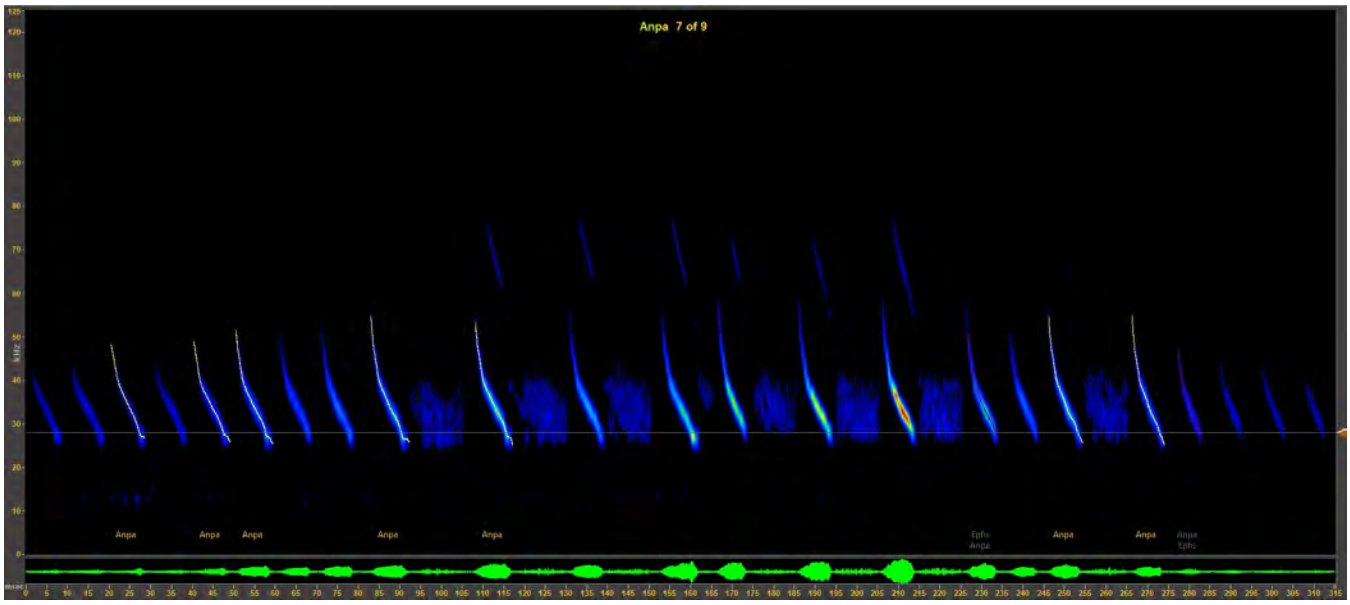
Table 6.2: Survey start dates for each year for each detector location

GRTS Cell	Location Name	2023
24566	NE_1	July 20
	NW_1	July 20
	SE_1	July 20

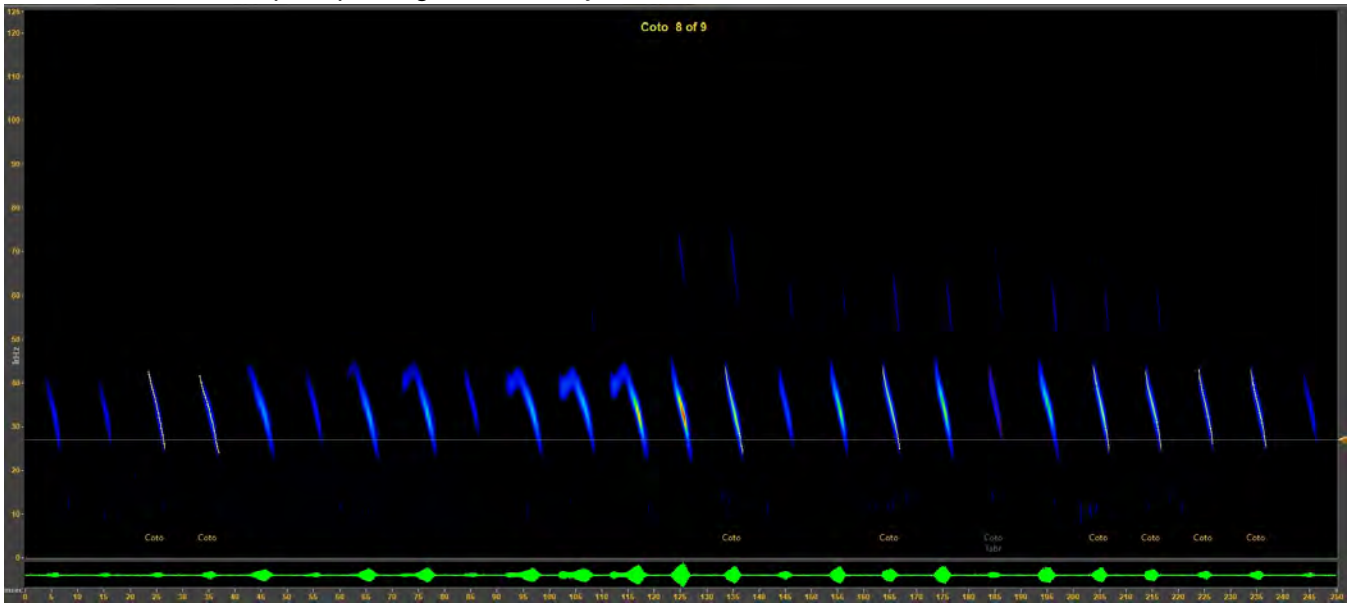
GRTS Cell	Location Name	2023
	SW_1	July 20
31990	NE_1	July 28
	NW_1	July 24
	SE_1	August 25
35830	NE_1	August 11
	SE_1	August 3
40950	NE_1	July 10
	SE_1	July 20
108913	NE_1	July 28
	SE_1	July 28
	SW_1	July 28
109437	NE_1	July 14
	NW_1	July 10
	SE_1	July 14
119891	NW_1	August 3
	SE_1	August 24
	SW_1	August 24
128515	NW_1	August 7
	SE_1	August 11
	SW_1	August 11

7 **Select Spectrograms**

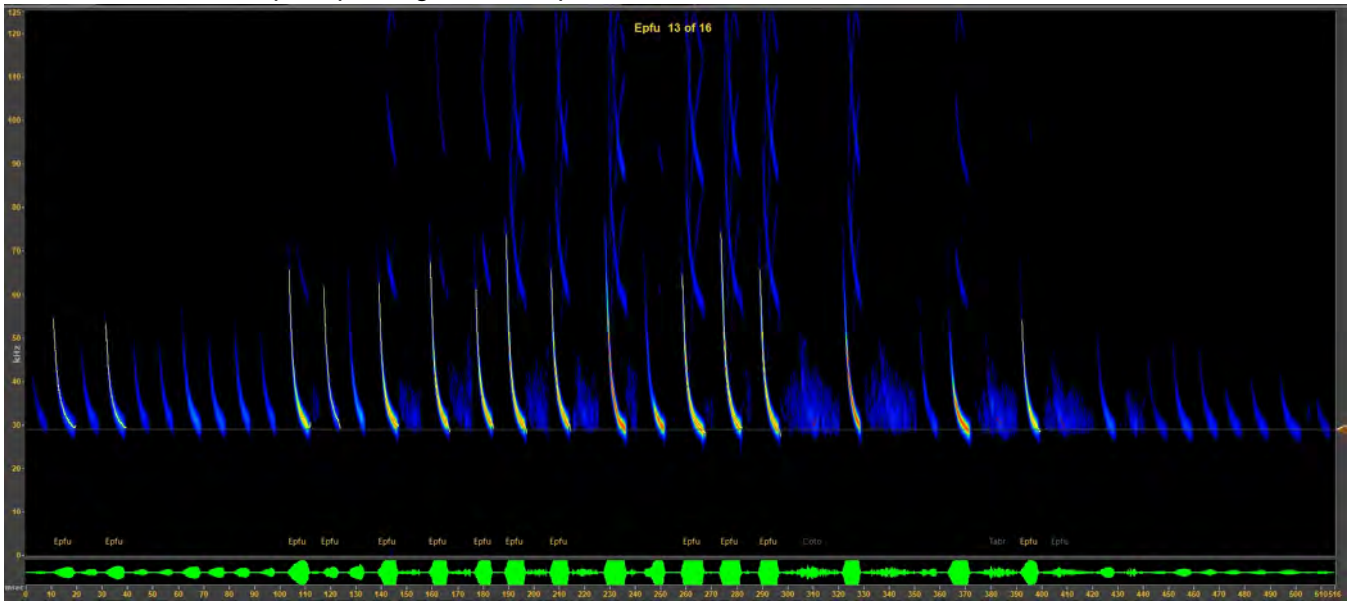
▼ Click to View Example Spectrograms for *Antrozous pallidus* detected at 109437 NE1



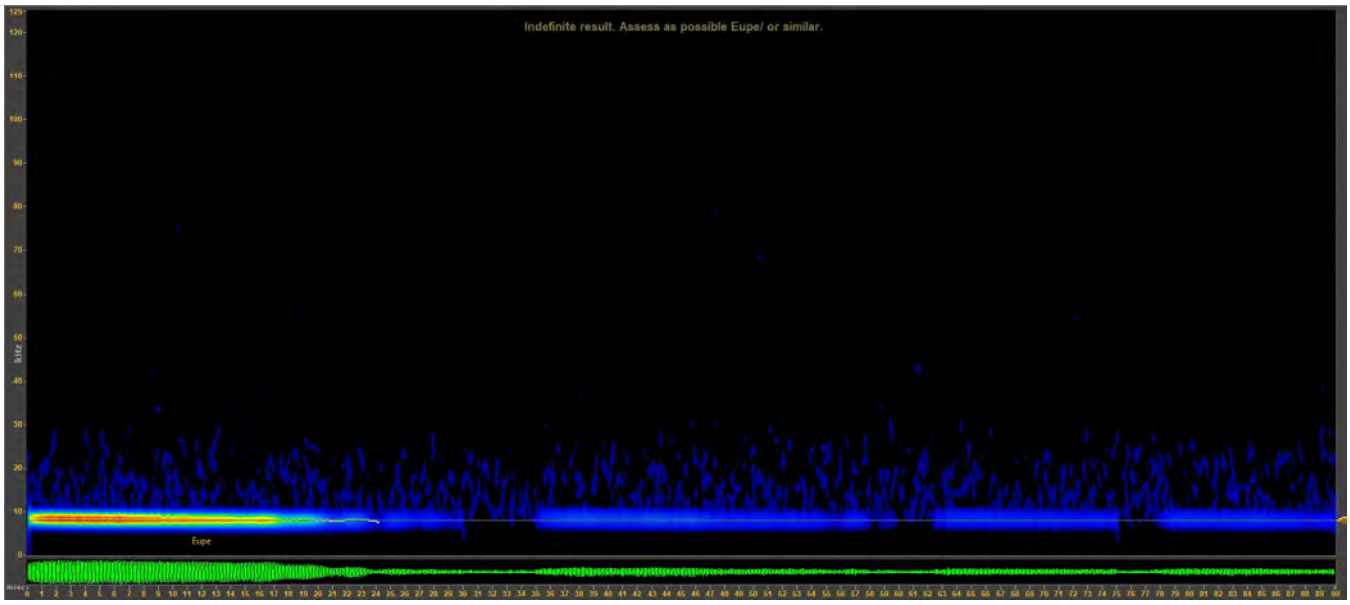
▼ Click to View Example Spectrograms for *Corynorhinus townsendii* detected at 35830 NE1



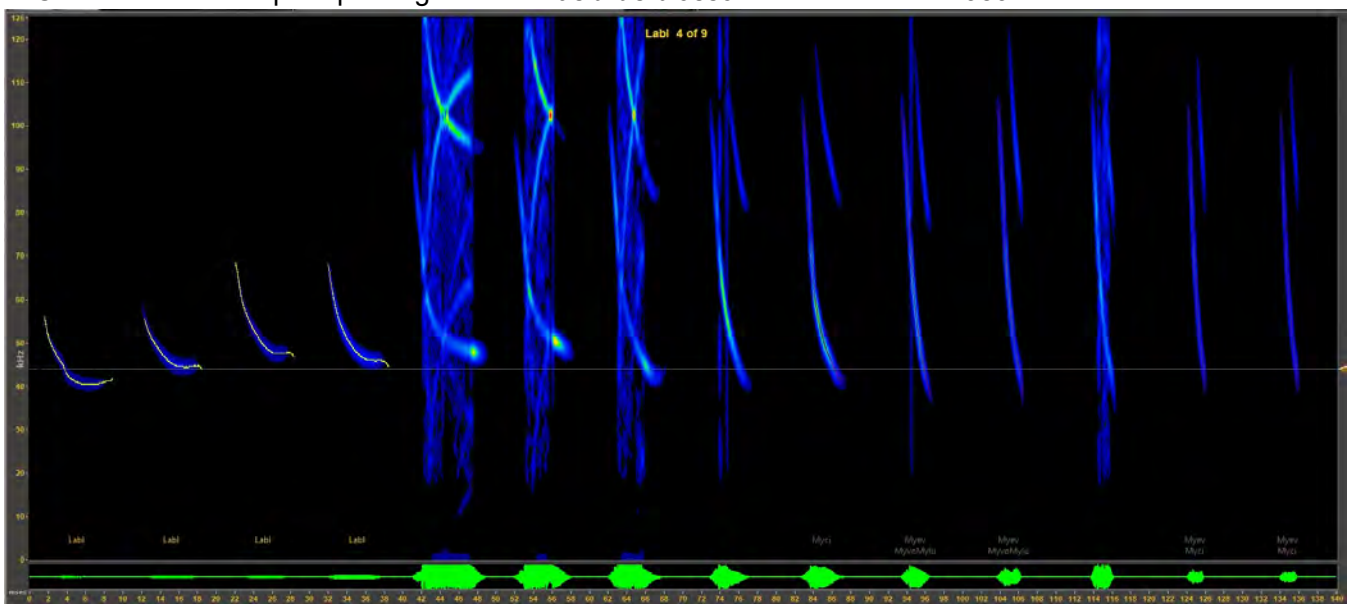
▼ Click to View Example Spectrograms for *Eptesicus fuscus* detected at 128515 SE1



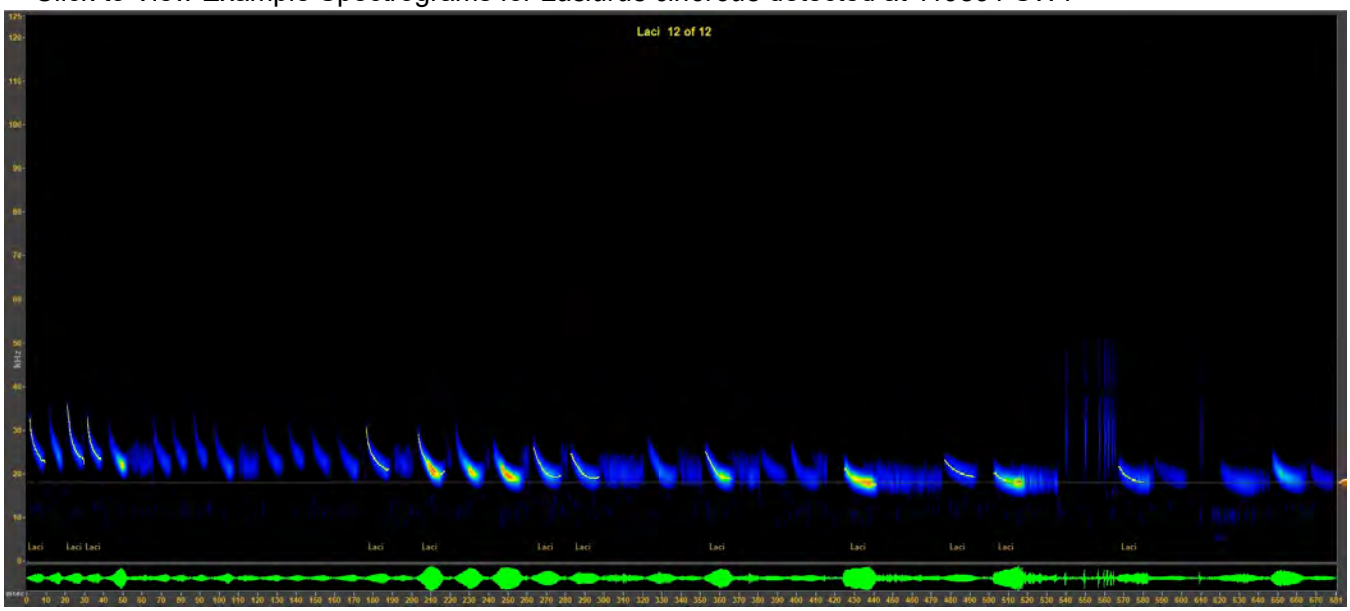
▼ Click to View Example Spectrograms for *Eumops perotis* detected at 35830 NE1



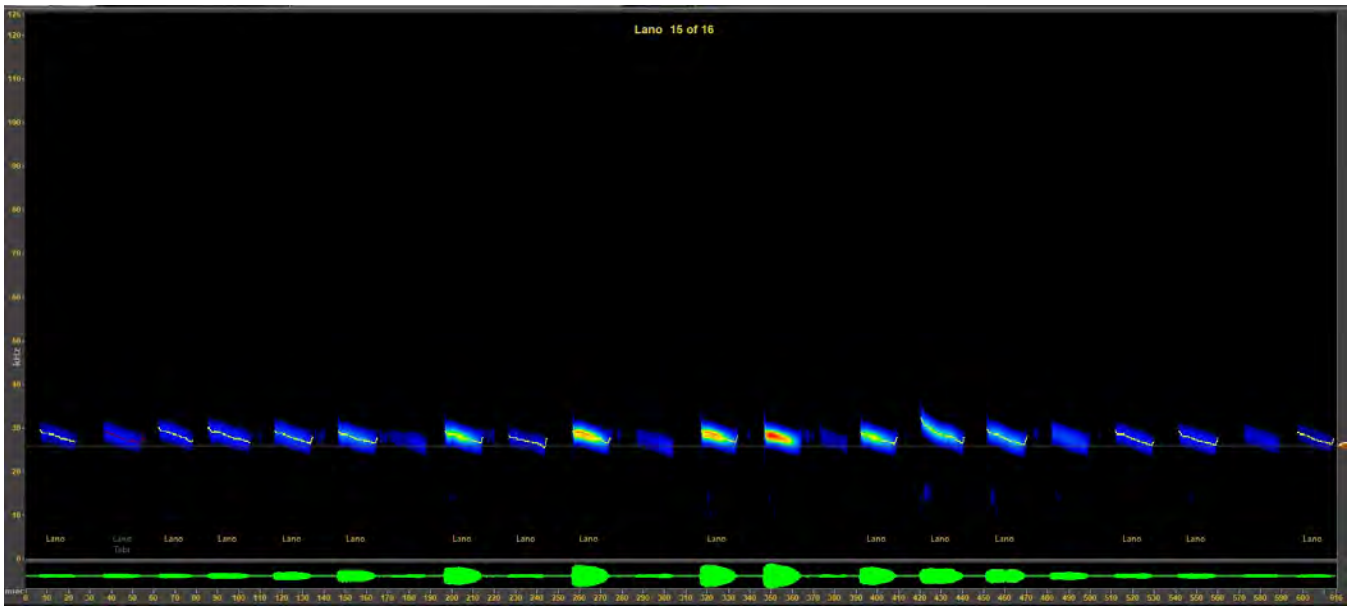
▼ Click to View Example Spectrograms for *Lasiurus blossevillii* detected at 119891 SW1



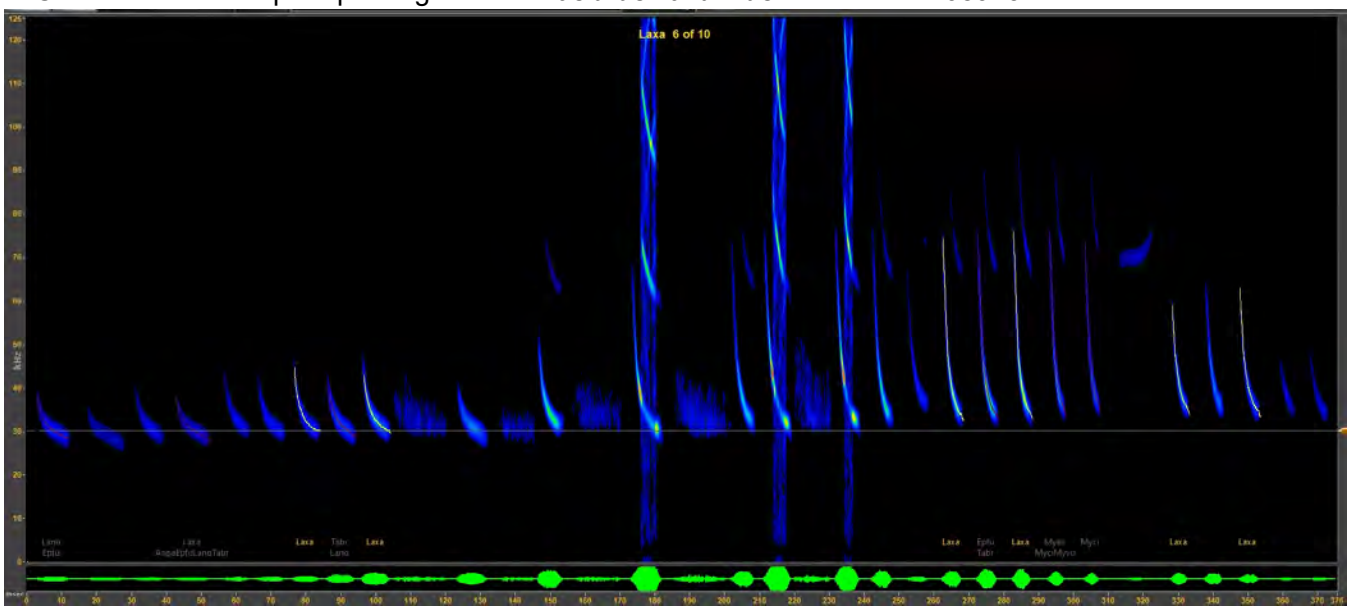
▼ Click to View Example Spectrograms for *Lasiurus cinereus* detected at 119891 SW1



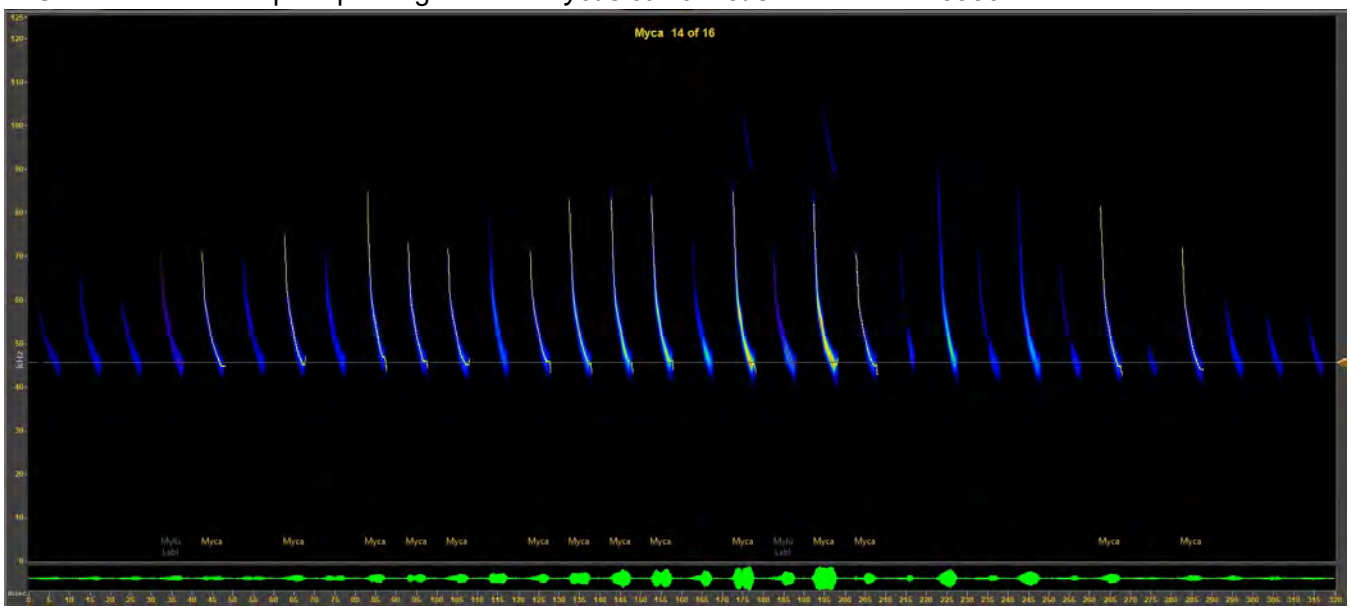
▼ Click to View Example Spectrograms for *Lasionycteris noctivagans* detected at 31990 SE1



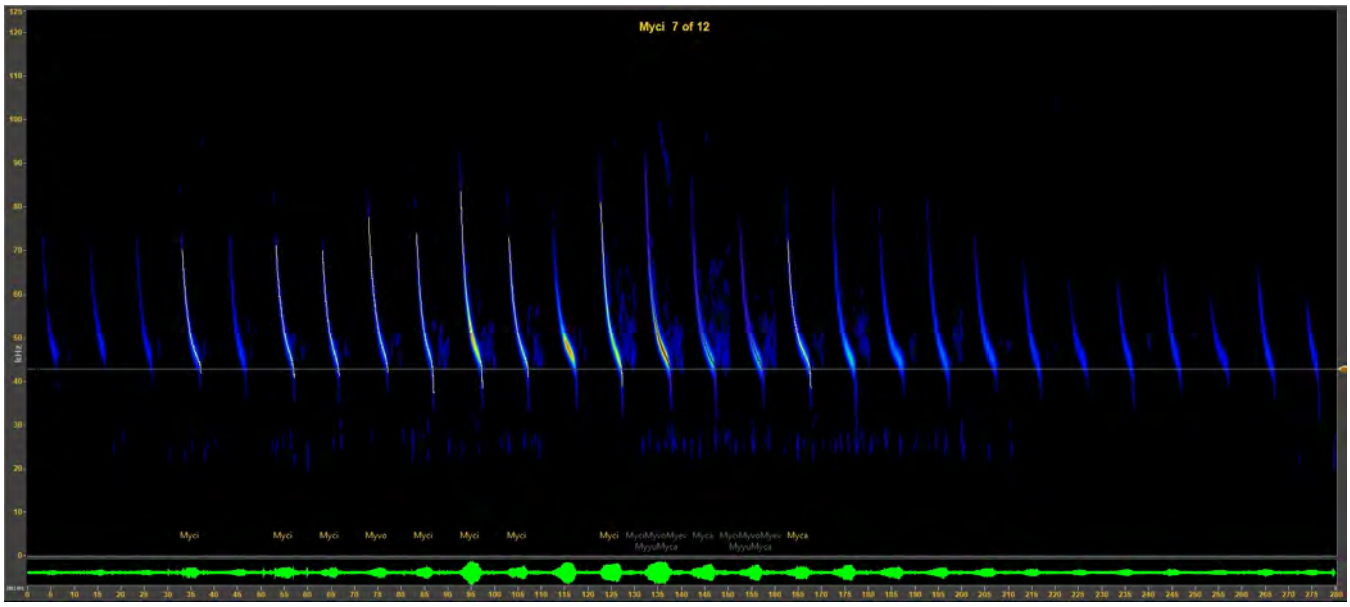
▼ Click to View Example Spectrograms for *Lasiurus xanthinus* detected at 108913 SE1



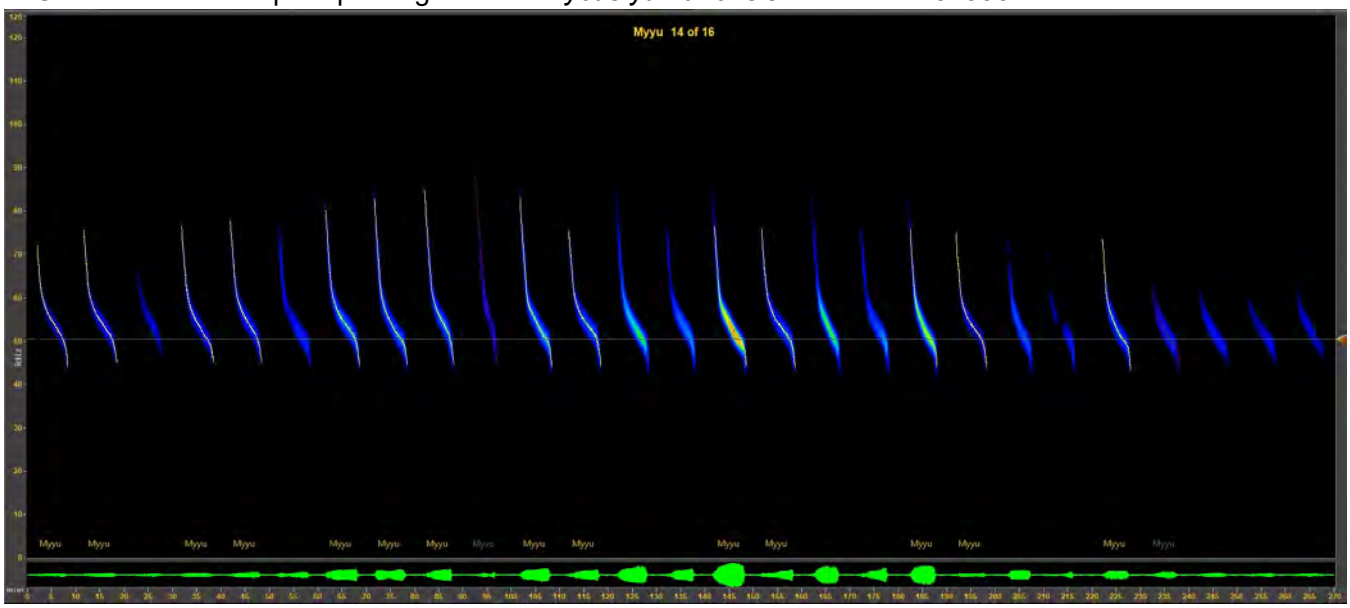
▼ Click to View Example Spectrograms for *Myotis californicus* detected at 40950 NE1



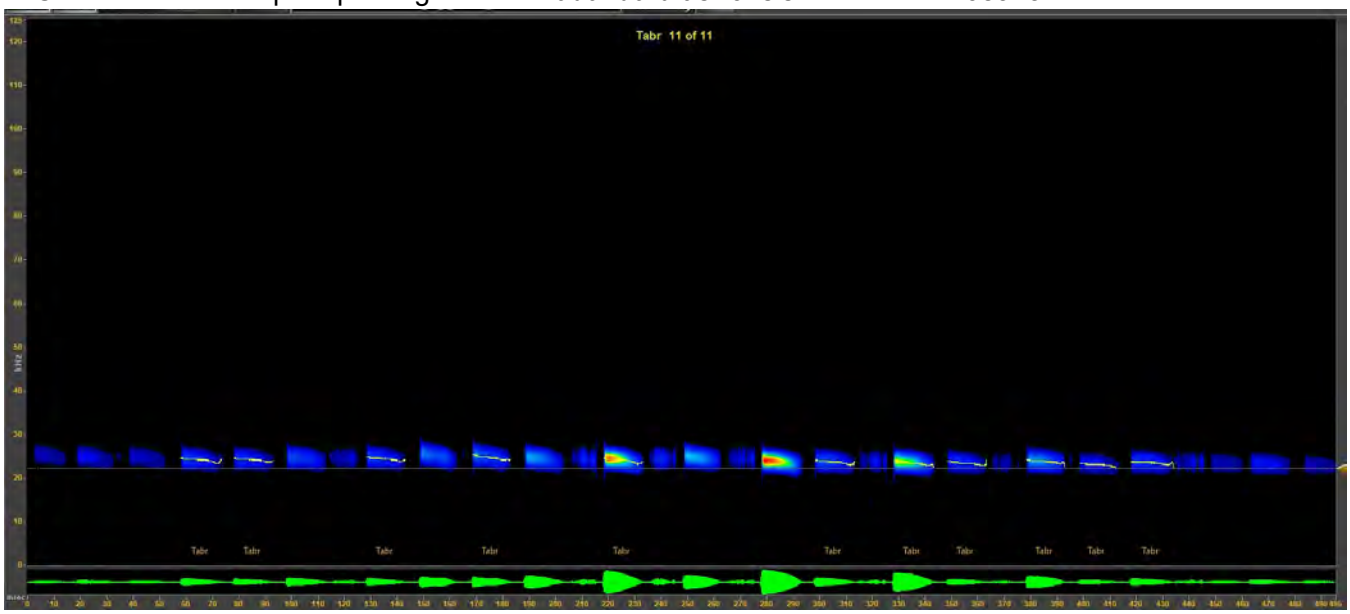
▼ Click to View Example Spectrograms for *Myotis ciliolabrum* detected at 40950 SE1



▼ Click to View Example Spectrograms for *Myotis yumanensis* detected at 31990 SE1



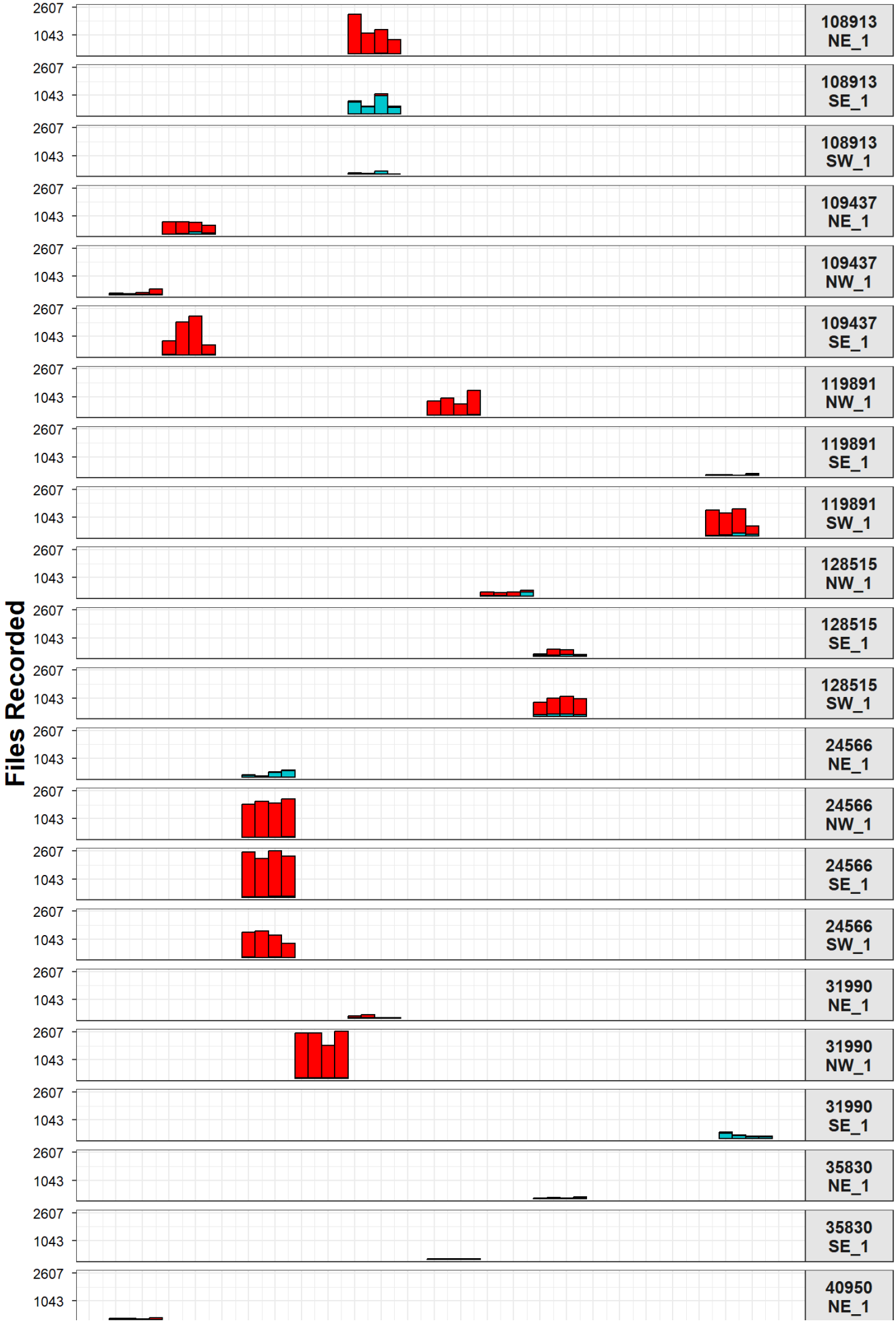
▼ Click to View Example Spectrograms for *Tadarida brasiliensis* detected at 108913 SW1

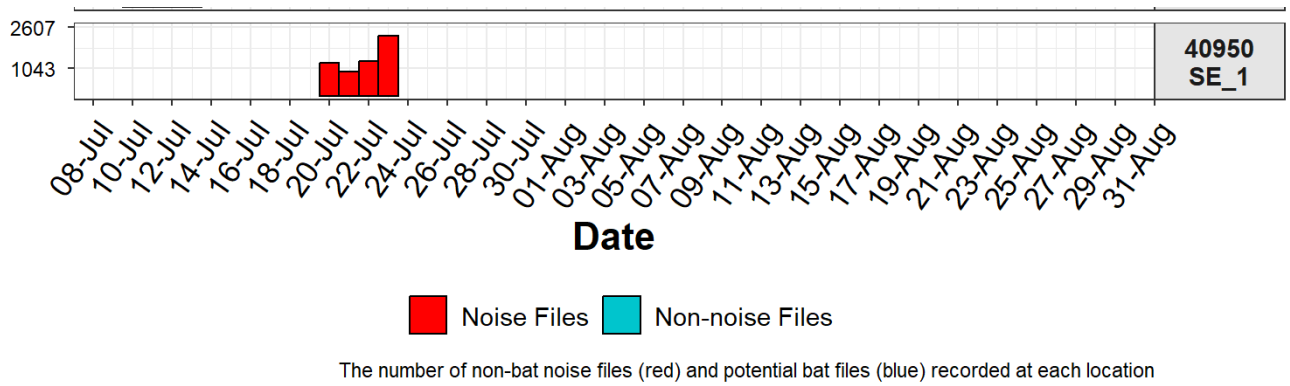


8 Noise Recordings

The number of noise files compared to non-noise files recorded by a bat detector can be an indication of the condition of a bat detector. Detectors recording large amounts of noise files should be re-calibrated, and the survey location should be re-evaluated. A high noise to bat ratio can could also indicate poor site choice (e.g., too close to water or clutter), lots of insects, or electrical interference. The more noise files recorded can likely mean lower quality non-noise recordings, leading to fewer recordings that can be manually identified to species.

8.1 Stationary Noise Recordings


Files Recorded
2607
1043
108913 NE_1
108913 SE_1
108913 SW_1
109437 NE_1
109437 NW_1
109437 SE_1
119891 NW_1
119891 SE_1
119891 SW_1
128515 NW_1
128515 SE_1
128515 SW_1
24566 NE_1
24566 NW_1
24566 SE_1
24566 SW_1
31990 NE_1
31990 NW_1
31990 SE_1
35830 NE_1
35830 SE_1
40950 NE_1



The number of non-bat noise files (red) and potential bat files (blue) recorded at each location

9 **Learn More**

All acoustic results were uploaded to the NABat project USAF West Region (#949) and can be viewed here (https://sciencebase.usgs.gov/nabat/#/projects/949). *NOTE: You need to have a NABat account and be a member of the project to view the results on Partner Portal. If you would like to view and download these results on NABat, or if you need help creating an account or being added to the NABat project please contact us or your regional Hub Coordinator.*

For any questions regarding these results, please contact rapid@batcon.org (mailto:rapid@batcon.org).

Introduction

In accordance with Consistency Determination CD-0003-24, the Department of the Air Force (DAF) has provided the below information regarding Measure 1.a.iii:

> **iii.** Monitoring of the on-base monarch butterfly populations in a manner sufficient to assess potential changes in habitat use patterns and population levels.

VSFB Monarch Butterfly Monitoring

The DAF has completed standardized counts of overwintering monarchs at VSFB since 1997 and will continue to complete these surveys annually per the Xerces Society's Western Monarch Count Protocol (attached).

Exhibit 8b
CD-0007-24

Monarch Count Survey Instructions

Protocol for the Xerces Society's Western Monarch Count

Equipment List

- Monarch Count Survey Instructions
- Monarch Count Datasheet (hardcopies, or set up on the Survey123 app)
- Binoculars
- Pen or pencil (if using hardcopy datasheets)
- Clipboard (if using hardcopy datasheets)
- Smartphone w/ GPS capability or GPS unit (helpful but not required)
- Smartphone w/ Compass app or handheld compass (helpful but not required)
- Backup portable phone charger & cord (if using Survey123 app)
- Kestrel pocket weather meter or outdoor weather thermometer (helpful, but not required)
- Plant identification field guide or the Seek by iNaturalist app (helpful but not required)
- Camera (helpful but not required)

When and How Often to Count

Monarch Count surveys should be conducted at least once per monitoring period (e.g., once during the Thanksgiving Count and once during the New Year's Count), although twice or more is preferred. Ideally, volunteers will conduct a Monarch Count during both monitoring periods, but *if necessary*, the Thanksgiving Count should be prioritized. Volunteers are welcome to establish weekly, bi-weekly, or monthly schedules throughout the entire monarch overwintering season (late October through early March) if their capacity allows – all monarch overwintering data will be included in the Xerces Society's Western Monarch Overwintering Sites Database, even if collected outside of the two official monitoring periods. However, it is important to conduct Monarch Counts during the Thanksgiving Count and New Year's Count in order to compare cluster sizes in a standardized way across sites and years.

Surveys should be conducted by **at least two observers** in the **early morning** while temperatures are low enough that monarch butterflies remain clustered from the evening before (usually below 13 °C or 55 °F). Weather measurements should be taken and recorded in the datasheet before beginning to count; measurements should be taken from the same location in the grove each visit (note that "wind direction" is the direction that the wind is coming FROM). ***Do not*** survey during heavy precipitation and/or strong winds because of poor visibility and increased chances of the butterflies being scattered and on the ground. Additionally, if a considerable number of fliers are observed, please complete your survey as usual, but plan to return another morning when conditions are more favorable for an accurate count.

Cluster Estimation Protocol

Record each cluster on a separate row/field of the datasheet:

1. Identify a cluster to estimate with your monitoring partner. It's important that you are both counting the same butterflies since you'll compare counts for accuracy at the end.
2. Individually count the number of monarchs in a small section or area of the cluster, then extrapolate that number out to arrive at count estimate for the entire cluster. Repeat this process one or two more times from different angles, then take the average.
3. Compare your estimate with that of your monitoring partner's; if both counts are within a 20% margin, record the average of the two counts (yours and your partner's) on the datasheet. If counts are *not* within 20%, discuss why and then start the count again.

4. Repeat this process until you and your monitoring partner have agreed upon estimates for each cluster present at the site. Sum your estimates and note the total number of clustered monarchs on your datasheet.
5. Sunners, loners, fliers, and grounders are tracked separately on the datasheet; tally these observations as you move around the site.
6. Sum all clustered monarchs + sunners + fliers + loners + grounders to produce the grand total monarch count.
    - *Note: dead monarchs or monarchs missing an abdomen (e.g., due to predation) should NOT contribute to the grand total. Instead, record number of dead monarchs in a separate field on the datasheet.*

Submitting Data

Monarch Count and Habitat Assessment data should be submitted as soon as possible through the Survey123 mobile app or online forms available at WesternMonarchCount.org. Monitoring partners will need to decide who is responsible for submitting their joint datasheet and plan accordingly to avoid submitting multiple reports of the same data. If inconsistencies, missing data or protocol concerns are noted, a Xerces staff person or regional coordinator will attempt to contact the individual(s) for clarification, using the email provided in their datasheet.

Monitoring Definitions

Monarch butterfly categories:

- **Cluster**: three or more adjacent butterflies with closed wings (likely that the cluster formed the previous day)
- **Sunners**: butterflies with open wings and temperatures usually exceed 55° F (likely that the sunning butterflies flew from their cluster to the sunning location)
- **Loners**: two or fewer butterflies with closed wings not associated with a cluster
- **Fliers**: any number of butterflies in flight
- **Grounders**: any number of live butterflies on ground (living monarchs missing an abdomen due to predation should be categorized as "dead")
- **Dead**: butterflies presumed dead or death is imminent (e.g., missing abdomen)
- **Mating**: individual butterflies engaged in mating activities
- **Tagged**: butterflies with a unique applied marking (usually a sticker) on hindwing

Site access categories:

- **Open Access:** Unrestricted direct access to the site/cluster trees (e.g., public parks or open spaces that remain open all/most hours, public walkways, roadways, or parking lots, etc.)
- **Limited Access:** Complete or partial access to the site/cluster trees *with* limitations or restrictions (e.g., fees, limited operating hours, requires site access coordination or special permissions, environmental obstacles, etc.)
- **No Access:** No direct access at this time; however, the site may or may not be visible from a nearby location, such as a public road (e.g., private property, restricted access area, environmental barriers, etc.)

Thank you for participating in the Western Monarch Count!

Please refer to the resources available at WesternMonarchCount.org for more information.

Measurements, analysis, and modeling of ascent sonic boom plan from Vandenberg Space Force Base

Summary

SLD 30 and the analysis team will investigate the causes of sonic booms produced by rocket ascents in Santa Barbara, Ventura, and Los Angeles counties, under various trajectories and weather conditions. The initiative, which involves measurements, modeling, and comprehensive analyses, will help SLD 30 gain a better understanding of which trajectories and weather conditions are more likely to generate acoustic events. Measurements will be taken during 3-4 launches each season (i.e. quarterly, appx 12-16 annually) to better assess the impact of changes in coastal weather patterns. PCBoom modeling will be conducted for each launch and the results will be incorporated along with actual measurement data into the existing data set of all measured launches. Analyses of the data will be performed to further refine the overall model and better correlate weather patterns with acoustic events. Statistical analyses will be performed with the data and model to identify the most significant factors in determining acoustic event intensity and potential impacts on coastal resources.

Measurements

To date, Brigham Young University (BYU) and California State University Bakersfield (CSUB) have conducted a total of ~80 measurements during nine Falcon 9 launches. SLD 30 will work to target data collection during varying weather patterns for at least three launches per quarter. The analysis team will prioritize data collection locations that are optimal for measurement fidelity while minimizing impact on the public. Where possible, the intent is to make use of locations where equipment can be left unattended to maximize the amount of data points collected.

Modeling

PCBoom 7.4 will be used to model launches with the most accurate weather profiles possible, as well as to be used as a predictive tool to look at how changing weather patterns and trajectory impact predictions. The analysis team will incorporate weather profile data and launch trajectory data into the PCBoom model to better understand the impacts of varying trajectories and changing weather patterns. The model will be iteratively improved by the incorporation of actual collected measurement data from each launch with the goal of developing a better understanding and an improved predictive tool. Weather balloon data from SLD 30 and other locations (e.g., Oxnard Airport) will be combined with atmospheric profile models (CFSv2 and ERA5) as input. SLD 30 will utilize multiple launch vehicle near-field pressure profiles; these serve as the input “source” for the numerical propagation of acoustic events and their intensities through the atmosphere.

Analysis

SLD 30 and the analysis team will conduct the study using a three-step approach:

Step 1: Conduct additional analysis of the measured data beyond simple overpressure maps. Waveform and spectral properties will be analyzed to gain insight into the characteristics of the measurement environment. The analysis team plans to incorporate SpaceX's measured data along with the current data set.

Step 2: Perform a comparison of measurements and models using different metrics used for measuring sound and how it is perceived (e.g. over pressure, decibels, A Waves). Certain metrics are more applicable to animals versus humans based on how sound is perceived by each. The analysis team will select and utilize the best metrics for this study.

Step 3: Investigate which factors contribute most to the on-land measured and predicted acoustic events. The analysis team has successfully used a method called Lasso Regression to determine which aircraft and environmental factors are most strongly correlated with aircraft sonic boom measurements and PCBoom predictions. This method is applicable to launch vehicles as well, and these techniques will be applied to this effort using varying launch vehicle types, flight profiles and atmospheric parameters (e.g., wind direction, temperature profile, etc.)

Deliverables

SLD 30 will convene a quarterly Working Group to include, but not limited to, the California Coastal Commission (CCC), the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and the Federal Aviation Administration (FAA). Quarterly reports will be delivered to the working group and a review of monitoring efforts and data will be conducted. If these results include adverse effects found to be attributed to launch related activities substantially different than previously identified, then the Working Group will have an opportunity to recommend additional monitoring, minimization and mitigation measures. If data recorded is of immediate concern, SLD 30 will share with the Working Group and host an ad hoc meetings to address the concern.

WBS Tasks

WBS 1.0: Perform Ascent Sonic Boom Measurements in Santa Barbara, Los Angeles, and Ventura County

WBS 1.1: Combined analysis team will complete visits to California for data collection for no less than three launches each quarter. Launches with higher probability of acoustic events on land will be prioritized.

WBS 1.2: Collect data in each season of the year.

WBS 2.0: Perform PCBoom Modeling and Simulation

WBS 2.1: Validate the PCBoom outputs between BYU and ManTech to ensure the same inputs are used.

WBS 2.2: Assess the PCBoom inputs related to Falcon-9 vehicle geometry and determine whether updated inputs should be used.

WBS 2.3: Exercise PCBoom using different meteorological profiles and models.

WBS 3.0: Determine Correlations Between Measurements, Meteorology, and Trajectory Data

WBS 3.1: Conduct full analysis of all measured acoustic events

WBS 3.2: Use day-of meteorological profiles and as-flown trajectory data to determine which parameters are the most correlated to ground acoustic event characteristics

WBS 4.0: Reporting

WBS 4.1: Prepare and deliver briefings at combined working groups.

WBS 4.2: Prepare and deliver final report, presentation, and recommendations for further steps

Period of Performance

An initial 18-month period of performance is expected, with 12 months for data collection and modeling done in parallel, and an additional 6 months for analysis and further refinement of the findings, beginning 25 October 2024.

Principal Investigators

Dr. Kent Gee, Department of Physics and Astronomy, Brigham Young University

Dr. Lucas K. Hall, Assistant Professor, Department of Biology, California State University Bakersfield

Introduction

In accordance with Consistency Determination CD-0003-24, the Department of the Air Force (DAF), through SLD 30 in cooperation with SpaceX has begun drafting the Lighting Management Plan outlined in Measure 4:

> **4. Lighting Management Plan.** A Lighting Management Plan is being completed and will be submitted to the USFWS as a requirement of the BO. DAF will provide the Commission with a copy of the approved management plan DAF will consider comments provided by the Executive Director on the Lighting Management Plan and address them, when practicable in coordination with the USFWS. Once the BO is issued, DAF will implement the Lighting Management Plan.

Lighting Management Plan

The Lighting Management Plan is currently in development and would be incorporated at SLC-4 to retrofit the existing facility's lighting by January 2025. The plan will incorporate best management practices in lighting retrofit design to reduce current and future lighting impacts into natural, undeveloped areas, to the maximum degree possible while still meeting operational requirements. This Lighting Management Plan will be accomplished through strategic placement of lights, and the use of shields, timers, and motion sensors wherever possible to minimize potential effects associated with novel persistent artificial light at night.

Exhibit 8d
CD-0007-24

Introduction

In accordance with Consistency Determination CD-0003-24, the Department of the Air Force (DAF), through SLD 30 in cooperation with SpaceX has begun implementation of the following condition to keep beach closures at no more than 12 and to prevent other potentially negative effects on beach access (e.g. reservation cancelations, etc.).

> **5. Coastal Access and Recreation Enhancement.** Within 30 days of the Commission's consideration of Consistency Determination No. CD-0003-24, DAF will provide, for Executive Director review and comments, an update on the Coastal Access and Recreation Enhancement efforts it is pursuing. The update will include (1) specific details and schedules for implementation of the commitments DAF has made for the evacuation shuttle, satellite internet and Highway 1 digital signage projects for Jalama Beach County Park and the Lompoc Unified School District third grade beach field trip program; (2) details of measures that SpaceX and DAF will take to ensure that the proposed launch activities will not exceed DAF's commitment to cause more than 12 annual closures of Jalama Beach; and (3) a minimum notice period, coordinated with the Santa Barbara County Parks and Recreation Department, for any planned evacuations for Jalama Beach. DAF will consider comments provided by the Executive Director in response to the update and strive to address them when possible.

Highway 1 Signage

Santa Barbara County Parks & Recreation, with the cooperation and support from DAF and SpaceX, has the lead for the project scope and timeline for implementation of a new informational welcome sign to Jalama Beach County Park based upon its jurisdictional responsibilities over the park. The DAF maintains ongoing coordination and support with Santa Barbara County on implementation of this project. The variable message sign is expected to be in place at the Highway 1 and Jalama Road intersection pending Santa Barbara County project plan timing. DAF can provide an update when a specific timeline is established.

Jalama Beach County Park Evacuation Shuttle

For launches that require an evacuation of Jalama Beach County Park, in cooperation with DAF, SpaceX had offered complimentary shuttle service to assist overnight campers in evacuating the site. Santa Barbara County Parks & Recreation, likely having jurisdictional authority on the park's access along with other Santa Barbara County offices, has declined use of this, citing concerns that it would "complicate the evacuation that some people already understand" (Jeffrey Lindgren, pers. comm.). If in the future Santa Barbara County Parks & Recreation determines it would be helpful in reducing access or reservation concerns and necessary, SpaceX would provide the shuttle service.

Starlink at Jalama Beach County Park

In cooperation with DAF and in coordination with Santa Barbara County Parks & Recreation and the Santa Barbara County Information Technology office, SpaceX has provided increased Starlink coverage for the public at Jalama Beach County Park. SpaceX provided an additional high power

Starlink satellite dish to complement the existing dish operated by Santa Barbara County. Two years of priority Starlink service has been provided to Jalama Beach County Park. Santa Barbara County Information Technology confirmed the system was fully operational on July 30, 2024.

Figure 1. Starlink Dish Installed at Jalama Beach County Park



Lompoc Unified School District Program

DAF has coordinated with Lompoc Unified School District (LUSD) Curriculum Director to coordinate logistics and requirements for all 3rd grade students to participate in a field trip to Surf Beach/Ocean Park. There are approximately 900 students across 9 schools that would participate in this program. DAF and SpaceX will provide staff to facilitate a natural resources program during the field trips. DAF would implement this program for two consecutive school years. Approximately 100 students would visit the beach at a time for an approximate 9 trips per school year.

Jalama Beach Evacuations

Prior to launch, Space Launch Delta 30 Range Safety evaluates risk criteria to determine if Jalama Beach County Park must be closed for public safety. Under the agreement between the Department of the Air Force and Santa Barbara County, SLD 30 must provide notice of a launch at least 7 days prior to the closure, and the closure is not to exceed 48 hours to cover the primary and back up day for the launch event. These evacuations would be infrequent and would only last as long as necessary to assure the public are safe during a launch (approximately up to six hours). A notification of receipt procedure has been developed between Space Launch Delta 30 Range Safety and Santa Barbara County Parks Department to ensure the request for the beach closure has been received and acknowledged to ensure timelines for notification to the country have been adhered to.

The Space Launch Delta, 2nd Range Operations Squadron maintains the current launch schedule for all activities occurring on Vandenberg Space Force Base. If a Jalama Beach evacuation is necessary, the operation in question is annotated and added to a calendar year running tally to ensure Space Launch Delta 30 does not exceed the 12 annual closures agreed to with Santa Barbara County.

Introduction

In accordance with Consistency Determination CD-0003-24, the Department of the Air Force (DAF), is providing this Marine Debris update pursuant to Measure 6:

> **6. Marine Debris.** Marine Debris. DAF will ensure that annual payments by the Space Exploration Corporation (SpaceX) are made at a rate of $20 (adjusted annually for inflation) for each pound of unrecoverable marine debris generated as a result of space launch and landing activities, including the release of weather balloons in advance of launch and/or landing activities occurring in State waters. These marine debris offset payments will be provided to the U.C. Davis Lost Fishing Gear Recovery Project (U.C Davis Program) and DAF and the Executive Director will collaborate to identify a public or non-profit organization focused on removal of hazardous waste from the marine environment or battery/electronic waste recycling and reduction efforts that can also receive funding. Once that organization is identified, future marine debris offset payments will be divided equally between it and the U.C. Davis Program. In addition, DAF will, within 30 days of the Commission's consideration of Consistency Determination No. CD-0003-24, provide an update to the Executive Director describing its recent efforts to evaluate and implement measures to reduce the amount of marine debris released as part of launch activities (and described in the CD and the 2023 EA/FONSI for 36 launches), such as by minimizing the number of weather balloons released per launch, exploring alternatives to the released weather balloons, and modifying the radiosondes. If technological and/or operational advancements in the future allow for further reductions of the use of weather balloons or marine debris associated with launches, DAF will consider further marine debris reduction efforts. DAF will also provide an annual report to the Executive Director by January 1st of each year that includes the amounts and types of marine debris released as part of each SpaceX launch and provides details about the amounts of plastics and other materials within the released debris.

Weather Balloons

Since December 2023, the DAF has reduced the requirement for weather balloon releases by 10-20 balloons per launch as recent technology has improved and protocols have been updated. Currently approximately 5 weather balloons are released per launch to measure weather variables. Further, the DAF is continuing to review and update protocols to see under what circumstances weather balloon releases may be waived or reduced (such as during stable weather conditions). The weather balloons are 100% biodegradable natural latex.

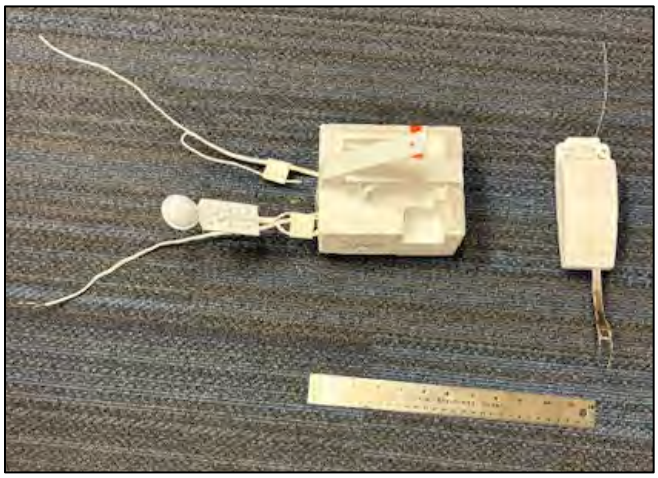


Weather Balloon with LMS Radiosonde

Exhibit 8f
CD-0007-24

Radiosondes

The DAF is currently updating the radiosondes used on weather balloons. The existing system is the Lockheed Martin Sippican LMS Radiosonde which has three 3-volt lithium batteries. The DAF is moving to a new system using the Vaisala RS-41 which is approximately 50% less weight, 1/3 the size of the model that has been previously used and uses two 1.5-volt AA lithium batteries.

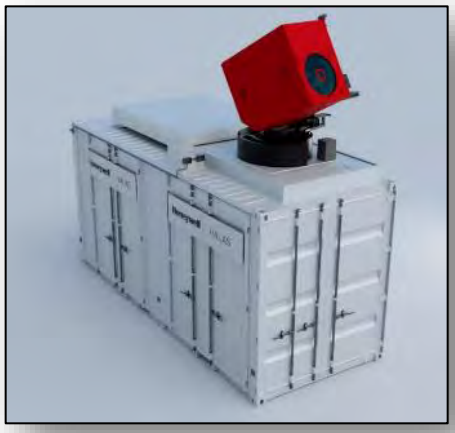


Vaisala RS-41 Radiosonde - New System (right)
Lockheed Martin Sippican LMS Radiosonde – Existing System (left)

Alternatives

The DAF has been and will continue to actively explore alternatives to using weather balloons. The following are currently under consideration and/or testing at Vandenberg Space Force Base:

1. Tropospheric Doppler Radar Wind Profiler/Vertical Wind Profiler
    a. Expected to reduce balloon usage by approximately half or more
2. High-Altitude Lidar for Atmospheric Sensing (HALAS) system
    a. Currently being tested at VSFB
    b. This system would reduce requirements for weather balloons, but would not fully replace
3. Unmanned Aircraft
    a. This is an experimental option that is being explored.
    b. There is potential for this to reduce/eliminate the need for some of the weather balloons.



HALAS System

Commercial and Recreational Fishing Coordination Plan

1. Introduction

This plan outlines the communication protocol and coordination efforts between Launch Service Providers (LSP), the Department of the Air Force (DAF), and the commercial and recreational fishing industry. The goal is to ensure the safety and awareness of mariners operating in the vicinity of VSFB during launch activities and hazardous operations. This plan has been developed in accordance with Consistency Determination CD-0003-24:

> **7. Commercial and Recreational Fishing Coordination Plan.** Within 30 days of the Commission's consideration of Consistency Determination No. CD-0003-24, DAF will submit a Commercial and Recreational Fishing Coordination Plan to the Executive Director for review and comments. The Plan will include the development and implementation of a communication protocol, including regular dialogue, developed in coordination with the commercial and recreational fishing industry most likely to be affected by launch and landing activities at Vandenberg Space Force Base as well as an email to local fishermen's associations that includes the date and time of the surveillance area, the vessel hazard area that is also available in the Notice to Mariners, and for how long these will be in effect. DAF shall consider comments provided by the Executive Director and strive to address them, when possible.

2. Communication Protocol

2.1 Danger Zone Hotline

Mariners operating in the Vandenberg SFB area will receive the status of Vandenberg Danger Zones via email or text alert. This will provide up-to-date information on launch activities and any associated danger zones in Figure 1.

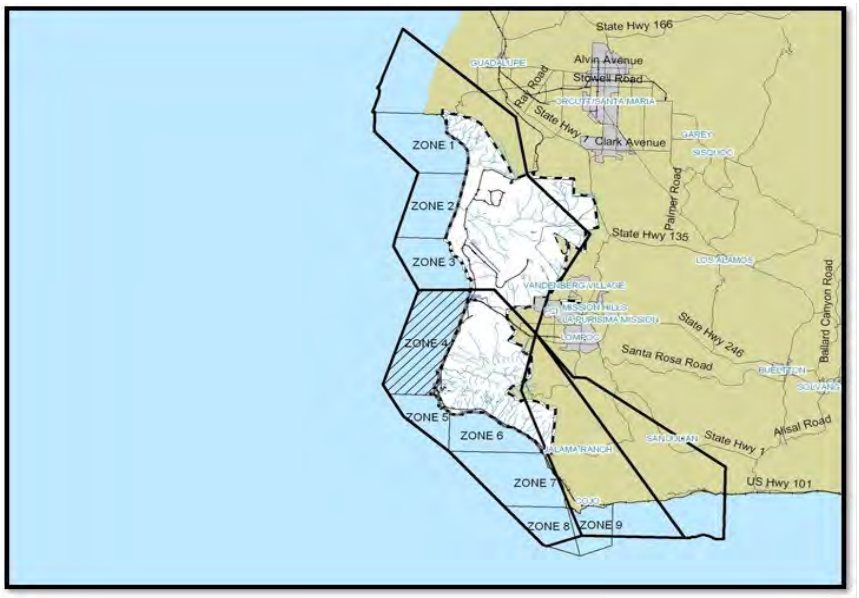


Figure 1. Vandenberg Danger Zones

Exhibit 8g
CD-0007-24

2.2 Frontier Control Operations

Frontier Control will be manned and available on marine channels 6 & 16 no later than 3 hours prior to scheduled launch operations.

3. Distribution List

The following Harbor Masters will be included in the distribution of launch notifications and updates through the Launch Service Provider and Space Launch Delta 30 (SLD 30) Public Affairs:

- Harbor Master, Morro Bay
- Harbor Master, Santa Barbara
- Harbor Master, Oxnard
- Harbor Master, San Luis
- Harbor Master, Ventura Marina
- Harbor Master, Port Hueneme

4. Public Notices

Public Notices to Mariners links are available at the Vandenberg SFB website at http://www.vandenberg.spaceforce.mil.

4.1 Local Notice to Mariners

Local Notices to Mariners are publicly published on the USCG LNM District 11 page, which is updated weekly. Mariners can access these notices at: https://www.dco.uscg.mil/Featured-Content/Mariners/Local-Notice-to-Mariners-LNMs/District-11/

5. Additional Communication Channels

5.1 Concerns and Questions

An avenue for questions or concerns will be established on the http://www.vandeneberg.spaceforce.mil website to address concerns from the fishing community.

5.2 Sign-Up for Launch Information

A sign-up system will be implemented, initially including harbor master's aforementioned, to notify commercial and recreational fishermen who opt-in to either text or email of the date, time frame, and launch activities, including a map of avoidance areas if available. This system will ensure timely and accurate information dissemination to the affected parties.

6. Town Hall Meetings

6.1 Purpose

Town hall meetings will be held at the Santa Barbara and San Luis Obispo harbors and organized to provide a platform for direct communication between Vandenberg SFB and the commercial and recreational fishing community. These meetings will serve to address concerns, provide updates, and gather feedback from stakeholders.

6.2 Schedule

Town hall meetings will be held in January/February 2025, and annually after that, to ensure ongoing communication and coordination. The schedule for these meetings will be published on the Vandenberg SFB website and distributed to the Harbor Masters listed in Section 3.

6.3 Agenda

The agenda for each town hall meeting will include:

- Updates on launch activities
- Review of recent launch events and any communication issues encountered
- Discussion of safety protocols and avoidance areas
- Open forum for questions and feedback from the fishing community

6.4 Participation

Representatives from Vandenberg SFB will be present at the town hall meetings from 2d Range Operations Squadron, Airspace & Offshore Management, the SLD 30 Safety Office, the SLD 30 Environmental team, and SLD 30 Public Affairs. Members of the commercial and recreational fishing community, including Harbor Masters and other stakeholders, are encouraged to attend and participate.

7. Measures of Effectiveness

7.1 Direct Messaging Effectiveness

The Measures of Effectiveness for the plan include stakeholder awareness, measured by the percentage of mariners aware of upcoming launch activities. This is gauged through engagement with harbor master's measuring satisfaction with communication efforts and sign-ups for the direct messaging system.

7.2 Town Hall Effectiveness

The effectiveness of town hall meetings is measured by the number of fishermen participating in town hall meetings, as well as the level of engagement and feedback from the fishing community who feel their concerns were addressed and the number of actionable feedback items implemented.

United States Department of the Interior
U.S. FISH AND WILDLIFE SERVICE
Ecological Services
Ventura Fish and Wildlife Office
2493 Portola Road, Suite B
Ventura, California 93003

IN REPLY REFER TO:
2022-0013990-S7-001-R001

August 28, 2024

Beatrice L. Kephart
30 CES/CEI
1028 Iceland Avenue
Vandenberg Space Force Base, California 93437

Subject: Biological Opinion on the Launch, Boost-Back, and Landing of the Falcon 9 First Stage at Space Launch Complex 4 (SLC-4) with project modification to include up to 16 additional launches between October 1 and December 31, 2024, Vandenberg Space Force Base, Santa Barbara County, California.

Dear Beatrice Kephart:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological and conference opinion based on our review of the U.S. Space Force's (Space Force) proposed authorization of the Space Exploration Technologies Corporation (SpaceX or project proponent) to conduct up to 16 Falcon-9 launches from SLC-4 between October 1 and December 31, 2024 on Vandenberg Space Force Base (VSFB), and its effects on the federally threatened California red-legged frog (*Rana draytonii*) and western snowy plover (*Charadrius nivosus nivosus*), and the proposed threatened southwestern pond turtle (*Actinemys pallida*) (88 Federal Register [FR] 68370 68399), in accordance with section 7 of the Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 et seq.). We received your June 27, 2024, amended biological assessment and communicated request to initiate formal consultation on June 28th, 2024.

We have based this biological and conference opinion on information that followed your June 27, 2024 revised biological assessment (MSRS 2024a), previous relevant information included or coordinated following your 2022 biological assessment (MSRS 2022a) on related operations, as well as subsequent information coordinated in 2024 between Space Force and Service staff. Electronic documents of information related to the consultation are stored at the Ventura Fish and Wildlife Office.

Definitions Related to Launch Noise and Overpressure Disturbance

We include brief descriptions on launch noise and overpressure disturbance that will be referenced in the following 'Not Likely to Adversely Affect Determination' sections. More specific detail on this modeling can be located under 'Project Description' found later in this document.

Exhibit 9
CD-0007-24

Launch and Static Test Fire Noise

The highest sound pressure level measure during a single event is the SPL_{max}. Although it provides some measure of the event, SPL_{max} does not fully describe the noise disturbance because it does not account for how long the sound occurs. Sound exposure level (SEL) takes into account the length of time a noise occurs and provides a measure of the net impact of the entire acoustic event.

Each of the 16 proposed full launches would generate noise disturbance from the ignition of the rocket fuel with a maximum sound level of 150 decibels (dB) SPL_{max} on SLC-4. Noise level would attenuate outward in all directions reaching 100 dB approximately 17 miles away (Appendix A, Figure 1A–F, Launch Noise Effect Area).

Two associated terrestrial landings would occur and produce similar levels which are expected to attenuate more quickly. Consequently, launch landing noise has a slightly smaller footprint entirely encompassed within the Launch Noise Effect Area, reaching 100 dB SPL approximately between 5.8 and 10.5 miles away. The terrestrial landings would occur approximately 6 to 10 minutes following a launch ascent.

Similarly, a total of two static test fires could occur one day before a full launch and is also considered a separate form of launch disturbance. Static test fires would impact a smaller portion of a full launch's disturbance footprint over a substantially shorter duration (7 seconds) and are consequently a separate distinct disturbance event that is not comparable or substitutable for a full launch. Associated static test fires would also produce noise levels of up to 145 dB SPL_{max} with levels attenuating outward in all directions reaching 100 dB SPL approximately 9.8 miles away (USSF, unpublished project data, 2024a).

Launch descent Sonic Boom

Each proposed launch ascent and descent (landing at SLC-4) would generate a separate sonic boom. Each sonic boom would produce disturbance in the form of overpressure, which is high energy impulsive sound that would last a fraction of a second (BRRC 2020, p. 32). Overpressure disturbance from launch ascent and landing would impact separate areas (Appendix A, Figure 2A–P, Sonic Boom Overpressure Effect Area). Static test fires would not create a sonic boom.

During the two Falcon-9 descents, overpressure levels would be up to 9.5 pounds per square foot (psf) at SLC-4 itself. Based on the visuals provided, these levels would attenuate quickly to 5.0 psf within the immediate vicinity of the launch pad (USSF, unpublished project data, 2024a; Appendix A Figure 2B).

Overpressure can be expressed as instantaneous noise disturbance (SPL_{max}) by using a mathematical conversion from psf to decibel levels. The biological assessment did not include conversions of overpressure into instantaneous noise disturbance (SPL_{max}). The Service used past

Falcon 9 monitoring reports to reference these conversions for purposes of facilitating comparison (Robinette and Rice 2019, p. 14, 2022, p. 13; MSRS 2022b, p. 4).

Launch Ascent Sonic Boom modeling (Mainland California)

The Space Force has included specific sonic boom modeling for the proposed project's launch ascent easterly trajectories that will be referenced in the following 'Not Likely to Adversely Affect Determination' sections. More specific detail on this modeling can be located under 'Project Description; Launch Sonic Boom (Overpressure Disturbance); Mainland California (Southeastern Santa Barbara, Ventura, and Los Angeles Counties) – Launch Ascent'.

To briefly summarize, the Space Force includes that 75 percent of the 16 launches are expected to contain easterly trajectories. The Service consequently understands that there would be 12 associated sonic booms over the 3-month project period (each separated by an anticipated average of 5 days). The Space Force's provided modeling indicates that the sonic booms that would impact these areas would be reasonably certain to be less than 1.0 psf (MSRS 2024a, p. 112). The Service consequently understands that the proposed project's associated mainland sonic boom disturbance would be relatively infrequent and that none of these 12 launches would reasonably result in sonic booms of over 1.0 psf to mainland California. To help provide a clear project description, the Service uses this understanding to define parameters considered within analysis. Appendix A, Figures 2I-P, are included to provide visual depiction of sonic boom modeling impacts within mainland California.

Not Likely to Adversely Affect Determination

The Space Force's request for consultation also included the determination that the proposed action may affect but is not likely to adversely affect the federally threatened marbled murrelet (*Brachyramphus marmoratus*), California gnatcatcher (*Polioptila californica californica*), and southern sea otter (*Enhydra lutris nereis*), and the federally endangered California tiger salamander (*Ambystoma californiense*), California condor (*Gymnogyps californianus*), unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*), tidewater goby (*Eucyclogobius newberryi*), arroyo toad (*Anaxyrus californicus*), and light-footed Ridgway's rail (*Rallus obsoletus levipes*). The Space Force also requested informal conference on the proposed western spadefoot (*Spea hammondii*), which is under review for potential listing under the Act.

Marbled Murrelet

Marbled Murrelet Occurrence

There are 25 total observations of marbled murrelets offshore from VSFB between 1995 and 2023 (eBird 2024). In 2023, one observation recorded two marbled murrelets near Brown's Beach south of Lion's Head on VSFB. In 2011, one observation recorded approximately 0.5 mile west of SLC-4 indicated presence of a marbled murrelet at an unreported distance offshore. Two

additional 1995 observations (each of one individual) taken from approximately 7.5 miles north of SLC-4 indicated presence offshore from Purisima Point. The remaining observations occurred north of Minuteman Beach. Marbled murrelets do not breed on VSFB due to lack of breeding habitat; project activities would only impact foraging adults which observers document infrequently. Marbled murrelet observations in this area have occurred as close as 984 to 6,561 feet from the shore (Strachan et al. 1995, p. 247).

Effects to Marbled Murrelet

Sound pressure and overpressure produced by the proposed project activities (launch, landing, and static test fire events) have the potential to affect marbled murrelets in the vicinity of SLC-4 during up to 16 launches, 2 boost-backs, and 2 static test fires between October 1, 2024 and December 31, 2024. Immediately off the coast, maximum anticipated noise levels during proposed activities at SLC-4 would be up to 130 dB SPL_{max} during Falcon 9 launches at SLC-4 (Appendix A, Figure 1D). This area would also experience sonic booms with overpressure levels up to 4.0 psf during each vehicle landing at SLC-4 (Appendix A, Figure 2E). However, marbled murrelets typically inhabit areas further off the coast (984 to 6,561 feet from shore) that would experience much lower noise levels. It is unknown how various noise and overpressure levels would affect marbled murrelet, but we expect any nearby individuals to exhibit a temporary startle response (i.e., dive and resurface) during launch, landing, or static test fire events and quickly return to normal behavior post-event (Bellefleur et al. 2009, p. 535). It is unlikely marbled murrelets would be present at the exact moment of a launch, landing, or static test fire event because of their transitory nature and overall scarcity within the action area. Therefore, the probability of noise-related impacts to marbled murrelets from project activities would be extremely low if they occur.

The Space Force has determined that there would be no effect to marbled murrelet populations located off-base from launch ascents with easterly trajectories that are likely to create low level (less than 1.0 psf) sonic booms (MSRS 2024a, p. 126).

Avoidance and Minimization Measures

1. The Space Force will ensure that annual marbled murrelet population surveys will continue to be conducted at the current levels to monitor the frequency and distribution of marbled murrelet within the action area.

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

1. Within the project vicinity, marbled murrelets occur irregularly and only as adults foraging offshore; they do not breed at VSFB.
2. Available monitoring data suggest that maximum noise levels produced from launch

operations are unlikely to have a significant effect on marbled murrelets. In the unlikely event any effects occur, we expect only minor temporary behavioral reactions to infrequent noise disturbance.

California Condor

California Condor Occurrence on VSFB

There have been two separate occurrences of California condor on VSFB based on GPS transmitter data: one individual in 2017 (studbook number 760) and another in 2022 (studbook number 1031). In both instances, it was a single condor that spent a short period of time (one to three days) at VSFB. These data indicate that while condors can occur on VSFB, the current frequency of occurrence is very low.

California Condor Occurrence Outside of VSFB

California condors occupy many of the foothills and mountains of Santa Barbara, Ventura, and Los Angeles Counties. These areas are occupied by both the Southern California Flock managed by Hopper Mountain National Wildlife Refuge Complex staff and Central California Flock managed by Ventana Wildlife Society and Pinnacles National Park. Both flocks overlap in distribution within the mainland California sonic boom overpressure effect area. The majority of California condor activity relative to VSFB is east of Interstate 101 in Santa Barbara County, more than 20 miles from SLC-4.

Effects to California Condor on VSFB

Sound pressure and overpressure produced by the proposed project activities (launch, landing, and static test fire events) have the potential to affect California condors in the vicinity of SLC-4 during up to 16 launches, 2 boost-backs, and 2 static test fires between October 1, 2024 and December 31, 2024. The maximum anticipated noise levels during proposed activities at SLC-4 would be up to 150 dB SPL_{max} during Falcon 9 launches at SLC-4 (MSRS 2024a, p. 104). This area would also experience sonic booms with overpressure levels up to 9.5 psf during each vehicle landing at SLC-4 (USSF 2024b). Launch noise would attenuate outward for approximately 17 miles. If California condors were present in the on-base portions of the proposed project area, they would likely be foraging or roosting. The Service anticipates that in the unlikely event that a California condor was within the immediate area of SLC-4 during the time of the launch, the potential magnitude of noise from launch, landing, or static test fire events, sonic booms, physical flame and steam, and visual disturbances could result in physical harm and other behavioral shifts to the species. However, GPS transmitter data indicate that California condor occurrences on VSFB are very rare or infrequent and it is unlikely that California condors would be on-base during project activities. Therefore, the probability of project-related impacts to California condors are very low.

Effects to California Condor Outside of VSFB

California condors occur within the region potentially impacted by sonic booms during missions with easterly trajectories. 12 launches (75 percent of the 16) that would occur between October 1 and December 31, 2024, would include easterly trajectories that would generate sonic booms with the potential to impact California condors within the mainland California sonic boom overpressure effect area. Sonic boom overpressure levels are dependent on atmospheric conditions. The Service considers for the purposes of this analysis that these sonic boom levels are reasonably expected to be under 1.0 psf (MSRS 2024a, p. 145), are not coupled with any visual stimuli, would occur relatively infrequently, and each last only a fraction of a second.

It is unknown how various noise and overpressure levels can affect California condors, but we expect individuals within this region to exhibit a temporary startle response or other minor and temporary behavioral shifts in response to noise from sonic booms. California condors are remarkably tolerant of human disturbance as indicated by the variety of hands-on management (J. Brandt, USFWS, pers. comm. 2024). Therefore, the probability of noise-related impacts to California condors from project activities off-base would be low if they occur.

Avoidance and Minimization Measures

1. Prior to any launch, the Space Force will determine if any California condors are present by coordinating with Service and Ventana Wildlife Society personnel (Note: VSFB computers are unable to review the Service's 'Daily Snapshot – California Condor Population' Google Earth imagery). The Space Force will contact the Service if California condors appear to be near or within the area affected by a launch from SLC-4. In the unlikely event that a California condor is nearby, Qualified Biologists will monitor California condor movements in the vicinity of VSFB and coordinate with the Service to analyze data before, during, and after launch events to determine whether any changes in movement occur.
2. The Space Force will coordinate with current Service personnel, including Arianna Punzalan, Supervisory Wildlife Biologist, USFWS California Condor Recovery Program, at arianna_punzalan@fws.gov or (805) 377-5471; or Steve Kirkland, California Condor Field Coordinator, USFWS California Condor Recovery Program, at steve_kirkland@fws.gov or 805-766-4630. The Space Force will also coordinate with current Ventana Wildlife Society personnel, including Joe Burnett, Senior Wildlife Biologist, at joeburnett@ventanaws.org or 831-800-7424.

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

1. The probability of a California condor being present on-base during project activities is extremely low, making associated effects discountable. In the unlikely event a California

condor is determined to be present at the time of launch activities (Measure 1), this scenario would be outside the parameters of this analysis.

2. We anticipate that effects that would occur off-base would be insignificant. If any effects occur from overpressure of less than 1.0 psf, we expect only minor temporary behavioral reactions to infrequent noise disturbance.

Southern Sea Otter

Southern Sea Otter Occurrence

Southern sea otters irregularly inhabit (i.e., transit, forage) the coast of VSFB between Purisima Point and Point Arguello. There is a small breeding colony approximately 5.5 miles south of SLC-4 at the boat harbor near Sudden Flats (MSRS 2022a, p. 46). Consequently, noise and overpressure produced from the proposed project's launch operations has the potential to affect southern sea otters in the vicinity of SLC-4.

Effects to Southern Sea Otter

Sound pressure and overpressure produced by the proposed project activities (i.e., launch, landing, and static fire events) have the potential to affect southern sea otters if present offshore at the time of launch within the vicinity of SLC-4. Immediately off the coast, maximum anticipated noise levels during proposed activities would be up to 130 dB SPL_{max} during Falcon 9 launches at SLC-4. Potentially occupied southern sea otter areas would also experience sonic booms with overpressure levels up to 5.0 psf during each boost-back landing at SLC-4. No psf to dB SPL comparison was provided and the Service assumes this level is comparable to instantaneous exposure of 140 to 150 dB SPL. The location of the southern sea otter breeding colony south of SLC-4 would experience slightly lower noise levels with maximum anticipated levels of up to 110 dB SPL_{max} during launches, and sonic boom overpressure levels up to 4.0 psf. Project-related activities could also impact southern sea otters via visual disturbance during launch and landing events.

The Space Force has conducted previous launch monitoring for southern sea otter that focuses on before and after counts of the population. This monitoring data during low levels (generally less than 10 launches a year) of space launch activities since 1998 indicate that launch noise and visual disturbances do not substantially affect the number of southern sea otters in the nearshore marine environments of VSFB (MSRS 2022a, p. 71). Southern sea otters adjacent to LF-05 on north base have historically experienced launch noise of 136.6 dB SPL associated with Peacekeeper launches and continue to experience 127.8 dB SPL associated with Minuteman III launches with no obvious observed effects on populations before or after launching (SRS 1999a as cited in MSRS 2021a, p. 55). Previous monitoring conducted during the SpaceX Sentinel 6A launch mission that contained a boost-back and landing actions with similar noise and overpressure levels on November 21, 2020 documented similar before and after launch counts of

southern sea otter (MSRS 2021b, p. 3). Biologists did not detect any discernible impact to southern sea otter populations from the launch activity.

The previous monitoring efforts have not reviewed behavioral reactions to southern sea otter during launch activities. The Service uses pinnipeds as appropriate surrogates to understand potential effects to southern sea otter from launch noise and overpressure. A 2023 annual report included pinniped launch monitoring that occurred during SLC-4 launches (USSF 2024c, p. 14-21 (Section 4.3)). Monitoring results included that different species of pinnipeds have had differing behavioral responses to launch disturbance including the following: elephant seals will raise their heads and flail during launchings, rarely fleeing into water; Pacific harbor seals would flee into water during launch events; reduction in number of California sea lion pups observed on VSFB; and several Pacific harbor seal pup mortality events (potentially as a result of trampling associated with adult's flee movements in response to launch events). However, the southern sea otter are generally less sensitive to noise when compared with Pacific harbor seals and California sea lions (Carswell, L., pers. comm., 2024). The Space Force will implement both camera and in person biological monitoring during launch events as described below (Avoidance and Minimization 1) to ensure no unanticipated behavioral effects of southern sea otter in response to launch disturbance occur.

Previous research indicates that sea otters may acclimatize to frequent noise disturbance. Davis et al. (1988, pp. 7, 14) conducted a study of northern sea otter's (*Enhydra lutris kenyoni*) response to underwater and in-air noise stimuli utilizing a variety of sounds, including air horns and an underwater acoustic harassment device capable of producing 190 dB SPL for longer period playbacks, pulsing sound every 15 seconds over a maximum of 3 hours. The louder underwater acoustic harassment device did not disturb northern sea otters (Davis et al. 1988, p. 22), but noise exposure to air horn noise resulted in a startle, fleeing response with individuals moving between 300 to 600 feet before resuming normal activity and exhibiting habituation to the variety of noise stimuli over a short amount of time (Davis et al. 1988, pp. 31, 35). The Service consequently anticipates that southern sea otters located off the coast of VSFB may already exhibit a degree of habituation due to the existing launch environment, and we do not currently expect the proposed project to result in novel effects. The Service will review the future proposed southern sea otter monitoring during launch operations to help confirm this expectation.

Permanent and temporary threshold shifts in hearing sensitivity have yet to be determined for the southern sea otter. The Service reviewed surrogate thresholds for otariid pinnipeds, closely related marine mammals, developed by the U.S. Navy and the National Marine Fisheries Service (Finneran and Jenkins 2012, pp. 5, 19–21; Navy 2017, p. 164). The lower limit for temporary threshold in-air shifts for otariids is 170 dB SPL, and the lower limit permanent threshold in-air shift is 176 dB SPL (Navy 2017, p. 164). The Service anticipates that these levels are above the likely predicted exposure levels between 110 dB SPL_{max} during launches and up to 150 dB SPL_{max} during boost-back events. The Service understands that the proposed project and that individual noise occurrences will be of short duration (less than one minute). The Service

consequently does not anticipate associated temporary or permanent hearing loss for southern sea otters.

In the unlikely event that a launch anomaly component or associated debris struck a southern sea otter on the water surface, it could result in disturbance, injury, or death to the individual. The Service assumes there is an extremely low probability of strike potential, as southern sea otters are not known to regularly occur and congregate under the proposed Falcon 9 launch azimuths (MSRS 2022a, pp. 6, 46).

Following vehicle landings that occur downrange on a droneship in the Pacific Ocean, SpaceX would transport the reclaimed vehicle first to the Port of Long Beach and then back to the VSFB Harbor via a 'roll-on-roll-off' barge. A tug would pull the barge from the Port of Long Beach into the VSFB Harbor. SpaceX personnel would then drive the first stage off the barge, transport it from the VSFB Harbor to SLC-4E and unload vehicle in the hangar. The proposed action would include up to 14 tugboat events between October 1, 2024 and December 31, 2024, utilizing roll-on-roll-off operations to the VSFB Harbor. Adverse effects to southern sea otter from VSFB activities in the VSFB harbor during these operations are unlikely. Boats that utilize the harbor during hours of darkness operate under a lighting management plan to reduce potential impacts to rafting otters from visual disturbance (SLD 30 2024, p. 39). The project proponent would also be required to maintain reduced wake speeds to avoid direct injury to southern sea otter individuals (Refer to SSO-4 in Tab A4, 30 CES 2023). Existing similar harbor operations have not demonstrated quantifiable effects to southern sea otter population levels in the past.

<u>Avoidance and Minimization Measures</u>

1. The Space Force biologist(s) will utilize at least two video cameras positioned at a high location, and trained on an area where sea otters typically rest/raft (e.g., known rafting sites immediately south of Purisima Point and off of Sudden Flats). Cameras will be repositioned as necessary and turned on immediately prior to a scheduled launch to help document sea otter behavior during launch/boost-back events. The Space Force will complete in person monitoring and record behavior response for at least three Falcon 9 launches and boost-backs that measure at least 2.5 psf during the proposed project. Considering fog and wave conditions may obscure visibility during individual launches, the Service understands that the Space Force will make meaningful attempts to capture southern sea otter behavioral reactions during adequate visibility conditions throughout the proposed project until this objective is met. Other technology such as infra-red cameras could be used if initial attempts to complete in person/video recording are not successful. The Space Force will save the video footage, share it with the Service within seven days following a launch in tandem with the associated received dB SPL and psf levels, and provide a summary of the observed behavior from the field biologists.
2. The Space Force will ensure that a Service Approved Biologist monitors southern sea otters from a monitoring location within occupied habitat on VSFB where landing events

at SLC-4W generate boost-back sonic booms of 2.5 psf or greater (i.e., Sudden Flats). Upon establishment of any new southern sea otter populations within areas of potential impact from project-related activities, the Space Force will consider additional monitoring locations (MSRS 2024a, p. 39).

   a. The Service Approved Biologist will conduct daily counts of southern sea otters from the monitoring location when otters are most likely rafting (between 9:00AM and 12:00PM) beginning three days before and continuing three days after boost-back and landing events, noting any mortality, injury, or abnormal behavior. Personnel will use both binoculars (10X) and a high-resolution (50–80X) telescope for monitoring.

3. The Space Force will deploy recording equipment at or near the monitoring location to document and quantify sonic boom levels.
4. The Space Force will require that project-related boats that utilize the harbor during hours of darkness operate under a lighting management plan to reduce potential impacts to rafting otters and other marine mammals from visual disturbance (SLD 30 2024, p. 39).(SLD 30 2024, p. 39).
5. As depicted in the 2022 Programmatic Biological Assessment, the Space Force will require the project proponent to adhere to the following measures in regard to watercraft speed within and adjacent to the VSFB Harbor (Refer to SSO-4 in Tab A4, 30 CES 2023):
   a. Within the harbor during hours of daylight, personnel will maintain a speed of less than 11.5 miles per hour (10 knots) if southern sea otters are present and maintain a minimum of 80 feet of separation from rafting southern sea otters;
   b. Within the harbor during hours of darkness, personnel will maintain a speed of less than 11.5 miles per hour (10 knots) at all times;
   c. Outside the harbor, personnel will maintain speeds of less than 17 miles per hour (15 knots) within depths of less than approximately 80 feet which correlates to approximately 5.5 miles from shore; and,
   d. Outside the harbor during hours of daylight, personnel will maintain a minimum of 325 feet of separation from rafting southern sea otters and 30 feet of separation from kelp. If this separation distance is determined to be infeasible in coordination with the Qualified Biologist, personnel will maintain a ‘no wake’ speed (5 miles per hour/4.3 knots) when within 30 feet of kelp.

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

1. Currently available information indicates that maximum noise and overpressure levels produced from launch operations are unlikely to have an observable effect on southern sea otters. Past population-level monitoring has not shown an effect.
2. The probability of launch anomaly debris striking a southern sea otter individual is anticipated to be extremely low.

3. Harbor operations would include avoidance and minimization that should be effective at reducing any potential for adverse effects to southern sea otter and effects would be considered insignificant should they occur.

Tidewater Goby

Tidewater Goby Occurrence on VSFB

Tidewater gobies have been documented in all major drainages of VSFB up to 7.5 miles upstream from the Pacific Ocean (Swift 1999). The project area consists of suitable habitat for the species within Honda Creek, San Antonio Creek, Shuman Creek, Jalama Creek, and the Santa Ynez River. The tidewater goby has not occurred in Honda Creek since 2008, potentially as a result of changing habitat suitability conditions precluding the occupancy of and persistence of fish. Tidewater gobies occur in the Santa Ynez River from the estuary to the 13th Street bridge and San Antonio Creek. In San Antonio Creek, tidewater gobies primarily inhabit the lagoon.

Effects to Tidewater Goby on VSFB

Sound pressure and overpressure produced by the proposed project activities (launch, landing, and static test fire events) have the potential to affect tidewater gobies that occur on-base. Project-related engine noise and vibrations could cause a temporary disruption to individuals within San Antonio Creek and the Santa Ynez River where they would experience variable noise levels not exceeding 115 dB SPL_{max} and variable overpressure levels not exceeding 2.0 psf (MSRS 2024a, p. 99) during up to 16 launches, 2 boost-backs, and 2 static test fires between October 1, 2024 and December 31, 2024. It is unknown how various noise and overpressure levels could affect tidewater gobies, but we currently expect individuals to only exhibit minor and temporary behavioral shifts, if any.

Within potential habitat for the species in Honda Creek, maximum anticipated in-air noise levels would be up to 123 dB SPL_{max} during launches at SLC-4 and maximum anticipated overpressure levels would be up to 3.0 psf during landings (MSRS 2024a, p. 99). However, using the best available information, the Service anticipates that disturbance would be overall unlikely given that the species has not occupied Honda Creek since 2008, potentially as a result of changing habitat suitability conditions. We currently anticipate that disturbance to other known to be occupied features located a further distance away from SLC-4 would likely be temporary and minor, if any, as a result of understood noise attenuation in water.

For the majority of the 91 days of the proposed project, the Space Force would source water from an existing connection between State Water and the VSFB water supply system. However, during annual maintenance that lasts approximately two weeks and may occur during this timeframe, VSFB utilizes four water wells in the San Antonio Creek Basin. The Service consequently conservatively assumes that across this 14-day period, up to 184,615 gallons (0.57 acre-feet) could be extracted from these wells in San Antonio Creek basin. Increasing water

extraction could reduce flow rates, hydration periods, or water levels in San Antonio Creek and negatively impact tidewater gobies. However, referencing previous analysis (USGS 2019, p. 5) and associated discussion with hydrologists involved with the associated hydrological modeling (C. Faunt and G. Cromwell, USGS, pers. comm. 2021), the proposed project's 0.57 acre-feet extraction amount would not be anticipated to result in measurable decline of streamflow or associated aquatic habitat.

The Space Force has determined tidewater goby populations would not be affected in off-base locations from launch ascents with easterly trajectories creating low level (less than 1.0 psf) sonic booms (MSRS 2024a, p. 99).

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

1. Any effects that would occur would be insignificant as a result of anticipated noise attenuation. If any effects occur, we expect only temporary and minor behavioral reactions to infrequent noise disturbance.
2. Tidewater goby does not currently occur in Honda Creek, and we understand there is currently low likelihood for recolonization.
3. Increased water extraction from the San Antonio Creek basin due to proposed project activities would be negligible.

Unarmored Threespine Stickleback

Unarmored Threespine Stickleback Occurrence on VSFB

Unarmored threespine stickleback occupy San Antonio Creek from Barka Slough to the lagoon (Swift 1999). The project area consists of unoccupied suitable habitat for the species within Honda Creek, Shuman Creek, Jalama Creek, and the Santa Ynez River. Historically in 1984, attempts to introduce unarmored threespine stickleback to Honda Creek were made but determined unsuccessful, potentially as a result of changing habitat suitability conditions precluding the occupancy of and persistence of fish. The presence of the species in Honda Creek is consequently unlikely.

Effects to Unarmored Threespine Stickleback on VSFB

Sound pressure and overpressure produced by the proposed project activities (launch, landing, and static fire events) have the potential to affect unarmored threespine stickleback that occur on-base. Project-related engine noise and vibrations could cause a temporary disruption to individuals within San Antonio Creek where they would experience variable noise levels not exceeding 105 dB SPL_{max} and variable overpressure levels not exceeding 2.0 psf (MSRS 2024a, p. 100) during up to 16 launches, 2 boost-backs, and 2 static test fires between October 1, 2024

and December 31, 2024. It is unknown how various noise and overpressure levels can affect unarmored threespine stickleback, but we expect individuals to only exhibit minor and temporary behavioral shifts, if any, as a result of understood noise attenuation in water.

Within potential habitat for the species in Honda Creek, maximum anticipated noise levels would be up to 123 dB SPL_{max} during launches at SLC-4 and maximum anticipated overpressure levels would be up to 3.0 psf during landings (MSRS 2024a, p. 99). However, using the best available information, the Service anticipates that any disturbance would be overall unlikely given that the species does not occupy Honda Creek and we do not anticipate the species to recolonize in the future due to the changing habitat conditions described above.

For the majority of the 91 days of the proposed project, the Space Force would source water from an existing connection between State Water and the VSFB water supply system. However, during annual maintenance that lasts approximately two weeks and may occur during this timeframe, VSFB utilizes four water wells in the San Antonio Creek Basin. The Service consequently conservatively assumes that across this 16-day period, up to 184,615 gallons (0.57 acre-feet) could be extracted from these wells in San Antonio Creek basin. Increasing water extraction could reduce flow rates, hydration periods, or water levels in San Antonio Creek and negatively impact unarmored threespine stickleback. However, referencing previous analysis (USGS 2019, p. 5) and associated discussion with hydrologists involved with the associated hydrological modeling (C. Faunt and G. Cromwell, USGS, pers. comm. 2021), the Service understands the proposed project's 0.57 acre-feet extraction amount would not be anticipated to result in measurable decline of streamflow or associated aquatic habitat.

The Space Force has determined unarmored threespine stickleback populations would not be affected in off-base locations from launch ascents with easterly trajectories creating low level (less than 1.0 psf) sonic booms (MSRS 2024a, p. 101).

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

1. Any effects that would occur are anticipated to be insignificant, if any, as a result of expected noise attenuation. If any effects occur, we expect only temporary and minor behavioral reactions to infrequent noise disturbance.
2. Unarmored threespine stickleback do not currently occur in Honda Creek, and there is low likelihood for recolonization.
3. We understand that increased water extraction from the San Antonio Creek basin due to proposed project activities would be negligible.

Arroyo Toad, Coastal California Gnatcatcher, and Light-Footed Ridgway's Rail

Arroyo Toad, Coastal California Gnatcatcher, and Light-Footed Ridgway's Rail Occurrence

Arroyo toad, coastal California gnatcatcher, and light-footed Ridgway's rail are not known to occur on VSFB. Arroyo toad, coastal California gnatcatcher, and light-footed Ridgway's rail occur throughout Santa Barbara, Ventura, and Los Angeles Counties, within the region potentially impacted by sonic booms during missions with easterly trajectories. Only select launches with easterly trajectories would create sonic booms that have the potential to reach these species. We do not expect sonic booms to reach these species from the other launch trajectories.

Arroyo Toad
Arroyo toads occur within the region potentially impacted by sonic booms during missions with easterly trajectories. Specifically, these areas include the upper Santa Ynez River, Sespe Creek, Piru Creek, Castaic Creek, and the upper Santa Clara River.

Coastal California Gnatcatcher
Within the region potentially impacted by sonic booms during missions with easterly trajectories, coastal California gnatcatchers occur across southern Ventura and western Los Angeles Counties (MSRS 2024a, p. 91).

Light-Footed Ridgway's Rail
Within the region potentially impacted by sonic booms during missions with easterly trajectories, light-footed Ridgway's rails occur at the Carpinteria Salt Marsh and the marshes at Naval Base Ventura County Point Mugu (MSRS 2024a, p. 93).

Effects to Arroyo Toad, Coastal California Gnatcatcher, and Light-Footed Ridgway's Rail

Arroyo toad, coastal California gnatcatcher, and light-footed Ridgway's rail are not expected to occur on VSFB; therefore, we do not anticipate any effects to arroyo toad, coastal California gnatcatcher, and light-footed Ridgway's rail from project activities on-base. Potential project effects would be limited to the proposed project's off-base sonic boom effects area for missions with easterly trajectories. For the purpose of this analysis, these sonic boom levels are reasonably expected to be under 1.0 psf (MSRS 2024a, p. 145). More specific detail on this modeling can be located under 'Project Description; Launch Sonic Boom (Overpressure Disturbance); Mainland California (Southeastern Santa Barbara, Ventura, and Los Angeles Counties) – Launch Ascent'.

Arroyo Toad
Of the 16 launches that would occur between October 1 and December 31, 2024, 12 would have easterly trajectories that would generate sonic booms with the potential to impact arroyo toads. For the purpose of this analysis, these sonic boom levels are reasonably expected to be under 1.0

psf (MSRS 2024a, p. 113). Each of the 12 sonic booms would last only a fraction of a second and would not be coupled with any visual stimuli in the areas we expect arroyo toads would occur. It is unknown how various noise and overpressure levels can affect arroyo toads, but we expect any potential effects are unlikely to manifest and would be overall negligible considering the sonic boom level would reasonably be very low, of very short duration, and likely comparable to ambient existing noise levels. Additionally, the Service anticipates arroyo toads would likely be aestivating between October 1 and December 31, 2024, when project activities would occur, and it is unlikely that arroyo toads would be above ground at the exact moment of a sonic boom. Therefore, referencing the available information, we do not anticipate any associated effects at this time.

After reviewing the information provided, we concur with your determination that the proposed project may affect but is not likely to adversely affect the arroyo toad based on insignificant effects. Our concurrence is based on the following:

1. Arroyo toads are likely to be aestivating underground during the time of project activities.
2. We anticipate that any effects that would occur from less than 1.0 psf sonic booms are unlikely to manifest and would be overall be insignificant.

Coastal California Gnatcatcher

Of the 16 launches that would occur between October 1 and December 31, 2024, 12 would have easterly trajectories that would generate sonic booms with the potential to impact coastal California gnatcatchers. Sonic boom overpressure levels are dependent on atmospheric conditions. For the purpose of this analysis, the Service understands these sonic boom levels are reasonably expected to be under 1.0 psf (MSRS 2024a, p. 147). Each of the 12 sonic booms would last only a fraction of a second and would not be coupled with any visual stimuli in the areas we expect coastal California gnatcatchers would occur. It is unknown how various noise and overpressure levels can affect coastal California gnatcatchers, but we expect any potential effects are unlikely to manifest and would be overall negligible considering the sonic boom level would reasonably be very low, of very short duration, and likely comparable to ambient existing noise levels. Coastal California gnatcatchers exhibit strong site tenacity (Atwood 1993, p. 152) and would be expected to return quickly in the unlikely event they flee if startled by a less than 1.0 psf sonic boom. Therefore, referencing the available information, we do not anticipate any associated effects at this time.

After reviewing the information provided, we concur with your determination that the proposed project may affect but is not likely to adversely affect the coastal California gnatcatcher based on insignificant effects. Our concurrence is based on the following:

1. We anticipate that any effects that would occur from less than 1.0 psf sonic booms are unlikely to manifest and would be overall be insignificant.

2. Coastal California gnatcatchers exhibit strong site tenacity and would be expected to return quickly in the unlikely event they are startled by low-level sonic boom noise during project operations.

Light-Footed Ridgway's Rail
Of the 16 launches that would occur between October 1 and December 31, 2024, 12 would have easterly trajectories that would generate sonic booms with the potential to impact light-footed Ridgway's rails. These sonic boom levels are reasonably expected to be under 1.0 psf (MSRS 2024a, p. 148). Each of the 12 sonic booms would last only a fraction of a second and would not be coupled with any visual stimuli in the areas we expect light-footed Ridgway's rail would occur. It is unknown how various noise and overpressure levels can affect light-footed Ridgway's rail, but we expect any potential effects are unlikely to manifest and would be overall negligible considering the sonic boom level would reasonably be very low, of very short duration, and likely comparable to ambient existing noise levels. Light-footed Ridgway's rails have exhibited successful territory establishment at Naval Base Ventura County Point Mugu (Zembal et al. 2016, p. 4), another military base where the species is subject to routine aircraft noise disturbance that is likely louder than noise from project-related sonic booms. Therefore, the probability of noise-related impacts to light-footed Ridgway's rails from project activities would be low if they occur.

After reviewing the information provided, we concur with your determination that the proposed project may affect but is not likely to adversely affect the light-footed Ridgway's rail based on insignificant effects. Our concurrence is based on the following:

1. We anticipate that any effects that would occur from less than 1.0 psf sonic booms are unlikely to manifest and would be overall be insignificant.
2. Light-footed Ridgway's rails are known to occur in other areas with routine noise disturbance from military aircraft operations.

Western Spadefoot

The western spadefoot is not listed under the Act; however, it is currently proposed threatened and under federal review for listing under the Act (88 FR 84252 84278).

Western Spadefoot Occurrence on VSFB

The western spadefoot has been documented in seasonal pools formed by heavy winter rains on north VSFB, most notably in vernal pools along New Mexico Avenue between 15th and 26th Streets. Several dozen western spadefoot were also documented in the VSFB cantonment area in 2010 in "Pond 82" incidentally while conducting California tiger salamander studies (U.S. Air Force 2014, p. 39). Additionally, historically occupied vernal pools exist within the southern portion of the cantonment area on north VSFB (Occurrence 1101; CNDDB 2024), approximately 6 miles from SLC-4. The species has not been recently observed in these areas but

conservatively assumes that due to existing suitable habitat and the proximity of extant records, these features still have the potential to support the species.

Western Spadefoot Occurrence Outside of VSFB

Off-base within the proposed Launch Noise effects area, western spadefoot are found in the Santa Rita Hills east of Lompoc (MSRS 2024a, p. 59). Western spadefoots occur in eastern Ventura and northwestern Los Angeles Counties within the region potentially impacted by sonic booms during missions with easterly trajectories. Numerous records exist near Simi Valley, Santa Clarita, and Los Angeles (Appendix A, Figure 2L).

Effects to Western Spadefoot on VSFB

Sound pressure and overpressure produced by the proposed project activities (launch, landing, and static test fire events) have the potential to affect western spadefoot individuals that occur on-base where they would experience variable noise levels up to 110 dB SPL_{max} and variable overpressure levels up to 2.0 psf during up to 16 launches, 2 boost-backs, and 2 static test fires from SLC-4 between October 1, 2024 and December 31, 2024. Suitable but unoccupied habitat could experience variable noise levels up to 115 dB SPL_{max} and potentially occupied pools could experience variable noise levels up to 118 dB SPL_{max} (MSRS 2024a, p. 114).

Based on environmental conditions, during the month of October, western spadefoots may be underground and aestivating. Potential effects to aestivating western spadefoots could include early emergence stimulated by vibration and associated injury or mortality from desiccation if this is improperly timed. Existing studies of Couch's spadefoot toads have documented the species emerge from aestivation due to ground vibrations from rainfall (Márquez et al. 2016) as well as motorcycle noise (Dimmitt and Ruibal 1980). However, in the experiments, Couch's spadefoot toad burrows were shallower than the burrows western spadefoot is anticipated to use during overwintering. The potential launch-related vibration may be of low frequency which attenuates less readily than high frequency (Norton et al. 2011, p. 658) and may travel further. However, the biological assessment has indicated that project-related terrestrial vibration should attenuate based on distance and depth of extant populations of western spadefoots from SLC-4 (MSRS 2024a, p. 119). Given that approximately 30 percent of sound energy attenuates for every centimeter of depth (Oelze et al. 2002) and western spadefoots typically burrow up to 3 feet deep (Stebbins 1972), it is unlikely that aestivating western spadefoots would be impacted by launch vibration or associated noise.

Western spadefoots are active above ground from November through June. Individuals that are above ground may startle from launch noise and overpressure that happens during project activities between October 1, 2024 and December 31, 2024. It is unknown how various noise and overpressure levels can affect western spadefoot, but we expect individuals may exhibit a minor and temporary startle response and resume normal behavior shortly thereafter. Therefore, based

on the available information, we currently anticipate that the probability of noise-related impacts to western spadefoot on-base from project activities would be insignificant.

Breeding and egg laying for western spadefoots normally occurs on VSFB from late winter to the end of March (U.S. Air Force 2014, p. 39), and the timing of breeding is determined by rainfall. Breeding may occur if there is heavy rainfall during the time of the proposed action, between October 1 and December 31, 2024. Western spadefoot tadpoles are fully aquatic until fully metamorphosized. The biological assessment indicates that launch noise would attenuate entirely between the air-water interface (Godin 2008), and consequently there would be no potential for impact to western spadefoot tadpoles. The Service also currently understands that any project-related terrestrial vibration should attenuate when it reaches the closest suitable aestivating or aquatic breeding habitat (approximately 5.25 miles from SLC-4) (MSRS 2024a, p. 115-116). The Space Force has indicated that only adult individuals, which are expected to be above ground for a short period of time, could be exposed to infrequent minor vibrations associated with launch activity (MSRS 2024a, p. 116). We understand that although western spadefoots may exhibit a temporary startle response, we expect any associated effects would be insignificant and that species would resume normal behavior shortly thereafter.

Effects to Western Spadefoot Outside of VSFB

The Santa Rita Hills locality of western spadefoot would be exposed to launch noise levels between 100 to 110 dB SPL_{max}. The Service anticipates that any temporary effects from launch noise on the Santa Rita Hills would be similar, if not less than, those discussed for western spadefoot on VSFB.

Western Spadefoot occur within the region potentially impacted by sonic booms during missions with easterly trajectories. Twelve launches (75 percent of the 16) that would occur between October 1 and December 31, 2024, would include easterly trajectories that would generate sonic booms with the potential to impact western spadefoot within the mainland California sonic boom action area. For the purpose of this analysis, the Service understands these sonic boom levels are reasonably expected to be under 1.0 psf (MSRS 2024a, p. 116). Each of the 12 sonic booms would last only a fraction of a second and is not coupled with any visual stimuli in the areas we expect western spadefoot toads would occur. Western spadefoots are active above ground from November through June. It is unknown how various noise and overpressure levels can affect western spadefoot, we currently expect any potential effects are unlikely to manifest and would be overall negligible considering the sonic boom level would reasonably be very low, of very short duration, and likely comparable to ambient existing noise levels.

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

1. We currently anticipate that any potential effects to above-ground western spadefoot would be limited to minor temporary behavioral reactions and that species would return to normal behavior shortly thereafter.
2. We understand that aestivating western spadefoots and tadpoles would not be disturbed by the proposed project being that project-related noise and terrestrial vibration should attenuate based on distance and depth of extant populations of western spadefoots from SLC-4.

California Tiger Salamander

California Tiger Salamander Occurrence on VSFB

Santa Barbara County Distinct Population Segment (DPS) of California tiger salamanders have not been detected on VSFB during regular protocol surveys of suitable habitat since 2006 (MSRS 2024a, p. 45).

California Tiger Salamander Occurrence Outside of VSFB

The closest occurrences of California tiger salamander to the proposed project are approximately 14 miles east of SLC-4 within the Santa Rita Hills.

Effects to California Tiger Salamander on VSFB

California tiger salamanders are not expected to occur on-base due to a lack of recorded observations during regular protocol surveys of suitable habitat since 2006. Therefore, we do not anticipate any effects to California tiger salamander on-base from the proposed project activities.

Effects to California Tiger Salamander Outside of VSFB

Sound pressure and overpressure produced by the proposed project activities (launch, landing, and static test fire events) have the potential to affect California tiger salamander that occur off-base within the Santa Rita Hills where they would experience variable noise levels not exceeding 105 dB SPL_{max} and variable overpressure levels up to 1.5 psf during up to 16 launches, 2 boost-backs, and 2 static test fires from SLC-4 between October 1, 2024 and December 31, 2024 (MSRS 2024a, p. 101-102). Sonic boom overpressure levels are dependent on atmospheric conditions. For the purposes of this analysis, we expect that the maximum potential level that California tiger salamander could experience would be 1.5 psf.

Between October 1 and December 31, California tiger salamanders will likely be underground and aestivating. California tiger salamanders live in burrows for majority of their lives and temporarily emerge from burrows following rainfall to migrate to breeding pools. Potential effects to California tiger salamanders could include launch related vibration of burrows. If vibration mimics characteristics of rainfall, this could induce early emergence and associated

injury or mortality from desiccation if this is improperly timed. Potential launch related vibration may be of low frequency which attenuates less readily than high frequency (Norton et al. 2011, p. 658) and may travel further. However, the biological assessment has indicated that project-related terrestrial vibration should attenuate based on distance and depth of extant populations of California tiger salamander from SLC-4 (MSRS 2024a, p. 102). Given that approximately 30 percent of sound energy attenuates for every centimeter of depth (Oelze et al. 2002) and that California tiger salamanders typically burrow deeper underground than surface noise is anticipated to reach (Barry and Shaffer 1994), it is unlikely that aestivating California tiger salamander would be impacted by launch vibration or associated noise. If California tiger salamanders are above ground during a launch ascent or landing, the species may have a temporary behavioral reaction (e.g. startle) in response and would return to normal behavior shortly thereafter. However, the Service anticipates that because California tiger salamanders are aboveground infrequently and for a short period (i.e., only a few rainy nights a year), sonic boom exposure and associated effects are overall unlikely to occur.

The Space Force has determined that there would be no effect to California tiger salamander populations located off-base within mainland California from launch ascents with easterly trajectories that are likely to create low level (less than 1.0 psf) sonic booms (MSRS 2024a, p. 102).

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

1. We anticipate that aestivating California tiger salamander would not be disturbed by routine launch disturbance. We understand that associated launch noise and vibration would attenuate entirely based on distance and depth of extant populations of California tiger salamander precluding any potential effects.
2. Any effects to above ground California tiger salamander would likely occur very infrequently and are expected to be overall discountable. We expect any potential effects to only include temporary minor behavioral reactions and that species would return to normal behavior shortly thereafter.

In reference to the above ‘Not Likely to Adversely Affect’ analysis, further consultation pursuant to section 7(a)(2) of the Act is not required. If new information becomes available or the proposed action changes in any manner that may affect a listed species or critical habitat in a manner not previously considered, you must contact us immediately to determine whether additional consultation is required. In reference to western spadefoot, regulations allow for an opinion issued at the conclusion of a conference to be adopted as a biological opinion when the species is listed or critical habitat is designated, but only if no significant new information is developed (including that developed during the rulemaking process on the proposed listing or critical habitat designation) and no significant changes to the Federal action are made that would alter the content of the opinion (50 CFR 402.10(d)).

Consultation History

On June 27, 2024, the Space Force provided an updated biological assessment for 50 launches from SLC-4 and the development of SLC-6. However, through conversation with the Ventura Fish and Wildlife office and Region 8 Office, the project description was revised to include only 14 launches, 2 static tests and 1 boost-back from SLC-4 between October 1 to December 31, 2024 (SpaceX, meeting communication, July 2, 2024a). The Space Force requested expedited formal consultation (by August 15, 2024) for this stand-alone consultation. However, through conversation with the Ventura Fish and Wildlife office and Region 8 Office, the project description was revised to include only 14 launches, 2 static tests and 1 boost-back from SLC-4 between October 1 to December 31, 2024 (SpaceX, meeting communication, July 2, 2024a). The Space Force requested expedited formal consultation (by August 15, 2024) for this stand-alone consultation. In a subsequent meeting, the Space Force and project proponent revised their project description on July 25, 2025 to include 16 launches, 2 static tests, and 2 boost-backs from SLC-4 between October 1 to December 31, 2024 (SpaceX, meeting communication, July 25, 2024b). The Service provided the Space Force sections of the draft biological opinion for review between July 15 and August 15, 2024. The Space Force provided comments between this period. The Service reviewed and incorporated changes to the project description where necessary. Following a phone call and then subsequent Space Force's comments on the draft biological opinion's effects analysis and relevant terms and conditions provided on August 13, 2024, the Service and Space Force agreed to revise the biological opinion's due date to August 28, 2024, to provide necessary time to address comments. The Service and Space Force continued to coordinate on comment resolution until August 20, 2024.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

Project Overview

The proposed project includes up to 16 launches of the Falcon 9 first stage vehicle from Space Launch Complex (SLC)-4 and Vandenberg Space Force Base, Santa Barbara County, California between October 1 to December 31, 2024. Collectively, SpaceX would not exceed 50 launches on VSFB within 2024.

A total of two separate associated static test fires and two return to launch site events (landing descent or 'boost-back') would also occur during this period. All other boost-back events will occur offshore.

Launch Operations

SLC-4

SpaceX would launch the Falcon 9 vehicle up to 16 times from SLC-4E between October 1 and December 31, 2024. A static test fire of engines may precede two launches. Following each launch ascent, SpaceX would perform a boost-back and landing descent of the first stage either downrange on a droneship in the Pacific Ocean (14 times) or at SLC-4W at VSFB (2 times).

The proposed action includes launch azimuths between 140 and 325 degrees.

Launch Schedule and Frequency
The base provided the Service a launch schedule between this period for the purposes of analysis. Each of the 16 launches would be separated by a calculated average of nominally 5 days. Launches could occur as frequently as three days apart but this would not occur regularly as depicted in the provided estimated launch schedule that the Service considered for purposes of this analysis (USSF 2024b).

Launch operations would occur day or night under all but extreme weather conditions (i.e., would not occur during gale force winds, high wind shear, or extreme thunder and lightning conditions). Individual launch ascent noise disturbance would last up to 1 minute and occur 16 times. Launch ascent may infrequently result in a separate instantaneous sonic boom that impacts portions of the Channel Islands and mainland California discussed below. Individual launch landing disturbance (boost-back) would occur 2 times during this 3-month period at SLC-4 and would last up to 17 seconds. Launch landing would also create a separate instantaneous sonic boom that impacts the vicinity of VSFB. The total time from launch to landing would be 6 to 10 minutes (Kaisersatt 2024).

A static test fire could occur one day before a full launch and is considered a separate form of launch disturbance. Static test fires would impact a smaller portion of a full launch's disturbance footprint over a substantially shorter duration (7 seconds) and are consequently a separate distinct disturbance event that is not comparable or substitutable for a full launch. The Space Force has included that two separate static test fires could occur between October 1 to December 31, 2024.

Table 1. Summary of proposed launch disturbance type details

Launch Disturbance Type	Duration/Frequency	Frequency	Number Proposed between Oct 1 to Dec 31, 2024
Static Test Fire	7 seconds	Up to one day before full launch	2
Launch (Ascent)	1 minute ascent	Once every 5 days on average (up to 3 days very infrequently)	16
Terrestrial landing (boost-back)	17 seconds landing coupled with instantaneous sonic boom	6 to 10 minutes following launch ascent, up to once every 5 days	2

Vehicle Terrestrial Landing at VSFB (Boost-back) and offshore landings

SpaceX would perform up to two terrestrial landings known as a 'boost-back' on SLC-4W at VSFB between October 1 and December 31, 2024. Terrestrial landings would involve the landing noise disturbance which produces an associated instantaneous sonic boom immediately following the landing disturbance. Terrestrial landing noise disturbance is depicted in Appendix A, Figures 2A-G. Landing noise would be of reduced duration and extent when compared to launch ascent. Associated noise and sonic boom levels are discussed in further detail below. Terrestrial landings would occur nominally no closer than five days apart.

Appendix A, Figure 3 depicts the offshore Vehicle Landing Effects Area where 12 landings would occur on a droneship. This area encompasses approximately 500 to 1,100 miles of the western coast between Baja California, Mexico and San Francisco, California. Sonic booms associated with droneship landings would be directed entirely at the ocean surface without impacting any land. No associated terrestrial noise or sonic boom would occur during droneship landing events.

Launch Noise

The Space Force provided modeling of individual launches and associated static test fire events for the purposes of this analysis using the SPL_{max} noise metric. SPL_{max} is the unweighted maximum instantaneous sound level, the highest sound pressure level measure during a single launch event. Although it provides some measure of the event, SPL_{max} does not fully describe the noise disturbance because it does not account for the duration of the sound. Sound exposure level (SEL) considers the length of time a noise occurs and provides a measure of the net impact of the

entire acoustic event. In previous analyses, the Service has considered the SEL metric; however, for the purposes of this analysis, the biological assessment did not include SEL information and consequently the Service will use the SPL_{max} metric.

The project proposes to use the existing Falcon 9 vehicle. The biological assessment indicates that engine noise would reach up to 150 dB SPL_{max} on SLC-4. During Falcon 9 launches, provided noise modeling indicates that noise levels would attenuate outward in all directions reaching 100 dB approximately 17 miles away from SLC-4.

As previously discussed in Table 1, noise produced by launch operations to terrestrial areas would last approximately 1 minute (60 seconds) during a full launch ascent, 17 seconds during terrestrial landings, and approximately 7 seconds during static fire events. Each event has a distinct noise disturbance area and temporal footprint and are not interchangeable.

Appendix A, Figures 1A–F depict the Launch Noise Effect Area, which is the modeled SPL_{max} footprint of the proposed project generated by noise modeling software RNoise. The Space Force indicates that the produced model incorporates numerous components, including the acoustic power of the rocket engine source, forward flight effects, the angle from the source to the receiver (directivity), Doppler effect, propagation between the source and receiver (ray path), atmospheric absorption, and ground interference to estimate received noise levels. RNoise assumes the surface of the earth is flat and therefore does not account for attenuation due to landforms. The Space Force has included that the produced model is conservative for areas shielded by hills, bluffs, or other features, such as buildings or dense vegetation. The Space Force has indicated in their biological assessment that atmospheric conditions have the potential to impact updated model output and associated accuracy. The Service will use the provided modeling and levels of the purposes of this analysis. More frequent or higher magnitude realized disturbance levels would be considered outside the scope of this analysis.

Launch Sonic Boom (Overpressure Disturbance)

Each proposed launch ascent and landing descent would generate a sonic boom resulting in overpressures of high energy impulsive sound. Sonic booms are low frequency, impulsive noise events with durations lasting a fraction of a second (BRRC 2020, p. 32). Sonic boom impact areas will depend on the launch trajectory. The Space Force used PCBoom to model sonic booms produced by the proposed project.

Northern Channel Islands – Launch Ascent

During launch ascent, a sonic boom with overpressure up to 5.0 psf could impact various linear pathways across the northern Channel Islands (Santa Rosa and Santa Cruz Islands) (Appendix A, Figure 2H). The Space Force has previously indicated that 30 percent of launches could impact the northern Channel Islands, with the vast majority constituting overpressure of under 2 psf (Kaisersatt, pers. comm, 2023a, p. 1). For this analysis, the Service consequently understands

that of the 16 launches, reasonably 5 launches could impact the northern Channel Islands with any sonic booms under 2.0 psf.

During launch descent, it would be very unlikely for any sonic booms to impact the northern Channel Islands during landing events at SLC-4 or on droneships in offshore areas. No additional modeling was provided to address this potential. Consequently, we will not consider this as a part of the proposed action as we understand it is not reasonably likely to occur. During downrange droneship landings in the proposed landing areas, sonic booms would be directed entirely at the ocean surface without impacting any land.

Mainland California (*Southeastern Santa Barbara, Ventura, and Los Angeles Counties*) – *Launch Ascent*

For easterly trajectories, the Space Force has included that Falcon 9 launch ascents from SLC-4 may produce sonic booms with the potential to impact southeastern Santa Barbara County, Ventura County, and Los Angeles County on the mainland of California. The Space Force includes that 75 percent of the 16 launches are expected to contain easterly trajectories. There would be 12 associated sonic booms over the 3- month project period (each separated by an anticipated average of 5 days).

This biological assessment includes the following modeling predictions: 15 percent of model runs predicted any impacts in eastern Santa Barbara County; 50 percent of these sonic boom levels were less than 0.25 psf, 87 percent were less than 1.0 psf, and 0.3 percent were greater than 2.0 psf. The highest level predicted for eastern Santa Barbara County was 2.13 psf in two small areas near Carpinteria, which the Service understands is not reasonably likely to occur (MSRS 2024, p. 25). 97 percent of the model runs predicted sonic boom impacts within Ventura County; 65 percent were less than 0.25 psf, 86 percent were less than 1.0 psf, and 0.04 percent were greater than 2.0 psf. The highest predicted boom level predicted for Ventura County is 2.03 psf which is again not reasonably likely to occur. 94 percent of model runs predicted impacts in western Los Angeles County; 95 percent were less than 0.25 psf, and 100 percent were less than 0.75 psf.

In summary, the Space Force's provided modeling indicates that the sonic booms that would impact these areas would be reasonably certain to be less than 1.0 psf (MSRS 2024, p. 112). The Service consequently understands that the proposed project's associated mainland sonic boom disturbance would be relatively infrequent and that none of these 12 launches would reasonably result in sonic boom of over 1.0 psf to mainland California. To help provide a clear project description, the Service states this understanding to define parameters considered within analysis.

Appendix A, Figures 2I-P are included to provide visual depiction of sonic boom modeling impacts within mainland California.

Vicinity of VSFB, Lompoc and Jalama Beach (*Launch Descent*)

For the purposes of this proposed project, the Space Force indicates that the Falcon 9 vehicle landings that occur at SLC-4, will create a sonic boom with overpressure of up to 9.5 psf (USSF 2024b). However, the Space Force's biological assessment only included sonic boom contour extent mapping for maximum level of 5.0 psf. Consequently, based on the information provided, the two proposed boost-backs could contain levels between 6.1 to 9.5 psf but that they would be entirely confined to the SLC-4 pad. The provided modeling encompasses the cantonment area of VSFB to the north, extending eastward to Lompoc, southward to encompass Jalama Beach, and westward across the Pacific Ocean. The extent of sonic boom impacts within the immediate vicinity of VSFB considered within this analysis is depicted both in this text summary as well as in Appendix A, Figure 2B, Sonic Boom Overpressure Effect Area.

Overpressure to decibel conversion

Overpressure can be expressed as instantaneous noise disturbance (SPL_{max}) by using a mathematical conversion from psf to decibel levels. The biological assessment did not include conversions of overpressure into instantaneous noise disturbance (SPL_{max}).

The Service reviewed past Falcon 9 monitoring reports to reference these conversions for purposes of facilitating comparison. Previous realized monitoring, prior to observed changes in past provided overpressure modeling for the same vehicle, indicates that the realized sonic boom at south Surf Beach was 3.6 psf which produced experienced noise levels of 138 dB SPL_{max}; 1.1 psf produced experienced noise of 129 dB SPL_{max} at Purisima Point; and 2.4 psf produced experienced noise of 135 dB SPL_{max} at Honda Creek (Robinette and Rice 2019, p. 14, 2022, p. 13; MSRS 2022b, p. 4). Consequently, considering the current consultation's proposed modeling, the proposed project overpressure levels in natural habitat outside of SLC-4 (e.g. 5.0 psf) would reasonably equate to maximum received noise levels between 140 to 150 dB produced from sonic booms.

Vehicle Recovery

Following vehicle landings that occur downrange on a droneship in the Pacific Ocean, SpaceX would transport the reclaimed vehicle first to the Port of Long Beach and then back to the VSFB Harbor via a 'roll-on-roll-off' barge. A tug would pull the barge from the Port of Long Beach into the VSFB Harbor. SpaceX personnel would then drive the first stage off the barge, transport it from the VSFB Harbor to SLC-4E and unload vehicle in the hangar.

The proposed action would include 12 events between October 1 and December 31, 2024, utilizing roll-on-roll-off operations to the VSFB harbor.

Roll-on-roll-off operations occur during daytime hours. However, boats can hotel in the harbor overnight. If a boat must hotel in the harbor overnight, its lights are turned on before dusk and

then kept on until morning. When at the dock, boats generally operate under auxiliary power thus do not move much. Within the harbor, boats operate at low speeds (generally 1 to 3 knots). Outside the harbor, boats do not exceed 10 knots (USSF 2024b).

Launch Fueling and Combustion

During launch operations, mobile fuel trailers would supply fuel (rocket propellant-1 (RP-1) and liquid oxygen (LOX) rocket propellant) to on-site ground support equipment. Black carbon (soot) can be a byproduct of rocket launches and is largely a factor of running a fuel-rich mixture, such as a fuel-rich gas generator rocket engine. The Space Force has included that the proposed project uses oxidizer-rich staged combustion engines that produce a diminutive amount of terrestrial soot. The primary emission products from the Falcon liquid engines are carbon dioxide (CO2), carbon monoxide (CO), water vapor, oxides of nitrogen, and carbon particulates. Although the exhaust is fuel-rich and contains high concentrations of CO, subsequent entrainment of ambient air results in complete conversion of the CO into CO2 and oxidation of the soot from the gas generator exhaust. Referencing previously produced environmental assessments for other Falcon 9 launch operations, the Space Force has specified that the proposed project's exhaust process results in the complete conversion of produced carbon monoxide into carbon dioxide as well as the oxidation of soot from the gas generation exhaust. The Space Force consequently expects that the produced soot would subsequently burn up in the exhaust plume (Kaisersatt, pers. comm., 2023a, p. 7).

No additional information detailing amounts of atmospheric emissions or an associated effects analysis from the proposed rocket launching were provided within the biological assessment.

Flame Duct, Deluge Water System, and Water Usage

At SLC-4, SpaceX would utilize an existing water-filled flame duct to reduce vibration impacts from noise on payloads. During Falcon 9 launches, approximately 70,000 gallons of water would be utilized per launch with approximately 40,000 gallons per landing. Using these estimates, for 16 launches and 2 terrestrial landing this would amount to roughly 1.2 million gallons (3.68 ac-ft) between October 1 and December 31, 2024, to support personnel and operational activities at SLC-4.

The Space Force has recently clarified that the current water source for VSFB, including SLC-4, is via an existing connection between State Water and the VSFB water supply system. For the majority of the 91 days of the proposed project, the Space Force would source water from this connection. However, during annual maintenance that lasts approximately two weeks and may occur during this timeframe, VSFB utilizes four water wells in the San Antonio Creek Basin. The Service consequently conservatively assumes that across this period (14 days), up to 184,615 gallons (0.57 ac-ft) could be extracted from these wells in San Antonio Creek Basin in support of the proposed project.

Launches would eject flame duct water. Based on prior Falcon 9 missions, approximately half of the volume of water remains in the flame duct and half is expelled as water and water vapor. Of the expelled water, approximately half is in the form of hot steam (17,500 gallons) with the remaining half being liquid (17,500 gallons). The proposed project would not create any overland flow of water into Spring Canyon as v-ditches divert and collect the water before it leaves the SLC-4 fence line. The containment features (e.g. v-ditch, etc.) within SLC-4 holds all water for a short duration until it dissipates. A minimal quantity of water reaches Spring Canyon in the form of steam and water droplets and is expected to dissipate quickly.

Vegetation Maintenance

The Space Force maintains vegetation within the v-ditch feature at SLC-4 on a periodic basis (Kaisersatt, pers. comm. 2023e). The Service assumes these activities could occur at any time of year.

SpaceX would continue to maintain all vegetation to just above ground level within a 3.3-acre area of Spring Canyon adjacent to SLC-4 (hereafter referred to as the Vegetation Management Area) that launches impact by the ejection of hot steam.

The Service also understands that the Space Force would continue to maintain firebreaks surrounding SLC-4 and that these activities could occur at any time of year.

AVOIDANCE AND MINIMIZATION MEASURES

For this analysis, all avoidance and minimization measures identified in previous consultations (Service 2017; 2017-F-0480) (Service 2023a; 2022-0013990-S7-001) are incorporated by reference for brevity due to operational similarity. The following is a list of additional avoidance and minimization measures applicable to this analysis. The measures provided below are either new for this analysis or sourced from the 2017 and/or 2023 consultations and reiterated for clarity.

Biologist Definitions

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

- Permitted Biologist: Biologist with a valid and current Section 10(a)(1)(A) Recovery Permit issued by the Service or specifically named as a Service Approved Biologist in a project-specific biological opinion. The Space Force will coordinate with the Service prior to assigning Permitted Biologists to a specific project.
- Service Approved Biologist: Biologist with the expertise to identify listed species and species with similar appearance. The Space Force will review and approve the resumes for each individual, and then submit them to the Service for review and approval no less

than 30 days prior to the start of the project. A Service Approved Biologist could train other biologists and personnel during surveys and project work; in some cases, a Service Approved Biologist could also provide on-site supervision of other biologists.

- Qualified Biologist: Biologist trained to accurately identify specific federally listed species and their habitats by either a Permitted or Service Approved Biologist. This person could perform basic project monitoring but would need to have oversight from a Permitted or Service Approved Biologist. Oversight will require a Permitted or Service Approved Biologist to be available for phone/electronic mail consultation during the surveys and to have the ability to visit during monitoring/survey activities if needed.

General Project Avoidance and Minimization Measures

As part of the proposed action, the Space Force proposes to implement the following measures. These protection and monitoring measures would apply to all aspects of the proposed action to protect and minimize effects on biological resources. The Space Force will ensure SpaceX takes all identified applicable actions as listed below.

GM-1 The Space Force will ensure that SpaceX continue to implement measures described in the 2017 biological assessment (MSRS 2017) which include: (1) SpaceX will follow the site-specific Stormwater Pollution Prevention Plan already implemented for SLC-4; (2) SpaceX will implement the Best Management Practices within the latest California Stormwater Quality Association's Stormwater Best Management Practices Handbook; (3) SpaceX will collect any rocket propellant seen floating in the retention basin using absorbent pads prior to discharge to the spray field; and (4) SpaceX will fully implement the procedures in VSFB's Hazardous Materials Emergency Response Plan in the event of a hazardous materials spill.

a. The Space Force will continue to sample water quality in lower Spring Canyon once annually whenever ponded water is present to ensure no project-related byproducts (i.e., launch combustion residue, operations-related run-off, etc.) have entered the waterway in a manner not previously considered in this analysis. The Space Force will continue to perform sampling a minimum of once a year until 2026, as required under BO 2022-0013990-S7-001 (USFWS 2023a). The Space Force will design water quality sampling to detect potential project related byproducts and any resulting associated changes in aquatic habitat (i.e., salinity, pH, etc.). Sampling will consider and utilize the most recent applicable advances in water quality sampling technology. The Space Force will include maps depicting sampling locations during annual reporting. The Space Force will collect and clearly present data including any associated chemical and nutrient presence, dissolved oxygen, water temperature, turbidity, and any other pertinent observations regarding ecosystem condition for purposes of annual comparison. If project-related water contamination occurs, the Space Force will coordinate with the Service, address sources of input, and begin remediation within the month.

GM-2 The Space Force will require 30 CES/CEIEA and Service approval of all Service Approved Biologists, which will be personnel who are familiar with and possess necessary qualifications to be approved for capture, handle, and release species as stated above. These biologists will be responsible for monitoring, surveying, and other biological field activities. They will also be responsible for relocating species at risk of being directly killed or injured by project related activities (such as California red-legged frog and southwestern pond turtle).

GM-3 The Space Force will require Qualified Biologists brief all project personnel prior to participating in project implementation activities. At a minimum, the training will include a description of the listed species and sensitive biological resources occurring in the area, the general and specific measures, and restrictions to protect these resources during project implementation, the provisions of the Act and the necessity of adhering to the provisions of and the penalties associated with violations of the Act.

GM-4 The Space Force will ensure that disturbances be kept to the minimum extent necessary to accomplish project objectives.

GM-5 The Space Force will ensure that all human-generated trash at the project site will be disposed of in proper containers and removed from the work site and properly secured in a suitable trash container at the end of each workday, all food waste will be properly contained, and trash will be removed from the work area weekly throughout the course of the proposed project.

GM-6 The Space Force will ensure that a Qualified Biologist will inspect any equipment left overnight prior to the start of work the following day. The Qualified Biologist will check equipment for presence of special-status species in the vicinity and for fluid leaks and immediately let 30 CES/CEIEA know to coordinate subsequent actions prior to the start of work.

GM-7 The Space Force will continue to remove nonnative, invasive predators encountered during survey efforts (i.e., bullfrogs [*Lithobates catesbeianus*]).

GM-8 The Space Force will ensure that any vegetation clearance (within Spring Canyon) or firebreak maintenance conducted between October 1 and December 31, 2024, in the vicinity of SLC-4 will require biological clearance surveys and the presence of a biological monitor during these work activities. As stated in GM-2, in the event listed species are encountered and are at risk of being directly killed or injured, or nests destroyed, by work activities, a Service Approved Biologist will be responsible for species relocation. To avoid transferring disease or pathogens between aquatic habitats during surveys and handling of amphibians, the Space Force will ensure that Service Approved Biologists will follow decontamination procedures described in the Declining Amphibian Population Task Force's Code of Practice (DAPTF) (USFWS 2002a).

GM-9 The Space Force will establish a pre-project baseline for hydrodynamic data within San Antonio Creek. During project operations the Space Force will collect hydrodynamic data annually using consistent data collection methodologies for purposes of comparison against the established baseline. The Space Force will use

this data to ensure that the proposed project's water extraction, when viewed in addition to the unknown total water extraction amount of permitted launch projects, is not measurably affecting flow rate or water level within San Antonio Creek.

GM-10 The Space Force will ensure that SpaceX prepare a lighting management plan for SLC-4 to retrofit the existing facility's lighting to be completed by January 2025. This plan will incorporate best management practices in lighting retrofit design to reduce current and future lighting impacts into natural, undeveloped areas, to the maximum degree possible while still meeting operational requirements. This requirement will be accomplished through strategic placement of lights, and the use of shields, timers, and motion sensors wherever possible to minimize potential effects associated with novel persistent artificial light at night. The SLC-4 lighting management plan will be submitted to the Space Force for approval and USFWS for reference prior to the end of 2024.

Species-specific Avoidance and Minimization Measures

California Red-Legged Frog

Measures GM-6 to GM-8 above address California red-legged frog avoidance. In addition, the following California red-legged frog specific measures are included:

CRLF-1 The Space Force will maintain exhaust ducts and associated v-ditch at SLC-4 be free of standing water to the maximum extent possible between launches to help minimize the potential to attract California red-legged frog to the area.

CRLF-2 The Space Force will require that a Qualified Biologist survey the SLC-4 features for California red-legged frog prior to any vegetation maintenance activities and relocate any encountered individuals.

CRLF-3 Vegetation removal clearance surveys and monitoring: refer to GM-8.

CRLF-4 Pre/Post Launch Surveys: At SLC-4, the Space Force will require a Qualified Biologist to perform one California red-legged frog survey annually during peak breeding season (typically November through April, depending on rainfall) in Spring Canyon when individuals are most likely to be present and detectable. If the Qualified Biologist does not encounter California red-legged frog at the time of this survey, the Space Force will not require any other subsequent pre-/post-launch surveys. If California red-legged frogs are present during the annual survey, the Space Force will require pre- and post-launch surveys and relocation of any California red-legged frogs encountered for each subsequent launch event.

CRLF-5 California red-legged frog baseline and launch monitoring:

a. The Space Force will implement long-term monitoring of annual population and distribution trends associated with California red-legged frog populations within Jalama Creek, Honda Creek, Bear Creek, and the Santa Ynez River. The Space

Force will develop a monitoring plan that adequately addresses potential short- and long-term project effects that may result from sensory pollutants.

i. The monitoring plan will clearly establish a pre-project baseline of the California red-legged frog average population level within each impacted breeding feature (Jalama Creek, lower Honda Creek, Bear Creek, and Santa Ynez River) and clearly define the survey area and methodology. Following project implementation, the Space Force will conduct quarterly surveys utilizing the same methodology within each impacted breeding feature during the breeding season when California red-legged frogs are most likely to be encountered.
ii. The monitoring plan will include passive bioacoustics monitoring (Wildlife Acoustics Song-Meter 4 or similar technology) and will establish California red-legged frog calling behavior baseline within each impacted breeding feature (Jalama Creek, Honda Creek, Bear Creek, and Santa Ynez River). In the event the baseline is unable to be established prior to an increase in historic average launch rate, the plan will include identified appropriate control sites outside of impacted areas for purposes of signal characteristic comparison for additional necessary reference. California red-legged frog calling behavior baseline will include applicable call characteristics (e.g., any changes in signal rate, call frequency, amplitude, call timing, call duration, etc.). The Space Force will ensure that bioacoustics monitoring conducted is designed to best address confounding factors in order to appropriately characterize impacts of launch, static fire, and landing events on calling behavior. Statistical analysis of results will incorporate long term annual population data whenever possible to ensure any observed changes in signal characteristics are not resulting in observable declines in population.

CRLF-6 The Space Force will conduct quarterly night surveys for California red-legged frog and spring tadpole surveys of lower Honda Creek, Jalama Creek, Bear Creek, and the Santa Ynez River to compare baseline California red-legged frog occupancy data collected over the past 10 years and assess if there are any changes in California red-legged frog habitat occupancy, breeding behavior (calling), and breeding success (egg mass and tadpole densities). The Space Force will record and measure the following during the surveys:

a. California red-legged frog detection density (number of individuals per survey hour) following the same survey methods conducted previously at these sites and throughout VSFB;
b. California red-legged frog locations and breeding evidence (e.g., calling, egg masses);
c. environmental data during surveys (temperature, wind speed, humidity, and dewpoint) to determine if environmental factors are affecting California red-legged frog detection or calling rates;

d. annual habitat assessments to measure flow rates, stream morphology, depths, and sediment to determine if any changes in California red-legged frog metrics are associated with other environmental factors, such as drought;
e. and, locations and densities of co-occurring anurans, including bullfrogs (*Lithobates catesbeianus*) and Baja California tree frogs (*Pseudacris hypochondriaca*).

CRLF-7 The Space Force will conduct bioacoustic monitoring annually during California red-legged frog breeding season (typically November through April, depending on rainfall) to characterize the noise environment and determine if there are changes in calling behaviors as the proposed project commences. The Space Force will place passive noise recorders and environmental data loggers (temperature, relative humidity, dew point) at two suitable breeding locations each within lower Honda Creek, Jalama Creek, Bear Creek, and the Santa Ynez River. Passive bioacoustic recording will occur throughout the entirety of the breeding season using the Wildlife Acoustics Song-Meter 4 (or similar technology) with software that enables autodetection of California red-legged frog calling. The Space Force will use bioacoustic monitoring to characterize and analyze impacts of launch, static fire, and landing events on calling behavior during the breeding season to assess whether Falcon 9 noise events affect California red-legged frog calling frequency or other characteristics.

CRLF-8 To address potential declining population trends that may be a result of the proposed project, the specified threshold criteria is described below.

a. California red-legged frog occupancy, or tadpole densities decline (or bioacoustics signal characteristics change) from baseline by 15 percent or more and,
b. the 15 percent decline (or signal characteristic change) from baseline maintains for two consecutive years.

CRLF-9 If any of these threshold criteria are met and cannot confidently be attributed to other natural- or human-caused catastrophic factors unrelated to the proposed action (see potential scenarios defined below), the Space Force will mitigate these impacts as discussed under the *Habitat Mitigation and Monitoring Plan* section below. Potential catastrophic scenarios include the following:

a. Fire, unrelated to project activities or launch operations, that directly impacts Jalama Creek, lower Honda Creek, Bear Creek, or the Santa Ynez River and is demonstrated to degrade or destroy breeding habitat.
b. Landslides or significant erosion events, unrelated to project activities or launch operations, in Jalama Creek, Honda Creek, Bear Creek, or the Santa Ynez River that result in the elimination or degradation of California red-legged frog breeding habitat.
c. Drought or climate impacts (clearly unrelated to launch activities) that quantifiably reduce available aquatic habitat further than what was available during existing baseline.

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

The Space Force will review the purported cause of decline with the Service and reach agreement. If cause of declines is determined to be inconclusive (e.g. if the Space Force and Service disagree), the Space Force will implement or require the project proponent to implement proposed mitigation.

CRLF-10 In the event the aforementioned California red-legged frog mitigation threshold criteria are met, the Space Force will implement the following California red-legged frog mitigation actions:

a. The Space Force will create new California red-legged frog breeding habitat at a 2:1 ratio (habitat enhanced: habitat affected with acreage calculated using National Wetlands Inventory data) for adverse effects to occupied California red-legged frog habitat, as determined above, at the San Antonio Creek Oxbow Restoration Area, an established wetland mitigation site on VSFB. Historically occupied by riparian vegetation, restoration efforts will focus on enhancing this abandoned tract of agricultural land to improve sensitive species habitat in San Antonio Creek and expand breeding habitat for California red-legged frog.
b. The Space Force will conduct additional restoration in the "expansion area" adjacent to the existing restoration area (where restoration has already been conducted in support of other projects). Restoration will involve digging a channel that reaches ground water. Spoils generated during excavation will be used to create a berm bordering the channel that will be planted with willows. This method is already being used at this site and has been proven to successfully create deep water aquatic habitat, that supports California red-legged frog reproduction, bordered by riparian woodland. The restored habitat mirrors naturally occurring high-flow channels in San Antonio Creek.
c. Action taken within this area will include site preparation via herbicide application, plowing, container plant installation, seeding, willow pole planting (via water jet, hand-held power auger, or manually driving a steel rod into the ground), and watering via water truck. The mitigation actions for California red-legged frog are included in the existing Service PBO (8-8-12-F-49R) and all applicable avoidance, minimization, and monitoring measures required under the PBO would be implemented.

<u>Southwestern Pond Turtle</u>

Measures GM-6 to GM-8 above address southwestern pond turtle avoidance. In addition, the following southwestern pond turtle specific measures are included:

SWPT-1 Southwestern pond turtle Baseline Monitoring: The Space Force will implement long-term monitoring of annual population and distribution trends associated with southwestern pond turtle populations within Jalama Creek, Honda Creek, Bear Creek, and the Santa Ynez River. The Space Force will develop a monitoring plan that adequately addresses potential short- and long-term project effects that may result from sensory pollutants. The plan will provide best practices in land for the conservation and recovery of the species.

SWPT-2 The monitoring plan will clearly establish methods to estimate average population levels to be used as a baseline within each impacted breeding feature (Jalama Creek, Honda Creek, Bear Creek, and the Santa Ynez River) and clearly define the survey area and methodology. The baseline of southwestern pond turtle populations by each feature and base-wide will be established prior to increased launching or an appropriate off-site control will be used.

a. The Space Force will identify overwintering, breeding, basking, and nesting habitat within the vicinity of SLC-4 and within identified major riparian features. Mark-recapture techniques will be used to monitor population sizes and movements of individuals.
b. The Space Force will implement annual habitat assessments to measure flow rates, stream morphology, depths, and sediment to determine if any changes in southwestern pond turtle metrics are associated with other environmental factors, such as drought.

SWPT-3 To address potential declining trends that may be a result of the proposed project, the specified threshold criteria are described below:

a. Southwestern pond turtle population estimates (baseline) decline by 15 percent or more and,
b. The 15 percent decline from baseline is maintained for two consecutive years.

SWPT-4 If any of these threshold criteria are met and cannot confidently be attributed to other natural- or human-caused catastrophic factors unrelated to the proposed action (see potential scenarios defined below), the Space Force will mitigate these impacts as discussed under the *Habitat Mitigation and Monitoring Plan* section below. Potential catastrophic scenarios include the following:

a. Fire, unrelated to project activities or launch operations, that directly impacts Jalama Creek, Honda Creek, Bear Creek, or the Santa Ynez River and is demonstrated to degrade or eliminate breeding habitat.
b. Landslides or significant erosion events, unrelated to project activities or launch operations, that result in the elimination or degradation of southwestern pond turtle habitat.
c. Drought or climate impacts (clearly unrelated to launch activities) that quantifiably reduce available aquatic habitat further than what was available during existing baseline.
d. Flash flood events during the breeding season that are more significant than that experienced during the existing baseline.

The Space Force will review the purported cause of decline with the Service and reach agreement. If cause of declines is determined to be inconclusive (e.g. if the Space Force and Service disagree), the Space Force will implement or require their project proponent to implement proposed mitigation.

SWPT-5 In the event the aforementioned southwestern pond turtle mitigation threshold criteria are met, the Space Force will implement the following southwestern pond turtle mitigation actions:

a. The Space Force will create new southwestern pond turtle habitat at a 2:1 ratio (habitat enhanced: habitat affected, with acreage calculated using National Wetlands Inventory data) for adverse effects to occupied southwestern pond turtle habitat, as determined above, at the San Antonio Creek Oxbow Restoration Area, an established wetland mitigation site on VSFB. Historically occupied by riparian vegetation, restoration efforts will focus on enhancing this abandoned tract of agricultural land to improve San Antonio Creek and provide habitat for southwestern pond turtle.
b. The Space Force will conduct additional restoration in the "expansion area" adjacent to the existing restoration area (where restoration has already been conducted in support of other projects). Restoration will involve digging a channel that reaches ground water. Spoils generated during excavation will be used to create a berm bordering the channel that will be planted with willows. This method is already being used at the site and has proven successful at creating deep water aquatic habitat, suitable for southwestern pond turtle, with adjacent riparian woodland that simulates naturally occurring high-flow channels.
c. The Space Force will ensure that actions taken within this area will include site preparation via herbicide application, plowing, container plant installation, seeding, willow pole planting (via water jet, hand-held power auger, or manually driving a steel rod into the ground), and watering via water truck.

SWPT-6 Vegetation removal clearance surveys and monitoring: refer to GM-8

<u>Western Snowy Plover</u>

WSPL-1 The Space Force will implement long-term monitoring of annual population and distribution trends associated with western snowy plover along Surf Beach. The Space Force will develop a monitoring plan that adequately addresses potential short- and long-term project effects that may result from sensory pollutants. The western snowy plover monitoring plan will include a clear, established baseline annual variation and decline threshold that would trigger proposed mitigation discussed below.

a. The Space Force will implement the current western snowy plover monitoring program on VSFB and continue to perform acoustic monitoring and geospatial analysis of nesting activity on South Surf Beach to assess potential adverse effects from Falcon-9 associated noise events.

b. The current Base-wide western snowy plover monitoring program estimates breeding effort, nest fates, and fledging success while recording patterns of habitat use through the season. The Space Force will continue to place sound level meters (SLMs) immediately inland of South Surf Beach to characterize the noise environment and any related launch and landing associated disturbance. The Space Force will perform annual geospatial analysis to identify declines in the western snowy plover population (both breeding and overwintering), nesting activity, and reproductive success that may result from collective effects of multiple Falcon launches and landings from SLC-4.

WSPL-2 To address potential declining trends that may be a result of the proposed project, the specified threshold criteria is described below.

a. Geospatial analysis shows a statistically significant decline (defined as a decline greater than the baseline annual variation in these variables over the past 10 years at South Surf Beach) in population or reproductive success, and

b. the decline from baseline maintains over two consecutive years within the areas impacted by noise from the Falcon 9.

WSPL-3 If any of these threshold criteria are met and cannot confidently be attributed to other natural- or human-caused catastrophic factors unrelated to the proposed action (see potential scenarios defined below), the Space Force will mitigate these impacts as discussed under the *Habitat Mitigation and Monitoring Plan* section below. Potential catastrophic scenarios include the following:

a. Significantly higher levels of tidal activity as compared with the existing baseline and demonstrable across remainder of base population.
b. Significant avian disease demonstrable across the recovery unit.
c. Separate work activities (i.e., restoration efforts) not related to the project.

The Space Force will review the purported cause of decline with the Service and reach agreement. If cause of declines is determined to be inconclusive (e.g. if the Space Force and Service disagree), the Space Force will implement or require the project proponent to implement proposed mitigation.

WSPL-4 In the event the aforementioned western snowy plover mitigation threshold criteria are met, the Space Force will implement the following western snowy plover mitigation actions:

a. The Space Force will increase predator removal efforts to include the non-breeding season, particularly focusing on raven removal at and adjacent to VSFB beaches. Raven population increases are a substantial threat to western snowy plover populations on VSFB. The Space Force anticipates that off-season raven control efforts will help reduce the raven population on VSFB prior to the breeding season which should increase nest success and overall breeding adult numbers (See Appendix A; Figure 4B)
b. Predator control actions will include trapping, shooting, and tracking western snowy plover predators from VSFB beaches and surrounding areas on Base.

> The mitigation actions for SNPL are permitted under the existing Service Beach Management BO (8-8-12-F-11R; Service 2015) and all applicable avoidance, minimization, and monitoring measures required under BO 8-8-12-F-11R will be implemented. CEIEA also maintains a USFWS depredation permit.

Habitat Mitigation and Monitoring Plan

As discussed in the avoidance and minimization measures above, the Space Force proposes habitat mitigation in the event the proposed project's monitoring detects a change in the established baselines of species populations (CRLF 8-10, SWPT 3-5, WSPL 2-4). In the event the Space Force detects declines and declines meet threshold trigger criteria, the Space Force will implement mitigation activities as detailed below.

The potential mitigation actions for California red-legged frog and southwestern pond turtle include the creation of new breeding habitat at a 2:1 ratio (habitat enhanced: habitat affected with acreage calculated using National Wetlands inventory data for riparian features) within the San Antonio Creek Oxbow Restoration "expansion area", which comprises approximately 7.5 acres (Appendix A, Figure 4A). The original Oxbow Restoration site approximately 3.25 acres of abandoned agricultural land that borders San Antonio Creek where riparian vegetation historically occupied. The Space Force initiated compensatory mitigation restoration work at this site associated with a separate previous project (2016-F-0103; Service 2018) in the fall of 2019 to improve California red-legged frog habitat within San Antonio Creek (MSRS 2020, p. 2). The proposed expansion area as well as the original Oxbow Restoration site are both located within the proposed action's launch noise effect area (Appendix A). Potential mitigation actions associated with the proposed project within the Oxbow Restoration area include expansion of the original site with preparation via herbicide application, plowing, container plant installation, seeding, willow pole planting, and watering via water truck. The existing biological opinion (2016-F-0103; Service 2018) includes potential mitigation actions for California red-legged frog and the Space Force will implement all required avoidance, minimization, and monitoring measures. Southwestern pond turtle is not currently covered under this document and is consequently addressed below. The Space Force will track and report on restoration efforts and success within an annual report. No additional off-site areas have yet been identified where proposed mitigation may occur. Although the Space Force has not yet identified specific additional recovery projects for California red-legged frog or southwestern pond turtle, their potential restoration activities will align with the objectives of the California red-legged frog Conservation Strategy (Service, *in prep*) with the commitment to achieve no net loss to the species (Kephart, in litt., 2022, p. 3; MSRS 2024a, p. 113).

The potential mitigation actions for western snowy plover include increasing predator control in the non-breeding season, including trapping, shooting, and tracking known predators of western snowy plover with particular focus on raven removal at and adjacent to VSFB beaches. The Service refers to areas targeted for predator control as the Predator Management Area which includes the majority of VSFB (Appendix A, Figure 4B). The Predator Management Area is

located on-base and falls within the proposed project's Noise and Overpressure Effect Area (Appendix A). An existing biological opinion (8-8-12-F-11R; Service 2015) permits these actions, and the Space Force will implement all required avoidance, minimization, and monitoring measures. The Space Force also maintains a depredation permit issued by the Service. The Space Force will report on predator removal efforts and success within an annual report. The Space Force has not yet identified specific alternative recovery projects for western snowy plover that may serve as an appropriate offset. However, the Space Force has communicated that they will pursue other beneficial actions including recovery opportunities outlined in the western snowy plover recovery plan (Service 1970, Service 2007a) and 5-year reviews (Service 2006a, 2019, 2020)following mutual agreement by the Service and the Space Force annually, supporting the Space Force's commitment to ensure no net loss (Kephart, in litt., 2022, p. 3; MSRS 2024a, p. 141).

ANALYTICAL FRAMEWORK FOR THE JEOPARDY AND ADVERSE MODIFICATION DETERMINATIONS

Jeopardy Determination

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

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

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the current status of the California red-legged frog, western snowy plover, California least tern, and southwestern pond turtle by taking

into account any cumulative effects, to determine if implementation of the proposed action is likely to reduce appreciably the likelihood of both the survival and recovery of the California red-legged frog, western snowy plover, California least tern, and southwestern pond turtle in the wild by reducing the reproduction, numbers, and distribution of that species.

STATUS OF THE SPECIES AND ITS CRITICAL HABITAT

Southwestern Pond Turtle

Legal Status

The southwestern pond turtle is not listed under the Act; however, it is currently proposed threatened and under federal review for listing under the Act (88 FR 68370).

The Service was petitioned to list 53 species of reptiles and amphibians, including the western pond turtle (*Actinemys marmorata*), as threatened or endangered under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531–1543), in July 2012. On April 10, 2015, we published a 90-day finding that the petition presented substantial scientific or commercial information indicating that listing may be warranted for the western pond turtle (80 FR 19262–19263). Since then, the western pond turtle was split into two separate species, the northwestern pond turtle (*Actinemys marmorata*) and southwestern pond turtle (*Actinemys pallida*). The species status assessment was issued in April 2023 (Service 2023b), compiling biological information and condition on both species.

Natural history and Species Description

The southwestern pond turtle is a medium-sized turtle, with adults ranging from 110 to 179 mm long (maximum carapace (shell) length) and weighing between 194 to 828 grams (Germano and Riedle 2015, p. 104). Females tend to have a smaller head, less angled snout, taller and rounder carapace, flat (rather than concave) plastron (underside of shell) , and thinner tail as compared to males (Holland 1994, pp. 2-4; Rosenberg et al. 2009, p. 10). Colors and markings vary geographically and by age with most appearing olive to dark brown, or blackish, occasionally without pattern but usually with a network of spots, lines, or dashes of brown or black that often radiate from growth centers of shields (Bury et al. 2012, p. 4; Stebbins and McGinnis 2018, pp. 204–205). Hatchlings are generally a brown-olive color with visible mottling on the head and neck (Hays et al. 1999, p. 2) that darken with age. Hatchlings are 25 to 31 mm long carapace length (CL) (approximately the size of an American quarter) and weigh 3 to 7 grams at the time of emergence (Bury et al. 2012, pp. 4, 17). The shell of hatchlings is soft and pliable, and the tail is nearly as long as the shell (Ashton et al. 1997, p. 3; Stebbins and McGinnis 2018, p. 205). The shell becomes fairly hard around three to four years of age (Bury et al. 2012, p. 4). Eggs are off-white, elliptical-oval shaped, and range from 32 to 42 mm long and from 18 to 25 mm in diameter (Bury et al. 2012, p. 15).

Seeliger (1945, entire) first proposed geographic differentiation of western pond turtles into northern and southern subspecies based on differences in coloration and the presence and shape of the inguinal scute, the plate where the carapace joins the plastron at the groin. Since then, the western pond turtle was split into two separate species, the northwestern pond turtle (*Actinemys marmorata*) and southwestern pond turtle (*Actinemys pallida*). Recent genetic results corroborate the morphologic distinctiveness (presence/absence of inguinal scutes) as one of the components differentiating northwestern and southwestern pond turtles (Shaffer and Scott 2022, p. 9).

Southwestern pond turtles are semi-aquatic, having both terrestrial and aquatic life history phases. Eggs are laid in upland terrestrial habitat, and hatchings, juveniles, and adults use both terrestrial and aquatic habitat. Terrestrial environments are required for nesting, overwintering, and aestivation (warm season dormancy), basking, and movement/dispersal. Aquatic environments are required for breeding, feeding, overwintering and sheltering, basking, and movement/dispersal. Perennial (i.e., year-round) and intermittent (i.e., not year-round) bodies of water occur throughout the range. Some are flowing/lotic (e.g., streams, rivers, irrigation ditches), while others are not flowing/lentic (e.g., ponds, lakes, and reservoirs).
Preferred aquatic conditions are those with abundant basking sites, underwater shelter sites (undercut banks, submerged vegetation, mud, rocks, and logs), and standing or slow-moving water (Holland 1991, pp. 13–14; Reese and Welsh Jr. 1998a, p. 852; Hays et al. 1999, p. 10; Bury and Germano 2008, p. 001.4; Ernst and Lovich 2009, p. 175). Western pond turtles inhabiting lentic aquatic habitat, such as ponds, lakes, and slack water habitats, often overwinter within the aquatic environment, burying themselves within the bottom substrate, such as mud. Various depths of water provide western pond turtles with habitat necessary for overwintering and hatchling growth. Primary habitat for hatchlings and young juveniles is shallow water with dense submerged vegetation and logs, which most likely provides shelter, prey, and thermoregulatory requirements or other functions for survival (Holland 1994, pp. 1-14, 2-12; Rosenberg and Swift 2013, p. 119). Western pond turtles are extremely wary and will rapidly flee from basking sites into the water when disturbed by the sight or sound of people at distances of greater than 100 m (328 ft) (Bury and Germano 2008, p. 001.5).

Nesting habitat is in close proximity to aquatic habitat and is typically characterized as having sparse vegetation with short grasses and forbs and little or no canopy cover to allow for exposure to direct sunlight (Holland 1994, p. 2-10; Rathbun et al. 2002, p. 232; Rosenberg et al. 2009, pp. 16–17; Riensche et al. 2019, p. 97). Females excavate nests in compact, dry soils that are 3 to 400 m from water (Holland 1994, p. 2-10; Holte 1998, p. 54). Soils need to be loose enough to allow nest excavation, and typically have a high clay or silt component. Disturbance needs to be infrequent enough or of sufficiently low intensity that nesting females are not disturbed. Nests are shallow and generally occur between 9 to 12 cm below the surface (Service 2023b, p. 22). Additional features of nesting habitat/sites that may be important include aspect, slope, and vegetation.

Overwintering is a state of little to no activity (e.g., brumation) that occurs during the cooler months of the year and can occur in either upland or aquatic environment (Holland 1994, p. 2-7;

Ultsch 2006, pp. 341, 356). During overwintering, southwestern pond turtle can utilize the duff and leaf litter layers leaving part of their carapace exposed. Southwestern pond turtles also use upland habitat for migration (intra-population (within local populations) movements occurring between aquatic and upland environments), dispersal (movement between populations/watersheds), and aestivation. Aestivation is a period of inactivity, usually in response to the hottest time of year or dry conditions (Hays et al. 1999, p. 7) that occurs in terrestrial habitat. Along the central California coast, western pond turtles that occupied pond habitat overwintered on-site, whereas most turtles from an adjacent stream left with the first heavy rains and overwintered in the upland or moved to the pond (Service 2023b, p. 26).

In Central California, southwestern pond turtle egg-laying takes place May to July. Additionally, from southwestern pond turtles will move from seasonal ponds and permanent streams and rivers to overwinter at least 500 meters away in September or October and finish overwintering between March and April (Bury et al. 2012). On VSFB, available information indicates that egg laying occurs between April and August (U.S. Air Force 2014, p. 38). Hatchlings could stay in the nest and overwinter as well.

The southwestern pond turtle is omnivorous and considered a dietary generalist (Holland 1994, p. 2-5), consuming a wide variety of food items. Prey resources are primarily found within water but can be captured or scavenged on land. Food captured or scavenged on land must be brought back to water for consumption, as they appear to be unable to swallow in the air (Holland 1994, p. 2-6). Animal matter appears to constitute a larger portion of the diet than plant material (Bury 1986, pp. 518–520; Holland 1994, pp. 2-5–2-6). Stomach contents reveal the diet consists of small aquatic invertebrates, with small vertebrates (fish, tadpoles, and frogs), carrion, and plant material (Bury 1986, p. 516; Holland 1994, pp. 2-5–2-6). Nonnative predators include American bullfrogs (*Lithobates catesbeianus*; hereafter bullfrogs) and invasive fish, such as large and smallmouth bass (*Micropterus* sp.; hereafter bass). Native predators of western pond turtles include raccoons, skunks, foxes, coyotes. mink, herons, river otters, burrowing small mammals, and giant water bugs.

Southwestern pond turtles mature slowly and have low fecundity but are potentially long-lived. In southern California, the smallest known reproductive female was approximately 111 mm carapace length and at least 6 to 7 years old (Holland 1994, p. 5-2). Courtship behaviors have been observed from April through November, with mating observed in May through September (Holland 1991, p. 23). Oviposition usually occurs from May through July (Bury et al. 2012, p. 15). Clutch size for western pond turtles varies from 1 to 13 eggs, and is positively correlated with body size (Holland 1994, p. 5-2; Holte 1998, p. 5). Incubation time is approximately 80 to 126 days (Holland 1994, pp. 2-10, 5-7). Western pond turtles exhibit temperature-dependent sex determination (TSD) during incubation (Ewert et al. 1994, p. 7). In California, female hatchlings were more likely when 30 percent of the sex-determining period occurred above 29° Celsius (C) (84° Fahrenheit (F)) (Christie and Geist 2017:49). In addition, lower fluctuations in temperature resulted in development of males, whereas females developed in nests with high and low temperature fluctuations. In southern and central California, some hatchlings may emerge from

the nest chamber in late-summer to early-fall, whereas others overwinter in the nest chamber and emerge in spring (Holland 1994, p. 2-10). The maximum lifespan of western pond turtles is unknown. However, they are long-lived species after reaching adulthood, with some northwestern pond turtles living to at least 55 years of age (Bury et al. 2012, p. 17).

Home range size and configuration varies between age class, sex, and location. Measured home ranges of western pond turtles average 1 hectare (2.5 acres) for males, 0.3 hectare (0.7 acre) for females, and 0.4 hectare (1 acre) for juveniles (Bury 1972). Female pond turtles in two southern California streams had home ranges that were longer and smaller (Goodman and Stewart 2000) than those observed by Bury (1972, entire), likely because the streams in southern California tend to be narrower so pond turtles have to move further distances to obtain sufficient resources. Western pond turtles are capable of dispersing substantial distances, although large overland movements are uncommon. Available information on radio-tagged western pond turtles in central California demonstrated that individuals spent over half of the year in terrestrial habitat, typically with movements no farther than 0.21 mile from seasonal ponds (Service 2023b, p. 27). However, dispersal of southwestern pond turtle between populations and watersheds is generally not well understood. Genetic analyses suggest that most movements occur within drainages, but few accounts of larger dispersal movements exist. Dispersal distance of 4.35 miles within aquatic habitat and 3.1 miles by a single individual of terrestrial upland habitat have been documented (D.C. Holland 1994, p. 7-28). However, in the same study, no movements between drainages were detected from three other sites with over 1,100 hundred captures and recaptures over a 7-year period indicating large movements are likely atypical and may be related to resource availability.

Rangewide status

The historical range of western pond turtles extends along the Pacific coast from British Columbia, Canada to the northern part of Baja California, Mexico, primarily west of the Sierra Nevada and Cascade ranges (Ernst and Lovich 2009, p. 173; Stebbins and McGinnis 2018, p. 205). Western pond turtles have been found at sites from brackish estuarine waters at sea level up to 2,048 meters (m) (6,719 feet (ft) (Ernst and Lovich 2009, p. 176) but mostly occur below 1,371 m (4,980 ft.) (Stebbins and McGinnis 2018, p. 205). The range of the southwestern pond turtle is restricted to those populations inhabiting the central Coast Range south from the middle of Monterey Bay to the species' southern range boundary in Baja California**.** A new population found south of the nearest reported population represents a range extension of 95.5 kilometers (and the only oasis population within the Central Desert ecoregion in Baja California) (Valdez-Villavicencio et al. 2016:265).

Shaffer and Scott (2022, entire) clarified areas of previous uncertainty immediately south, east, and west of the San Francisco Bay, where there were no specimens used in Spinks et al. (2014:2233) when describing northwestern and southwestern pond turtles, and the range around the San Francisco Bay presented in Thomson et al. (2016:297). Based on these genomic data, Shaffer and Scott recommended that the border along the coast between the two species was in

the middle of Monterey Bay (Shaffer and Scott 2022, p. 5). It also clarified the contact zone between the two species at the edge of the South Coast Ranges where they meet the floor of the Central Valley; although there are individuals with genetics from both species along the area where the species come into contact in this area, it appears that the boundaries are adjacent but do not overlap (Shaffer and Scott 2022, pp. 4–5).

Threats and Conservation Needs

Habitat destruction and alternation are primary threats to the southwestern pond turtle. Extensive land conversion due to urbanization and agriculture has resulted in substantial losses to both upland and aquatic habitats across the range (Holland 1994, p. 1-23; Hays et al. 1999, pp. ix, 31; Spinks et al. 2003, p. 258; Bury and Germano 2008, p. 001.6; Rosenberg et al. 2009, p. 40; Thomson et al. 2016, pp. 300–301). As a result, a large fraction of the remaining habitat in southern California existing only as patches with little suitable upland habitat available for nesting (Thomson et al. 2016, p. 301). Overall, the range of the southwestern pond turtle is fragmented to varying degrees by human activities, with some sites extirpated, and in many cases, only small, isolated groups or individuals remaining (Holland 1991, p. 13).

Aquatic resources used by the western pond turtle have experienced high levels of loss, alteration, and degradation throughout the range of the two species (Reese and Welsh Jr. 1998b, p. 505; Germano 2010, p. 89). A substantial portion of the losses of aquatic habitat are due to anthropogenic water use (e.g., dams and diversions for the purposes of providing water for human use). Moreover, within the historical range of the western pond turtle, an extensive system of hydrologic infrastructure, including dams, reservoirs, diversions, and aqueducts, supports extensive agricultural and municipal water uses, and provides domestic water to many densely populated areas (Lund et al. 2007, p. 43; Hanak et al. 2011, pp. 19–69). These alterations include stream channelization, altered flow regimes, groundwater pumping, water diversions, damming, and water regulation for flood risk management (flood control), which affect hydrology, thermal conditions, and structure of western pond turtle aquatic and upland habitat.

Loss of upland habitat adjacent to southwestern pond turtle aquatic habitat can isolate pond turtles from surrounding populations and eliminate nesting sites, thus limiting the ability to successfully reproduce (Holland 1994, entire; Spinks et al. 2003). Agricultural areas and grazing pastures provide suitable habitat for nesting southwestern pond turtles, but certain practices, such as plowing and irrigation, could destroy nests (Crump 2001, entire). Western pond turtle eggs have permeable shells that have been observed to rupture after absorbing excess moisture, killing the pond turtle embryo (Feldman 1982:10). For example, this could be a problem in urban areas that are irrigated (Spinks et al. 2003:263).Roads can affect western pond turtle viability because of vehicles killing or injuring individuals or disturbing basking behavior, and by reducing connectivity between populations, which reduces migration between upland and aquatic habitat (Rosenberg et al. 2009:41; Nyhof 2013, p. 43; Thomson et al. 2016:301; Nicholson et al. 2020:entire; Manzo et al. 2021:494, S1 text supplement).

Development can also indirectly lead to habitat degradation and/or mortality as a result of down cutting and erosion, introduction of non-native plants and animals, water pollution, and recreational activities (Holland 1991). Increased runoff from irrigation results in down cutting and erosion which can eliminate pools, basking sites, and refugia used by pond turtles and isolates the aquatic environment from the surrounding upland environment. Invasion by nonnative aquatic plant species, such as *Arundo* spp. can alter the stream hydrology and displace emergent aquatic vegetation that provides refuge for juvenile turtles. Introduced non-native and urban-related animals include predators (e.g., non-native fish, bullfrogs, crayfish, dogs, and corvids) and competitors (e.g., non-native turtles, such as the red-eared slider).
Recreational activities such as hiking, biking, fishing, boating, and off-highway vehicles, and the associated disturbance within or adjacent to aquatic and nest habitats, can affect western pond turtles in a variety of ways, depending on the region and type of recreation. Some forms of recreation may cause mortality of individuals through trampling, while others degrade habitat, disturb pond turtle behavior, and/or contribute to other threats. For example, recreational activities may interact with the threat of collection because humans may encounter the species while engaging in other activities. Western pond turtles are extremely wary and will rapidly flee from basking sites into the water when disturbed by the sight or sound of people at distances of greater than 100 m (328 ft) (Bury and Germano 2008, p. 001.5).

Desiccation of waterways from drought has led to declines and extirpations of western pond turtle populations by negatively affecting the quality and/or quantity of its aquatic habitat, impacting survival, recruitment, and connectivity, and exacerbating the effects of other threats. Western pond turtle mortality during drought is well documented, and appears to occur as a result of drought-induced starvation (Lovich et al. 2017, p. 7) and/or drought-induced predation (Purcell et al. 2017, p. 21). Extended drought occurring during 1986–1987 through at least 1991 caused major population declines and extirpations in many areas, but most significantly in southern and central California (Holland 1991, p. 65). During this time, turtles in small to moderate sized watercourses were abundant until 1988–1989, but as water continued to dry, resulting in major increases in distance to the next water source, turtles concentrated in the few remaining pools exhausted available prey, and were exposed to increased predation.
During normal drought conditions, when water levels are low, western pond turtles can aestivate in upland habitat or move to another water body if one is within migration and/or dispersal distance. Aestivating southwestern pond turtles remained in upland habitat for approximately 7 months (mean 201 days, range 154 to 231 days) during the 2011–2012 drought (Belli 2016, p. 57), suggesting that even in a severe drought, individuals could remain alive to repopulate the water body once conditions become suitable again (see Purcell et al. 2017). However, extended drought conditions and/or increased frequency of droughts, could have substantive effects on populations, and other synergistic effects could also make repopulation by aestivating individuals unlikely. In addition, because females often forego nesting when conditions are unfavorable, extended drought can result in reduced reproduction and recruitment opportunities.

The conservation needs for pond turtles include conserving large blocks of suitable aquatic and associated upland habitat and maintaining connectivity by providing suitable habitat linkages for

dispersal. Management activities that address threats to this species include controlling nonnative plants such as *Arundo donax*, controlling non-native aquatic predators and competitors such as fish, bullfrogs, crayfish, and red-eared sliders, and limiting predation by urban predators, such as dogs, ravens, and mammalian mesopredators such as coyote and raccoon (Service 2023b, pp. 48, 50-51, 61). Bullfrogs have been introduced into western pond turtle habitat and influence viability of the species by increasing predation pressure on hatchlings and small juveniles, and thus are considered to have the largest impact on western pond turtle demography (Service 2023b, pp. 87-88, 89-90, 95). Due to the potential threat posed by road mortality, measures such as the installation of low-lying fine-mesh fence or barrier fencing in areas likely to be used by pond turtles may help minimize this source of mortality. In addition, because pond turtles may be collected as pets or non-native red-eared sliders purchased from the pet store could be released into the wild, public education regarding these effects would benefit this species.

California Red-Legged Frog

Legal Status

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

Natural History

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

California red-legged frogs breed in aquatic habitats; larvae, juveniles, and adult frogs have been collected from streams, creeks, ponds, marshes, deep pools and backwaters within streams and creeks, dune ponds, lagoons, and estuaries. They frequently breed in artificial impoundments such as stock ponds, given the proper management of hydro-period, pond structure, vegetative cover, and control of exotic predators. While frogs successfully breed in streams and riparian

systems, high spring flows and cold temperatures in streams often make these sites risky egg and tadpole environments. An important factor influencing the suitability of aquatic breeding sites is the general lack of introduced aquatic predators. Accessibility to sheltering habitat is essential for the survival of California red-legged frogs within a watershed and can be a factor limiting population numbers and distribution.

California red-legged frogs are "irruptive" breeders where their breeding capacity is highly dependent on local environmental conditions, specifically the availability of cool water for egg deposition and larval maturation (Jennings and Hayes 1994, p. 62). California red-legged frogs breed from November to May and breeding activity typically begins earlier at southern coastal than northern coastal localities (Storer 1925, p. 2; Alvarez et al. 2013, pp. 547-548). Breeding may start as late as March or April in Sierra Nevada localities, due to low temperatures at these sites in January and February (Tatarian 2008, p. 16). Breeding in southern California localities may start as late as April, as exemplified in Matilija Canyon following the 2017 Thomas Fire (P. Lieske, pers. comm., 2021). High water flows in the winter and spring also can delay breeding in streams and rivers (Fellers et al. 2001, p. 157). Female California red-legged frogs lay only one egg mass in a breeding year and each egg mass contains between 300 to 4,000 eggs (Storer 1925, p. 240). Frogs typically deposit egg masses in relatively shallow water (approximately 1.6 to 2 feet deep) on emergent vegetation within 4 feet of shore (Storer 1925, p. 239; Jennings and Hayes 1994, p. 64). However, the species can deposit eggs on a wide variety of substrates including boulders and cobbled substrate and submerged tips of overhanging branches, and egg masses have been documented 39 feet from shore and in water up to 10.5 feet deep (Alvarez et al. 2013, pp. 544-545; Wilcox et al. 2017, p. 68). California red-legged frog tadpoles hatch from egg masses after 6 to 14 (Storer 1925, p. 241). Tadpole development and growth rates are variable and likely temperature dependent (Fellers 2005, pp. 552-554). Occasionally, tadpoles may overwinter and then metamorphose the following spring, a phenomenon so far observed in Santa Clara, Marin, Contra Costa, and San Luis Obispo Counties (Fellers et al. 2001, entire).

The juvenile California red-legged frog life stage is defined as the time after an individual undergoes metamorphosis (when they lose their tails and become small froglets) which typically occurs four to five months after hatching and it spans to when an individual is able to breed (Storer 1925, p. 241; Wright and Wright 1949, p. 422). On average, the juvenile life stage is from about five months of age to three years in California red-legged frogs. Immediately after metamorphosis, juveniles shelter near their natal pond. However, some juveniles may disperse in the fall to nearby moist uplands or different aquatic habitat to avoid predation by larger, older frogs. Hayes and Tennant (1985, p. 604) found juveniles to seek prey diurnally and nocturnally, whereas adults were largely nocturnal. During periods of wet weather, starting with the first rains of fall, some individual California red-legged frogs may make long-distance overland excursions through upland habitats to reach breeding sites. In Santa Cruz County, Bulger et al. (2003, p. 90) found marked California red-legged frogs moving up to 1.74 miles through upland habitats, via point-to-point, straight-line migrations without regard to topography, rather than following riparian corridors. Most of these overland movements occurred at night and took up to 2 months.

Similarly, in San Luis Obispo County, Rathbun and Schneider (2001, p. 1302) documented the movement of a male California red-legged frog between two ponds that were 1.78 miles apart in less than 32 days; however, most California red-legged frogs in the Bulger et al. (2003, p. 93) study were non-migrating frogs and always remained within 426 feet of their aquatic site of residence (half of the frogs always stayed within 82 feet of water). Rathbun et al. (1993, p. 15) radio-tracked three California red-legged frogs near the coast in San Luis Obispo County at various times between July and January; these frogs also stayed close to water and never strayed more than 85 feet into upland vegetation. Scott (2002, p. 2) radio-tracked nine California red-legged frogs in East Las Virgenes Creek in Ventura County from January to June 2001, which remained relatively sedentary as well; the longest within-channel movement was 280 feet and the farthest movement away from the stream was 30 feet.

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

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

Rangewide Status

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

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

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

Recovery

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

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

4. The species is successfully reestablished in portions of its historical range such that at least one reestablished population is stable/increasing at each core area where California red-legged frog are currently absent.
5. The amount of additional habitat needed for population connectivity, recolonization, and dispersal has been determined, protected, and managed for California red-legged frogs.

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

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

Western Snowy Plover

Legal Status

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

Natural History

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

Foraging Behavior

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

Breeding

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

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

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

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

Western snowy plover chicks are precocial, leaving the nest with their parents within hours after hatching (Service 2007b, p. 14). They are not able to fly for approximately 1 month after

hatching; fledging requires 29 to 33 days (Warriner et al. 1986, p. 26). Broods rarely remain in the nesting area until fledging (Warriner et al. 1986, p. 28; Lauten et al. 2010, p. 10). Casler et al. (1993, pp. 6, 11–12) reported broods would generally remain within a 1-mile radius of their nesting area; however, in some cases would travel as far as 4 miles.

Wintering

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

Rangewide Status

Historical records indicate that nesting western snowy plovers were once more widely distributed and abundant in coastal Washington, Oregon, and California (Service 2007b, p. 21). In Washington, western snowy plovers formerly nested at five coastal locations (WDFW 1995, p. 14) and at over 20 sites on the coast of Oregon (Service 2007b, p. 24). In California, by the late 1970s, nesting western snowy plovers were absent from 33 of 53 locations with breeding records prior to 1970 (Page and Stenzel 1981, p. 27).

The first quantitative data on the abundance of western snowy plovers along the California coast came from window surveys conducted during the 1977 to 1980 breeding seasons by Point Reyes Bird Observatory (Page and Stenzel 1981, p. 1). Observers recorded an estimated 1,593 adult western snowy plovers during these pioneering surveys. The results of the surveys suggested that the western snowy plover had disappeared from significant parts of its coastal California breeding range by 1980 (Service 2007b, p. 27).

Breeding and winter window survey data from 2005 to 2022 includes approximately 250 sites in Washington, Oregon, and California, with most sites located in California (Table 2). In California, biological monitors counted 1,830 western snowy plovers during the 2022 breeding window survey, and 4,196* western snowy plovers during the 2021 to 2022 winter window survey (Service 2022a, entire). Across the Pacific Coast range, the 2022 breeding window survey estimated 2,371 western snowy plovers, and the 2021 to 2022 winter window survey estimated

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

4,803 western snowy plovers in Washington, Oregon, and California (Service 2022a, entire). These numbers demonstrate that monitors counted a large percentage of all western snowy plovers in the Pacific Coast range in California during both winter and breeding window surveys.

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

Year	*RU1*	*RU2*	*RU3*	*RU4*	*RU5*	*RU6*	*TOTAL (U.S. Pacific Coast)*
2023	487	64	368	308	676	433	2336
2022	541	71	281	281	804	393	2,371
2021	624	84	263	292	737	358	2,358
2020	469	46	147	308	855	484	2,309
2019	479	41	190	303	807	397	2,217
2018	402	52	235	361	874	451	2,375
2017	342	56	246	369	856	464	2,333
2016	477	46	202	366	820	373	2,284
2015	340	38	195	348	963	376	2,260
2014	269	27	178	374	822	346	2,016
2013	260	23	202	261	754	326	1,826
2012	234	21	147	324	771	358	1,855
2011	202	28	249	311	796	331	1,917
2010	196	19	275	298	686	311	1,785
2009	182	15	147	279	707	257	1,587
2008	147	18	133	257	717	269	1,541
2007	175	26	207	270	676	183	1,537
2006	158	45	102	357	917	298	1,877
2005	137	41	124	337	969	209	1,817

Recovery and Threats

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

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

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

1. An average of 3,000 breeding adults has been maintained for 10 years, distributed among 6 recovery units as follows: Washington and Oregon, 250 breeding adults; Del Norte to Mendocino Counties, California, 150 breeding adults; San Francisco Bay, California, 500 breeding adults; Sonoma to Monterey Counties, California, 400 breeding adults; San Luis Obispo to Ventura Counties, California, 1,200 breeding adults; and Los Angeles to San Diego Counties, California, 500 breeding adults. This criterion also includes implementing monitoring of site-specific threats, incorporation of management activities into management plans to ameliorate or eliminate those threats, completion of research necessary to modify management and monitoring actions, and development of a post-delisting monitoring plan.
2. A yearly average productivity of at least one (1.0) fledged chick per male has been maintained in each recovery unit in the last 5 years prior to delisting.
3. Mechanisms have been developed and implemented to assure long-term protection and management of breeding, wintering, and migration areas to maintain the subpopulation sizes and average productivity specified in Criteria 1 and 2. These mechanisms include establishment of recovery unit working groups, development and implementation of participation plans, development and implementation of management plans for Federal and State lands, protection and management of private lands, and public outreach and education.

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

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

ENVIRONMENTAL BASELINE

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

Action Area

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

Appendix A, Figures 1A-F depict the Launch Noise Effect Area of potential disturbance, Appendix A, Figures 2A–P depict the Sonic Boom Overpressure Effect Area of potential disturbance associated with the sonic boom produced during vehicle SLC-4 landing. The Service includes the Space Force's updated 2024 modeling and understands that the Space Force indicates that mainland California (between eastern Santa Barbara and Northern Los Angeles

counties) experience very low levels (understood to be insignificant) both in terms of frequency and magnitude. We also understand that the Overpressure Effect Area includes various sonic boom trajectories consisting of a narrow band across Santa Rosa Island and Santa Cruz Island (Appendix A, Figure 2H). The Space Force again anticipates this portion of the Overpressure Effect Area to receive irregular and infrequent disturbance. This would be like be up to 5 times between October 1 to December 31, 2024, with anticipated levels well below 2 psf. Further unanticipated changes to our understanding of the action area may warrant reinitiation as described at the end of this document.

Appendix A, Figures 4A-B depicts a portion of the described potential mitigation areas that may be associated with the proposed project. The Service considers all areas within the noise and overpressure effect areas, water extraction within the San Antonio Creek Basin, as well as potential mitigation/restoration areas to encompass the entirety of the action area.

Habitat Characteristics of the Action Area

The proposed action includes more frequent utilization of an existing launch site, SLC-4, located in south VSFB. SLC-4 currently contains predominantly ruderal and developed areas. SLC-4 is located immediately north of Spring Canyon, 0.75 mile southwest of Bear Creek, and approximately 0.5 mile east of Surf Beach. Primary vegetation types within the near vicinity of SLC-4 include Central Coast Scrub, Central Dune Scrub, Central Coastal Arroyo Willow Riparian Forest and Scrub, and Bishop Pine Forest (30 CES 2021, Appendix A, Figure 2). Spring Canyon also contains dense eucalyptus stands. SpaceX currently removes vegetation to just above ground level within a 3.327-acre impact area of Spring Canyon that is affected by liquid and water vapor expelled from the flame duct, an action previously consulted on in 2017 (Service 2017; 2017-F-0480). SpaceX also currently conducts additional mowing surrounding SLC-4 in previously disturbed portions.

The Launch Noise Effect and Overpressure Effect Areas include the vast majority of VSFB apart from a small northern portion of the installation. The Launch Noise Effect Area also includes a wide diversity of native and non-native habitat types including multiple riparian features, central dune scrub, maritime chapparal, live oak woodland, and pine forest (30 CES 2021, Appendix A, Figure 2). Riparian features located within the Launch Noise Effects area contains aquatic habitat with deep ponded features as well as Central Coast Arroyo Willow Riparian Forest and Scrub (30 CES 2021, Appendix A, Figure 2).

A limited portion of proposed project's water extraction and potential mitigation activities would occur within San Antonio Creek, a perennial feature that contains intact Central Coast Arroyo Willow Riparian Forest and Scrub (30 CES 2021, Appendix A, Figure 2).

Off base components include portions of mainland California between eastern Santa Barbara County to northern Los Angeles County as well as narrow linear pathways across Santa Rosa Island and Santa Cruz Island (Appendix A, Figure 2H). The mainland California portion includes

a diverse array of native and non-native habitats including the Los Padres National Forest and large portions of urban development. Santa Rosa Island is one of California's Channel Islands and is managed by the National Park Service as part of the Channel Islands National Park. The topography of Santa Rosa Island in the overpressure effects area is generally mountainous, with elevations ranging between sea level and 1,000 feet above mean sea level and includes a variety of vegetation types including coastal sage scrub and chaparral.

Existing Conditions in the Action Area

SLC-4 is an active launch site occupying approximately 122 acres in the south base of VSFB. Prior to 2022, VSFB has generally supported an average of 6.2 rocket launches per year with very recent highs of 17 launches in 2022 and 29 in 2023. SpaceX constitutes the majority of all recent launches from VSFB (with 28 of the 29 in 2023) with a marked increase in launch frequency from SLC-4 in 2023 and an anticipated 36 launches in January to September 2024.

Other active or permitted launch programs that are not yet realized and may be cancelled also occur within the Launch Noise Effect Area making the true potential for collective launch numbers difficult to ascertain. However, the Space Force has confirmed that no more than 110 launches could occur annually in the future. However, SpaceX operations from SLC-4 currently constitute the majority of realized launches on VSFB with 28 of the 29 launches in 2023 being Falcon-9.

The Space Force has clarified that the water source for all base operations has transitioned to State Water. The only period in which well water from San Antonio Creek is utilized is during an annual maintenance period which typically occurs in late October to early November and lasts approximately 2 weeks (York, pers. comm., 2024).(York, pers. comm., 2024).

In February 2024, the Service reviewed available historic NASA Visible and Infrared Imaging Radiometer Suite (VIIRS) data and recognizes an increase in the lighting levels associated with SLC-4 occurred between 2020 and 2023. At present, the surrounding area of SLC-4 is exposed to similar artificial light at night levels as is observable within the city of Lompoc (NASA 2024a; b).

Mainland California encompasses a large area that is comprised of both natural areas and urban development that experience variable degree of both lighting and noise disturbance. Santa Rosa Island generally encompasses undisturbed natural areas.

Previous Consultations in the Action Area

On May 14, 2021, Vandenberg Air Force Base changed its name to Vandenberg Space Force Base. Consultations prior to this date refer to the Air Force. The Service includes recent consultations within the on-base portion of the Action Area below.

1. April 25, 2023: The Service issued a final biological opinion to the Space Force for the Phantom Launch Program at SLC-5 Project. We determined that the proposed action was not likely to jeopardize the continued existence of the western snowy plover and the California red-legged frog. This action has not yet occurred to date.
2. March 22, 2023: The Service issued a final reinitiation of the 2017 biological opinion of the SpaceX project at SLC-4 from the existing 12 launches to 36 launches annually (with launch rate not to exceed 3 times a month separated by every 8 days) (Service 2023; 2022-0013990-S7-001). We determined that the proposed action was not likely to jeopardize the continued existence of the western snowy plover, California least tern and the California red-legged frog. This action is currently in progress.
3. October 4, 2022: The Service issued a final biological opinion to the Space Force for the Terran 1 Launch Program (Relativity Space, Inc.) at SLC-11 Project. We determined that the proposed action was not likely to jeopardize the continued existence of the western snowy plover and the California red-legged frog. This action has not yet occurred to date.
4. September 26, 2022: The Service issued a final biological opinion to the Space Force for the Honda Bridge Replacement Project. We determined that the proposed action was not likely to jeopardize the continued existence of beach layia (*Layia carnosa*) or the California red-legged frog. This action is currently in progress.
5. November 18, 2020: The Service issued a biological opinion to the Air Force for the Blue Origin Orbital Launch Site at SLC-9 Project. We determined that the proposed action was not likely to jeopardize the continued existence of the California least tern, western snowy plover, and California red-legged frog. This action has not yet occurred to date.
6. November 21, 2018: The Service issued a reinitiation of a biological opinion to the Air Force on routine mission operations and maintenance activities at VAFB for changes to California red-legged frog-specific avoidance and minimization measures. We concluded the proposed action was not likely to jeopardize the continued existence of the California red-legged frog or alter effects of the proposed activities on the beach layia, Gaviota tarplant (*Deinandra increscens* ssp. *villosa*), Lompoc yerba santa (*Eriodictyon capitatum*), Vandenberg monkeyflower (*Diplacus vandenbergensis*), vernal pool fairy shrimp (*Branchinecta lynchi*), El Segundo blue butterfly (*Euphilotes battoides allyni*), tidewater goby, unarmored threespine stickleback, California least tern, and western snowy plover.
7. December 12, 2017: The Service issued a biological opinion to the Air Force for the proposed launch, boost-back, and landing of the Falcon 9 first stage at Space Launch Complex 4 (SLC-4). We concluded that the proposed action was not likely to jeopardize the continued existence of the El Segundo blue butterfly, California red-legged frog, California least tern, and western snowy plover. This project began in the spring of 2018 and is currently ongoing.
8. February 4, 2015: The Service issued a biological opinion to the Air Force for the proposed beach management plan for VAFB. We concluded that the proposed action was not likely to jeopardize the continued existence of the El Segundo blue butterfly, California red-legged frog, California least tern, and western snowy plover.

9. December 3, 2015: The Service issued a programmatic biological opinion to the Air Force for routine mission operations and maintenance activities at VAFB. We concluded that the proposed action was not likely to jeopardize the continued existence of the Vandenberg monkeyflower, beach layia, Gaviota tarplant, Lompoc yerba santa, vernal pool fairy shrimp, El Segundo blue butterfly, California red-legged frog, tidewater goby, unarmored threespine stickleback, California least tern, and western snowy plover.
10. September 9, 2014: The Service issued a biological opinion to the Air Force for the proposed replacement of the 13th Street Bridge on the Santa Ynez River. We concluded that the proposed action was not likely to jeopardize the continued existence of the tidewater goby and California red-legged frog. The National Marine Fisheries Service also issued a biological opinion (WCR-2014-1093) for effects on the federally endangered southern California Distinct Population Segment of the southern steelhead (*Oncorhynchus mykiss*).

Condition (Status) of the Species in the Action Area

Southwestern pond turtle

The southwestern pond turtles are anticipated to occupy wetland and riparian features across VSFB (U.S. Air Force 2014, p. 38) On north VSFB, southwestern pond turtles have been documented along San Antonio Creek, the Santa Ynez River, Shuman Creek, Lake Canyon, MOD Lake, and Punchbowl Pond. On south VSFB, southwestern pond turtles have been documented along Honda Creek and Jalama Creek (U.S. Air Force 2014, p. 38; MSRS 2024a, p. 64). The distribution surveys conducted as recently as 2013 confirmed southwestern pond turtle at all eight of these locations, but no population estimates were provided. In April 1995 and June 1996, southwestern pond turtles were sampled on Vandenberg Space Force Base, and 179 individuals total were sampled from Pine Canyon and Punchbowl Pond (Germano and Rathbun 2008). The Space Force has not yet conducted comprehensive southwestern pond turtle surveys across the base, but the survey effort is currently in progress.

Bear Creek has not been surveyed for turtles but is known to support California red-legged frog, and therefore may reasonably support southwestern pond turtle breeding. Biologists familiar with Bear Creek reported that the habitat may reasonably support the species during high rain years, and otherwise was identified as marginal habitat (USSF 2024d). Bear Creek is located approximately 0.75 mile to the northeast of SLC-4 and so is within the Launch Noise Effect and Overpressure Effect Areas. Noise modeling projects Bear Creek would receive noise levels between 125 to 130 dB SPL_{max} of engine noise during launches and understood overpressure levels of up to 5.0 psf during boost-backs (USSF, unpublished data, 2024b), which would equate to between 140 to 150 dB SPL, as previously discussed. Due to the adjacent of potential suitable southwestern pond turtle breeding habitat and their documented overwintering dispersal distance, the Service considers that the species has limited potential to occur within vegetation clearance and firebreak maintenance areas surrounding SLC-4 between October 1 and December 31, 2024.

Honda Creek, located 2 miles south of SLC-4, is known to support southwestern pond turtle (U.S. Air Force 2014, p. 38) with documented observations as recent as 2023 from the Honda Bridge Replacement project. Noise modeling projects Honda Creek would receive levels between 115 to 125 dB SPL_{max} of engine noise during launches and up to 5.0 psf (approximately 140-150 dB SPL) during boost-backs (USSF, unpublished data, 2024b). However, past realized monitoring results indicate Honda Creek has received an instantaneous sonic boom with overpressure level of 2.4 psf (comparable noise level of up to 135 dB SPL_{max}), which were the realized levels recorded during previous Falcon 9 launch monitoring (MSRS 2022b, p. 4).

The Santa Ynez River and San Antonio Creek are both large perennial features that are anticipated to support southwestern pond turtle. Large portions of each feature are included in the Launch Noise Effects and Overpressure Effect Areas. The Santa Ynez River is located approximately 4 miles north of SLC-4 while San Antonio Creek is located approximately 10 miles to the north. Available noise modeling projects that the Santa Ynez River would receive up to 118 dB SPL_{max} of engine noise during launches and overpressure of up to 4.0 psf during boost -backs. Modeling anticipates San Antonio Creek would receive engine noise levels between 100 to 110 dB SPL_{max} during launches and is located just outside of the area of overpressure effect (USSF, unpublished data, 2024b). San Antonio Creek contains the potential San Antonio Creek Oxbow Restoration expansion area that the Space Force may utilize for project mitigation purposes. Additionally, the proposed well water extraction area is in San Antonio Creek and includes 9.5 miles of downstream habitat between Barka Slough to the estuary.

Additionally, Shuman Creek and Canada del Jolloru may potentially support southwestern pond turtle breeding habitat considering they are known to support California red-legged frog breeding. Southwestern pond turtle have also been documented in isolated natural wetlands throughout VSFB (U.S. Air Force 2014, p. 38). Suitable upland dispersal habitat exists throughout VSFB between the various riparian zones and ponds. The vast majority of the Launch Noise Effect and Overpressure Effect Areas support areas of dense vegetation that could provide shelter for dispersing southwestern pond turtle.

Population outside VSFB

Jalama Creek is located just outside of VSFB and within the Launch Noise and Overpressure Effect area (Figure 1A and 2B). This feature likely supports suitable southwestern pond turtle breeding habitat considering it is known to support California red-legged frog breeding (MSRS 2024a, p. 48).

Within the mainland California portion of the Action Area potentially impacted by low level (less than 1.0 psf) sonic boom from missions with easterly trajectories, southwestern pond turtle are known from CNDDB records throughout Santa Barbara County, Ventura County, and Los Angeles County (MSRS 2024a, p. 66).

California Red-legged Frog

Population within VSFB

California red-legged frogs have been documented in nearly all permanent streams and ponds on VSFB as well as most seasonally inundated wetland and riparian sites (MSRS 2022c, p. 33). Spring Canyon is an ephemeral drainage located approximately 200 feet south of SLC-4. Throughout the majority of the drainage there is no definable channel and minimal evidence of potential pooling or surface water flow. Several small areas of Spring Canyon may constitute suitable habitat for California red-legged frog during wet periods when adequate surface water is present (MSRS 2022a, p. 27). A Permitted Biologist reassessed the drainage following an above-average rain year in July 2017 and found no suitable California red-legged frog breeding habitat within the Vegetation Removal Area or downstream. Between 2017 and 2022, the Space Force performed 11 survey efforts within the Spring Canyon Vegetation Removal Area and found no suitable breeding habitat or California red-legged frog individuals, likely a result of the protracted drought conditions in Santa Barbara County (MSRS 2022a, p. 28). It is therefore unlikely that California red-legged frog occupy the existing Vegetation Removal Area on a regular basis, other than as transitory habitat.

Bear Creek, located approximately 0.75 mile to the northeast of SLC-4, is within the Launch Noise Effect and Overpressure Effect Areas. A night survey of the Bear Creek Lagoon in late February 2024 documented 12 adult and 11 juvenile California red-legged frog (MSRS 2024a, p. 110). Noise modeling projects Bear Creek would receive noise levels between 125 to 130 dB SPL_{max} of engine noise during launches and understood overpressure levels of up to 5.0 psf during boost-backs (USSF, unpublished data, 2024b), which would equate to between 140 to 150 dB SPL as previously discussed.

Biologists have also consistently documented a moderately sized population and breeding habitat of California red-legged frogs over the last 10 years across variable survey efforts within Honda Creek. Honda Creek is located approximately 2 miles south of SLC-4 and is within the Launch Noise Effect and Overpressure Effect Areas. Noise modeling projects Honda Creek would receive levels between 115 to 125 dB SPL_{max} of engine noise during launches and up to 5.0 psf (approximately 140-150 dB SPL) during boost-backs (USSF, unpublished data, 2024b). However, past realized monitoring results indicate Honda Creek has received an instantaneous sonic boom with overpressure level of 2.4 psf (comparable noise level of up to 135 dB SPL_{max}), which were the realized levels recorded during previous Falcon 9 launch monitoring (MSRS 2022b, p. 4). Using protocol night California red-legged frog survey information between 2013 and 2022, adult frogs encountered ranged between 1 to 12 individuals with the current average annual high number being 7.2 adult individuals within the approximate anticipated Launch Noise Effect and Overpressure Effect Areas. Honda Creek includes multiple deep pond features that biologists have documented support breeding with 68 juveniles in 2017 and with 50 tadpoles and over 13 egg masses observed in 2022 (USSF, unpublished data, 2022). In April 2024, 8 adult and 7 juvenile California red-legged frog were documented during a night survey on the lower Honda

Creek stretch, exceeding the average number of adults (7.2) observed on this same stretch over the past 11 years (MSRS 2024a, p. 110).

The Santa Ynez River and San Antonio Creek are both large perennial features. Large portions of each feature are included in the Launch Noise Effects and Overpressure Effect Areas. The Santa Ynez River is located approximately 4 miles north of SLC-4 while San Antonio Creek is located approximately 10 miles to the north. Both features are thought to support large populations of California red-legged frog and breeding habitat (MSRS 2016, p. 37, MSRS 2022c, p. 34) although the presence of non-native predators (e.g. bullfrogs) is considered to be a current threat. Available noise modeling projects that the Santa Ynez River would receive up to 118 dB SPL_{max} of engine noise during launches and overpressure of up to 4.0 psf during boost-backs. Modeling anticipates San Antonio Creek would receive engine noise levels between 100 to 110 dB SPL_{max} during launches and is located just outside of the area of overpressure effect (USSF, unpublished data, 2024b). San Antonio Creek contains the potential San Antonio Creek Oxbow Restoration expansion area that the Space Force may utilize for project mitigation purposes. Additionally, the proposed well water extraction area is in San Antonio Creek and includes 9.5 miles of downstream habitat between Barka Slough to the estuary.

Additionally, Shuman Creek and Canada del Jolloru supports California red-legged frog population and breeding habitat. California red-legged frog have also been documented in isolated natural wetlands on south VSFB (MSRS 2024a, p. 48). Suitable upland dispersal habitat exists throughout VSFB between the various riparian zones and ponds. The vast majority of the Launch Noise Effect and Overpressure Effect Areas support areas of dense vegetation that could provide shelter for dispersing California red-legged frog, especially during periods of wet weather.

Population outside VSFB

Jalama Creek is located just outside of VSFB and within the Launch Noise and Overpressure Effect area (Figure 1B and 2C). This feature is known to support a California red-legged frog population and suitable breeding habitat (MSRS 2024a, p. 48).

Within the mainland California portion of the Action Area potentially impacted by low level (less than 1.0 psf) sonic boom from missions with easterly trajectories, California red-legged frogs are known to occupy the south coast of Santa Barbara County, including Gaviota Creek, Arroyo Honda, Arroyo Quemado, and other nearby creeks and tributaries. There are also observations of California red-legged frog from San Antonio Creek in Ojai, Las Virgenes Creek near Calabasas, and the Ventura River near Casitas Springs, from 2000 to 2016 (MSRS 2024a, p. 50).

Western Snowy Plover

Population within VSFB

VSFB provides critically important nesting and overwintering habitat for western snowy plovers, which includes all sandy beaches and adjacent coastal dunes from the rocky headlands at the north end of Wall Beach on north VSFB to the rock cliffs at the south end of Surf Beach on south VSFB (approximately 12.5 miles). VSFB averaged 225 breeding adults between 2014 to 2019 making it roughly 25 percent of Recovery Unit 5 and approximately 10 percent of the entire species range. Available historic data has shown that VSFB has consistently supported the largest populations of breeding western snowy plovers across the entire species range while simultaneously supporting high numbers of overwintering individuals. Being that this analysis focuses on a short period between September to December, the Service will include information on the condition of overwintering individuals for western snowy plover.

The nearest observation of anticipated overwintering western snowy plover to the action area's Launch Noise Effect Area is on the southern end of Surf Beach, approximately 0.8-mile northwest of SLC-4; The Launch Noise Effect Area now encompasses the entirety of beaches that western snowy plovers occupy on VSFB (Appendix A, Figure 1C). This is in contrast to the action area previously understood within the 2023 Biological Opinion. The noise and overpressure modeling has been updated to address identified inaccuracies in both disturbance magnitude and extent. The revised modeling indicates that the entire VSFB western snowy plover population (both breeding and overwintering) would fall within the Launch Noise Effect Area and would routinely experience short term (up to one minute) noise levels of over 100 dB SPL, with the Surf Beach population experiencing levels between 110 to 130 dB SPL. The vast majority of the VSFB western snowy plover population is also located within the Overpressure Effect Area, which encompasses all western snowy plover occupied beaches up to 0.75 mile north of Purisima Point (Appendix A, Figure 2D). A large portion of Surf Beach could experience instantaneous levels of up to 5.0 psf during terrestrial boost-back events. Although no conversion was provided, reviewing past available information, the magnitude of this overpressure levels would be roughly between 140 to 150 dB SPL during associated sonic booms (Robinette and Rice 2019, p. 14; reference to 3.63 psf which converts to an instantaneous noise disturbance of 138 dB SPLmax).

Vandenberg is an important overwintering location for western snowy plover, supporting 360 roosting plovers in total in 2024. More specifically, Vandenberg South Beaches (comprised of Surf Beach North and South, and Wall Beach) which would be subjected to both higher launch noise and overpressure levels supported 146 roosting plovers in 2024 (Service, unpublished data, 2024a). Table 3 below demonstrates that overwintering populations have been variable across the number of individuals observed on South Beaches (Service 2024b).

Table 3. VSFB Overwintering western snowy plover population counts

YEAR	Number of overwintering individuals Across VSFB	Number of overwintering individuals on South Beaches
2024	360	146
2023	214	62
2022	256	143
2021	289	152
2020	221	116
2019	290	199
2018	117	80

VSFB is also the largest breeding site for western snowy plover within the species range. South Beaches have also demonstrated capacity to support 327 breeding adults and up to 303 nests historically (SRS 2004, pp. 13 and 19), with 93 breeding adults and 179 nests in 2023 (MSRS 2024b, Appendix D, p. 57). This being said, the proposed project will take place between October 1 to December 31, 2024 which is outside of the known western snowy plover breeding season.

Recovery

Southwestern pond turtle

The southwestern pond turtle is not listed under the Act; however, it is currently proposed threatened and under federal review for listing under the Act (88 FR 68370). We consequently have not yet developed a recovery plan for southwestern pond turtle to assess its recovery status or how VSFB may factor into such status. However, a range-wide conservation strategy was developed with multi-stakeholder support from Washington, Oregon, Nevada, and California in the United States and from Baja California Norte, Mexico. The strategy was prepared by representatives from Federal and State entities, along with non-governmental organizations, scientists, and other experts on western pond turtles ([RCC] Western Pond Turtle Range-wide Conservation Coalition 2020).

The goal of the conservation strategy is to ensure long-term viability in the wild of the two species of western pond turtles (i.e., northwestern, and southwestern pond turtles). To achieve the goal, the following recovery efforts on VSFB should be implemented:

1. Coordinate Strategy implementation efforts through the Western Pond Turtle Range-wide Conservation Coalition and working groups.
2. Conduct distribution and abundance surveys of known, historical, and potential habitat to help determine priority conservation areas, and conduct more detailed surveys in targeted areas to determine long-term trends of populations.

3. Identify management regions, and priority conservation areas within those regions, and secure their long-term conservation.
4. Investigate the genetic variability of the western pond turtle throughout its range.
5. Scientific investigation of threats to facilitate and enhance recovery efforts.
6. Ameliorate and manage threats to western pond turtle populations and habitat, particularly in priority conservation areas.
7. Avoid and minimize direct and indirect adverse effects to western pond turtles and their habitat.
8. Consider population augmentation to enhance viability of severely depleted populations once causes for decline or extirpation have been addressed.
9. Develop and implement an effective outreach and education program about western pond turtles.

California Red-legged Frog

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

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

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

Western Snowy Plover

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

In 2019, the population trajectory of RU5 was considered stable, positive, with minimal annual fluctuation (Service 2019, p. 5). Annual monitoring reports from several of the larger sites, including VSFB, report fecundity results that exceed the recovery criterion in most years (Service 2019, p. 5). As of 2024, the draft 5-year review and communication with the Arcata USFWS indicate that RU4 and RU5 show non-growth trends while RU1, 2, 3, and 6 show statistically significant growth (Service 2024c, p. 8). Between 2018 and 2023, the most recent data indicates that RU5 is the only recovery unit experiencing notable downward population trajectory. RU5 population has not attained or exceeded the recovery target in any survey year (Service 2024c, p. 8; July 9th 2024, pers. comm. Arcata FWS Office).

In 2023, VSFB recorded 196 breeding adults. This is less than half of the identified 400 breeding adult site recovery goal. In 2022, VSFB comprised approximately 26 percent of breeding adults in RU5, 12 percent of California's breeding population, and 10 percent of breeding adults rangewide (Service 2022b, entire). Table 4 outlines average numbers of breeding adults counted during breeding window surveys from 2014 to 2022. Percentages illustrate the numbers of breeding western snowy plovers at VSFB relative to numbers rangewide, across California, and within RU5.

Table 4. 2014–2022 breeding adult averages from uncorrected (raw) breeding window survey numbers for the Pacific Coast range of western snowy plover, California, RU5, and VSFB with relative percentages (Service 2022b).

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

EFFECTS OF THE ACTION

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

In conducting this analysis, we have considered factors such as previous consultations, 5-year reviews, published scientific studies and literature, and the professional expertise of Service personnel and other academic researchers with aspects directly related to the sensitive species involved in determining whether effects are reasonably certain to occur. We have also

determined that certain consequences are not caused by the proposed action, such as the increase or spread of disease, poaching, or collecting, because they are so remote in time, or geographically remote, or separated by a lengthy causal chain, so as to make those consequence not reasonably certain to occur.

Effects of the Proposed Action on the Southwestern Pond Turtle

Firebreak Maintenance

The Space Force will maintain existing SLC-4 firebreaks and these activities could occur at any time of year. No southwestern pond turtle survey data or habitat assessment exists in the vicinity of SLC-4. Bear Creek is located approximately 0.15 mile from the nearest firebreak that appears to be associated with SLC-4. Bear Creek contains California red-legged frog breeding habitat, and we therefore anticipate suitable southwestern pond turtle breeding and overwintering habitat could be located in near vicinity. Southwestern pond turtle individuals could appear on firebreaks during maintenance activities and could be killed or injured. However, we anticipate most individuals, if any, within these areas would likely be overwintering underground at the time of vegetation clearance due to the timing of the proposed project which would reduce the likelihood of direct injury. In the unlikely event that southwestern pond turtle chose to overwinter or nest within firebreak clearance areas and are not identified, these individuals or nests could be crushed and destroyed. The existing firebreak areas would be unlikely to support nesting or overwintering habitat due to compact soils but assume that they could occur on the periphery of the road edge where vegetation maintenance may occur. We understand that the Space Force has not yet surveyed these areas and expects that suitable southwestern pond turtle breeding habitat, of marginal quality, may exist nearby in Bear Creek. To attempt to minimize potential effects, the Space Force will ensure that during any SLC-4 firebreak maintenance work conducted between October 1 and December 31, 2024, that a biologist will conduct clearance surveys and monitor these work activities (GM-2 and GM-8). If southwestern pond turtles are found during firebreak maintenance, the Space Force will require a Service Approved Biologist to relocate the species, limiting the duration of handling, requiring proper transport of individuals, and identifying suitable relocation sites (GM-8). The Space Force will also reduce any associated risk of spreading disease during capture and relocation activities by requiring implementation of DAPTF (GM-8). Using the available information, the Service consequently anticipates associated likelihood of effects would be low.

Launch Operations Effects on Base

Lighting

An increase in artificial night lighting associated with the proposed project increased operations could have adverse physiological and behavioral effects on southwestern pond turtle. An increase in artificial night lighting may also increase southwestern pond turtle predation rates if predators are able to better detect dispersing individuals. However, the Service does not

anticipate lighting effects to southwestern pond turtle, between October 1 and December 31, 2024, are likely to occur because the species should be overwintering underground or at the bottom of perennial ponds likely at a distance of over 1 mile from SLC-4. Therefore, for this consultation, the Service will not analyze effects of lighting from SLC-4 to southwestern pond turtles.

Flame Duct Use and associated vegetation maintenance

The proposed project includes up to 16 launches, 2 boost-backs, and 2 static test fires occurring from October 1 to December 31, 2024 from SLC-4. Each launch requires water release associated with the flame bucket with liquid water directed to the SLC-4 v-ditch feature and a minimum amount of water vapor directed towards Spring Creek. The maximum temperature of the water vapor would be 130 degrees Fahrenheit at the point it would reach Spring Canyon. Water vapor releases may cause injury or mortality of southwestern pond turtle through scalding individuals in the Spring Creek area if present within the vicinity. Associated Spring Canyon vegetation maintenance may also cause injury or mortality to southwestern pond turtles. Currently, the nearest known occupied feature with records of southwestern pond turtle is Honda Creek, 2 miles to the South of SLC-4. Marginally suitable but not known to be occupied habitat for southwestern pond turtles occurs in Bear Creek, located 0.75-mile northeast of SLC-4. As indicated in the Status of the Species above, southwestern pond turtle typically move no farther than 0.21 mile from seasonal ponds (Service 2023b, p. 27) with atypical dispersal distance 3.1 miles across terrestrial upland habitat (Holland 1994, p. 7-28). Consequently, although southwestern pond turtle has the capacity to disperse the distance required between currently known occupied habitat such as Honda Creek to Spring Canyon, dispersal movements of this distance are expected to be very uncommon. In addition, since 2017, the Space Force has performed 11 survey efforts within the Spring Canyon Vegetation Removal Area and found no suitable permanent aquatic habitat (MSRS 2022a p. 28). It is therefore unlikely that southwestern pond turtle currently occupy the existing Vegetation Removal Area or would move into these areas in the near future based on the characteristics of the drainage. The Space Force will further minimize potential effects by requiring biologists to conduct clearance surveys to ensure no unanticipated southwestern pond turtles are located in Spring Canyon (GM-8). If southwestern pond turtle is present during the clearance surveys, the Space Force will require relocation of any southwestern pond turtle encountered (GM-2). These avoidance measures should further reduce potential for unanticipated effects from flame duct use to southwestern pond turtle. Reviewing available information on dispersal movements in combination with minimization measures, associated effects are unlikely to occur.

Approximately 17,500 gallons of hot water (130 degrees Fahrenheit) is expelled from the flame duct during each individual launch and ultimately reaches the v-ditch feature located within the fenceline of SLC-4. The Space Force has indicated that this water is temporarily stored within the feature and dissipates rapidly (Kaisersatt, pers. comm., 2023e). The Service consequently assumes that water is no longer present within 24 hours of an individual launch. The temporarily stored water would not reach a depth level or hydroperiod that would support southwestern pond

turtle breeding. The Service understands that associated hydrophytic vegetation may be present and the Space Force would conduct feature maintenance on a regular basis (Kaisersatt, pers. comm., 2023e). The v-ditch feature could constitute suitable transitory southwestern pond turtle habitat as a result and individuals may be attracted to the feature in response to increased water presence associated with more frequent launching. Any southwestern pond turtle that is within the v-ditch during a launch event has the potential to be injured or result in mortality from scalding water. V-ditch maintenance, including sediment and vegetation removal, may also result in the injury or death of southwestern pond turtles if present.

Exposure to launch-related contaminants could injure or kill southwestern pond turtle. As detailed in the project description in the 2017 biological opinion, SpaceX has constructed a civil diversion structure and retention basin at SLC-4 to minimize the amount of water entering Spring Creek from water release activities. The Space Force will ensure that SpaceX will continue to avoid and minimize these effects by implementing measures described in the 2017 biological assessment (MSRS 2017) which include: (1) SpaceX will follow the site-specific Stormwater Pollution Prevention Plan already implemented for SLC-4; (2) SpaceX will implement the Best Management Practices within the latest California Stormwater Quality Association's Stormwater Best Management Practices Handbook; (3) SpaceX will collect any rocket propellant in the retention basin using absorbent pads prior to discharge to the spray field; and (4) SpaceX will fully implement the procedures in VSFB's Hazardous Materials Emergency Response Plan in the event of a hazardous materials spill. The civil diversion structure and collection of fuel with absorbent pads should reduce the potential for effects on southwestern pond turtle that may be dispersing through Spring Canyon provided the various plans and practices to control contaminants and sedimentation are effective.

The Space Force anticipates the proposed project's launches would produce a diminutive amount of soot byproduct. If soot or other similar launch related byproducts come into contact with southwestern pond turtle or enter adjacent occupied waterbodies, it has the potential to injure or kill individuals. Contaminants in general have been identified as a significant threat in freshwater ecosystems through indirect and direct toxicity to organisms (Service 2023b, p. 57). Toxicology studies have resulted in negative effects including immune system suppression, smaller eggs, reduced growth rates of hatchlings, endocrine disruption (altered sex determination), and other physiological and behavioral effects (ODFW 2015, p. 65). Southwestern pond turtle can be exposed to toxins in both their aquatic and terrestrial habitats. Being that they are long-lived, higher order predators, southwestern pond turtles are understood to be particularly susceptible to contaminants through bioaccumulation. Previous research has documented that bioaccumulated contaminants in female turtles can be off-loaded to eggs through the yolking process (Beale et al. 2022, entire). Appropriate avoidance would include prevention of all chemical byproduct into aquatic and terrestrial environments and sites known to be contaminated should be cleaned up according to applicable federal, state and local laws and policies (ODFW 2015, p. 65). However, the Space Force references a comparable launch assessment (FAA 2020, entire) and expects that the actual amount of soot produced would be diminutive being that it would subsequently burn up in the exhaust plume (Kaisersatt, pers. comm., 2022). Consequently, the proposed action

would not produce any discernable level of launch-related byproduct contamination and is unlikely to affect southwestern pond turtle or their habitat.

Capture and relocation of southwestern pond turtle in the area prior to individual launches may cause injury or death because of improper handling, containment, transport, or release into unsuitable habitat. There is the likelihood of disease transmission if an individual is introduced to a different population altogether including Pond Turtle Shell Disease (Lambert et al. 2021), or chytrid fungus, although there are no studies on freshwater turtles spreading chytrid. Although we do not have an estimated survivorship for translocated southwestern pond turtle, intraspecific competition, lack of familiarity with the location of potential breeding, feeding, and sheltering habitats, and increased risk of predation reduces survivorship of translocated wildlife in general. The Space Force will minimize effects by using Service Approved Biologists as proposed, limiting the duration of handling, requiring proper transport of individuals, and identifying suitable relocation sites (GM-8). The Space Force will also reduce any associated risk of spreading chytrid fungus during capture and relocation activities by requiring implementation of DAPTF (GM-8). The Service expects the relocation of individuals from vegetation management and water release areas to greatly reduce the overall level of injury and mortality, if any, which would otherwise occur. Having only experienced biologists engage in the activity would greatly reduce the potential for injury or mortality due to mishandling.

Water Extraction

At SLC-4, SpaceX would utilize an existing water-filled flame duct to reduce vibration impacts from noise on payloads. During Falcon 9 launches, approximately 70,000 gallons of water would be utilized per launch with approximately 40,000 gallons per landing. Using these estimates, for 16 launches and 2 terrestrial landings this would amount to 1.2 million gallons (3.68 ac-ft) to support personnel and operational activities at SLC-4 between October 1 and December 31, 2024.

The Space Force has recently clarified that the current water source for VSFB, including SLC-4, is via an existing connection between State Water and the VSFB water supply system. For the majority of the 91 days of the proposed project, the Space Force would source water from this connection. However, during annual maintenance that lasts approximately 2 weeks, VSFB utilizes four water wells in the San Antonio Creek Basin. The Service consequently assumes that across this period (14 days), up to 184,615 gallons (0.57 ac-ft) could be extracted from these wells in San Antonio Creek Basin.

Water withdrawal from the San Antonio Creek wells has the potential to reduce streamflow and water levels within San Antonio Creek. This could adversely affect all life stages of southwestern pond turtle downstream of Barka Slough by reducing associated wetland and riparian habitats supported by the existing groundwater level and extent of inundated area. However, referencing previous analysis (USGS 2019, p. 5) and associated discussion with hydrologists involved with the associated hydrological modeling (C. Faunt and G. Cromwell,

USGS, pers. comm. 2021), the proposed project's 0.57 acre-feet extraction amount would not be anticipated to result in measurable decline of streamflow or associated aquatic habitat.

Factors including future surrounding water usage (e.g., collective existing and future launch program needs, surrounding agriculture, etc.) as well as increased variability of annual precipitation due to climate change, including shorter wet seasons and longer dry periods, may influence true effects (Myers et al. 2017, p. 15, 59). An additional hydrological model incorporating various precipitation scenarios predicts that an extraction amount of 921 acre-feet would decrease inundated area between 0.14 and 10.14 percent (AECOM 2019, p. 6). Similarly, given that the maximum project-related water extraction amount is less than 1 percent of the 921 acre-feet used for the supplemental model analysis, it is reasonably foreseeable that it would not result in a discernable reduction of inundated area. Although potential impacts to associated riparian terrestrial habitat were not initially characterized, based on the best available information (AECOM 2019; USGS 2019), the Service does not anticipate measurable decline in the quality or overall extent of these associated habitats as a result of the project proposed extraction amount at this time. However, there has been a level of habitat change within Barka Slough driven by increasing groundwater withdrawals from the San Antonio Creek groundwater basin for agriculture on and off VSFB. Since the 1980's, withdrawals have exceeded the recharge rate for the basin (Public Works 2020 as referenced in MSRS 2022d, p. 5). Since the 1950's, ground water levels have dropped between 33 to over 98 feet (USGS 2019 as referenced in MSRS 2022d, p. 5). The VSFB is now connected to State Water as their primary water source for all base needs with the exception of an annual maintenance period where water would be sourced from San Antonio wells for a period of approximately 2 weeks. The Space Force did not provide estimates for anticipated basewide water extraction during this period. Without this information, the Service is unable to make clear quantifiable reference for how the proposed project would add to the existing baseline of water extraction. To ensure no unanticipated effects occur during the 3-month project window, the Space Force will reference a previously established pre-project baseline for hydrodynamic data within San Antonio Creek and monitor hydrodynamic data (GM-9). The Space Force will use this data to ensure that the proposed project's water extraction is not measurably affecting flow rate or water level within San Antonio Creek.

Climate change

Reptiles are sensitive to the projected effects of climate change. Being that reptiles are ectotherms, altered temperatures could impact critical physiological processes. Western pond turtle nest sites and embryo development are sensitive to temperature because the species exhibit temperature-dependent sex determination (Service 2023b, p. 59). There is also the potential that rising temperatures could increase the number of warm days for developing embryos, potentially enhancing reproductive success in the wild. In other species of reptiles, studies focusing on the active season predict a largely positive response to warming because increases in temperature can prolong the active season, but results from a meta-analysis of winter warming on reptile traits were less clear, with some positive but some negative effects (Moss and MacLeod 2022,

pp. 264-266). Benefits to reproduction may be outweighed by the cumulative negative impacts (e.g., isolation of populations, skewed sex ratios, loss of aquatic habitats, etc.) to individuals and their habitats (Service 2023b, p. 60). Following a review of recent research on rocket launch emissions on stratospheric ozone and global climate impacts (Ryan et al. 2022, entire), the Service anticipates that emissions produced by the proposed project has the potential to contribute to these projected effects. However, the Space Force did not provide any information or analysis regarding emissions produced by the proposed project. Until the Space Force is able to provide relevant information including project-specific emission analysis, the Service is unable to discuss associated effects further at this time.

Launch Noise and Overpressure

The Service anticipates that launch and static test fire events have the potential to create associated ground vibration within the vicinity of SLC-4. Any southwestern pond turtle that may be nesting or overwintering in areas near SLC-4 have the potential to be exposed to vibration. Southwestern pond turtle utilizes shallow nests (3.5 to 4.7 inches) and can dig into shallow leaf litter layer to overwinter meaning that associated vibration is unlikely to be attenuated by substrate. The Service assumes that potential launch-related vibration may be of low frequency which attenuates less readily than high frequency (Norton et al. 2011, p. 658). We cannot anticipate the level of substrate vibration that the proposed project may produce at this time but assume conservatively that low levels of vibration may occur routinely for a short period (from 7 seconds to up to 2 minutes on average every 5 days) during project operation in the area immediately surrounding SLC-4. We have no specific data on the response of nesting or overwintering southwestern pond turtle to varying levels or duration of exposure to launch operation vibration. We consequently use available research on the effects of vibration on related reptiles including the soft-shelled turtle (*Pelodiscus sinensis*) as a surrogate. In a laboratory study, soft-shelled turtle were exposed to vibration stress for 30 minutes at 2 hour intervals during the day for 28 days, at an average vibration level of 61.6 (+/-16.6) dB V and an average noise level of 73.6 (+/-4.8) dBA during day time (Hur and Lee 2010, p. 242). Exposure to long-term vibration produced significantly elevated stress hormone and glucose levels, which remained elevated for 28 days following cessation of stress. In addition, aspartate transferase (AST) and alanine transaminase (ALT), enzymes released in the blood when organs including the liver and spleen are damaged, were also significantly elevated following exposure (Hur and Lee 2010, p. 243). These findings are suggestive that routine launch-related vibration exposure may adversely affect southwestern pond turtle survival and population success, particularly following repeat vibration disturbance distress that occurs over time. The biological assessment did not provide vibration modeling for the purposes of this analysis to enable comparison to possible vibration exposure levels. Without this modeling, the Service cannot anticipate the specific vibration levels that the proposed project may produce but understands that in comparison to the referenced study, much shorter vibration duration and overall frequency of potential vibration events would occur within what we assume is only the immediate area surrounding SLC-4 from October 1 to December 31, 2024, during 16 launches, 2 boost-backs, and 2 static test fires. The effects observed in the study could occur at some level for

southwestern pond turtles from the proposed project. The Space Force has also previously indicated to the Service that vibration sources (SLC-4) would be located at a sufficient distance from nearby riparian habitat that may support breeding or overwintering to preclude any associated effects that would result from routine vibration. As discussed in the Status of the Species above, typical southwestern pond turtle movements from season ponds are 0.21 mile and although considered atypical, dispersal distance of 3.1 miles have been documented. Disturbances to species of turtles that are overwintering, or are in brumation, have increased chances of mortality (Palmer et al. 2019). Using the available information, project-related vibration effects are possible and may impact a presumed low level of southwestern pond turtle within the immediate area of SLC-4. However, updated survey information including an assessment of occupied and suitable habitat, realized vibration monitoring, and vibration modeling are all needed at this time to help the Service assess potential effects.

The proposed project's launch operations would produce noise and overpressure levels that may adversely affect southwestern pond turtle. We have limited information on hearing sensitivity and hearing loss (aerial, underground, or underwater) for reptiles in general. There are no specific studies on the effects of noise and overpressure disturbance on the southwestern pond turtle while they are overwintering underground or underwater, however past research has demonstrated that the species perceives and responses to relatively low levels of noise disturbance (Bury and Germano 2008, p. 001.5). Although hearing capabilities of turtles is relatively poorly understood, recent research demonstrates that noise pollution in aquatic environments can cause hearing loss in closely related surrogate species. Researchers have previously exposed red-eared slider (*Trachemys scripta elegans*) to noise conditions of differing durations and volumes. One study involved sound exposure levels (SELs) of low frequency white noise (50-1000 hz) ranging between 155 and 193 dB and duration between 5 to 30 minutes. No temporary hearing loss occurred at the lowest SEL (155 dB) tested. However, temporary hearing loss (known as temporary threshold shift, TTS), was observed at SEL of 161 dB and higher (Salas et al. 2023, pp. 1007, 1009). Red-eared sliders tested did show recovery to baseline auditory condition could occur relatively quickly (i.e. within 30 minutes), but in some instances took more than 2 days, depending on the exposure level and individual variability (Salas et al. 2023, p. 1014). It is important to consider that while the available study showed recovery from underwater TTS in the frequency tested, other reptiles have shown incomplete recovery from aerial exposed TTS with variable frequency (Salas et al. 2023, p. 1013). Hearing loss that results from anthropogenic noise has the potential to impact sound-mediated reptile behavior including acoustic communication to attract mates, parental care, and navigation (Salas et al. 2023, p. 1004). Although TTS thresholds are known to be different in-air and underwater, using the best available information, we do not currently anticipate that project activities would result in hearing loss considering no temporary hearing loss occurred at 155 dB referencing the aforementioned research on red-eared sliders. This level is slightly higher than the maximum expected to be produced by the proposed project. This being said, additional information is still needed to help understand the potential for auditory harm at realized noise levels.

Southwestern pond turtles have been documented across VSFB and within features within the near vicinity of SLC-4 including Honda Creek and the Santa Ynez River. Potential marginal suitable breeding habitat may exists within Bear Creek. Noise modeling projects Honda Creek would receive levels up to 123 dB SPL_{max} of engine noise during the 16 launches and up to 5.0 psf (approximately 140-150 dB SPL) during 2 boost-backs (USSF, unpublished data, 2024b). Bear Creek would receive noise levels up to 128 dB SPL_{max} of engine noise during launches and understood overpressure levels of up to 5.0 psf (approximately 140-150 dB SPL) during 2 boost-backs (USSF, unpublished data, 2024b). Available noise modeling projects that the Santa Ynez River would receive up to 118 dB SPL_{max} of engine noise during launches and overpressure of up to 4.0 psf during boost-backs. These features are recognized to be the most proximate to SLC-4 and would experience the highest magnitude of noise and overpressure disturbance. Multiple other features which are known or thought to potentially support southwestern pond turtle, including Canada del Jolloru, Jalama Creek, San Antonio Creek, and Shuman Creek, are also all within the Launch Noise Effect Area with most also in the Overpressure Effect Area. These additional features would also experience routine levels of noise and overpressure disturbance at slightly lower levels. Any southwestern pond turtles present in upland dispersal habitat directly adjacent to SLC-4 may experience modeled noise levels of 150 dB SPL_{max} and overpressure of up to 9.5 psf. To summarize, southwestern pond turtles throughout the Launch Noise Effect Area would experience routine noise levels between 100 to 150 dB SPL_{max} (from 7 seconds to up to 2 minutes on average every 5 days between October 1 to December 31, 2024). Within the Overpressure Effect Area, southwestern pond turtle populations would also experience overpressure levels between 0.5 to 9.5 psf a total of two times between this same period. Although the specific acoustic thresholds of southwestern pond turtle are unknown, the Service anticipates that the species may perceive and behaviorally respond to launch noise. Southwestern pond turtle is considered to be extremely wary of noise and vibration disturbance and will rapidly flee from basking sites into the water when disturbed by minimal sound (e.g. people at distances of greater than 328 ft) (Bury and Germano 2008, p. 001.5). Analysis of disturbance types showed that southwestern pond turtle showed similar response to motor vehicle disturbance (Nyhof 2013, p. 53), which consist of low frequency noise anticipated to be similar to that produced during rocket launches. If southwestern pond turtles are disturbed frequently during their brumation, hormonal regulation and physiological processes may be disrupted. The Service considers undisturbed overwintering to be important to southwestern pond turtle's life cycle as it enables hormone regulation, which is tied to growth, metabolism, and reproduction. Since southwestern pond turtles are a long-lived species, there is a need for long-term monitoring to understand effects across different life events for southwestern pond turtle (e.g., locomotion, changes to habitat use, and chronic stress) to inform best management practices. However, given difficulties associated with detecting southwestern pond turtle to effectively monitor for potential effects for the duration of this consultation (three months), the Space Force will create a monitoring program to track southwestern pond turtle habitat occupancy and assess whether changes in the acoustic environment are impacting the distribution and population size of southwestern pond turtles over time (SWPT-2).

A small amount of literature exists on the impacts of anthropogenic noise on reptiles. It is unknown whether southwestern pond turtle would exhibit a stress response to the routine noise or overpressure disturbance associated with the proposed project. However, the Service considers that it is conservatively reasonable to expect they may exhibit a stress response considering that southwestern pond turtle is sensitive to sounds of humans at distances of greater than 300 feet, have been documented to preferentially select habitat that is located away from human disturbance, and exhibit decreased basking in areas with higher rates of vehicle disturbance (Service 2023b, p. 45). In the event that southwestern pond turtle exhibits a stress response to the proposed project's frequent exposure to high levels of noise and overpressure disturbance, this could cause routinely elevated levels of stress hormone over the project duration. Prolonged elevated stress hormone concentrations can have deleterious effects on species' growth, survival, reproduction, and immune function (Sapolsky et al. 2000; Tennessen et al. 2014; Rodgers 2020). The U.S. Army conducted a study on the response of Colorado checkered whiptail (*Aspidoscelis neotesselatus*) when exposed to intermittent noise disturbance from aircraft flyover noise. When exposed to a week of intermittent flyover noise up to 112.22 dB in comparison to a control week of no noise disturbance, the Colorado checkered whiptail was found to modify its behaviors by spending less time moving and more time eating, and also exhibited higher levels of corticosterone and ketone bodies (markers of stress) (Kepas et al. 2023). However, no specific thresholds of disturbance level or frequency are known. The Service considers that although the project may result in effects to southwestern pond turtle's stress hormone accumulation and associated behavior, deleterious physiological effects, and overall habitat degradation, until the novel effects of the project activity are studied, we are unable to adequately anticipate the magnitude of any specific response at this time.

In combination with the existing launch baseline on VSFB, the proposed project may contribute to potential long-term effects from chronic stress caused by routine acute launch disturbance across launch programs. Although the proposed project would only occur between October 1 and December 31, 2024, it may contribute to a degree to potential collective effects. Collective effects may include long-term population level effects including reduced reproductive success, survival, fitness, and spatial displacement. Although we do not have an estimated survivorship of displaced southwestern pond turtle, this could result in injury or death to individuals as a result of increased intraspecific competition, lack of familiarity with new locations of potential breeding, feeding, and sheltering habitats, and increased risk of predation. However, it is unknown how southwestern pond turtle would react to repetitive launch events of variable disturbance levels with increasing frequency. Improved monitoring information is needed to help identify thresholds that quantify what level of noise or frequency of disturbance would elicit stress hormone responses that may lead to negative population level impacts. Consequently, the Service cannot adequately determine the magnitude of potential collective effects with the addition of the proposed project on the southwestern pond turtle populations within the vicinity of VSFB at this time.

Potential mitigation and herbicide usage

Following review of the effects of the proposed action, the Service anticipates the proposed project could result in the temporary degradation in the quality of adjacent southwestern pond turtle overwintering habitat in the vicinity of VSFB due to associated noise and overpressure disturbance from routine launching. The proposed project also may contribute to potential population level collective effects that may occur over time. The potential mitigation actions for southwestern pond turtle include the creation of new breeding habitat at a 2:1 ratio (habitat enhanced: habitat affected) within the San Antonio Creek Oxbow Restoration 'expansion area' (Appendix A, Figure 4A). Mitigation actions that may occur as result of the project include site preparation via herbicide application, plowing, container plant installation, seeding, willow pole planting, and watering via water truck. These activities have the potential to affect southwestern pond turtle and could injure or kill individuals within these areas. The Service was not provided a list of potential herbicide products that may be used during restoration activities. Certain herbicides, have the potential to cause lethal or sub-lethal toxicity to all life stages of southwestern pond turtle if an exposure pathway exists. Southwestern pond turtle could be exposed to herbicides and surfactants in aquatic and dispersal habitats associated with restoration areas or contaminated runoff from treated areas. A commonly used product in riparian restoration is glyphosate which often is combined with a polyethoxylated tallowamine (POEA) surfactant. Using amphibians as an available surrogate, glyphosate products containing POEA surfactants have been shown to have both lethal and sub-lethal effects to amphibians including decreased size, increased time to metamorphosis, tail malformations, and gonadal abnormalities (Howe et al. 2004, pp. 1930-1933; Govindarajulu 2008, pp 3-8). Glyphosate and POEA readily bind to soil and sediments (Tush and Meyer 2016, p. 5784), and these chemicals may be less available to southwestern pond turtle in terrestrial habitats. Adverse effects to southwestern pond turtle from the use of herbicides can be minimized through proper application methods that reduce potential exposure pathways and other best management practices. Herbicide products that do not contain a surfactant or use a low-toxicity, non-POEA surfactant would also minimize effects (Howe et al. 2004, p. 1937; Govindarajulu 2008, p. 31). Without the ability to assess individual herbicides, application methods, or the potential restoration areas that may be utilized, the Service assumes herbicide usage within future southwestern pond turtle restoration areas may create potential for injury or mortality of southwestern pond turtle if present.

The proposed mitigation acreage within the Oxbow restoration area currently constitutes approximately 7 acres in total and is located entirely within the proposed project's launch noise effect area (Appendix A, Figure 1A and 4A). Consequently, in the event launch noise is found to impact southwestern pond turtle abundance and distribution across any of the individual major riparian features, the proposed mitigation strategy may not serve to offset the observed effects effectively and quantifiably. However, the Service considers the Space Force's commitment to ensure that objectives of the proposed mitigation are met and demonstrate clearly and quantifiably that no net loss in occupied southwestern pond turtle habitat and population size has occurred. In accordance with the Service's compensatory mitigation policy (88 FR 31000; Service 2023c), the Space Force will develop restoration methods to ensure the objectives of the

proposed mitigation (2:1 acreage offset) are met. These actions will be taken following mutual agreement by the Service and the Space Force to demonstrate they have achieved this goal to be consistent with this analysis.

Launch Operations Effects Off-Base (Mainland CA – eastern Santa Barbara, Ventura, and northern Los Angeles Counties)

Launch Noise and Overpressure

Southwestern pond turtles occupy the habitat within the Noise Effect and Overpressure Effect Areas off-base across Santa Barbara, Ventura, and Los Angeles counties. The southwestern pond turtle in these areas may infrequently experience 10 sonic booms, each separated by an average of 5 days, all of which we expect to reasonably be under 1.0 psf between October 1 and December 31, 2024. During the time of this project, southwestern pond turtles are expected be underwater or underground overwintering. When terrestrially overwintering, southwestern pond turtles may be shallowly underground or within leaf litter and may be exposed to launch noise and overpressure. When overwintering underwater, southwestern pond turtles may be in the shallow water, and may experience noise differently compared to being deep underwater. The extent of effects of noise and vibrations caused by sonic booms to southwestern pond turtles in brumation underground and underwater are unknown at this time. We expect general effects from sonic boom noise to be similar to those discussed above. However, based on the provided modeling information for the proposed project, any potential effects are unlikely to manifest and would be overall negligible considering the associated sonic boom level magnitude is understood to be far lower, of very short duration, likely comparable to ambient existing noise levels, and would occur relatively infrequently between October 1 to December 31, 2024. Continued monitoring of realized sonic boom and associated noise levels is necessary to ensure these assumptions are correct.

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

Firebreak Maintenance

Effects related to SLC-4 firebreak maintenance activities for California red-legged frog are included in the existing Service PBO (8-8-12-F-49R) and all applicable avoidance, minimization, and monitoring measures required under the PBO would be implemented.

Launch Operations Effects on Base

Operational Lighting

The proposed project has the potential to generate effects associated with increased artificial lighting at night. The Service requested that the Space Force provide specific lighting levels that

are currently being produced at SLC-4 during existing launch operations. This information has not yet been provided. In 2023, the vast majority of existing launches were conducted at night. The Service reviewed available historical light pollution satellite data (Visible Infrared Imaging Radiometer Suite (VIIRS) dataset 2017-2023; NASA 2024) and video footage from night launches of similar vehicles that demonstrate the potential magnitude of acute lighting levels generated from associated rocket flare. Following a review of this best available information, the proposed project has the potential to increase exposure to artificial light pollution in the vicinity of SLC-4.

No new lighting infrastructure would be added to SLC-4 as a result of the proposed project. However, increased operational usage of the existing SLC-4 facility to support up to 16 launches and 2 landings between October 1 to December 31, 2024, would reasonably increase average illumination of the site, particularly if launches operations continue to be scheduled at night. The Service reviewed the existing light pollution dataset (VIIRS) which demonstrates a significant increase in the lighting levels surrounding the vicinity of SLC-4 occurred between 2020 and 2023, potentially as a result of the large increase in past night operations to support 28 SpaceX launches in 2023. No previous design considerations were taken into the development of SLC-4 to help reduce novel associated light pollution. SLC-4 is located within 1 mile from Bear Creek and 2 miles from Honda Creek, with both features supporting California red-legged frog occupation and breeding. VIIRS data indicates that current SLC-4 operational lighting may be routinely illuminating associated California red-legged frog riparian and upland dispersal habitat as a result of associated sky-glow. Sky-glow is an increase in the apparent brightness of the night sky as a result of artificial lighting, often enhanced by clouds or fog. The Service understands that each night launch also has the potential to generate short term (approximately 1 to 3 minutes depending on if a terrestrial boost-back is involved) of higher levels of artificial night lighting as a result of associated rocket flare. Consequently, reviewing the available information for the purposes of this analysis, the proposed project is likely to increase the average number of nights that California red-legged frog habitat within Bear Creek, Honda Creek, and adjacent SLC-4 upland habitat may be illuminated by assumed low levels of site operation lighting and higher levels of acute rocket flare.

An increase in artificial night lighting associated with the proposed project could have adverse physiological and behavioral effects on California red-legged frogs. Although we have no specific data on the response of California red-legged frogs to artificial night lighting exposure, laboratory and field studies of related anurans indicate artificial lighting can result in changes in hormone production and growth, as well as altered activity levels including increased movement and foraging (Baker and Richardson 2006; Wise 2007; Hall 2016; May et al. 2019). An increase in artificial night lighting may also increase anuran predation rates if predators are able to better detect dispersing adult frogs that may move more in newly lit environments.

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

25). The number of insects attracted to a lamp is disproportionally affected by the emission of ultraviolet light, regardless of the proportion of ultraviolet radiation emitted (Barghini and Augusto Souze de Medeiros 2012, entire; B. Seymoure, pers. comm., 2023), indicating that even 'low-UV' lighting options attract insects. Permanent ultraviolet lighting adjacent to roadways or parking areas associated with SLC-4 launch facility may result in higher likelihood of vehicle strikes if California red-legged frogs increase foraging in these areas in combination with increased worker and vehicle presence. Launch operations may physically injure or kill California red-legged frog individuals if lighting surrounding the launch pad attracts them and they come within close vicinity of features including parking lots or the flame bucket. Considering the existing VIIRS data and being that SLC-4 is within the near vicinity to Honda Creek and Bear Creek, both of which are known to contain a moderately sized population of California red-legged frogs and breeding habitat, the Service reasonably anticipates that increased artificial lighting associated with the proposed project's further increase in launching has the potential to result in the temporary degradation of both associated California red-legged frog riparian and upland habitat. To attempt to minimize these effects, the Space Force will require development of a lighting plan for the proposed project (GM-10). This plan will require that the project proponent retrofit the existing facility's lighting with the intention to reduce scatter into natural, undeveloped areas to the maximum degree possible. This requirement will be accomplished through strategic placement of lights, and the use of shields, timers, and motion sensors to the maximum extent possible to minimize potential effects associated with novel persistent artificial light at night. The Service consequently expects that this lighting retrofit will help minimize anticipated associated effects to increased exposure to artificial light at night as a result of the proposed project.

Flame Duct Use and Vegetation Clearance

Each of the proposed 16 launches requires water release associated with the flame bucket with liquid water directed to the SLC-4 v-ditch feature and a minimum amount of water vapor directed towards Spring Creek. The maximum temperature of the water vapor would be 130 degrees Fahrenheit at the point it would reach Spring Canyon. Launches conducted between October 1 and December 31, 2024, and their associated water vapor releases may cause higher potential for injury or mortality of California red-legged frogs through scalding individuals in the Spring Creek area. The wet season would magnify these effects when California red-legged frogs are more active and are more likely to be present in Spring Canyon. However, between 2017-2022, the Space Force has performed 11 survey efforts within the Spring Canyon Vegetation Removal Area and found no suitable breeding habitat or California red-legged frog individuals (MSRS 2022a p. 28). It is therefore unlikely that California red-legged frog occupy the Vegetation Removal Area (or adjacent SLC-4 existing firebreaks) on a regular basis, other than for transitory upland habitat. SpaceX would minimize potential impacts by implementing minimization measures. Previous monitoring requirements included within the 2017 biological assessment included that a Qualified Biologist would conduct pre-activity surveys for California red-legged frog in the water release area following each launch (MSRS 2017, p. 14). Given the previous negative survey findings that followed 11 individual launches, the Space Force will

now require a Qualified Biologist to perform one California red-legged frog survey annually during peak breeding season (November to May) in Spring Canyon when individuals are most likely to be present and detectable. If the Qualified Biologist does not encounter California red-legged frog at the time of this survey, the Space Force will not require any other subsequent pre-/post-launch surveys. If California red-legged frogs are present during the annual survey, the Space Force will require pre- and post-launch surveys and relocation of any California red-legged frog encountered for each subsequent launch event (CRLF-4). These avoidance measures should reduce the potential for California red-legged frog death or injury; however, biologists may not detect some individuals during pre-activity surveys resulting in California red-legged frog death or injury. We expect such effects would occur infrequently if ever.

Capture and relocation of California red-legged frogs in the area prior to individual launches may cause injury or death as a result of improper handling, containment, transport, or release into unsuitable habitat. Although we do not have an estimated survivorship for translocated California red-legged frogs, intraspecific competition, lack of familiarity with the location of potential breeding, feeding, and sheltering habitats, and increased risk of predation reduces survivorship of translocated wildlife in general. The Space Force will minimize effects by using Qualified Biologists as proposed, limiting the duration of handling, requiring proper transport of individuals, and identifying suitable relocation sites (GM-2). The Service expects the relocation of individuals from vegetation management and water release areas to greatly reduce the overall level of injury and mortality, if any, which would otherwise occur. Having only experienced biologists engage in the activity would greatly reduce the potential for injury or mortality due to mishandling.

SpaceX has constructed a civil diversion structure and retention basin to minimize the amount of water entering Spring Creek from water release activities. SpaceX will continue to avoid and minimize these effects by implementing measures described in the 2017 biological assessment (MSRS 2017) which include: (1) SpaceX will follow the site-specific Stormwater Pollution Prevention Plan already implemented for SLC-4; (2) SpaceX will implement the Best Management Practices within the latest California Stormwater Quality Association's Stormwater Best Management Practices Handbook; (3) SpaceX will collect any rocket propellant in the retention basin using absorbent pads prior to discharge to the spray field; and (4) SpaceX will fully implement the procedures in VSFB’s Hazardous Materials Emergency Response Plan in the event of a hazardous materials spill. The civil diversion structure and collection of fuel with absorbent pads should reduce the potential for effects to California red-legged frogs. Provided the various plans and practices to control contaminants and sedimentation are effective, these measures should also reduce the potential for such impacts on California red-legged frog habitat.

Approximately 17,500 gallons of hot water (130 degrees Fahrenheit) is expelled from the flame duct during each individual launch and ultimately reaches the v-ditch feature located within the fenceline of SLC-4. The Space Force has indicated that this water is temporarily stored within the feature and dissipates rapidly (Kaisersatt, pers. comm., 2023e). The Space Force will maintain SLC-4 features to be free of standing water to the maximum extent possible between

launches to minimize the potential to attract California red-legged frog to the area (CRLF-1). The Service consequently understands that water would not present within 24 hours of an individual launch and that the temporarily stored water would not reach a depth level or hydroperiod that would support California red-legged frog breeding. Associated hydrophytic vegetation may be present and the Space Force would conduct feature maintenance on a regular basis (Kaisersatt, pers. comm., 2023e) that may occur between October 1 and December 31, 2024. The v-ditch feature may consequently constitute suitable transitory California red-legged frog habitat as a result and individuals may be attracted to the feature in response to increased water presence associated with the proposed project. Consequently, the Service assumes that any California red-legged frogs that come in contact with the v-ditch have the potential to be injured or result in mortality from associated contact with scalding water. The Service also assumes that v-ditch maintenance including sediment and vegetation removal may also result in the injury or death of adult California red-legged frogs if present.

The Space Force anticipates the proposed project's launches would produce a diminutive amount of soot byproduct. If soot or other similar launch related byproducts contact dispersing California red-legged frogs or enter adjacent occupied waterbodies, the Service assumes it has the potential to injure or kill California red-legged frogs due to their highly permeable skin and susceptibly to waterborne pollutants (Jung 1996, p. i; Llewelyn et al. 2019, p. 1). However, the Space Force references a comparable launch assessment (FAA 2020, entire) and expects that the actual amount of soot produced would be diminutive being that it would subsequently burn up in the exhaust plume (Kaisersatt, pers. comm., 2022). Consequently, the Service assumes that the proposed project's launch byproducts are unlikely to impact dispersing California red-legged frog or their aquatic habitats.

Water Extraction

At SLC-4, SpaceX would utilize an existing water-filled flame duct to reduce vibration impacts from noise on payloads. During Falcon 9 launches, approximately 70,000 gallons of water would be utilized per launch with approximately 40,000 gallons per landing. Using these estimates, the Service understands for 16 launches and 2 terrestrial landing this would amount to 1.2 million gallons (3.68 ac-ft) between October 1 and December 31, 2024, to support personnel and operational activities at SLC-4.

The Space Force has recently clarified that the current water source for VSFB, including SLC-4, is via an existing connection between State Water and the VSFB water supply system. For the majority of the 91 days of the proposed project, the Space Force would source water from this connection. However, during annual maintenance that lasts approximately two weeks, VSFB utilizes four water wells in the San Antonio Creek Basin. The Service consequently assumes that across this period (14 days), up to 184,615 gallons (0.57 ac-ft) could be extracted from these wells in San Antonio Creek Basin.

Water withdrawal from the San Antonio Creek wells has the potential to reduce streamflow and water levels within San Antonio Creek. This could adversely affect all life stages of California red-legged frog downstream of Barka Slough by reducing associated wetland and riparian habitats supported by the existing groundwater level and extent of inundated area. However, referencing previous analysis (USGS 2019, p. 5) and associated discussion with hydrologists involved with the associated hydrological modeling (C. Faunt and G. Cromwell, USGS, pers. comm. 2021), the proposed project's 0.57 acre-feet extraction amount would not be anticipated to result in measurable decline of streamflow or associated aquatic habitat.

Factors including future surrounding water usage (e.g., collective existing and future launch program needs, surrounding agriculture, etc.) as well as increased variability of annual precipitation due to climate change, including shorter wet seasons and longer dry periods, may influence true effects (Myers et al. 2017, p. 15, 59). An additional hydrological model incorporating various precipitation scenarios predicts that an extraction amount of 921 acre-feet would decrease inundated area between 0.14 and 10.14 percent (AECOM 2019, p. 6). Similarly, given that the maximum project related water extraction amount is less than 1 percent of the 921-acre feet used for the supplemental model analysis, it is not reasonably foreseeable that it would result in a discernable reduction of inundated area. Although potential impacts to associated riparian terrestrial habitat were not initially characterized, based on the best available information (AECOM 2019; USGS 2019), the Service does not anticipate measurable decline in the quality or overall extent of these associated habitats as a result of the project proposed extraction amount at this time. There has been a level of habitat change within Barka Slough driven by increasing groundwater withdrawals from the San Antonio Creek groundwater basin for agriculture on and off VSFB. Since the 1980's, withdrawals have exceeded the recharge rate for the basin (Public Works 2020 as referenced in MSRS 2022d, p. 5). Since the 1950's, ground water levels have dropped between 33 to over 98 feet (USGS 2019 as referenced in MSRS 2022d, p. 5). The Service also understands that there are additional launch programs currently permitted that represent the existing water extraction baseline. However, the Space Force did not provide the total permitted annual extraction amounts. Without this information, the Service is unable to make clear quantifiable reference for how the proposed project would add to the existing baseline of water extraction. Consequently, additional monitoring and analysis would be necessary to understand the impacts of the proposed project's extraction levels in the event the existing baseline continues to overdraft over time. To ensure no unanticipated effects occur during the 3-month project window, the Space Force will reference a previously established pre-project baseline for hydrodynamic data within San Antonio Creek and monitor hydrodynamic data (GM-9). The Space Force will use this data to ensure that the proposed project's water extraction is not measurably affecting flow rate or water level within San Antonio Creek.

Climate

Amphibians are vulnerable to the projected effects of climate change with leading threat factors including habitat loss, disease, and invasive species (Olson and Saenz 2013, entire). Amphibian species with narrow tolerances for temperature and moisture regimes may be at heightened risk.

Following a review of recent research on rocket launch emissions on stratospheric ozone and global climate impacts (Ryan et al. 2022, entire), the Service anticipates that emissions produced by the proposed project has the potential to contribute to these projected effects. However, the Space Force did not provide any information or analysis regarding emissions produced by the proposed project. Until the Space Force is able to provide relevant information including project specific emission analysis, the Service is unable to discuss associated effects further at this time.

Launch Vibration, Noise, and Overpressure

The Service anticipates that the proposed project's 16 launches, 2 landings, and 2 static test fire events have the potential to create associated ground vibration within the vicinity of SLC-4. We cannot anticipate the level of substrate vibration that the proposed project may produce at this time but assume conservatively that low levels of vibration may occur routinely for a short period (from 7 seconds to up to 2 minutes every 5 days) during the operation of SLC-4. The Service assumes that potential launch related vibration may be of low frequency which attenuates less readily than high frequency (Norton et al. 2011, p. 658). We have no specific data on the response of California red-legged frogs to varying levels or duration of exposure to launch operation vibration. We consequently use available research on the effects of vibration on related anurans (frogs) as a surrogate. In a laboratory study, researchers investigated the effects of low frequency vibrations on early embryonic development of African clawed frog (*Xenopus laevis*). The study demonstrated that vibrating embryos in petri dishes overnight during the embryo development process at three low frequency levels (7, 15, and 100 hertz) induced significant levels of physiological effects (heterotaxia defined by the abnormal position of the heart, gall bladder, and/or gut loop), with some treatments inducing neural tube defects as well as bent tail morphology (Vandenberg et al. 2012, pp. 3-5). Other research has demonstrated negative effects of anthropogenic vibration on anuran communication. Researchers carried out field based vibratory playbacks during 13 days from sunset until dawn when male common midwife toads (*Alytes obstetricans*) were calling. During vibratory playback stimuli, call rate of the common midwife toad significantly decreased with a smaller number of toads ceasing calling activity completely or abandoning their calling sites (Caorsi et al. 2019, p. 2). These findings suggest that if launch related vibration occurs during the breeding season, routine exposure to low frequency vibration may adversely affect California red-legged frogs and has the potential to negatively impact breeding success during launch operations. Launch operations on SLC-4 would occur within approximately 1 mile of California red-legged frog breeding habitat within Bear Creek and 2 miles from Honda Creek. The biological assessment did not provide vibration modeling for the purposes of this assessment. The Service cannot anticipate the specific vibration levels that the proposed project may produce. Although more information is needed to predict the magnitude of potential effects, the Service currently assumes that the proposed project would generate short term, infrequent vibration and the project site is located a sufficient distance from California red-legged frog breeding habitat to preclude any associated effects that would result from routine vibration.

The proposed project's launch operations would produce noise and overpressure levels that may adversely affect California red-legged frogs between October 1 and December 31, 2024. There are no studies on the effects of noise and overpressure on California red-legged frogs, but available literature on the effects of noise disturbance on anurans in general has grown in recent years (Zaffaroni-Caorsi et al. 2022, entire). A previous study reviewed the effects of noise exposure on bullfrogs, which are closely related to California red-legged frogs. Although no specific acoustic thresholds were determined during the study, researchers exposed American bullfrogs to sound levels greater than 150 dB SPL for 20 to 24 hours straight, which produced observable damage to their inner ears (Simmons et al. 2014a, p. 1629). Bullfrogs' inner ears showed physical signs of recovery between 3 to 9 days after noise exposure (Simmons et al. 2014b). A moderate population of breeding California red-legged frogs are known to occur approximately 1 mile north of SLC-4 within Bear Creek and 2 miles south within Honda Creek. California red-legged frogs would receive noise and overpressure levels of up to 128 dB SPL_{max} and 5.0 psf at Bear Creek with 123 dB SPL_{max} and 5.0 psf at Honda Creek (Appendix A, Figures 1B and 2C; MSRS 2022a, MSRS 2024a, p. 104). Any California red-legged frogs present in upland habitat in the immediate vicinity of SLC-4 may experience modeled noise levels of 150 dB SPL_{max} with overpressure up to 9.5 psf. Multiple additional known populations of California red-legged frog within major riparian features (e.g. Santa Ynez River, San Antonio Creek, Shuman Creek, and Canada de Jolla, and Jalama Creek) occur over 4 miles from SLC-4 and would receive noise and overpressure disturbance of reduced levels. In summary, California red-legged frog within the vicinity of VSFB would experience noise levels between 100 to 150 SPL_{max} between 1 to 2 minutes on average once every 5 days during up to 16 full launches. They would experience simultaneous boost-back overpressure levels between 0.5 to 9.5 psf a total of two times during this same period. Populations would also receive levels of 100 to roughly 125 dB SPL_{max} (Appendix A, Figure 1B; MSRS 2022a, p. 53) during 2 separate static test fires for 7 seconds within this five-day period. Although the proposed project's maximum noise levels are only slightly lower than those documented to produce observable damage to bullfrog ears, the duration of the noise events would be much shorter than the exposure duration used in this study. However, the specific acoustic thresholds of California red-legged frog are unknown. If the proposed project's noise levels did result in hearing damage to California red-legged frogs, it may temporarily deafen them. The Service assumes the California red-legged frog inner ear recovery period may be similar to the 3- to 9-day recovery period exhibited by bullfrogs. If the proposed project's noise levels physically damage the inner ears of California red-legged frog and given that the project's noise events would occur on average every 5 days, this may lead to routine deafening. Routine deafening of a substantial portion of breeding populations within the most proximate features including Bear Creek and Honda Creek may alter California red-legged frogs' ability to effectively communicate across the breeding season when frogs are calling with the potential to result in overall lower likelihood of reproductive success. California red-legged frogs that exhibit hearing loss may have a decreased ability to detect danger which increases their risk of predation. However, without refined specific acoustic threshold information, the Service is unable to determine if the proposed project will result in routine deafening of the specified California red-legged frog populations. The Service considers that although specific acoustic thresholds are not available, the bullfrog surrogate study used higher noise levels

(greater than 150 dB SPL) with significantly longer exposure duration (20 to 24 hours). The same study reported that shorter duration (4 hours) of levels below 150 dB SPL did not produce observable morphological damage (Simmons et al. 2014b). Using this available information, the Service does not currently anticipate that project activities would result in hearing loss. This being said, additional information is needed to help understand the potential for auditory harm at realized noise levels.

Being that observed call rate changes could be correlated with hearing loss, the Service has reviewed the Space Force's previous short-term California red-legged frog call rate monitoring conducted following a single Falcon 9 launch event (MSRS 2022b, entire; MSRS 2023, pp. 12, 15-16). Although monitoring documented notable increases in call rate following an individual launch, data was collected over an insufficient time period (6 days) to be able to analyze results in a meaningful manner. To address the need for better information and the potential for effects, the Space Force will implement long-term, passive bioacoustic monitoring during the California red-legged frog breeding season to characterize the baseline noise environment and determine if there are changes to call rate that may indicate inner ear damage (CRLF-7). This additional monitoring will help detect changes in calling behavior to ensure consistency with this analysis.

In addition to call rate, changes in other signal characteristics including amplitude, frequency, duration, and complexity may be impacted with the introduction of novel noise disturbance. Changes (increases or decreases) to an individual's signal characteristics may represent energetic and vocal performance trade-offs. Receiver interpretation of altered signals may influence assessment of signaler quality. This could impact the fitness of anuran populations over the duration of the proposed project (three months during the 2024 breeding season). Anurans rely heavily on acoustic signals to attract females and to defend resources against rivals. Previous research looking at traffic noise has demonstrated a trade-off between call rate and call duration in *Hyla versicolor* (Schwartz et al. 2002). Females were found to prefer calls that were delivered at high rates with longer durations (Gerhardt et al. 1996; Gerhardt and Brooks 2009), suggesting that environmental factors that influence the tradeoff of call rate and call duration could influence overall fitness. Multiple related frog species have been shown to alter call amplitudes during motorbike noise exposure (Cunnington and Fahrig 2010). The energetic costs of calling increases exponentially with call amplitude with an approximate doubling in energetic cost for each 3 dB increase in amplitude (Parris 2002). Previous work suggests that increased energetic costs of calling may inhibit growth rate as a result of allocating more energy towards call effort (Given 1988). This may result in lower reproductive output (Gibbons and McCarthy 1986) and increased risk of desiccation (Heatwole et al. 1969 as referenced in Yi and Sheridan 2019) both of which can lead to decreases in population size. Potential changes in signal frequency could also reduce transmission distance and overall reduce signal efficiency. In bird species, adjustments in signal frequency can decrease song complexity which can profoundly affect reproductive success (Montague et al. 2013). Preliminary monitoring of California red-legged frog during high launch years (e.g. 2023 and early 2024) has not shown immediate declines in breeding populations in Honda Creek and Bear Creek (MSRS 2024a, p. 110). However, confounding factors, including the notable rehydration of breeding habitat on VSFB during the

2023-2024 rain year after consecutive years of extreme drought between 2012 and 2022 (Palmer Drought Severity Index; NOAA 2024a) may reasonably be influencing current population numbers. This would mean potential associated effects may not be detected over the short-term without proper statistical analysis. Although more information is needed regarding how rocket noise disturbance may impact California red-legged frog signaling performance and overall fitness, using the best available information, the proposed routine noise disturbance over the duration of the proposed project (three months) has the potential to impact the breeding success of California red-legged frog during the 2024 breeding season. We currently anticipate observable impacts during the three-month project duration would be to an overall limited degree.

Similarly, launch noise and overpressure associated with sonic booms may impact all California red-legged frogs in the action area by altering their physical behavior. California red-legged frogs may react to individual project related launch noise and overpressure created by sonic booms by startling or remaining immobile making them more susceptible to predation or desiccation. They may also react to launch related disturbances by diving into water or retreating away from the affected areas. Overpressure disturbance would occur infrequently (twice) during the three-month period and be separated by at least five days. However, the proposed project's boost-back overpressure disturbance in combination with routine launch ascent noise disturbance and separate static test fires would subject local California red-legged frog populations to novel disturbance frequency. Acute disturbance on average every five days across the three-month period of the proposed project has the potential to induce novel effects as a result of repetitive (chronic) stress.

In certain frog species, acute stress has been shown to induce an immediate increase in stress hormone (corticosterone) production (Hammond et al. 2018). Chronic stress, such as frequent exposure to noise and overpressure disturbance, can cause chronically high levels of stress hormone (Troïanowski et al. 2017). Prolonged elevated stress hormone concentrations can have deleterious effects on growth, survival, reproduction, and immune function (Sapolsky et al. 2000; Tennessen et al. 2014). Relatively recent research demonstrates that increases in advertisement calling rate may be correlated with stress hormone production, which can result in an overall tradeoff in energy otherwise allocated for immunocompetence (Troïanowski et al. 2017; Park and Do 2022). Research has documented cases of anuran spatial displacement in response to traffic noise playback experiments (Caorsi et al. 2017, pp. 9, 14), with different movement effects depending on land cover type (Nakano et al. 2018, entire). Somewhat conversely, it has been suggested that noise can trigger tonic immobility, a paralysis-like fear response, in anurans as a result of increased stress levels (Tennessen et al. 2014, p. 6) which may make them more vulnerable to predation. The U.S. Army conducted a study on the response of Colorado checkered whiptail when exposed to intermittent noise disturbance from aircraft flyover noise. When exposed to a week of intermittent flyover noise up to 112.22 dB in comparison to a control week of no noise disturbance, the Colorado checkered whiptail was found to modify its behaviors by spending less time moving and more time eating, and also exhibited higher levels of corticosterone and ketone bodies (markers of stress) (Kepas et al. 2023). The study also

suggests that noise disturbance that occurs during the breeding season may induce higher levels of impact when energy would otherwise be invested into developing offspring. Consequently, the Service considers that repetitive stress incurred during the wet season, when California red-legged frogs are more active, may magnify the effect of these behavioral responses by altering breeding behaviors such as migration and calling. However, no specific thresholds of disturbance level or frequency are known. The Service considers that although the project may result in effects to dispersal behavior, calling, and stress hormone accumulation that could have deleterious physiological effects and overall degrade the quality of existing habitat, until the novel effects of the project activity are studied, we are unable to adequately anticipate the magnitude of any specific response at this time.

The Space Force provided preliminary audiogram analysis which suggests there would not be overlap in the species' hearing sensitivity and low frequency noise produced by rocket launches. Specifically, the provided audiogram analysis suggests that California red-legged frog may only be able to perceive a negligible portion of the launch noise, hearing less than 25 dB (the human equivalent of whispering) across the entire launch event (MSRS 2024a, p. 106). However, subsequent subject matter expert review of this material indicates the provided hearing curve and corresponding weighting function are not established and there is still significant uncertainty around the hearing capabilities of California red-legged frog (J. Tennessen, pers. comm., 2022). Consequently, the specific disturbance levels and frequency thresholds that may impact California red-legged frogs are unknown and must still consider that the species may reasonably perceive and experience a stress response from associated launch disturbance.

In combination with the existing launch baseline on VSFB, the proposed project may contribute to potential long-term effects from chronic stress caused by routine acute launch disturbance across launch programs. Although the proposed project would only occur between October 1 and December 31, 2024, it may contribute to a degree to potential collective effects. Collective effects may include long-term population level effects including reduced reproductive success, survival, fitness, and spatial displacement. Although we do not have an estimated survivorship of displaced California red-legged frogs, this could result in injury or death to individuals as a result of increased intraspecific competition, lack of familiarity with new locations of potential breeding, feeding, and sheltering habitats, and increased risk of predation. However, it is unknown how California red-legged frogs would react to repetitive launch events of variable disturbance levels with increasing frequency. Improved monitoring information is needed to help identify thresholds that quantify what level of noise or frequency of disturbance would elicit stress hormone responses that may lead to impacts to breeding and reproduction or other negative population level effects. Consequently, the Service cannot adequately determine the magnitude of potential collective effects with the addition of the proposed project on the residential and breeding California red-legged frog populations within the vicinity of VSFB at this time.

Following review of the effects of the proposed action, the Service anticipates the proposed project would likely result in the temporary degradation in the quality of adjacent California red-

legged frog aquatic and dispersal habitat in the vicinity of VSFB due to associated noise and overpressure disturbance from routine launching. The proposed project also may contribute to potential population level collective effects that may occur over time. The potential mitigation actions for California red-legged frog include the creation of new breeding habitat at a 2:1 ratio (habitat enhanced: habitat affected) within the San Antonio Creek Oxbow Restoration 'expansion area' (Appendix A, Figure 4A). The Space Force indicates that previous restoration methods have proven successful at creating deep water aquatic habitat, suitable for California red-legged frog breeding and riparian woodland that simulate naturally occurring high-flow channels within approximately 2 acres of former agriculture land. Recent survey efforts have successfully detected 19 California red-legged frogs at this site, demonstrating that California red-legged frogs can newly colonize these areas for breeding several years after restoration site establishment (Kaisersatt, pers. comm. 2023b, entire). Biologists documented several male frogs calling, indicating that the site may be used for future breeding. Mitigation actions that may occur as result of the project include site preparation via herbicide application, plowing, container plant installation, seeding, willow pole planting, and watering via water truck. These activities have the potential to affect California red-legged frogs. An existing biological opinion (2016-F-0103; Service 2018) addresses the associated effects of this portion of the proposed action for California red-legged frog, and the Space Force will implement all required avoidance, minimization, and monitoring measures from that biological opinion. However, the proposed mitigation acreage constitutes approximately seven acres in total and is located entirely within the proposed project's launch noise effect area (Appendix A, Figure 1A and 4A). Consequently, in the event more frequent launch noise associated with the proposed project is found to impact California red-legged frog abundance and distribution, the proposed mitigation strategy may not serve to effectively quantifiably offset observed effects. The Space Force has not yet identified other locations of mitigation activities that may contribute to the Space Force's goal of no net loss at this time. However, the Service considers that the Space Force's commitment to ensure they meet the objectives of the proposed mitigation and are able to clearly demonstrate quantifiably that no net loss in occupied California red-legged frog habitat and population size, as stated in the Description of the Proposed Action above, has occurred. In accordance with the Service's compensatory mitigation policy (88 FR 31000; Service 2023c), the Space Force will develop restoration methods to ensure the objectives of the proposed mitigation (2:1 acreage offset) are met. Restoration activities will align with the objectives of the California red-legged frog Conservation Strategy (Service, *in prep*) with the goal of achieving no net loss to the species (Kephart, in litt., 2022, p. 3; MSRS 2024a, p. 113). These actions will be taken following mutual agreement by the Service and the Space Force to demonstrate they have achieved this goal to be consistent with this analysis.

Launch Operations Effects Off-Base (Mainland CA – eastern Santa Barbara, Ventura, and northern Los Angeles Counties)

Launch Noise and Overpressure

California red-legged frogs occupy the habitat within the Overpressure Effect Areas off-base across eastern Santa Barbara, Ventura, and Los Angeles counties. California red-legged frog in these areas may infrequently experience 10 sonic booms, each separated by an average of 5 days, all of which we expect to be under 1.0 psf between October 1 and December 31. We expect general effects from sonic boom noise to be similar to those discussed above but understand that based on the provided modeling information for the proposed project, any potential effects are unlikely to manifest and would be overall negligible considering the sonic boom's associated noise level magnitude is far lower, of very short duration, likely comparable to ambient existing noise levels, and would occur relatively infrequently between October 1 to December 31, 2024. Continued monitoring of realized sonic boom and associated noise levels is necessary to ensure these assumptions are correct.

Regarding off-base climate effects, see discussion above.

Effects of the Proposed Action on the Western Snowy Plover

Launch Operations Effects on Base

Operational Lighting

The proposed project has the potential to generate effects associated with increased artificial lighting at night. The Service requested that the Space Force provide specific lighting levels that are currently being produced at SLC-4 and on adjacent habitat including Surf Beach from existing launch operations to help inform the Service's ability to anticipate potential for lighting effects from the proposed project. This information has not yet been provided. The majority of recent launches from SLC-4 have been conducted at night and that the proposed project could potentially conduct all 16 launches at night. The Service reviewed available historical light pollution satellite data (Visible Infrared Imaging Radiometer Suite (VIIRS) dataset 2017-2023; NASA 2024a; b), photos of Falcon-9 flare during a night launch, and video footage from night launches of rocket vehicles that demonstrate the potential magnitude of acute lighting levels generated from associated rocket flare. Following a review of this best available information, the proposed project has the potential to increase western snowy plover exposure to artificial light pollution in the vicinity of SLC-4. No new lighting infrastructure would be added to SLC-4 as a result of the proposed project. However, increased operational usage of the existing SLC-4 facility to support up to 16 launches between October 1 to December 31, 2024, could reasonably increase average illumination of the vicinity of SLC-4 as a result of associated sky-glow as previously defined.

The Service reviewed the existing light pollution dataset (VIIRS) which demonstrates an apparent significant increase in the average lighting levels in the vicinity surrounding SLC-4 that occurred between 2017 and 2023 (NASA 2024a; b), potentially as a result of the large increase in past night operations to support 28 SpaceX launches in 2023. No previous design considerations were taken into the development of lighting infrastructure on SLC-4 to help reduce novel associated light pollution. SLC-4 is located 0.8 mile from adjacent western snowy plover habitat in South Surf Beach. Although refined specific light monitoring information is needed, the VIIRS data indicates that SLC-4 operational lighting may be routinely illuminating adjacent habitat, including nearby beaches, at low levels. In addition, each night launch has the potential to generate short term (approximately 1 to 3 minutes depending on if a terrestrial boost-back is involved) of higher levels of artificial night lighting as a result of associated rocket flare. Although we understand there is a clear potential for project associated lighting to increase, without clear light-monitoring information, the Service is currently unable to anticipate specific lighting levels to help us reasonably predict the magnitude of potential effects from the proposed project. Reviewing the best available information for the purposes of this analysis, the proposed project has the potential increase the number of days that western snowy plover overwintering habitat on Surf beach could be illuminated by low levels of site lighting and higher levels of acute rocket flare as a result of associated sky-glow.

Increased project-related lighting on Surf Beach could include effects to western snowy plover roosting success. Previous research has demonstrated that significant declines were found in the likelihood of plovers roosting in locations where exposure to artificial night lighting exceeded routine illuminance levels as low as approximately one half a full moon (threshold of 50 millilux (mlx) irradiance for effect, with 50 percent of their peak probability of presence above 100 mlx) (Simons et al. 2021, p. 5). The study suggests that the disruption of behaviors related to roosting associated with elevated levels of artificial night lighting are likely a result of perceived increased predation risk in illuminated coastal areas. This is consistent with existing research on related shorebird nocturnal behavior, where data suggests that species use darkness as a refuge to help avoid detection from nocturnal predators (Mouritsen 1992, entire). Without the ability to reference lighting levels, the low levels of routine Surf Beach illumination resulting from increased operation usage of SLC-4 site lighting in combination with 16 ascent and 2 landing events of anticipated higher illumination levels from rocket flare produced between October 1 to December 1, 2024, has the reasonable potential to degrade adjacent Surf Beach western snowy plover roosting habitat. In the event that routine lighting was found to be occurring in these areas, it is possible that these areas would be considered less suitable by the species to support successful roosting. The area most likely to be exposed to increased project-related lighting would be South Surf Beach, although the existing data indicates that the entirety of Surf Beach may be affected (NASA 2024a; b). This effect has the potential to be significant for the species as Surf Beach is an important overwintering location for western snowy plover, supporting 146 roosting plovers in 2024 (refer to Table 3, Condition of Status of Species).

Following discussion of the available data with lighting experts, the Service understands that VIIRS data cannot alone be used to compare to the aforementioned identified lighting thresholds

in existing literature as a result of differences in lighting unit (radiance). Additionally, VIIRS data should not be used to assess lighting trends within smaller sample areas (e.g. Surf Beach alone) due to issues of scale. Following review of existing data, specialists recommended that site specific light monitoring would be needed to ground truth experienced light levels and duration. Consequently, more information is needed for the Service to clearly predict the magnitude of potential impacts at this time. The Service currently expects that the proposed project would constitute degradation of Surf Beach roosting habitat but that effects should be reduced with the implementation of SLC-4 lighting retrofits proposed (GM-10).

Launch Noise

The Service conferred with avian hearing experts on the launch noise parameters of the proposed project. Potential effects from repeated launch noise disturbance events between 100-130 dB SPL associated with 16 launch ascents and between 140-150 dB SPL during two boost-backs include hearing damage from short exposure noise exposure, communication masking, and harassment (annoyance) that could result in changes in species abundance and distribution (Dooling, R., pers. comm. 2024). Following review of the available information, the Service anticipates that the proposed project's routine launch noise would likely result in temporary degradation of western snowy plover overwintering habitat between October 1 and December 31, 2024, from these effects.

Repetitive launch noise disturbance events have the potential to damage western snowy plover hair cell receptors and result in hearing loss. Auditory damage across species can occur, even if low frequency noise is not thought to be readily perceptible (Kugler et al. 2014; Williams 2014). Available recommended guidelines indicate that avian hearing damage can occur during single impulse (blast) levels of 140 dB(A) and multiple impulse noise source types (e.g. jackhammer, pile driver) levels of 125 dB(A) (Dooling and Popper 2007, p. 25). A-weighted and unweighted decibels are not equivalent, and no approximate conversion was provided for the purposes of this analysis. Consequently, the Service assumes that 125 dB(A) is roughly equivalent to 120 dB SPL and that noise sources used to generate this guidance are of low-frequency, generally similar to rocket disturbance. The Service anticipates that, due to its direct adjacency to SLC-4, potential impacts would be higher across Surf Beach, with the highest potential impacts expected at South Surf Beach. Approximately half of Surf Beach would be exposed to noise levels greater than 120 dB SPL during each launch ascent (Appendix A, Figure 1C). All of Surf Beach would be exposed to noise levels up to 150 dB SPL during the two boost-backs (Appendix A, Figure 2D).

Existing research shows that birds show some resistance to hearing damage, particularly as a result of their ability to regenerate auditory hair cells (Stone and Rubel 2000, p.1; Dooling et al. 2008, entire). However, the magnitude, duration, and frequency of noise disturbance events would likely play a role in the potential to induce routine hearing loss and can also vary by species. The Service does not have data on the specific acoustic thresholds of the western snowy plover and consequently have reviewed available research conducted on other avian species as a surrogate. Previous research has demonstrated that when the Japanese quail (*Coturnix coturnix*)

was exposed to a 1.5 kHz octave band noise at 116 dB SPL for four hours, individuals showed hearing loss of up to 50 dB SPL immediately following exposure, with hearing loss most severe at frequencies at and above 1 kHz and with considerable variation between subjects (Niemiec et al. 1994). This indicates that following exposure at these levels, quails would need normal noises to be 50 dB SPL louder to hear them. Quail and other avian species have the ability to regenerate auditory hair cells following acoustic trauma (Ryals and Rubel 1988; Dooling et al. 2008). Niemiec et al (1994) demonstrated that quail hearing improved and recovered within 8 to 10 days following exposure. This is a longer period than is being considered during the proposed project (acute launch noise disturbance on average every 5 days). Following repeat exposure, the amount of time it took for quail's hearing to recover increased. Although birds show recovery of sensitivity and hair cell receptors, the amount of hearing loss and recovery rates differ among avian species (Ryals et al. 1999; Beason 2004). Ryals et. al (1999) conducted a comparative study that tested different bird species (including quail and budgerigars (*Melopsittacus undulatus*) under similar noise exposure of 112-118 dB SPL for 12 hours. Quails showed significantly greater susceptibility to hearing loss and acoustic trauma with a permanent threshold shift of approximately 20 dB SPL as long as one year following exposure (Ryals et al. 1999, p. 74). In comparison budgerigars showed much faster recovery, to within 10 dB SPL within three days. Existing literature also indicates that there is considerable variation among species in the amount of acoustic trauma and the time involved in hearing loss and recovery and that these differences cannot be predicted from a species' appearance or behavior (Ryals et al. 1999; Dooling and Popper 2007, p. 26). The Service has reviewed the available avian auditory damage estimated guidelines and available literature. Being that the proposed project's noise levels exceed 120 dB SPL (ranging up to an understood 150 dB SPL_{max}) and the anticipated frequency of disturbance (on average a launch every 5 days) may occur faster than potential unknown hearing recovery time, the Service considers that repetitive exposure to high intensity noise disturbance, perceived or not, has the reasonable potential to cause routine hearing damage in western snowy plover between October 1 and December 31, 2024. Effects may occur across a large portion of Surf Beach which was most recently estimated to support approximately 146 overwintering western snowy plovers during this period (refer to Table 3, Condition of Status of Species).

The Service recognizes that these auditory harm guideline estimates were developed using both domesticated avian and small mammal studies, and that there is considerable variation between species. There are no available studies identifying the specific acoustic thresholds that may cause damage to the western snowy plover or the anticipated recovery time if hearing loss does occur as a result of the proposed project. The Service also understands that the Space Force is conducting a study to investigate possible changes in western snowy plover acoustic responses to increased launch frequency, establish baseline vocalizations in 2024, and analyze potential communication disruptions from rocket launches (Govtribe 2024; Miller 2024). Although an appropriate off-site reference population would be necessary when accounting for the current elevated rate of launch disturbance on VSFB and considering that behavioral response cannot alone predict hearing loss, changes in vocal performance may still be helpful to understand if the project may be causing routine impacts to western snowy plover hearing and consequently,

communication. Previous work has demonstrated that deafened birds can develop abnormal species-specific calls (Heaton et al. 1999, p. 1), although this may not be readily demonstrated in species that lack complex song such as shorebirds.

In the event hearing loss occurs from a single launch, the short duration proposed between repetitive launch disturbance events could reasonably preclude the species' ability to regenerate the acoustic hair cells and recover their full hearing ability. Considering that VSFB serves as an important stop-over site for western snowy plover across the species range, potential effects to overwintering western snowy plover's hearing could result in impacts on the species' population as a result of possible disruption in communication, masking, increased vigilance or distraction leading to decreased foraging effort, and the decreased ability to detect predators. Although we will need to review the results of the future western snowy plover communication study (Govtribe 2024; Miller 2024) to help determine whether hearing loss and communication impacts may be occurring, more information is needed to help assess magnitude of potential effects.

In the event repetitive launch noise events significantly influenced long-term hearing loss as was demonstrated with the aforementioned study on quail (Ryals et al. 1999, p. 74), there is a potential that effects could result in decreased reproductive success and long-term survival across the majority of VSFB population. The proposed project however is limited from October 1 to December 31, 2024, and using the available information the Service does not currently anticipate associated impacts to western snowy plover breeding populations at this time.

In the event that the proposed project does not result in auditory harm, western snowy plover may still be annoyed to the extent that overwintering populations abundance and distribution across VSFB is impacted. The proposed project's disturbance frequency has the potential to displace western snowy plover populations, potentially stimulating migration away from noisy areas. Although we do not have an estimated survivorship of displaced western snowy plover, this could result in injury or death to individuals as a result of increased intraspecific or interspecific competition, lack of familiarity with new locations of potential breeding, feeding, and sheltering habitats, and increased risk of predation. All of which reduces survivorship of displaced individuals in general. The Space Force has suggested that the species would only minimally perceive launch noise disturbance referencing an established audiogram for the domesticated mallard duck (MSRS 2024a, p. 131-132). The Service has reviewed this information in tandem with past monitoring results of the Falcon 9 launches and boost-backs at SLC-4. The proposed project will have similar launch noise and sonic boom disturbance levels as it is the same launch vehicle from the same location. Biologists monitored the June 18, 2022 Falcon 9 SARah-1 mission with boost-back and first stage recovery at SLC-4 that created an estimated sonic boom overpressure of 2.57 psf which converts to an instantaneous noise disturbance of 135.8 dB SPL_{max} at the western snowy plover monitoring location on South Surf Beach (Robinette and Rice 2022, p. 13). They noted that during the individual launch, incubating western snowy plovers reacted to both the launch ascent noise and the sonic boom produced by the return flight of the first-stage with more intense reactions to the sonic boom including hunker

response (Robinette and Rice 2022, p. 1). Biologists reported no difference in bird abundance before and after launch and boost-back (Robinette and Rice 2022 pp. 1–2, 13). The biological assessment also includes that in 2023 video camera monitoring, western snowy plover behaviorally responded to varying degrees to all launch events with 92 percent of all annual monitoring demonstrating an alert response, 11 percent demonstrating startle response, 7 percent demonstrating a hunker response. No nesting western snowy plover flushed off nests during launch noise events (MSRS 2024a, p. 135). However, the lack of a flush response does not adequately support that the species is not perceiving or distressed by launch noise events being that this species is known to exhibit very high levels of nest tenacity. The Service reviewed available literature supporting that western snowy plover will maintain body position under extreme weather (with adults documented to be completely buried under sand during gale force winds sitting on eggs without flushing; Farrar et al. 2012, entire). In addition, the Service reviewed available monitoring information that California least tern, a more closely related shorebird surrogate than the domesticated mallard duck that was used in the provided audiogram analysis, does exhibit a full flush response to launch noise alone (MSRS 2024a, p. 142). Consequently, using this information, the Service anticipates that overwintering western snowy plovers are likely capable of perceiving and behaviorally responding to the proposed project's launch noise and sonic boom disturbance. In the event launch noise disturbance of sufficient magnitude occurs frequently enough to annoy western snowy plover, the Service anticipates this could result in changes in species abundance and distribution during the overwintering period. The Service worked to compile available western snowy plover data from 2018 to 2023, in which 2023 experienced significantly higher launch levels than historic averages. Although necessary statistical analyses of long term western snowy plover data (Service 2023a; refer to Reporting Requirement 2, p. 85) have not yet been provided, referencing available monitoring information for purposes of comparison the Service considers that in 2023, Surf Beach (both North and South Surf Beach sites) appear to have experienced an atypical increase in nest abandonment and a decrease in nest establishment (Service, compiled 2018-2023 data by VFWO, 2024d). Additional analysis utilizing available data between 2020 and 2023 indicates a declining trend in western snowy plover residency time during the breeding season within the south base sites more proximate to SLC-4 when compared with north base sites, which largely remained constant (Service, unpublished data from AFWO, 2024e). More information, including the aforementioned required statistical analysis of long-term dataset, is needed to help more confidently speak to any observed trends as they may relate to overwintering populations.

The Service has also requested comparable shorebird monitoring data from other rocket launch facilities in Cape Canaveral, Florida as well as Boca Chica, Texas. The Service was unable to obtain any available comparable long-term shorebird monitoring from Cape Canaveral which has historically launched similar vehicles at a more frequent rate than VSFB. Boca Chica, Texas supports the SpaceX Starship Heavy facility. This facility launches a much larger rocket that produces significantly higher disturbance levels and includes unique effects such as a physical debris cloud. The Service also understands that this facility underwent 'intensive' testing as well as launching between 2021-2022 (Newstead and Hill 2022, p. 12), but it is unclear specifically how frequent associated disturbance events occurred. Understanding the differences between this

launch facility and SLC-4 at VSFB, the Service has reviewed what we consider the best current available comparable shorebird monitoring information that may help inform future effects in relation to potential changes in species distribution and abundance resulting from more frequent rocket launching. Available reporting from the Boca Chica facility indicates there have been significant observed declines in overwintering piping plover (*Charadrius melodus*) abundance, with a decrease of approximately 54 percent (from over 308 to below 142) between 2018 to 2021 (CBBEP 2021; Attachment 1, p. 4). Following this finding, statistical analysis conducted across numerous piping plover overwintering sites confirmed that Boca Chica was the only site to experience severe decline of overwinter piping plover abundance in 2019 and 2020, but then rebounded in 2021 when SpaceX Superheavy rocket launches were required to temporarily stop (Newstead and Hill 2022, pp. 12-14). The top model for Boca Chica included the 'launch year' covariate. Additional available reporting has also indicated that the population of snowy plover (*Charadrius nivosus*) nesting in the area has declined during years with Starship Heavy launch activity. No specific disturbance thresholds have been identified and the Service is currently unable to anticipate the potential magnitude of effects on overwintering western snowy that may result from up to 16 Falcon-9 launches between October 1 to December 31, 2024, occurring on average every 5 days. However, the Service anticipates that the proposed action may result in short-term adverse effects including behavioral reactions to overwintering western snowy plover. Non-observable physiological responses of western snowy plover to noise disturbance may include an increased heart rate or altering of metabolism and hormone balance. These responses may cause energy expenditure, reduced feeding, and habitat avoidance or displacement that results in increased vulnerability to predation (Radle 2007, p. 5). Consequently, using the best available information at this time, the Service anticipates that the proposed project has the potential to impact the abundance and distribution of overwintering western snowy plover on VSFB in the event the magnitude and frequency of the project's launch disturbance annoys them to an extent they no longer consider the habitat suitable. We are unable to assess the magnitude of these specific effects at this time until more monitoring information is available. However, we anticipate that the project, at a minimum, would constitute temporary degradation of western snowy plover overwintering habitat between October 1 and December 31, 2024.

The proposed project has the potential to contribute to long-term adverse effects that result from routine intermittent acute noise disturbance. The proposed project would contribute to the disturbance frequency of the existing launch noise disturbance baseline. In recent history, VSFB has supported an average of 6.2 launches per year with a notable increase to the maximum of 29 realized launches 2023. Although no information is available on potential western snowy plover population response to specific noise disturbance thresholds at certain temporal frequency, western snowy plovers do appear to demonstrate sensitivity to frequent noise disturbance. Biological monitors reported that a 20-minute fireworks display (lower levels of more frequent acute noise; variable intermittent disturbances that ranged from 59 dB to 80 dB for 20 minutes) at Coal Oil Point Reserve in Goleta, California, visibly agitated western snowy plovers (BRC 2018, entire). Camera footage captured western snowy plovers displaying stress responses (i.e., shallow breathing, frantic head turning, flushing) during the noise events. Although this described disturbance profile is at notably lower noise levels than the proposed project and

occurs significantly more frequently than the proposed project, we use this information as one of the best available references when considering the species tolerance thresholds for disturbance frequency. Chronically elevated stress hormone concentrations can have deleterious effects on species. Responses may cause energy expenditure, reduced feeding, reproductive losses, bodily injury resulting in increased vulnerability to predation, and habitat avoidance (Radle 2007, p. 5). Referencing current best available information, the Service considers that although the project has the potential to contribute to collective effects and result in population level effects (both over the short and long term), we are unable to anticipate the magnitude of potential response at this time.

Due to the location of the SLC-4 facility in relation to the subject western snowy plover habitat on Surf Beach, western snowy plovers may also experience visual disturbance from launch operations. We expect effects would not be greater than the noise disturbance effects occurring simultaneously as described above. Associated lighting effects are discussed separately above.

Climate effects

Western snowy plovers are vulnerable to the projected effects of climate change with leading threat factors including habitat loss due to sea level rise as well as reduced habitat suitability, nest survival, overwinter survivorship, and quality of nesting and roosting habitats (Service 2019, p. 7). Following a review of recent research on rocket launch and associated returning satellite emissions on the depletion of stratospheric ozone and global climate impacts (Maloney et al. 2022; Ryan et al. 2022; Ferreira et al. 2024), available information indicates that projected increases in rocket launches would have the potential to significantly contribute to these effects. Recent research demonstrates that air pollutants released by rocket launches in the upper atmosphere, their re-entry, and associated space debris, can have a disproportionate effect on global warming (Ryan et al. 2022). Produced modeling demonstrates various scenarios that all indicate rocket produced black carbon would increase stratospheric temperatures, change the global circulation by altering subtropical jet streams, and reduce the total ozone column (Maloney et al. 2022). Researchers anticipate with the current rate of projected rocket launch increases, impacts on the ozone layer have the potential to be substantial. Calculations indicate that after a decade of projected global rocket launch increases, ozone loss in the upper atmosphere would be equivalent to 16 percent of the ozone layer recovery previously achieved (Ryan et al. 2022; EPA 2024).

Considering the potential for increased global temperatures, the western snowy plover may experience variable effects. Recent research indicates that extended cold weather can decrease overwintering populations, with a higher rate of female plover mortality (Stenzel et al. 2023, entire). Current climate projections predict that west coast of California winter weather will experience increasing mean temperatures and substantially fewer instances of anomalously cold weather events which could contribute to the growth of western snowy plover populations (Stenzel et al. 2023, p. 10). Alternatively, climate change induced sea level rise will directly impact the extent and distribution of western snowy plover habitat and is considered to be an

effect of much greater magnitude (reviewed in Stenzel et al. 2023, p. 10). Without the specific proposed project's emission analysis that would be needed, the Service uses the defined action area to attempt to minimally speak to potential effects to western snowy plover on VSFB and has reviewed several potential scenarios using sea level rise modeling. The NOAA Sea Level Rise viewer indicates that VSFB is considered to be an area of low vulnerability with respect to the threat of sea level rise (NOAA 2024b). However, under a one-foot sea level rise scenario, approximately 23 acres (13 acres on north base and 10 acres of south base) of the 1,611 available acres of occupied western snowy plover habitat on VSFB could be lost. Under a two-foot sea level scenario, approximately 43 acres (25 acres on north base and 18 acres on south base) of an identified 1,611 available acres of suitable occupied habitat could be lost.

However, the Space Force did not provide any information or analysis regarding upper atmospheric emissions produced by the proposed project. Until the Space Force is able to provide relevant information including project specific emission analysis as required (50 CFR 402.14(c)(1)(iv) to ensure the proposed activity is not likely to jeopardize the continued existence of federally listed species or adversely modify designated critical habitat (7(a)(2)), the Service is unable to further discuss this effect at this time.

Proposed mitigation

In the event of observed population declines (as described in WSPL 2-4), the Space Force would implement proposed mitigation actions for western snowy plover which include predator control in the Predator Management Area (Appendix A, Figure 4B), including trapping, shooting, and tracking known western snowy plover predators with particular focus on raven removal at and adjacent to VSFB beaches. An existing biological opinion (8-8-12-F-11R; Service 2015) analyzes and permits these actions, and the Space Force will implement all required avoidance, minimization, and monitoring measures. The potential mitigation is located within the proposed project's launch noise effect area (Appendix A, Figure 1A and 4B). Consequently, in the event launch noise is found to impact western snowy plover's abundance and distribution, the potential proposed mitigation strategy may not be effective to quantifiable offset observed effects. The Space Force has not yet identified other mitigation actions that they would take to provide assurances of their goal of no net loss at this time. However, the Service considers that the Space Force's commitment to ensure they meet the objectives of the proposed mitigation and are able to clearly demonstrate quantifiably that no net loss in occupied western snowy plover habitat and population size, as stated in the Description of the Proposed Action above, will result from project activities (Kephart, in litt., 2022, p. 3; MSRS 2024a, p. 141). In the event the proposed predator control mitigation alone does not quantifiably demonstrate no net loss, the Space Force will pursue other beneficial actions including recovery opportunities outlined in the western snowy plover recovery plan (Service 2007c) or 5-year review (Service 2019). These actions to reach no net loss criteria will be taken following mutual agreement by the Service and the Space Force to demonstrate they have achieved this goal to be consistent with this analysis.

Launch Operations Effects Off-base – Mainland CA

Western snowy plover occupies the habitat within the Overpressure Effect Areas off-base across eastern Santa Barbara, Ventura, and Los Angeles counties. The western snowy plover in these areas may infrequently experience 10 sonic booms, each separated by an average of 5 days, all of which we expect to be under 1.0 psf between October 1 and December 31. We expect general effects from sonic boom noise to be similar to those discussed above but understand that based on the provided modeling information for the proposed project, any potential effects are unlikely to manifest and would be overall negligible considering the sonic boom's associated noise level magnitude is far lower, of very short duration, is assumed to be comparable to ambient existing noise levels, and would occur relatively infrequently between October 1 to December 31, 2024. Continued monitoring of realized sonic boom and associated noise levels is necessary to ensure these assumptions are correct.

We also understand that the Overpressure Effect Area includes various sonic boom trajectories consisting of a very narrow band across Santa Rosa Island and Santa Cruz Island (Appendix A, Figure 2H). The Space Force has indicated that they anticipate this portion of the Overpressure Effect Area to receive irregular and infrequent disturbance across what we understand is a very small spatial area. We currently do not anticipate effects to overwintering plovers on the Channel Islands due to the very limited spatial extent depicted as well as what we understand should be very infrequent (5 times) and low level (generally under 2 psf) sonic booms. Since initiation of consultation, additional sonic boom modeling information and public testimony exists in relation to sonic booms occurring on the Channel Islands (CCC 2024). However, the Service has not been provided any updated project description information by the Space Force. Consequently, to help clarify, monitoring of realized sonic boom spatial extent and magnitude is necessary in these areas to ensure the Service's understanding of the proposed action and action area are correct.

Regarding off-base climate effects, see discussion above.

Effects on Recovery

Southwestern pond turtle

As previously discussed, the southwestern pond turtle is not listed under the Act; however, it is currently proposed threatened and under federal review for listing under the Act (88 FR 68370). We consequently have not yet developed a recovery plan for southwestern pond turtle to assess its recovery status or how VSFB may factor into such status. However, a peer reviewed species status assessment (Service 2023b) and a range-wide conservation strategy (WPTRWCC 2020) are available for reference. Based on these documents, the recovery of southwestern pond turtle would focus on coordinating strategy implementation efforts, conducting distribution and abundance surveys, identify priority conservation areas, ameliorate and manage identified threats, and carefully consider potential population augmentation.

Temporary adverse effects may occur as a result of the proposed action and include potential impact and degradation of habitat to southwestern pond turtle populations within the near vicinity of VSFB. The proposed project may contribute to potential collective effects that impact southwestern pond turtle abundance and distribution over time. We are unable to anticipate the magnitude of potential effects from increased launch frequency at this time with the available information.

The Space Force will survey and provide both estimates on southwestern pond turtle population levels as well as quantify types of associated southwestern pond turtle habitat within identified impacted major riparian features (SWPT-2) to help meet identified current goals. The Service currently anticipates that the amount of habitat that will temporarily be disturbed relative to the known distribution of the species within its larger range would not result in a substantial reduction in the future recovery of the species if listed. In addition, the Space Force's commitment to enhance southwestern pond turtle habitat at a 2:1 ratio in the event of observed declines will help reduce the magnitude of effects on the species distribution. Although adverse effects are likely to occur as a result of the proposed action, we do not anticipate they will diminish VSFB's anticipated contribution to the recovery of the southwestern pond turtle at this time.

California Red-legged Frog

We do not anticipate the proposed project would interfere with the specific recovery goals for Core Area 24 (Santa Maria-Santa Ynez River) provided in the Service's 2002 recovery plan for the species. Although the function of VSFB major riparian features (e.g. Honda Creek, Bear Creek, and the Santa Ynez River) is not specified within the recovery plan, the recovery plan states the goal of protecting existing California red-legged frog populations within Core Area 24 (Service 2002, p. 75). The Service anticipates that project operations will result in overall temporary habitat degradation from frequent launch disturbance events across a larger portion of occupied California red-legged frog breeding habitat across the vicinity of VSFB and most likely within features including Bear Creek and Honda Creek due to their proximity to SLC-4. The proposed project may contribute to potential collective effects that impact California red-legged frog abundance and distribution over time. We are unable to anticipate the magnitude of potential effects from increased launch frequency at this time with the available information.

However, based on the available information and minimization measures, including potential mitigation and the Space Force's commitment to ensure no net loss to the species, we expect adverse effects to the recovery of California red-legged frogs would be low. Although adverse effects are likely to occur as a result of the proposed action, we do not anticipate they will diminish the VSFB population's contribution to the recovery of the California red-legged frog at this time.

Western Snowy Plover

The proposed project does not include any construction activities and thus will not physically remove any western snowy plover habitat; however, we anticipate that project operations would result in temporary habitat degradation across occupied western snowy plover overwintering habitat, with the highest levels of routine disturbance and degradation associated across Surf Beach. Although potential effects from the novel frequency of proposed launch noise disturbance may occur, we are unable to anticipate the magnitude of potential effects at this time with the available information. With the Space Force's commitment to mitigation actions ensuring no net loss if a population decline is detected, we do not anticipate the proposed action will diminish the VSFB population's contribution to the recovery of the western snowy plover. With this assurance, we do not currently anticipate that the proposed project would interfere with the recovery goals provided in the 2007 recovery plan for the species (Service 2007c, entire).

Summary of Effects

Southwestern pond turtle

In summary, we expect adverse effects to southwestern pond turtle may occur due to the proposed action between October 1 and December 31, 2024. Project elements including firebreak maintenance from SLC-4, flame ducts and vegetation management in Spring Canyon, launch-related byproducts, and engine noise and overpressure from launch operations all have the potential to impact the species. Effects to the species can include direct effects such as mortality and injury, chronic stress, and habitat degradation. The proposed action's launch noise and overpressure effects populations of the species found on and off VSFB.

The Space Force will maintain existing SLC-4 firebreaks and these activities could occur at any time of year. The existing firebreak areas would be unlikely to support nesting or overwintering habitat due to compact soils but assume that they could occur on the periphery of the road edge where vegetation maintenance may occur. Firebreak maintenance may injure or kill overwintering turtles or destroy nests found within the buffers of the road but not likely within the road itself. With our current understanding of southwestern pond turtle distribution and Space Force's avoidance and minimization measures, the Service consequently anticipates associated likelihood of effects would be low.

The Project's associated flame bucket and deluge system may produce temporary high intensity flame and steam that could result in the injury or mortality of any overwintering southwestern pond turtles within Spring Canyon during launch or test fire events. With our current understanding of southwestern pond turtle distribution and Space Force's avoidance and minimization measures, the Service consequently anticipates associated likelihood of effects would be low.

Launch-related soot or other chemical byproducts that come into contact with southwestern pond turtle habitat may affect southwestern pond turtles over the long term through bioaccumulation. However, the Space Force anticipates the amount of soot produced would be diminutive (Kaisersatt, pers. comm., 2022) and that the civil diversion structure and collection of fuel with absorbent pads should reduce potential effects. Using this provided information, the Service consequently assumes associated likelihood of effects would be low.

The Space Force would authorize a maximum of 0.57 acre-feet of water extraction from San Antonio Creek Basin per year to support the project. Using existing hydrological modeling and past discussion with USGS hydrologists for reference, the Service does not anticipate measurable decline in the quality or overall extent of these associated habitats as a result of this extraction at this time.

Project operational noise and overpressure disturbance from routine launching may result in behavioral and physiological responses in overwintering southwestern pond turtle that may be present in the action area. The Service cannot adequately determine the anticipated impacts of how the proposed project's launch disturbance events in combination with the existing launch disturbance baseline from other launch operations in the near vicinity may affect overwintering southwestern pond turtle populations located across base and off-base until the novel effects of the project activity are studied.

Based on the available information and minimization measures, including potential mitigation ensuring no net loss, we expect adverse effects to the recovery of southwestern pond turtles would be low. Although adverse effects are likely to occur as a result of the proposed action, we do not anticipate they will diminish the VSFB population's contribution to the recovery of the southwestern pond turtles at this time.

California Red-legged Frog

In summary, we expect adverse effects to California red-legged frog are likely to occur due to the proposed action. The project's associated flame bucket and deluge system may produce temporary high intensity flame and steam that could result in the injury or mortality of any California red-legged frogs within Spring Canyon during launch or test fire events. Given the previous negative survey findings that followed 11 individual launches, the Space Force will now require a Qualified Biologist to perform one California red-legged frog survey annually during peak breeding season (November to May) in Spring Canyon when individuals are most likely to be present and detectable. Avoidance measures employed during launches should reduce the potential for California red-legged frog death or injury; however, biologists may not detect some individuals during pre-activity surveys resulting in California red-legged frog death or injury. We expect such effects would occur infrequently.

Increased periods of standing water within the flame duct or v-ditch within SLC-4 associated with increased launch frequency may attract California red-legged frog to the area. We expect

California red-legged frog may be injured or killed if attracted to and found within these features as a result of scalding water.

In the event enough soot or other similar launch related byproducts contact dispersing California red-legged frogs or enter adjacent occupied waterbodies, the Service assumes it has the potential to injure or kill California red-legged frogs due to their highly permeable skin and susceptibly to waterborne pollutants (Jung 1996, p. i; Llewelyn et al. 2019, p. 1). However, the Space Force anticipates the amount of soot produced would be diminutive (Kaisersatt, pers. comm., 2022) and that the civil diversion structure and collection of fuel with absorbent pads should reduce potential effects. Using this provided information, the Service consequently assumes associated likelihood of effects would be low.

The Space Force would authorize a maximum of 0.57 acre-feet of water extraction from San Antonio Creek Basin per year to support the project. Using existing hydrological modeling and past discussion with USGS hydrologists for reference, the Service does not anticipate measurable decline in the quality or overall extent of these associated habitats as a result of this extraction at this time.

Project operational lighting, vibration, noise, and overpressure, from routine launching may induce behavioral and physiological responses in California red-legged frog that may be present in the action area. Increased lighting could attract California red-legged frog to SLC-4 and result in increased vehicle strikes. An increase in artificial night lighting may also increase anuran predation rates if predators are able to better detect dispersing adult frogs that may move more in newly lit environments. Using the best available information, the Service does not anticipate launch noise levels would induce routine deafening or physiological effects on California red-legged frog populations within occupied features on base at this time. However, the Service considers that portions of the Space Force's population could experience negative effects from routine exposure to sensory pollutants (vibration, noise, overpressure) and with potential repetitive (chronic) production of stress hormone. In combination with the existing launch baseline on VSFB, the proposed project may contribute to potential long-term effects from chronic stress caused by routine acute launch disturbance across existing launch programs. We are unable to anticipate the potential magnitude of species' response at this time. To help address the need for better information, the Space Force will implement passive bioacoustic monitoring during the California red-legged frog breeding season to characterize calling behavior baseline (bioacoustics baseline) and determine if there are unanticipated changes/response (CRLF-7).

Following review of the effects of the proposed action, the Service anticipates the proposed project is likely to result in the temporary degradation in the quality of adjacent California red-legged frog riparian and upland dispersal habitat due to launch operations and associated sensory pollutants. In the event the Space Force detects an unanticipated decline in California red-legged frog distribution and abundance or changes in call signal characteristic, not directly attributed to other factors (e.g., drought or wildfire), they will implement mitigation actions for California red-legged frog by creating new breeding habitat at a 2:1 ratio (habitat enhanced: habitat

affected). The Service considers the Space Force's commitment to ensure they meet the objectives of the proposed mitigation and are able to clearly demonstrate that no net loss in occupied California red-legged frog habitat or population size has resulted from project activities.

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

Western Snowy Plover

In summary, we expect adverse effects to western snowy plover may occur due to the proposed action. Project operational lighting, noise, overpressure disturbance from routine launching between October 1 and December 31, 2024, would degrade occupied overwintering western snowy plover habitat across VSFB with the highest effects expected across Surf Beach. The proposed project has the potential to induce auditory harm as well as behavioral and physiological responses in overwintering western snowy plover that may be present in the action area. The Service cannot adequately determine the magnitude of effects to overwintering western snowy plover populations located across Surf Beach until the novel effects of the project activity are studied. However, with commitment to mitigation actions in place ensuring no net loss if the Space Force detects a population decline, we do not anticipate the proposed action will diminish the VSFB population's contribution to the recovery of the western snowy plover.

CUMULATIVE EFFECTS

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

CONCLUSION

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

This conclusion includes our conference opinion addressing proposed southwestern pond turtle. Regulations allow for an opinion issued at the conclusion of a conference to be adopted as a biological opinion when the species is listed or critical habitat is designated, but only if no significant new information is developed (including that developed during the rulemaking process on the proposed listing or critical habitat designation) and no significant changes to the Federal action are made that would alter the content of the opinion (50 CFR 402.10(d)).

Our conclusions are contingent on the implementation of the project as described in this biological opinion, including the implementation of the proposed monitoring and mitigation plan. If the applicant fails to implement these plans as described in this biological opinion or is otherwise unable to offset declines to listed species consistent with management plan intent within timeframes specified in the terms and conditions of this document, we will consider this conclusion invalid.

Southwestern pond turtle

Reproduction

The proposed project would not result in the physical loss of southwestern pond turtle breeding habitat. However, the Service anticipates that the proposed project would constitute temporary degradation of southwestern pond turtle habitat across VSFB, particularly in features most adjacent to SLC-4 including Bear Creek, Honda Creek, and portions of the Santa Ynez River due to sensory pollutants (e.g., noise, overpressure, and potential for vibration) associated with the proposed action's increase in launch operations. Until the novel effects of the project activity are studied, the Service is unable to anticipate the specific response at this time using available information. If the proposed project's increased launch frequency demonstrates declines from established population baselines across riparian features, the Space Force will implement mitigation as described at the San Antonio Creek Oxbow Restoration expansion area to ensure no net loss in southwestern pond turtle occupied breeding habitat and overall population size. We expect the Space Force will demonstrate successful colonization and breeding within the San Antonio Creek Oxbow Restoration expansion area to offset potential project impacts at a 2:1 ratio. Should the Oxbow Restoration site not meet mitigation requirements depicted in the project description, we expect that the Space Force will implement other recovery objectives coordinated with the Service that quantifiably demonstrate no net loss to be consistent with this effects analysis. We consequently conclude that the proposed project would not reduce overall southwestern pond turtle reproduction on VSFB or rangewide.

Numbers

We are unable to determine the exact number of southwestern pond turtles that could occur in the action area that the proposed project may affect because existing survey data are insufficient to estimate population numbers. Proposed project activities could affect individual southwestern pond turtles by injury or death. Project operations may result in routine stress on southwestern

pond turtle populations within Honda Creek, Bear Creek, and portions of the Santa Ynez River that may reasonably cause sublethal effects that lead to gradual decline over the long term. Until the novel effects of the project activity are studied, the Service is unable to anticipate the specific response at this time using available information. The number of southwestern pond turtles that the proposed activities may affect is unknown, but the Service anticipates would likely constitute a moderate portion of the total VSFB population. However, we assume this number would be relatively small across the entirety of the species' range. Additionally, if the proposed project's increased launch frequency demonstrates a reduction in southwestern pond turtle numbers the Space Force will implement mitigation as described at the San Antonio Creek Oxbow Restoration expansion area to ensure no net loss in southwestern pond turtle abundance. Should the Oxbow Restoration site not quantifiably meet mitigation requirements depicted in the project description, we expect that the Space Force will implement other recovery objectives coordinated with the Service that quantifiably demonstrate no net loss to be consistent with this effects analysis. Therefore, we conclude that the proposed project would not appreciably reduce the number of southwestern pond turtles on VSFB or rangewide.

Distribution

The proposed project would likely constitute temporary degradation of occupied aquatic and terrestrial southwestern pond turtle habitat across Vandenberg, particularly within features adjacent to SLC-4 including Honda Creek, Bear Creek, and the Santa Ynez River due to sensory pollutants (e.g., noise, overpressure, potential vibration) associated with the proposed action's operations. Until the novel effects of the project activity are studied, the Service is unable to anticipate specific species' response at this time using available information. If the proposed project's increased launch frequency demonstrates a reduction in species abundance and distribution in these features, the Space Force indicates they will implement mitigation as described at the San Antonio Creek Oxbow Restoration expansion area to ensure no net loss in occupied habitat. However, the proposed mitigation site is in north base, over ten miles from Honda Creek. The Space Force has not identified other locations of mitigation activities that may contribute to the Space Force's goal of no net loss at this time. Consequently, in the event the proposed project results in reduced occupation of southwestern pond turtles within Honda Creek, Bear Creek, or the Santa Ynez River, this may constitute a large reduction in the overall distribution of the species across south base and across the entire VSFB population. However, any observed reduction would not appreciably reduce the distribution rangewide. We consequently conclude that the proposed project may reduce southwestern pond turtle distribution in the action area and across VSFB but would not appreciably reduce distribution rangewide.

Recovery

The southwestern pond turtle is not currently listed under the Act; however, it is currently proposed threatened and under federal review for listing under the Act (88 FR 68370). We

consequently have not yet developed a recovery plan for southwestern pond turtle to assess its recovery status or how VSFB may factor into such status. Using the available information and considering minimization measures, including mitigation ensuring no net loss, we expect adverse effects to the recovery of southwestern pond turtles on VSFB would be low. We expect the Space Force will demonstrate successful implementation and subsequent species abundance within the San Antonio Creek Oxbow Restoration expansion area to offset impacts. Should the Oxbow Restoration site not meet mitigation requirements depicted in the project description, we expect that the Space Force will implement other recovery objectives coordinated with the Service that quantifiably demonstrate no net loss to be consistent with this effects analysis. Therefore, we conclude that the proposed action would not appreciably reduce the likelihood of recovery of the southwestern pond turtle on VSFB or rangewide.

Conclusion

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

1. We anticipate that project effects could reduce the reproductive success of southwestern pond turtles at the local population level. However, the Space Force's commitment to monitor and mitigate reductions of individuals to meet their proposed goal of no net loss, the project would not appreciably reduce numbers of the southwestern pond turtles locally across VSFB or rangewide.
2. We anticipate that project effects could reduce the number of southwestern pond turtles at the local population level. However, the Space Force's commitment to monitor and mitigate reductions of individuals to meet their proposed goal of no net loss, the project would not appreciably reduce numbers of the southwestern pond turtles locally across VSFB or rangewide.
3. The project has the potential to reduce the species' distribution locally across VSFB but is not anticipated to appreciably reduce the distribution rangewide.
4. Although a recovery plan for southwestern pond turtle does not exist yet, we do not anticipate the proposed project would interfere with likely recovery objectives because of the Space Force's commitment to monitor and mitigate reductions of individuals to meet their proposed goal of no net loss. Consequently, the project would not cause any effects that would appreciably preclude our ability to recover the species.

California Red-legged Frog

Reproduction

The proposed project would not result in the physical loss of California red-legged frog breeding habitat. However, the proposed project may constitute routine degradation of breeding habitat across the action area, particularly within features adjacent to SLC-4 including Bear Creek, Honda Creek, and portions of the Santa Ynez River due to sensory pollutants (e.g., lighting, noise, overpressure, and potential for vibration) associated with the proposed action's increase in launch operations. Until the novel effects of the project activity are studied, the Service is unable to anticipate the specific response at this time using available information. If the proposed project's increased launch frequency demonstrates a reduction in reproductive success, the Space Force has indicated that they will implement mitigation as described at the San Antonio Creek Oxbow Restoration expansion area to ensure no net loss in California red-legged frog occupied breeding habitat and overall population size. We expect the Space Force will demonstrate successful colonization and breeding within the San Antonio Creek Oxbow Restoration expansion area to offset potential project impacts at a 2:1 ratio. Should the Oxbow Restoration site not meet mitigation requirements depicted in the project description, we expect that the Space Force will implement other recovery objectives coordinated with the Service that quantifiably demonstrate no net loss to be consistent with this effects analysis. We consequently conclude that the proposed project would not reduce overall California red-legged frog reproduction on VSFB, in the Northern Transverse Ranges and Tehachapi Mountains Recovery Unit, or rangewide.

Numbers

We are unable to determine the exact number of California red-legged frogs that could occur in the action area that the proposed project may affect because existing survey data are insufficient to estimate population numbers, and the numbers of individuals in the action area likely vary from year to year. Proposed project activities could affect individual California red-legged frogs to the point of injury or death. Project operations may result in routine stress on the California red-legged frog population in the action area, particularly within Honda Creek, Bear Creek, and portions of the Santa Ynez River. Although the proposed project would only occur between October 1 and December 31, 2024, in combination with the existing baseline, it may contribute to cumulative sublethal effects that cause decline over the longer term. Until the novel effects of the project activity are studied, the Service is unable to anticipate the specific response at this time using available information. The number of California red-legged frogs that the proposed activities may affect would likely constitute a moderate portion of the total VSFB population. However, we assume this number would be relatively small across the entirety of the species' range. Additionally, if the proposed project's increased launch frequency demonstrates a reduction in California red-legged frog numbers the Space Force will implement mitigation as described at the San Antonio Creek Oxbow Restoration expansion area to ensure no net loss in California red-legged frog abundance. We expect the Space Force will demonstrate successful

colonization and subsequent species abundance within the San Antonio Creek Oxbow Restoration expansion area to offset impacts. Should the Oxbow Restoration site not meet mitigation requirements depicted in the project description, we expect that the Space Force will implement other recovery objectives coordinated with the Service that quantifiably demonstrate no net loss to be consistent with this effects analysis. Therefore, we conclude that the proposed project would not appreciably reduce the number of California red-legged frog on VSFB, in the Northern Transverse Ranges and Tehachapi Mountains Recovery Unit, or rangewide.

Distribution

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

Recovery

We do not anticipate that the proposed project would interfere with the specific recovery goals for Core Area 24 (Santa Maria-Santa Ynez River) provided in the Service's 2002 recovery plan for the species. Although the function of select features within the proposed action area including Bear Creek, Honda Creek, and the Santa Ynez River are not specified, the recovery plan states the goal of protecting existing California red-legged frog populations within Core Area 24 (Service 2002, p. 75). Using the available information and considering minimization measures, including potential mitigation ensuring no net loss, we expect adverse effects to the recovery of California red-legged frogs on VSFB would be low. We expect the Space Force will demonstrate successful colonization and subsequent species abundance within the San Antonio Creek Oxbow

Restoration expansion area to offset impacts. Should the Oxbow Restoration site not meet mitigation requirements depicted in the project description, we expect that the Space Force will implement other recovery objectives coordinated with the Service that quantifiably demonstrate no net loss to be consistent with this effects analysis. Therefore, we conclude that the proposed action would not appreciably reduce the likelihood of recovery of the California red-legged frog on VSFB, in the Northern Transverse Ranges and Tehachapi Mountains Recovery Unit, or rangewide.

Conclusion

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

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

Western Snowy Plover

Reproduction

The proposed project would not result in the physical loss of western snowy plover habitat. However, the Service anticipates that the proposed project would constitute routine degradation of overwintering habitat across the action area, particularly within Surf Beach due to sensory pollutants (e.g., lighting, noise, overpressure) associated with the proposed action's increase in launch operations. Until the novel effects of the project activity are studied, the Service is unable to anticipate the specific response to western snowy plover breeding success at this time using

available information. The proposed project is occurring outside of the species' breeding period and consequently the Service does not anticipate impacts to the reproductive success of the species at this time. Consequently, we do not anticipate the proposed action will appreciably reduce the reproductive capacity of western snowy plover populations locally on VSFB or rangewide.

Numbers and Distribution

VSFB constitutes nearly 25 percent of western snowy plover in RU5 and approximately 10 percent of the western snowy plover population rangewide. Additional information and analysis are needed to understand how western snowy plover populations may be impacted over the overwintering season and over time as a result of habitat degradation associated with the proposed project's novel disturbance frequency. The Service also considers that Space Force's proposed western snowy plover mitigation (increased predator control), if triggered, would be implemented within the impacted area and may not serve to effectively preclude overall changes in species distribution. In the event the proposed project results in reduced occupation of western snowy plover at South Surf Beach, this could constitute a reduction in the overall distribution of the species across south base and across the VSFB population. The Space Force has not identified other locations of mitigation activities that may contribute to the Space Force's goal of no net loss at this time. However, with the Space Force's commitment to implementing mitigation actions ensuring no net loss in place, any observed reduction would not appreciably reduce the numbers or distribution within RU5 or rangewide. We consequently conclude that the proposed project may reduce western snowy plover distribution in the action area and across VSFB, but we do not anticipate the proposed action will appreciably reduce the numbers or distribution of western snowy plover populations within RU5 or rangewide.

Recovery

Due to both the numbers of western snowy plover and quantity of habitat supported, VSFB plays a critical role in the species' recovery. We anticipate that project operations would result in temporary habitat degradation across occupied western snowy plover overwintering habitat, with the highest levels of routine disturbance and degradation associated with Surf Beach adjacent to SLC-4. Although potential effects from the novel frequency of proposed launch noise disturbance may occur, we are unable to anticipate the magnitude of effects at this time with the available information. However, with the Space Force's commitment to mitigation actions ensuring no net loss if a population decline is detected, we do not anticipate the proposed action will diminish the VSFB population's contribution to the recovery of the western snowy plover at this time. With this assurance, we do not currently anticipate that the proposed project would interfere with the recovery goals provided in the 2007 recovery plan for the species (Service 2007c, entire).

Conclusion

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

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

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened wildlife species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harass" means an "intentional or negligent act or omission which creates [a] likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering" (50 CFR. 17.3). Harm in the definition of "take" in the Act means an act which actually kills or injures wildlife. Such [an] act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering (50 CFR 17.3). Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not the purpose of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement and occurs as a result of the action as proposed. Being that section 9 of the Act does not prohibit take of proposed or candidate animal species, an incidental take statement provided with a conference opinion does not become effective unless the Service adopts the opinion once the listing is final (50 CFR 402.10(d)).

AMOUNT OR EXTENT OF TAKE

Southwestern pond turtle

We anticipate that some southwestern pond turtle could be taken as a result of the proposed action. We expect the incidental take to be in the form of capture, injury, harass, harm and mortality and the associated degradation of suitable habitat resulting from increased frequency of launch disturbance. We cannot quantify the precise number of southwestern pond turtle that may be taken as a result of the actions that Space Force has proposed because southwestern pond turtle move over time; for example, animals may have entered or departed the action area since the time of pre-construction surveys. The protective measures proposed by Space Force are likely to prevent direct mortality or injury of most individuals during launch operations at SLC-4. In addition, finding a dead or injured southwestern pond turtle is unlikely. Consequently, we are unable to reasonably anticipate the actual number of southwestern pond turtle that would be taken by the proposed project; however, we must provide a level at which formal consultation would have to be reinitiated. The Environmental Baseline and Effects Analysis sections of this biological opinion indicate that adverse effects to southwestern pond turtle would likely be low given the species is anticipated to be overwintering during proposed project activities with unknown but potential moderate abundance in the near vicinity of SLC-4 (e.g. Honda Creek, Bear Creek, Santa Ynez River and Jalama Creek). We, therefore, anticipate that take of southwestern pond turtle may also be low. We also recognize that for every southwestern pond turtle found dead or injured, other individuals may be killed or injured that are not detected, so when we determine an appropriate take level, we are anticipating that the actual take would be higher, and we set the number below that level.

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

Therefore, the Space Force must contact our office immediately to reinitiate formal consultation if they observe any of the following scenarios during Launch Operations (Table 5):

i. The southwestern pond turtle established baseline (SWPT-1) is 15 or more individuals across an individual feature and a greater than 20 percent (up to 8 individuals) decline from baseline is observed during the proposed project.

ii. The southwestern pond turtle established baseline (SWPT-1) is less than 15 individuals and a greater than 25 percent decline from baseline is observed during the proposed project;
iii. Two individuals (adult or juvenile) or one nest of southwestern pond turtle are found killed, wounded, or destroyed over the course of operations;
iv. and/or five individuals (adult or juvenile) or one nest of southwestern pond turtle are relocated over the course of operations.

Project activities that are likely to cause additional take should cease as the exemption provided pursuant to section 7(o)(2) may lapse and any further take could be a violation of section 4(d) or 9.

Table 5. Summary of incidental take for the southwestern pond turtle life stages during Launch Operations of the proposed project.

Life Stage	***Quantity during Operations***	***Type of Take***
Adults or juveniles (Within Honda Creek, Bear Creek, Jalama Creek, or Santa Ynez River)	Scenario 1- If the Established Baseline* is greater than 15 individuals: 20% decline (up to 8 individuals) from established baseline during proposed project. OR Scenario 2 – If the Established Baseline* is less than 15 individuals: 25% decline from established baseline during proposed project.	Habitat modification disrupting sheltering/breeding
Adults or juveniles	2 during project operations	Killed or wounded (including during capture and relocation)
Nest	1 during project operation	Killed or wounded (including during capture and relocation)
Adults or juveniles	5 during project operation	Captures and relocation
Nest	1 during project operation	Relocation

*Established Baseline within monitoring plan described in SWPT-2 for each unique major riparian feature.

California Red-legged Frog

We anticipate that some California red-legged frogs could be taken as a result of the proposed action. We expect the incidental take to be in the form of capture, injury, harass, harm and mortality and associated degradation of suitable habitat resulting from increased frequency of

launch disturbance. We cannot quantify the precise number of California red-legged frogs that may be taken as a result of the actions that Space Force has proposed because California red-legged frogs move over time; for example, animals may have entered or departed the action area since the time of pre-construction surveys. The protective measures proposed by Space Force are likely to prevent direct mortality or injury of most individuals during launch operation at SLC-4. In addition, finding a dead or injured California red-legged frog is unlikely. Consequently, we are unable to reasonably anticipate the actual number of California red-legged frogs that would be taken by the proposed project; however, we must provide a level at which formal consultation would have to be reinitiated. The Environmental Baseline and Effects Analysis sections of this biological opinion indicate that adverse effects to California red-legged frog may be moderate given the potential for moderate abundance of California red-legged frog in the near vicinity of SLC-4 (e.g. Honda Creek, Bear Creek, Santa Ynez River and Jalama Creek). We, therefore, anticipate that take of California red-legged frogs may also be moderate. We also recognize that for every California red-legged frog found dead or injured, other individuals may be killed or injured that are not detected, so when we determine an appropriate take level, we are anticipating that the actual take would be higher, and we set the number below that level.

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

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

i. The California red-legged frog established baseline (CRLF-5ai) is 15 or more individuals across an individual feature and a greater than 20 percent (up to 8 frogs) decline from baseline is observed during the proposed project.
ii. The California red-legged frog established baseline (CRLF-5ai) is less than 15 individuals and a greater than 25 percent decline from baseline is observed during the proposed project;
iii. Two adult or juvenile California red-legged frogs are found killed or wounded over the course of operations;
iv. and/or 10 adults or juveniles are captured and relocated over the course of operations.

Project activities that are likely to cause additional take should cease as the exemption provided pursuant to section 7(o)(2) may lapse and any further take could be a violation of section 4(d) or 9.

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

Life Stage	*Quantity during Operations*	*Type of Take*
Adults or juveniles (Within Honda Creek, Bear Creek, Jalama Creek, or Santa Ynez River)	Scenario 1- If the Established Baseline* is greater than 15 individuals: 20% decline (up to 8 frogs) from established baseline during proposed project. OR Scenario 2 – If the Established Baseline* is less than 15 individuals: 25% decline from established baseline during proposed project.	Habitat modification disrupting sheltering/breeding
Adults or juveniles	2 during proposed project	Killed or wounded (including during capture and relocation)
Adults or juveniles	10 during proposed project	Captures and relocation

*Established Baseline within monitoring plan described in CRLF-5ai for each unique major riparian feature.

Western Snowy Plover

We anticipate that all western snowy plovers present in the action area could be harassed as a result of the proposed action. We expect the incidental take to be in the form of injury if project operations annoys or disturbs the species to a degree that results in changes to overwintering behavior patterns including sheltering and feeding; physiological responses that result in bodily injury; and associated degradation of suitable overwintering habitat resulting from increased frequency of launch disturbance. We cannot quantify the precise number of individuals that may be taken due to fluctuations in population. Take may rise to a statistically significant level of decreased western snowy plover overwintering occupancy from the established baseline across the entirety of Surf Beach. If the Space Force observes a statistically significant decline from baseline (WSPL-2), proposed mitigation efforts would need to be effective in quantifiably offsetting the impact to result in no net loss to the species to be considered consistent with this analysis.

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

i. The Space Force observes a 10 percent reduction in the abundance, spatial distribution, or occupancy time of overwintering adults across South VSFB Beaches when compared to the 10-year established baseline (see Term and Condition #11b below; WSPL-1) across the duration of the proposed project that are unrelated to defined scenarios in WSPL-3.

Project activities that are likely to cause additional take should cease as the exemption provided pursuant to section 7(o)(2) may lapse and any further take could be a violation of section 4(d) or 9.

REASONABLE AND PRUDENT MEASURES

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

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

1. The Space Force must ensure that biologists used for survey, monitoring, training, and capture and relocation tasks are skilled and experienced.
2. The Space Force must reduce potential for injury or mortality of southwestern pond turtles, California red-legged frogs, and western snowy plovers.
3. The Space Force must monitor and communicate effects to ensure they are consistent with this analysis.
4. The Space Force must offset or require the project proponent to offset all impacts of the take on the western snowy plover, California red-legged frog, and southwestern pond turtle inside the action area.

TERMS AND CONDITIONS

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

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

1. The Space Force must request Service approval of any biologist who will conduct activities related to this biological opinion at least 30 days prior to any such activities

being conducted. The Space Force must use the Biologist Authorization Request Field Experience Tracking Form (Appendix B) and provide biologist resumes listing their experience and qualifications to conduct specific actions that could potentially affect listed species and their habitats). A Qualified Biologist(s) is more likely to reduce adverse effects based on their expertise with the covered species. Please be advised that possession of a 10(a)(1)(A) permit for the covered species does not substitute for the implementation of this measure. Authorization of Service Approved Biologists is valid for this consultation only.

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

2. As a part of the prepared lighting management plan for SLC-4 (GM-10), the Space Force must consult with a lighting specialist (e.g. designated by the Illuminating Engineering Society of North America or the U.S. Green Building Council) to ensure light pollution is minimized to the maximum degree possible. Best management practices must include using the minimum number of lumens to accomplish lighting needs. The Space Force must also reduce the effects of ultraviolet lighting on California red-legged frogs on all external permanent site lighting. To accomplish this, the Space Force may choose lighting with either no ultraviolet emissions or equip fixtures with an ultraviolet filter on external permanent site lighting. These actions will help avoid attracting insects and subsequent California red-legged frog individuals to SLC-4 (refer to Longcore and Rich 2017).
3. In addition to GM-8 (Vegetation clearance), the Space Force must schedule any routine vegetation clearance or firebreak maintenance to occur at least 48 hours outside of forecasted and realized precipitation events (greater than 0.25 inch during a 24-hour period according to National Weather Service 72- hour forecast) to help reduce potential for injury for dispersing California red-legged frog and southwestern pond turtle.
4. If southwestern pond turtle nests or overwintering individuals are found during clearance surveys of SLC-4 firebreak maintenance or Spring Canyon vegetation maintenance, and the individuals and nests are not in threat of being destroyed, injured, or killed, then a 100-foot buffer around nests and overwintering individuals must be enforced. If any overwintering individual or nest is in threat of being destroyed, injured, or killed, then the individual or nest must be relocated in coordination with the Service. If a location for nest relocation cannot be identified, then the Space Force must work with the Service to find partners able to safekeep the nest until overwintering season is over. The Space Force must immediately communicate with the Service in the event that buffers are enforced and prior to any necessary relocation.
5. To minimize potential injury and mortality to California red-legged frog and southwestern pond turtle during any v-ditch maintenance activities, the Space Force must require a biologist first survey the feature and subsequently monitor work activities to relocate individuals of these species found.

6. To reduce potential injury of southwestern pond turtle during potential future restoration work which may use herbicide products, the Space Force must adhere to the following measures:
    a. The Space Force must only use chemical control of invasive plants when other methods are determined to be ineffective or would create greater environmental impacts than chemical control. The Space Force must evaluate herbicide use on a project-by-project basis with consideration of (and preferences given towards) integrated pest strategies whenever possible to minimize potential impacts.
    b. The Space Force must require that 30 CES/CEIEA staff familiar with southwestern pond turtle biology review and approve all individual chemicals to be used within suitable habitat. When developing proposed restoration projects, the Space Force must consider all potential for exposure pathways of any chemical product and associated degradation products to occupied species' habitat including but not limited to product persistence and mobility within various soil types. If working within the vicinity of occupied aquatic habitat, the Space Force must use products demonstrated to have low mobility and are considered to be non-toxic or practically non-toxic to aquatic species. If using glyphosate, the Space Force must either use this product without a surfactant or with a non-POEA surfactant like AgriDex®.
    c. The Space Force must not apply herbicides/pesticides within 48 hours of a predicted (greater than 50 percent chance forecast) significant rain event (0.25 inch or greater with 24-hour period). The National Weather Service 72-hour forecast must be consulted for the project area.
    d. The Space Force must follow all chemical label specifications and adhere to best management practices identified by the California Invasive Plant Council (Cal-IPC 2015). Marker dyes must be utilized in all herbicide mixtures so workers can readily see spills, drift, or misapplication. To avoid chemical drift, no foliar spray applications may be conducted when wind speeds exceed 12-mph. Foliar spray applications must use directed sprayers with low-pressure, large droplet nozzles (Cal-IPC 2015).
    e. The Space Force must require that personnel conducting herbicide treatments possess a current qualified applicator license.

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

7. The Space Force must provide or require the project proponent to provide adequate funding and support staff to implement the following monitoring requirements. Determination of supporting staff needs will be at the discretion of 30 CES.
8. The Space Force must continue monitoring experienced noise and sonic boom levels within consistent monitoring locations both on VSFB and previously established off base areas of mainland California to ensure realized levels of each static fire, launch, and boost-back are consistent with what was considered within this analysis. Monitoring locations must include Surf Beach, Honda Creek, Bear Creek, Santa Ynez River, and

Jalama Creek as well as Santa Rosa and Santa Cruz Islands. This information must be included in a clear table in the final report and include psf to SPL_{max} conversions whenever applicable.

9. The Space Force must implement light monitoring at SLC-4 and surrounding habitat to ensure light pollution effects are consistent with this analysis. The Space Force must use a sky-quality camera (e.g. GONet) to collect anticipated sky-glow light data produced by the proposed project. Monitoring specifics must include the following:
    a. The Space Force must establish 2 monitoring locations within open California red-legged frog transitory habitat 100 feet from SLC-4 and 2 monitoring locations within Surf Beach (one in South Surf Beach and one in North Surf Beach)
    b. The Space Force must collect lighting data during hours of darkness during i) the first 2 weeks of normal project operations at SLC-4; ii) 3-night launches and; ii) 2-night launches with boost-back landing (if these occur during the proposed project). Associated weather data (e.g. fog) must also be provided during associated monitoring events.
    c. The Space Force must provide collected lighting data to the Service as soon as it becomes available and summarize all findings in the Annual report.

    The Service can provide lighting specialist contacts to help establish this monitoring program to ensure monitoring design meets requirements. A description of light monitoring program will be provided to the Service before the start of the proposed project.
10. The Space Force must implement vibration monitoring to ensure effects to California red-legged frog and southwestern pond turtle are consistent with assumptions made in this analysis. Vibration monitoring specifics must include the following:
    a. Vibration data logger sensors (similar to those used at standard construction sites) must be placed in the following locations: i) Spring Canyon ii) Bear Creek directly adjacent to suitable California red-legged frog breeding habitat, and iii) San Antonio Creek adjacent to the Oxbow restoration site.
    b. At each location, a sensor must be placed above ground as well as below ground (at 1 foot depth) to ensure vibratory impacts to aestivating California red-legged frog and southwestern pond turtle are not occurring.
    c. Vibration monitoring must occur during at least 3 individual launches as well as during the 2 launches with boost-backs. Launch ascents during boost-back events can be used to meet the 3-launch requirement.
    d. The Space Force must provide collected vibration data to the Service as soon as it becomes available and summarize all findings in the Annual report.
11. To determine whether sound levels from the proposed project are causing auditory harm to western snowy plover populations on Surf Beach, the Space Force must establish a controlled monitoring design to help determine realized effects. The monitoring design may involve the use of non-native avian surrogates exposed to realized or simulated launch noise compared to control conditions. Additionally, the Space Force must coordinate with researchers that have previous experience with examining hair cell loss in avian basilar papilla (e.g. Stone and Rubel 2000; Dooling et al. 2008; Sato et al. 2024,

etc.) and review monitoring design with the Service to be completed prior to 2025. The Space Force must also provide the results of the aforementioned western snowy plover communication study (Govtribe 2024; Miller 2024) to help determine whether hearing loss and communication impacts may be occurring as soon as those results are available.

12. As stated in GM-1, the Space Force must sample water quality in lower Spring Canyon once annually whenever ponded water is present to ensure no project related byproducts (i.e., launch combustion residue, operations-related run-off, etc.) have entered the waterway in a manner not previously considered in this analysis. In the event that water does not adequately pond to collect a sample, the Space Force must instead conduct soil sampling to achieve the intent of this measure. If the Space Force finds that project related water or soil contamination has occurred, the Space Force must coordinate with the Service, address sources of input, and remediate within 30 days.
13. Monitoring/Mitigation Plan:
    a) The Space Force must develop a proposed monitoring plan (CRLF-5, SWPT-1 and 2, WSPL-1) as it relates Falcon-9 operation at SLC-4 across this three-month project. Monitoring activities must be conducted between October 1 and December 31, 2024, will, at a minimum, include the following:
        1. Noise ground truthing monitoring as described in Term and Condition 8;
        2. Light monitoring as described in Term and Condition 9;
        3. Vibration monitoring as described in Term and Condition 10;
        4. Full development of auditory harm monitoring design depicted in Term and Condition 11;
        5. Water quality (or soil) sampling monitoring as described in Term and Condition 12;
        6. Proposed California red-legged frog surveys and monitoring (CRLF-4 to 7 with required control reference site) which can occur during the breeding season;
            i. California red-legged frog bioacoustics monitoring: As part of the proposed monitoring plan, the Space Force must include the California red-legged frog bioacoustics monitoring design. The Space Force must ensure that bioacoustic monitoring conducted is designed to best address confounding factors in order to appropriately characterize potential impacts of launch, static fire, and SLC-4W landing events on calling behavior. Being that the bioacoustics baseline was unable to be established prior to high existing rates of launching in 2024, the Space Force must also identify and include at least one necessary appropriate control site outside of the Launch Noise impact area (as originally proposed in CRLF-(a)ii) prior to the start of the proposed project for purposes of signal characteristic comparison. Data collected between October 1 and December 31, 2024, must include applicable call characteristics (e.g., changes in signal rate, call frequency, amplitude, call timing, call duration, etc.) and other relevant site variables (e.g. climate data, water temperature, etc.) to serve in purposes of analysis

as well in the development of the California red-legged frog bioacoustics baseline.

7. Overwintering western snowy plover window surveys and camera/human monitoring.
    i. The Space Force must collect overwintering western snowy plover population information by continuing to conduct winter window surveys.
    ii. The Space Force must deploy at least two landscape level cameras trained on areas known to support high levels of overwintering western snowy plover populations on Surf Beach OR require human monitoring of populations whenever possible. Camera/human monitoring must occur during three launches (including two boost-backs and that occur during both night and day-time) to understand behavioral reactions of the species during the overwintering season.

The Space Force must provide this plan to the Service for review prior to the implementation of the proposed project to ensure it is consistent with expectations made within this analysis, including that potential project related short and long-term effects are detectable and clearly defined.

Monitoring Plan Associated Analysis

Using collected data during the project and other available long-term data, the Space Force must prepare a multivariate statistical analysis of the potential changes in aforementioned species populations trends. This analysis must be provided as soon as it is available in 2025, appropriately within the annual report, and prior to any further proposed increase in launch cadence. This will help address previous requirements that the Service has not yet received (Service 2023; Reporting Requirement 2). In coordination with the Service, this analysis must be conducted by an experienced independent third party who is funded by the Space Force or the project proponent and are provided (a) available historical population data (b) frequency of launches and on-base boost-back landings over different time scales; (c) seasonality of launches and sensitive times of year for respective species; (d) geospatial variability; (e) required off-base control reference site data; (f) climatic and oceanographic patterns (e.g. El Niño, Pacific Decadal Oscillation, storms, ocean temperature); (g) required realized levels of acoustic and lighting monitoring data; (h) and patterns of other variables including (as relevant to the respective species), but not limited to, breeding rates, beach width, and forage base or food web trends. Relevant population trends to analyze include, but are not limited to, population sizes and locations for California red-legged frog and western snowy plover. The Space Force must develop a comprehensive plan to collect sufficient data on species information for the southwestern pond

turtle to address the analyses above during the appropriate seasons for the species. The Space Force must then use this information to conduct a similar analysis (as described for the California red-legged frog and western snowy plover) when this data is available in 2025. Multivariate statistical analysis is necessary to help both detect take (e.g. atypical population declines, changes in spatial distribution that may be otherwise difficult to discern) as well as determine if observed changes in populations may be a result of the proposed project.

13b) The Space Force must provide an update to the existing long-term monitoring plan (refer to Condition 8 within Service 2023a) that pertains to Falcon-9 operation at SLC-4 by December 31, 2024, to address effects across all seasons to begin full implementation no later than January 1, 2025. The Space Force must also update the existing monitoring plan to include aforementioned language described in the 'Monitoring Plan Associated Analysis' to be conducted on an annual basis. The Space Force must coordinate with the Service to develop and approve the updated plan prior to implementation. The following topics must be updated in the existing plan:

California red-legged frog (CRLF-5) and southwestern pond turtle (SWPT-1 and 2)

The California red-legged frog and southwestern pond turtle portions of the monitoring plan must explain how they will clearly establish baseline of these species' average population levels within each of the major impacted breeding features (Honda Creek, Bear Creek, Santa Ynez River, Canada del Jolloru, and Jalama Creek). The Space Force must clearly explain how past or new survey data is being utilized to establish a reasonable baseline and include the survey area and methodology used. To ensure consistent data collection for analysis, all subsequent surveys must utilize the same established methodology within each impacted breeding feature.

i. California red-legged frog bioacoustics monitoring: As part of the proposed monitoring plan, the Space Force must include the California red-legged frog bioacoustics monitoring design. The Space Force must clearly define how they will establish California red-legged frog calling behavior baseline (bioacoustics baseline) within select impacted breeding features closest to SLC-4 (Honda Creek, Bear Creek, Santa Ynez River, and Jalama Creek).

ii. As part of the southwestern pond turtle monitoring plan, the Space Force must incorporate clear methodology on how they plan to survey, monitor, and track southwestern pond turtle populations (e.g. mark-recapture, transmitter, etc.). The Space Force must also provide an established methodology to identify overwintering, breeding, basking, and nesting habitat within the vicinity of SLC-4 and within identified impacted major riparian features (e.g. Honda Creek, Bear

Creek, Santa Ynez River, and Jalama Creek) by the end of the proposed project (December 31, 2024) for planned implementation no later than January 1, 2025.

Western snowy plover (*WSPL -1*)

The western snowy plover section of the monitoring plan must also include a clear, established baseline for metrics including i) number of roosting (overwintering) adults on South and North VSFB beaches. This would be an update to the existing plan's baseline related to breeding metrics (e.g. ii) breeding adults, iii) nest attempts, and iv) hatching success rate). This baseline is needed to help detect and determine the magnitude of potential project related effects. This baseline will be the mean (with 95 percent confidence interval) established over the most recent 10-year period with relatively low levels of launches per year (2011-2020) and include available data across the entirety of Surf Beach.

14. The Space Force must update the existing mitigation plan (refer to Condition 7 within Service 2023a) and provide it to the Service by December 31, 2024. The plan must also reiterate scenarios when this additional mitigation would not occur as described in SWPT-4, CRLF-9, and WSPL-3. The plan must include specific quantifiable success criteria the Space Force will obtain within 5 years' time from when the proposed project triggers mitigation that will serve to address the Space Force's goal of no net loss in species' distribution and abundance. In the event the Space Force does not obtain the success criteria, the Space Force must reduce project effects to align with our analysis until alternative effective mitigation is achieved.
    a. The plan must detail mitigation actions, including how the Space Force will calculate mitigation acreages (California red-legged frog and southwestern pond turtle) and identify what additional areas on or off-base would be restored in the event mitigation threshold triggers are met (in addition to required Oxbow Restoration site depicted in Term and Condition 15). The Space Force must include these additional identified restoration areas to provide assurances their proposed 2:1 acreage ratio (habitat enhanced: habitat affected) would be able to be readily met if needed as proposed in the project description.

The following terms and conditions implement reasonable and prudent measure 4:

15. The Space Force must offset or require the project proponent to offset associated temporary habitat degradation as analyzed for species that are likely to be adversely affected by the proposed project as follows:

Offset for Western snowy plover

The Space Force must fund or require the project proponent to fund at least one full-time staff position to conduct predator control across known western snowy plover occupied VSFB beaches between at least October 1 through December 31, 2024. The

implementation of this work is expected to help demonstrate mitigation efficacy to achieve quantifiable no net loss in western snowy plover abundance and distribution as analyzed.

To provide additional assurances, the Space Force must fund or require the project proponent to fund off-base recovery work equivalent to predator control across 8 km of shoreline to offset project impacts on the take of roosting western snowy plover and degradation of its overwintering habitat from October 1 through December 31, 2024. For this specific consultation, the Service and the Space Force worked collectively to agree that the Space Force or the project proponent will fund an amount of at least $73,680 towards off base projects that support western snowy plover recovery. This amount was calculated using the total basewide VSFB 2024 predator management costs incurred during the breeding season applied to the 8 km of Surf Beach across the three-month duration of the proposed project. The Service will provide the Space Force a list of identified currently available western snowy plover recovery projects to select from to apply this off-base funding mitigation amount prior to January 1, 2025.

The Space Force must report on the status of mitigation implementation during the proposed project's annual report.

Offset for southwestern pond turtle/California red-legged frog:

For this specific consultation, the Service and the Space Force worked collectively to agree that the Space Force or the project proponent will fund the proposed mitigation involving restoration of the 7-acre Oxbow Restoration site with work to begin in 2025. The implementation of this work will also help demonstrate mitigation efficacy to quantifiably achieve no net loss in California red-legged frog abundance and distribution as analyzed.

As specified above, separate from the Oxbow restoration work, the Space Force must identify the additional restoration areas which would be utilized to meet their proposed 2:1 acreage mitigation ratio (as described in CRLF-10 and SWPT-5). The Space Force must include clear depiction of these areas in the proposed mitigation plan and must fund or require that the project proponent fund this additional future work in the event that described mitigation threshold triggers are met (CRLF-8 or SWPT-3).

REPORTING REQUIREMENTS

Pursuant to 50 CFR 402.14(i)(3), the Space Force must report the progress of the action and its impact on the species to the Service as specified in this incidental take statement.

The Space Force must submit a final report to the Service's Ventura Fish and Wildlife Office via electronic mail within 90 days following completion of the proposed project. The reports must describe all activities that were conducted under this biological opinion, including activities and conservation measures that were described in the proposed action and required under the terms and conditions, and discuss any problems that were encountered in implementing conservation measures or terms and conditions and any other pertinent information. The report(s) must also include the following information:

1. Documentation of any impacts of the proposed activities on southwestern pond turtle, California red-legged frog, and western snowy plover; results of biological surveys and observation records; documentation of the number of individuals of any life stage of southwestern pond turtle, California red-legged frogs, or western snowy plovers injured or killed; the date, time, and location of any form of take; approximate size and age of those individuals taken; and a description of relocation sites or rehabilitation outcomes for captured individuals.
2. The Space Force must include a discussion of the progress with the implementation of their monitoring plan. This must include survey and monitoring information of the populations of southwestern pond turtle and California red-legged frog populations within major riparian features (e.g. Honda Creek, Bear Creek, Santa Ynez River, and Jalama Creek); and of overwintering western snowy plovers within South and North Base. This discussion must include a summary of all monitoring activities and address any observed changes in population and distribution trends documented over time that may be associated with long-term effects of increased launch frequency (See Term and Condition 13 and associated analysis). The discussion must also address any potential improvements to the monitoring plan design efficacy, including advances in technology that may aid in sublethal effects detection for consistency with the above analysis.
    a. The California red-legged frog and southwestern pond turtle monitoring discussion must also include: (*i*) date and times of launches and static test fires that impacted Honda Creek, Bear Creek, Santa Ynez River, and Jalama Creek as well as received noise levels at each feature of static test fire, launch, and sonic boom events (including psf conversions to SPL_{max}); (*ii*) documentation and an analysis of effects by the activities evaluated in this biological opinion (see Term and Condition 13a); (*iii*) discussion of project effects that result in take of California red-legged frog or southwestern pond turtle as well as any observed changes to habitat use pattern, reproduction, or behavior over the course of the project as a result of routine launch disturbance; and, (*iv*) any other pertinent information as required by this biological opinion.
        i. This discussion must include the bioacoustics monitoring results within Honda Creek, Bear Creek, Santa Ynez River, and Jalama Creek. The report must include software analysis methods (can refer to Higham et al. 2020, Kruger et al. 2016) used to document changes in signal characteristics as well as estimate chorus size. The report will include results and discussion of any changes to California red-legged frog calling

behavior (e.g., changes in signal rate, call frequency, amplitude, call timing, call duration, etc.) in comparison with the established California red-legged frog bioacoustics baseline, the required off-base control site for reference, as well as any simultaneous observed changes in California red-legged frog annual population data within each feature.

b. The western snowy plover monitoring discussion must include: (*i*) date and times of launches and static test fires that impacted Surf Beach as well as received noise levels of static test fire, launch, and sonic boom events including psf conversions to SPL_{max}; (*ii*) documentation and an analysis of effects by the activities evaluated in this biological opinion (see Term and Condition 13a) (*iii*) discussion of effects that result in take of western snowy plover as well as any observed changes to habitat use pattern or behavior of birds. Note that this discussion must address any observed changes in population and distribution trends documented over the course of this project that may be associated with long-term effects of increased launch disturbance; and (*v*) any other pertinent information as required by this biological opinion.

3. The Space Force must include a description of mitigation activities implemented and any relevant coordination with the Service. The Space Force must include discussion of the status of and whether implemented mitigation has attained applicable success criteria outlined in Term and Condition 15. The Space Force must also include quantifiable metrics to clearly demonstrate that they have achieved no net loss in species abundance or overall distribution to ensure that mitigation efforts are consistent with this analysis.
4. Results from noise monitoring (Term and Condition 8); Light monitoring (Term and Condition 9); Vibration monitoring (Term and Condition 10); Progress report of auditory harm monitoring design development and implementation (Term and Condition 11); Water quality (or soil) monitoring (Term and Condition 12); Pre-project baseline comparison with annual hydrodynamic data results for San Antonio Creek water extraction as specified in Avoidance and Minimization Measure GM-9.
5. The Space Force must submit federally listed species observations over the course of the project to the California Natural Diversity Database (CNDDB).

The report should also include a discussion of any problems encountered implementing the terms and conditions and other protective measures, recommendations for modifying the terms and conditions to enhance the conservation of federally listed species, and any other pertinent information.

DISPOSITION OF DEAD OR INJURED SPECIMENS

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

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

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

CONSERVATION RECOMMENDATIONS

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

1. We recommend that the Space Force work with project proponents to design the launch schedule such that launches, particularly launches with associated boost-backs involving terrestrial landing, occur to the maximum extent possible outside of sensitive breeding windows for listed species. Previous monitoring and comparable literature indicate that routine and frequent exposure to disturbance during these sensitive windows and corresponding accumulation of stress hormone has the potential to significantly impact long-term breeding success and overall population level fitness. In the event that impacts to breeding success, abundance, and distribution are observed in response to increased launch cadence, we strongly recommend proactively working with project proponents on designing the launch schedule to avoid sensitive windows to help preclude associated effects and build in temporal separation between disturbance events to minimize the induced stress on species.
2. The Space Force has indicated there is uncertainty in modeling projections as a result of atmospheric conditions (MSRS 2024a, p. 99). We recommend that prior to any further implementation of launches with easterly trajectories with identified mainland sonic boom potential, that the Space Force require the project proponent to explore partnership with NASA’s Neil A. Armstrong Flight Research Center that have demonstrated

experience with aircraft sonic boom research and attenuation. Service staff have previously spoken to interested parties at this research center and can help facilitate this connection with your team. This partnership could help with model projection accuracy and subsequently also prove valuable to address future improvements in vehicle design and operational optimization. To ensure consistency with this analysis, we recommend that the Space Force implement measures for making decisions on launch time and trajectory based on this coordination and analysis of available data to avoid and minimize to the maximum degree possible the spatial extent and severity of sonic booms experienced both on and off-base.

3. Correspondingly, we recommend that the Space Force proactively require their project proponents to design launch vehicles (and SLCs) to attenuate sensory pollutants, similar to what is being done with aircraft at another installation (i.e., Edwards Air Force Base, X-59 Quiet SuperSonic Technology; NASA 2022, entire). Design considerations in combination with new sensory pollutant attenuation technologies may prove to be pertinent based on a growing body of evidence that suggests noise, vibration, and light can have detrimental impacts on natural ecosystems as previously discussed.
4. We recommend and encourage the Space Force to proactively coordinate with the Service as they learn new information related to this proposed project and during the early stages of future project development. This will improve efficiencies for both agencies and promote the development of meaningful recommendations to avoid and minimize impacts to listed species.
5. We recommend that the Space Force proactively conduct a small-scale California red-legged frog egg-mass relocation study into the existing Oxbow Restoration site. Previous survey efforts have not yet demonstrated that California red-legged frog will utilize these areas for breeding (Evans 2022, p. 4; Kephart 2022, p. 2). This study could help determine whether manual facilitation of California red-legged frog establishment to ensure no-net loss of species abundance is achievable.
6. We recommend that the Space Force continue to coordinate with researchers familiar with study design involving short- and long-term ecological effects of sensory pollutants in the development of the effects monitoring plan for the project. We also recommend that the Space Force implement a basewide monitoring strategy to address the potential for compounding impacts of collective launches across the base.
7. We recommend that the Space Force work with researchers to develop a habitat suitability model that addresses launch disturbance frequency. The Space Force could use a model to inform the number, spacing, and distribution of the collective launch scheduling to make appropriate management decisions to reduce effects. We recommend modeling results incorporate sensitive time windows, such as breeding seasons, and be used to inform launch scheduling to promote recovery goals and adhere to the Space Force's 7(a)(1) obligations.
8. We recommend that proposed southern sea otter monitoring be conducted by a NMFS-approved Protected Species Observer trained in marine mammal science.
9. We recommend that the Space Force coordinate with National Park Service partners to inform them of potential project related impacts to Channel Islands and coordinate

required noise monitoring locations (Recommended Contact - Annie Little, Channel Islands National Park, Supervisory Natural Resource Manager, 1901 Spinnaker Drive Ventura, CA 93001, Office: 805-658-5763, annie_little@nps.gov)

10. We recommend that the Space Force continue to monitor and assess potential effects of project launch and associated boost-back activities on the adjacent western monarch butterfly overwintering site located in Spring Canyon and elsewhere in the near vicinity. We recommend that monitoring of the on-base monarch butterfly populations be conducted in a manner sufficient to assess potential changes in habitat use patterns and population levels. As applicable, we would recommend that the Space Force address observed effects by incorporating management actions that benefit the species. We recommend that the Space Force implement measures outlined in Appendix C.
11. We recommend that the Space Force conduct vegetation and firebreak maintenance around SLC-4 outside of identified southwestern pond turtle nesting and overwintering periods to the maximum degree practicable. These seasons are generally thought to align with early fall (September); however, guidance can vary geographically and by feature type. Consequently, VSFB biologists familiar with the local population of southwestern pond turtle should be consulted to identify the best period to avoid unintentional impacts to aestivating or nesting southwestern pond turtle if suitable habitat is identified within the vicinity of SLC-4.

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

REINITIATION NOTICE

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

If you have any questions regarding this matter, please contact our Section 7 inbox by electronic mail at fw8venturasection7@fws.gov with the project title and reference number (2022-0013990-S7-001-R001) in the subject line.

Sincerely,

Stephen P. Henry
Field Supervisor

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PERSONAL COMMUNICATIONS

Brandt, J. 2024. Joseph Brandt, USFWS Biologist and California condor species expert, review comments on draft California condor NLAA section within SpaceX 2024 Biological Opinion. Draft dated July 18, 2024.
Carswell, L. 2024. Lilian Carswell, USFWS Biologist and SSO species lead; Microsoft Teams chat to Sarah Termondt, USFWS Biologist regarding pinniped hearing sensitivity in comparison with otter. Sent May 30, 2024, at 9:44 AM.
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sent to Sarah Termondt, USFWS Biologist, regarding clarification on Phantom Launch soot production. Dated August 26, 2022

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Seymoure, B. 2024 Assistant Professor of Biological Sciences and lighting specialist at University of Texas at El Paso. Email conversation and meetings with Sarah Termondt, USFWS biologist, regarding VIIRS data surrounding SLC-4, UV Filter BMPs; Email conversation and meetings between February 16 to 22, 2024.

Schwartz, C. 2023. Graduate Student, San Francisco State University, Department of Biology. Email conversation with Sarah Termondt, USFWS biologist, regarding recommended improvements to Space Force's proposed bioacoustic monitoring design for amphibians. Email thread dated January 20 to July 17, 2023.

SpaceX. 2024a. Communication during July 2, 2024 In person meeting held at VSFB with Microsoft Teams virtual component between USFWS Region 8 Office, USFWS Ventura Field Office, SpaceX, and U.S. Space Force including Paul Souza (Regional Director) and Kiko Dontchev (SpaceX) and Col. Mark Shumaker (USSF) regarding agreement to bridge consult for 14 launches from SLC-4 between October to December 31, 2024.

SpaceX. 2024b. Communication during July 25, 2024 12:00pm Microsoft Teams Meeting with USFWS Region 8 Office, USFWS Ventura Field Office, SpaceX, and U.S. Space Force including Paul Souza (Regional Director) and Kiko Dontchev (SpaceX) regarding changes to proposed project description from 14 with 1 boost back to 16 launches with 2 boost backs from SLC-6 between October to December 31, 2024.

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APPENDIX A – Figures

Launch Noise Effect Area

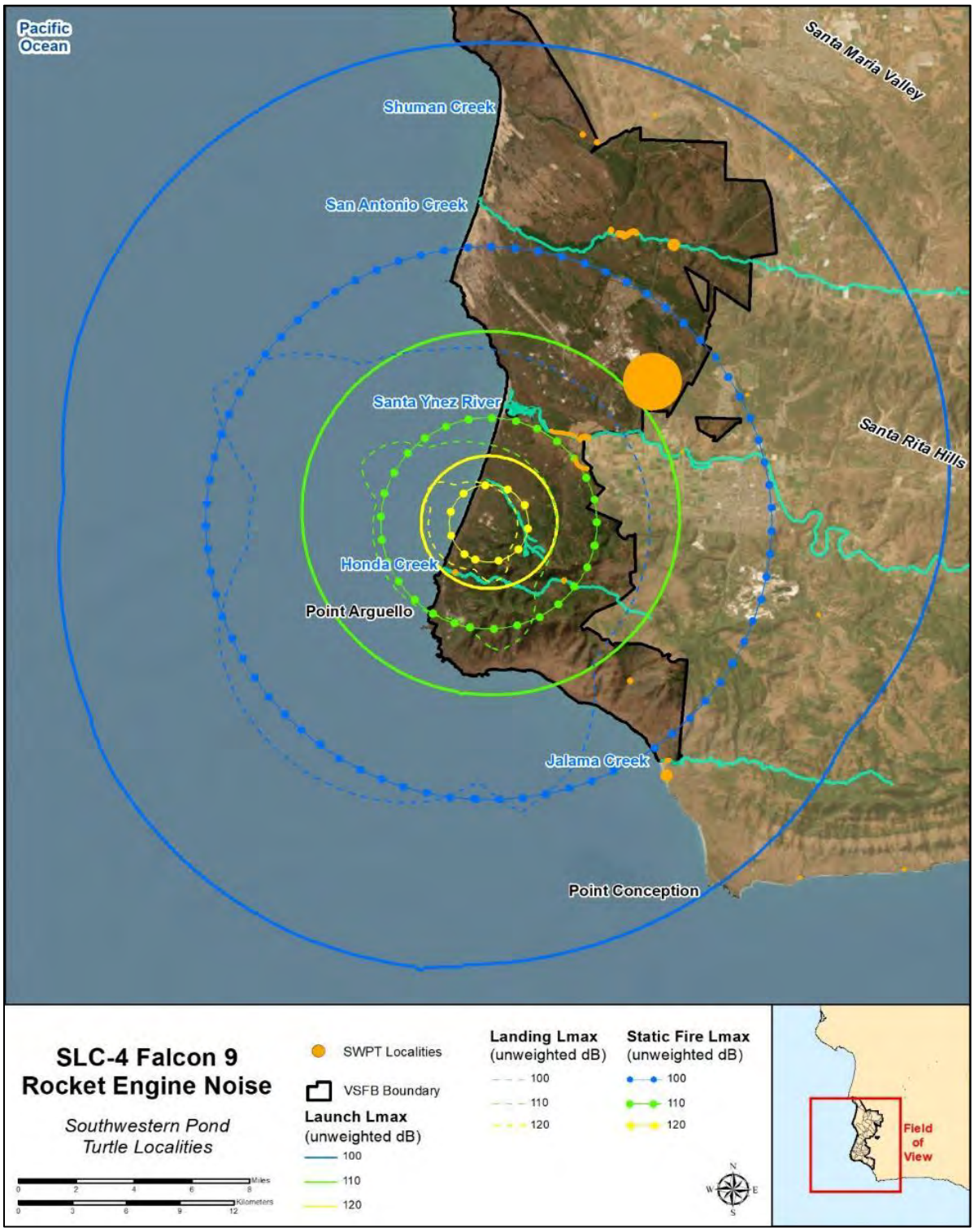


Figure 1A. Southwestern pond turtle occurrences and the projected Launch Noise Effect Area.

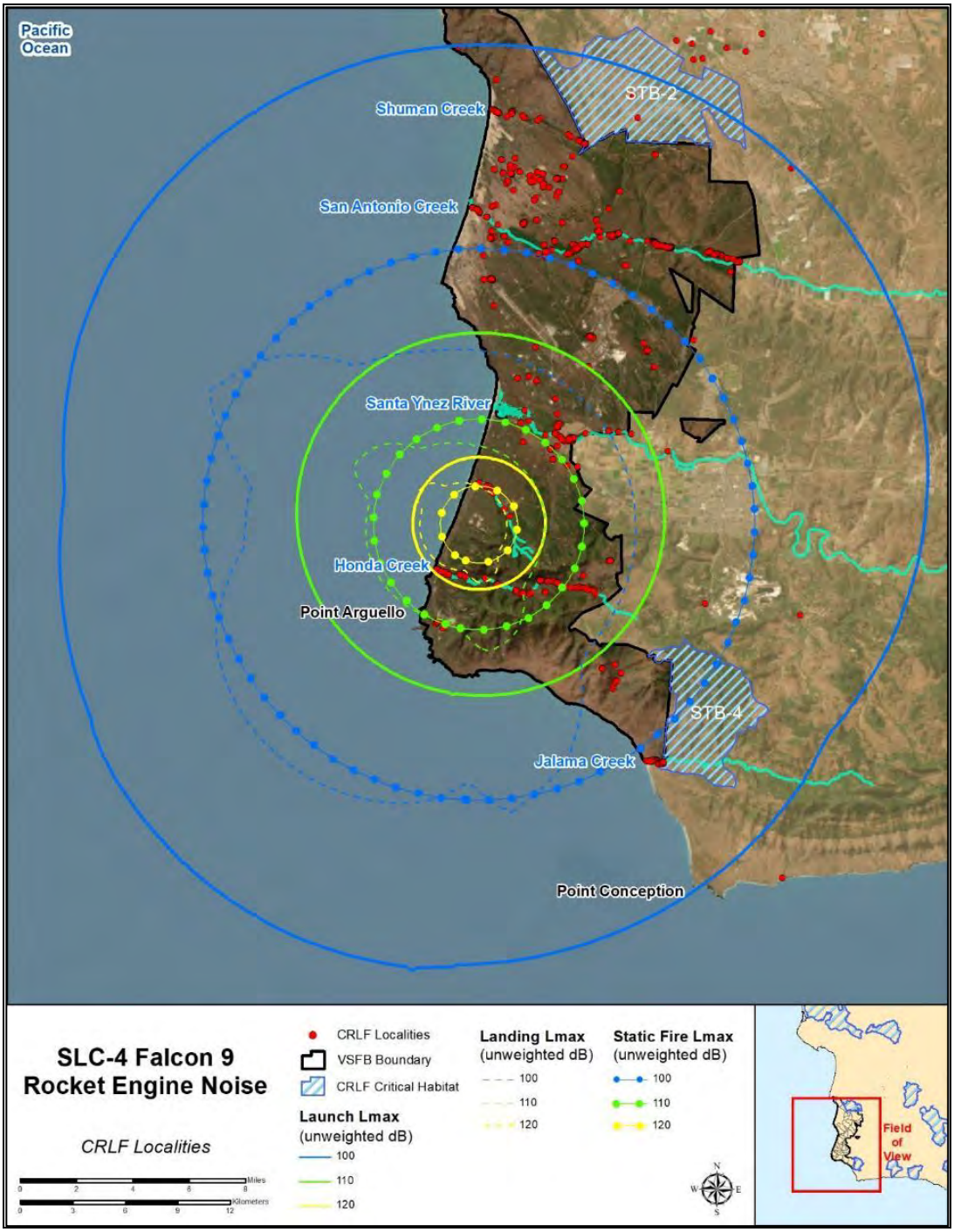


Figure 1B. California red-legged frog occurrences and the projected Launch Noise Effect Area.

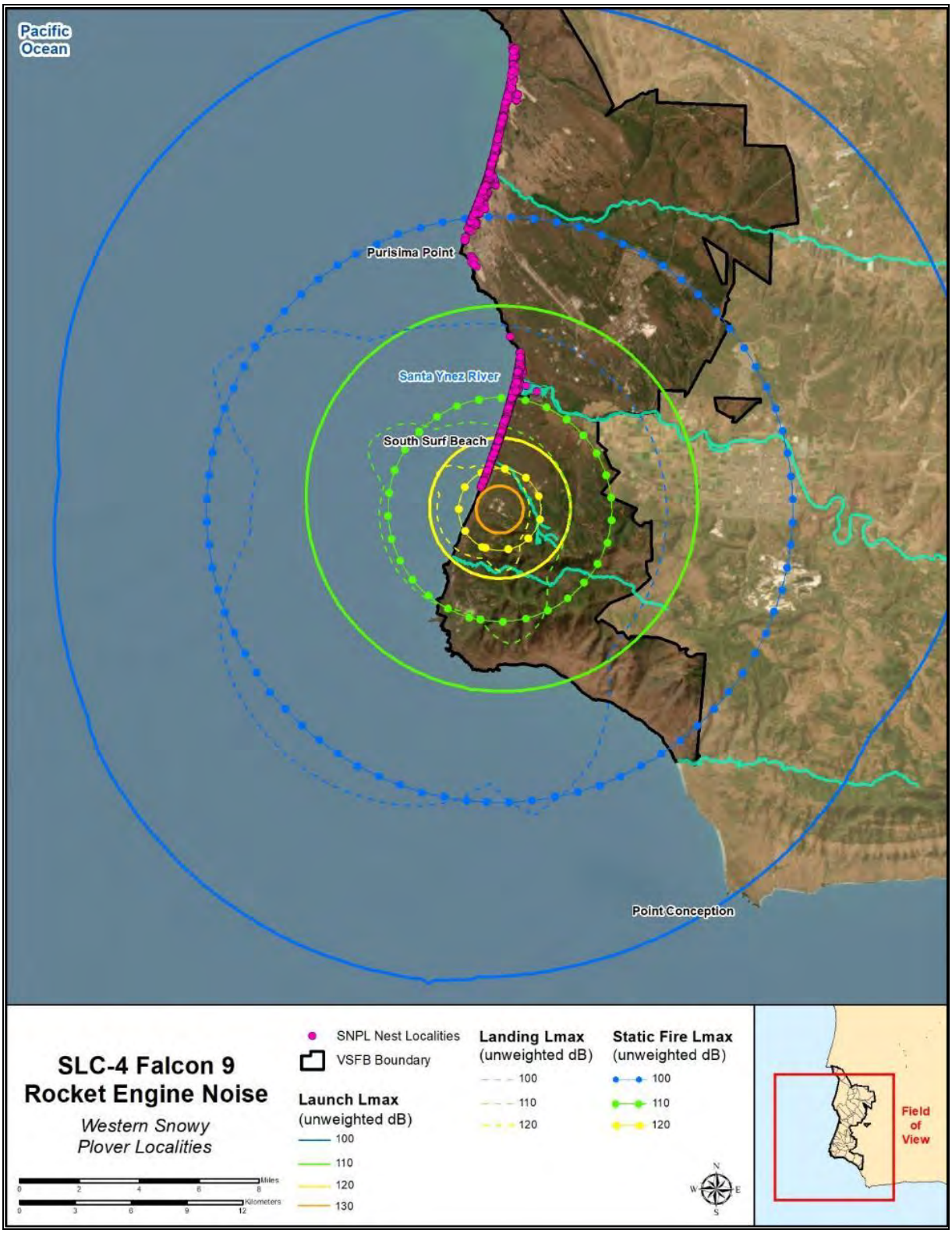


Figure 1C. Western snowy plover nesting occurrences and the projected Launch Noise Effect Area.

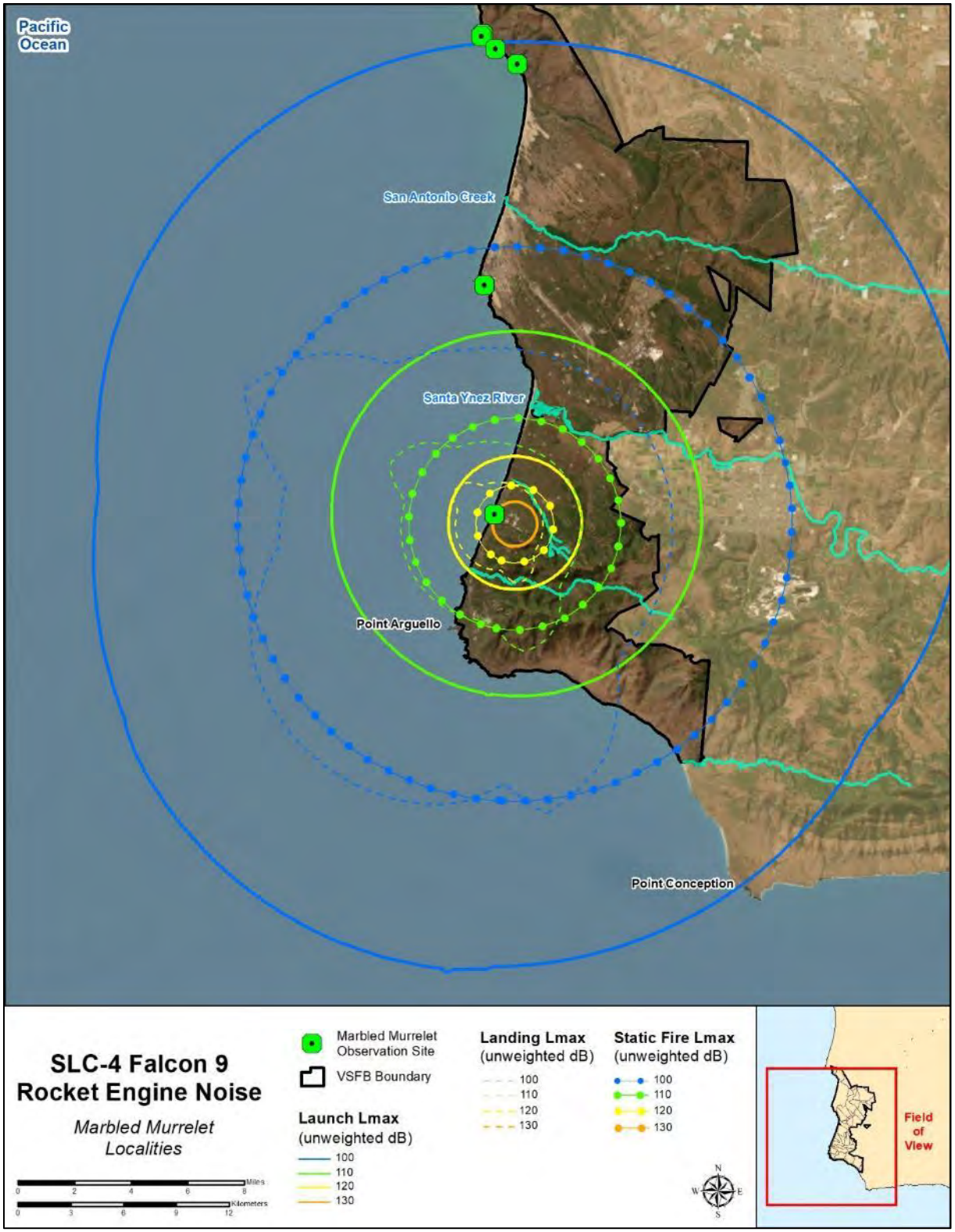


Figure 1D. Marbled Murrelet occurrence observation sites and the projected Launch Noise Effect Area.

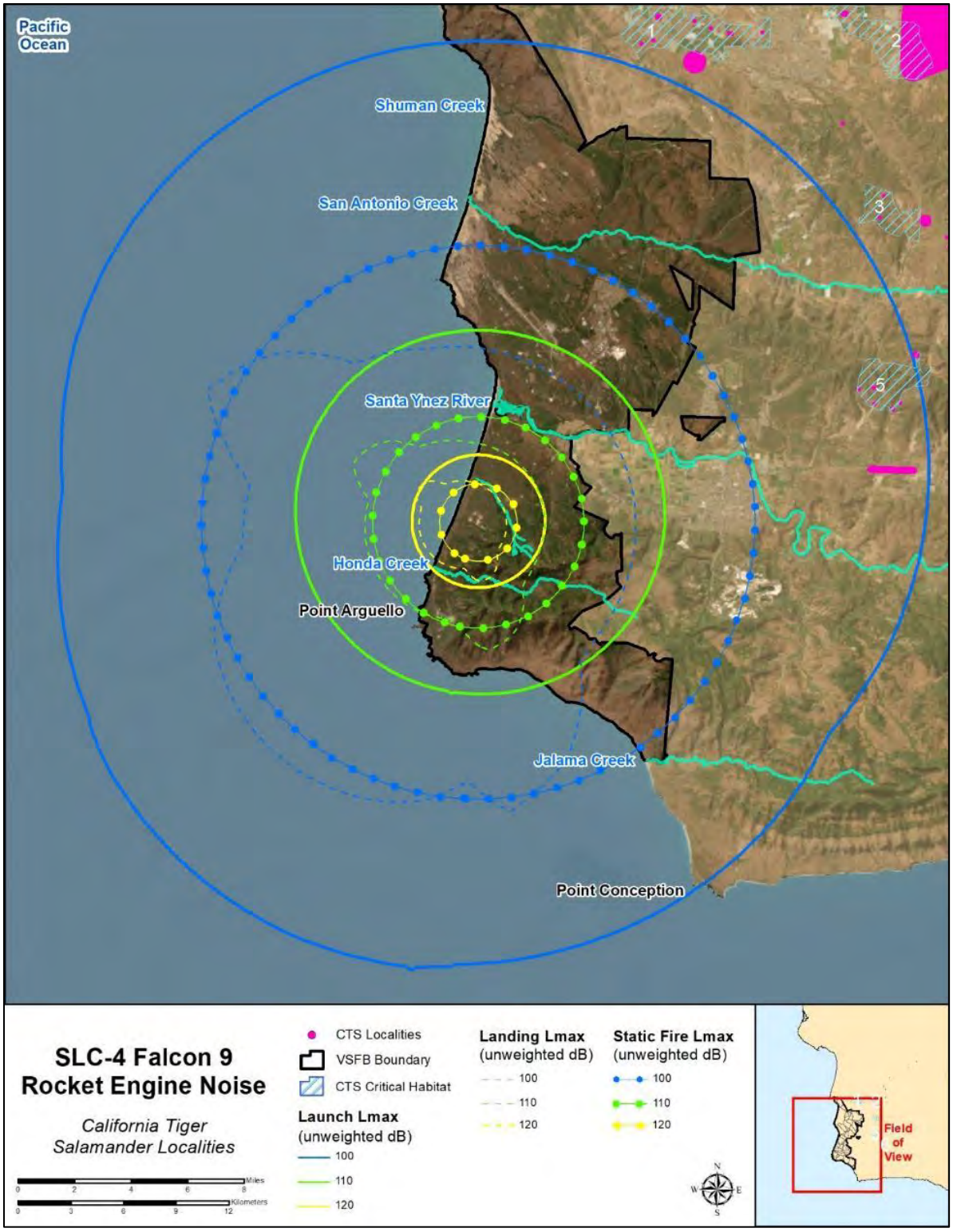


Figure 1E. California tiger salamander occurrences and the projected Launch Noise Effect Area.

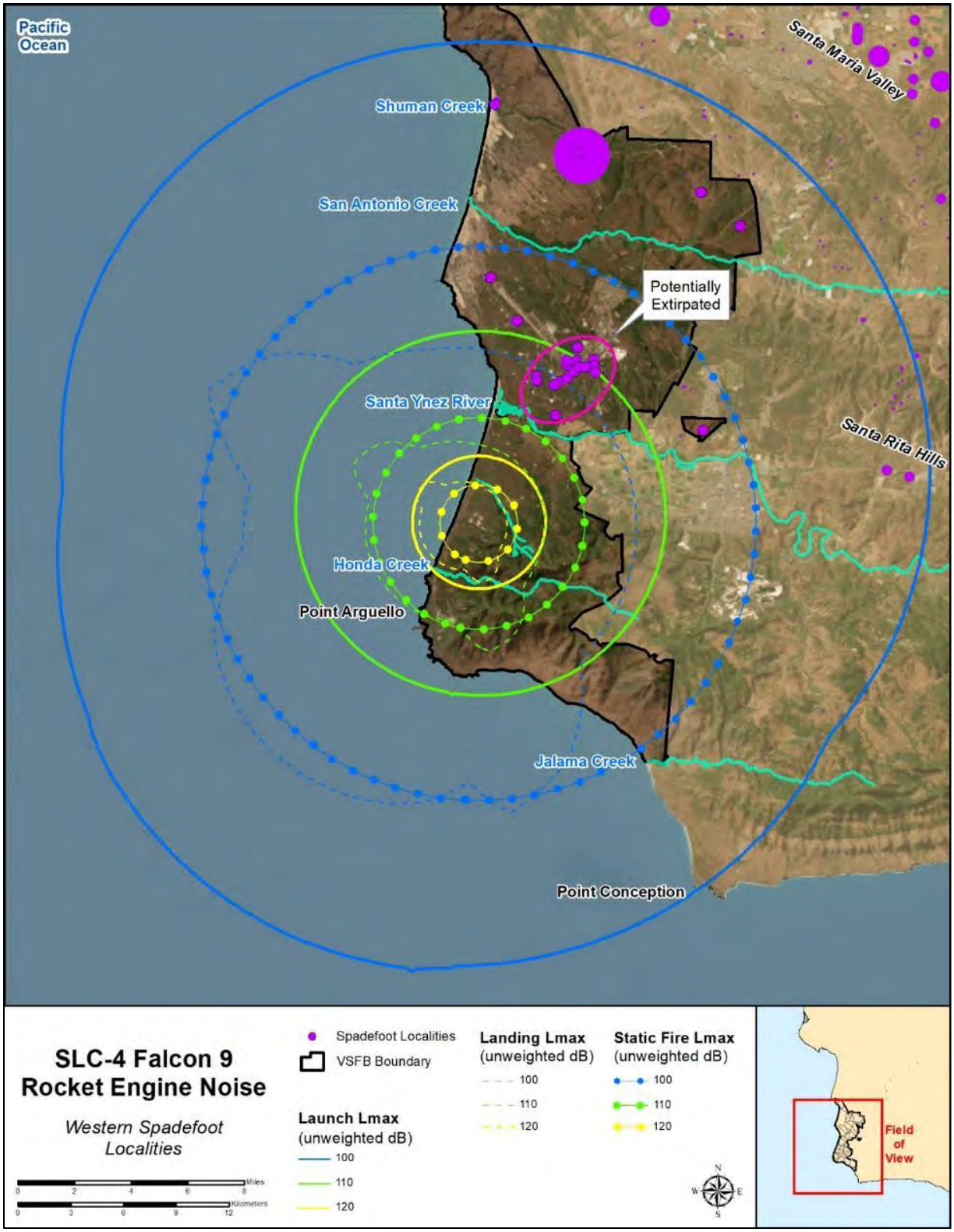


Figure 1F. Western spadefoot occurrences and the projected Launch Noise Effect Area.

Sonic Boom Overpressure Effect Area; Launch Descent (boost-back landing)

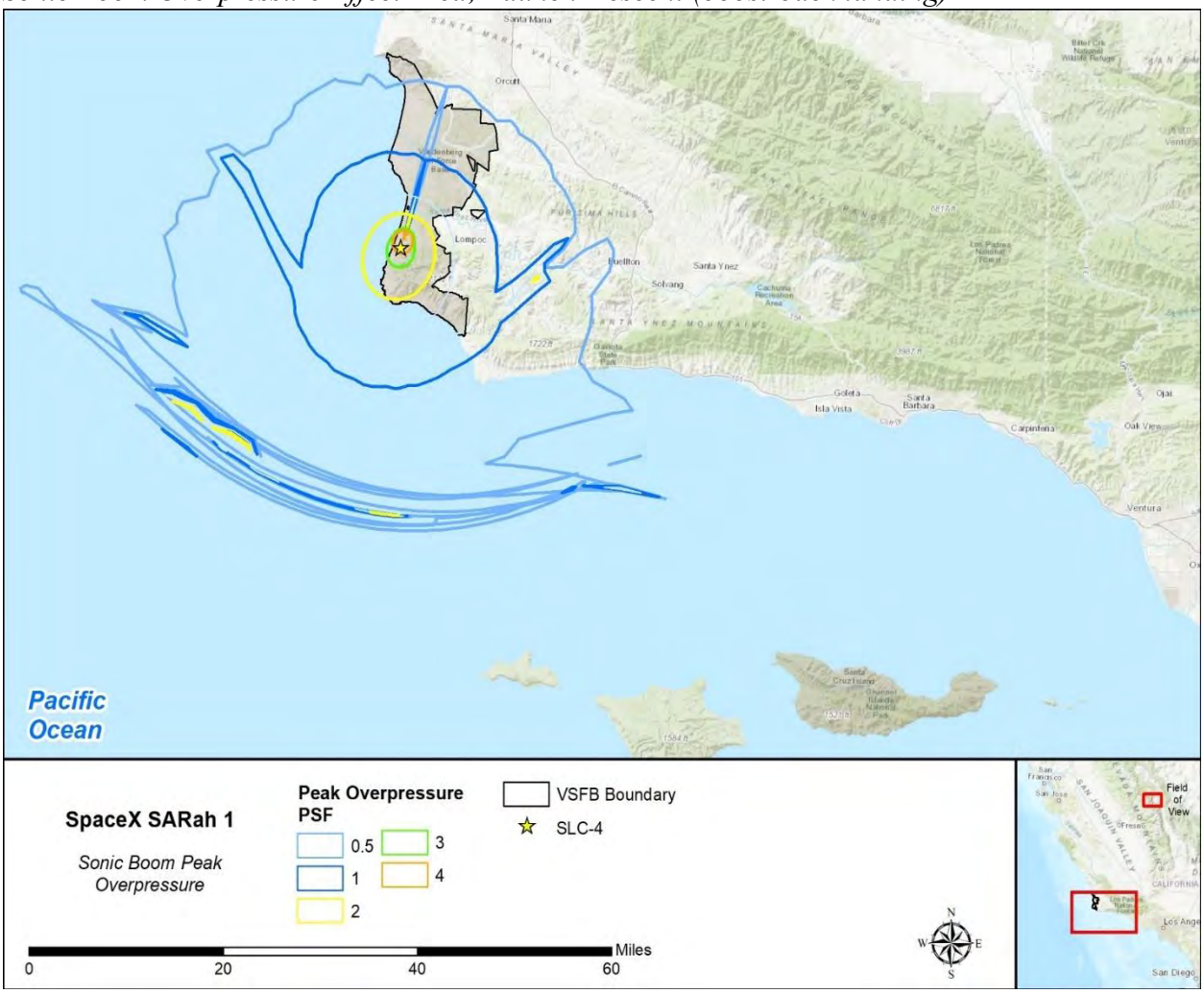


Figure 2A. The Sonic Boom Overpressure Effect Area impacting VSFB during launch descent to SLC-4.

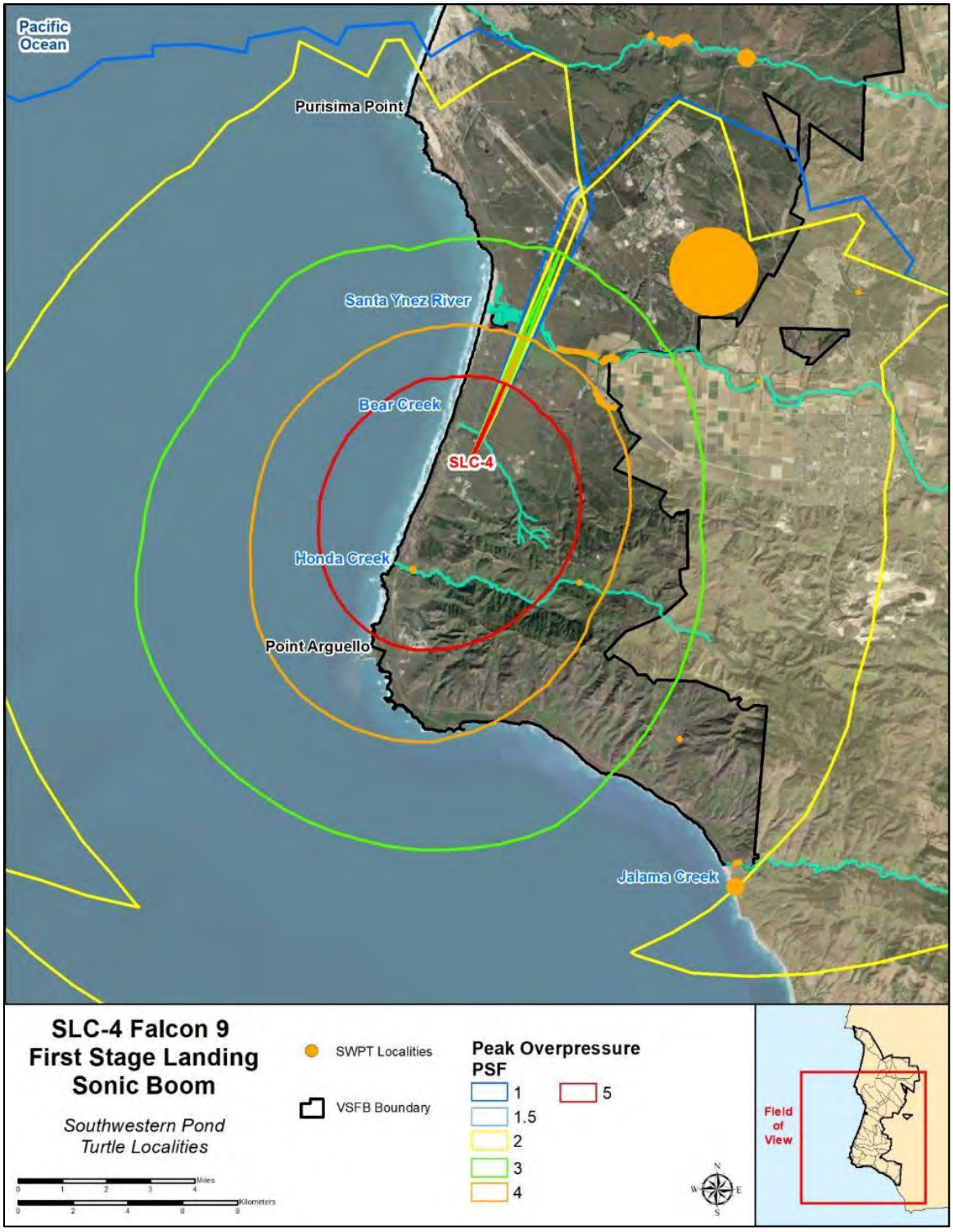


Figure 2B. Southwestern pond turtle occurrences and the projected Sonic Boom Overpressure Effect Area produced during vehicle landing at SLC-4.

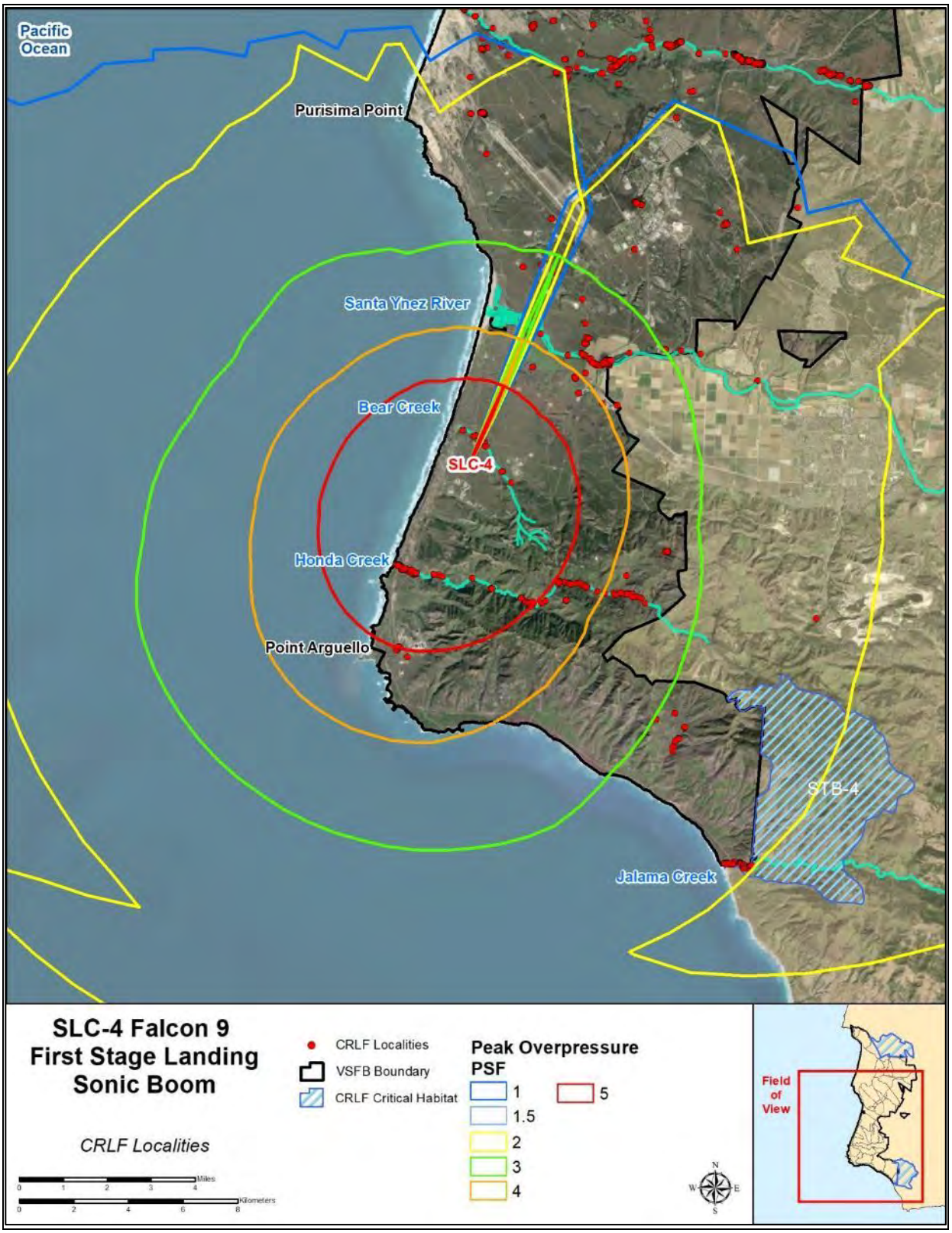


Figure 2C. California red-legged frog occurrences and the projected Sonic Boom Overpressure Effect Area produced during vehicle landing at SLC-4.

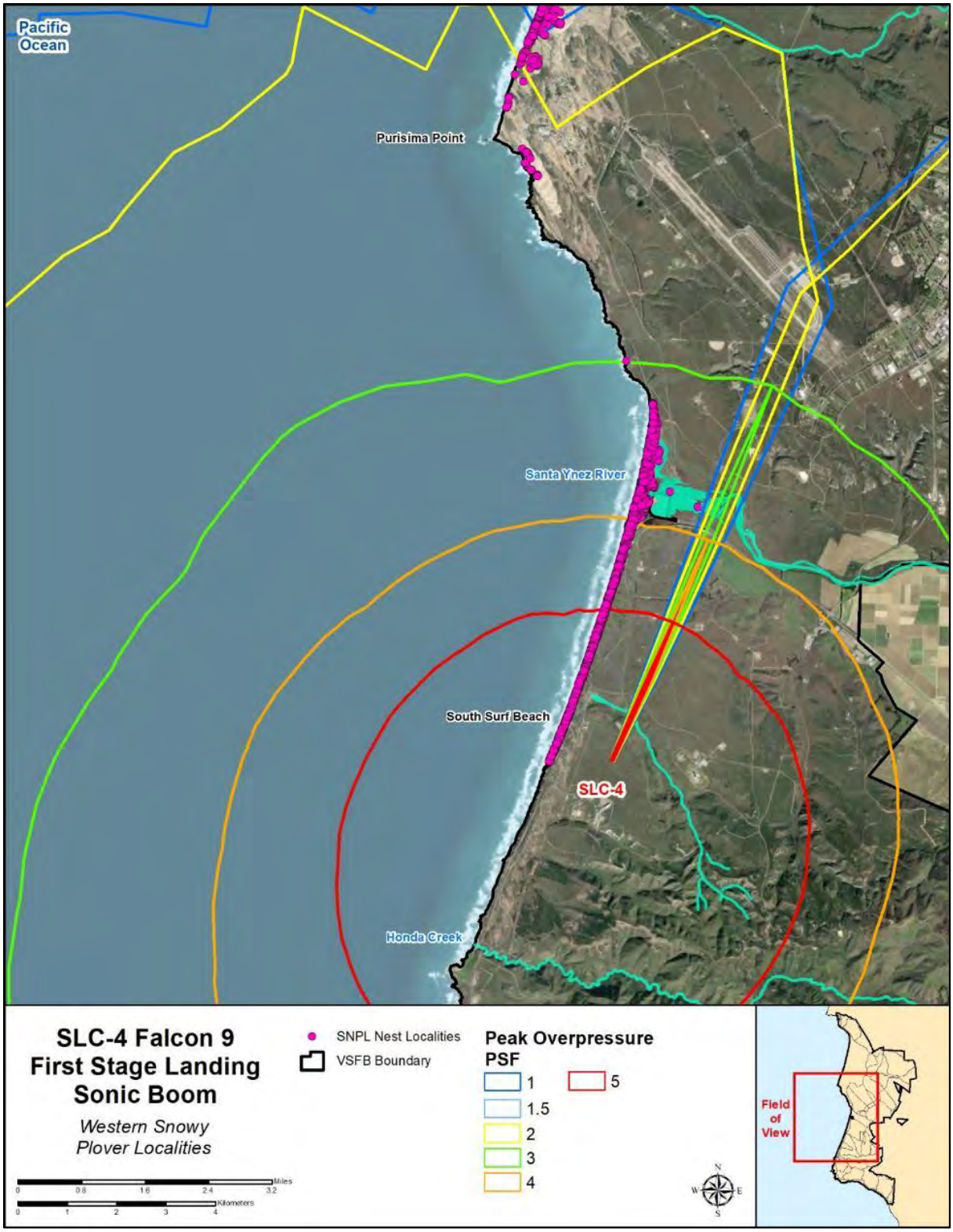


Figure 2D. Western snowy plover nesting occurrences and the projected Sonic Boom Overpressure Effect Area produced during vehicle landing at SLC-4.

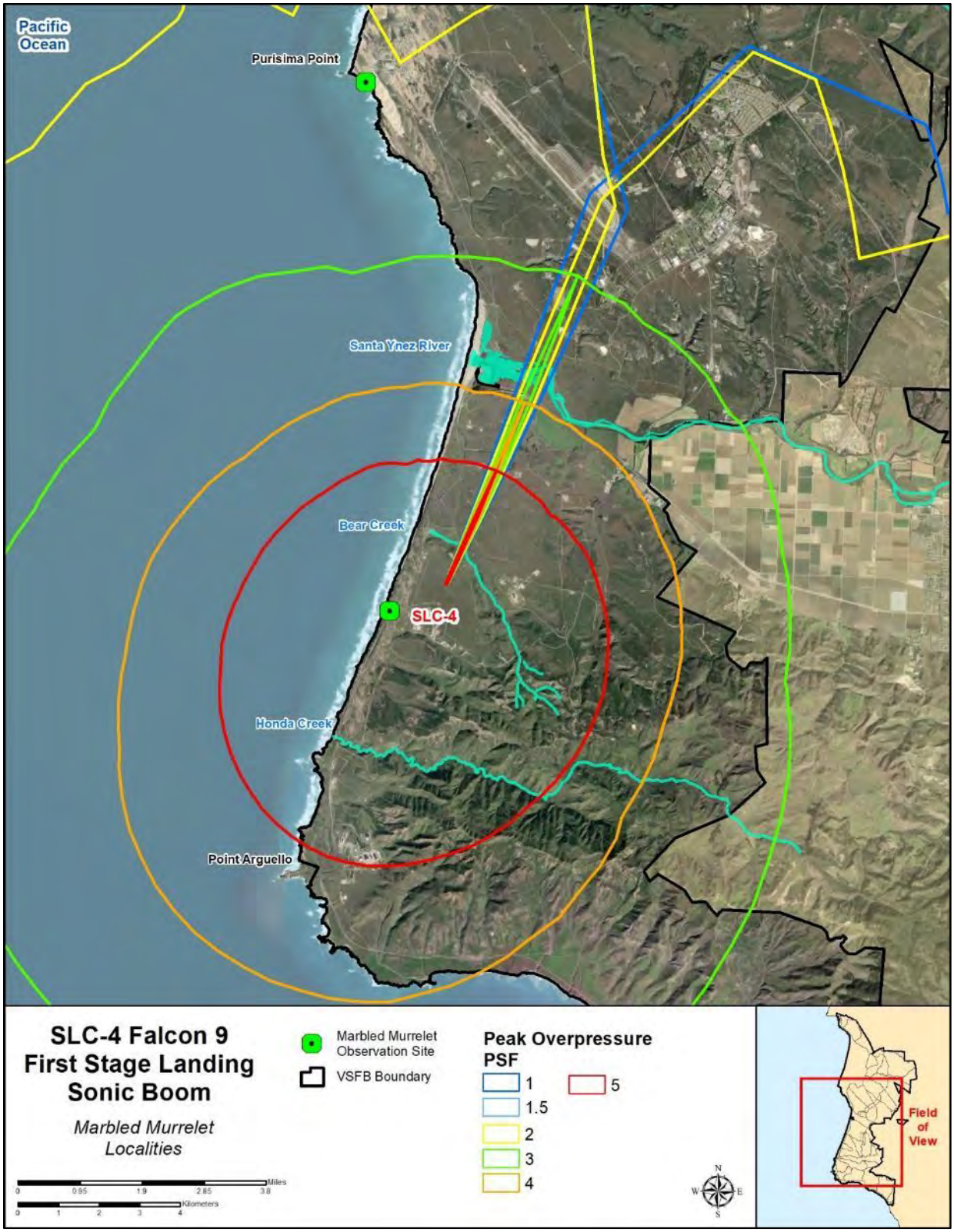


Figure 2E. Marbled murrelet occurrence observation sites and the projected Sonic Boom Overpressure Effect Area produced during vehicle landing at SLC-4.



Figure 2F. California tiger salamander occurrences and the projected Sonic Boom Overpressure Effect Area produced during vehicle landing at SLC-4.

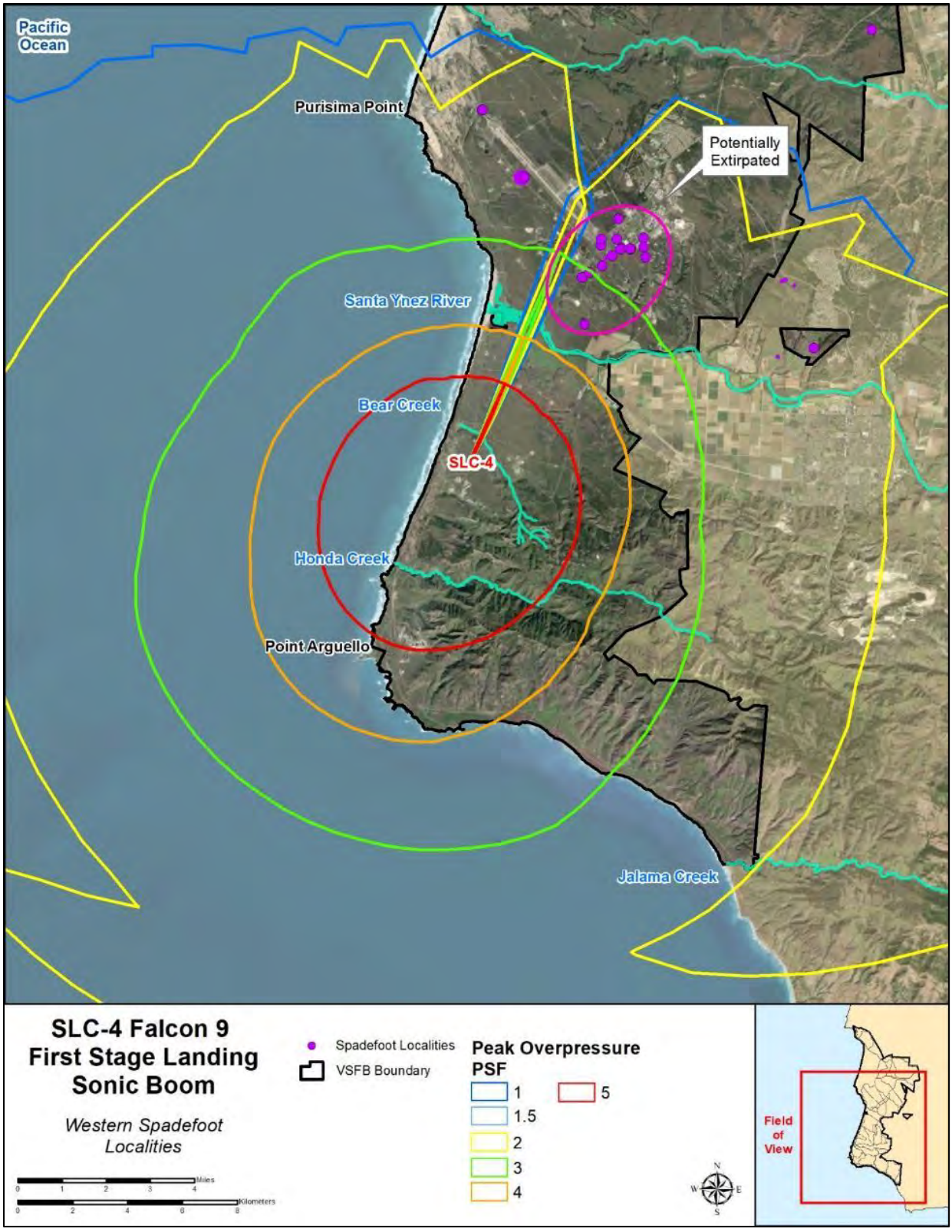


Figure 2G. Western spadefoot occurrences and the projected Sonic Boom Overpressure Effect Area produced during vehicle landing at SLC-4.

Sonic Boom Overpressure Effect Area; Launch Ascent

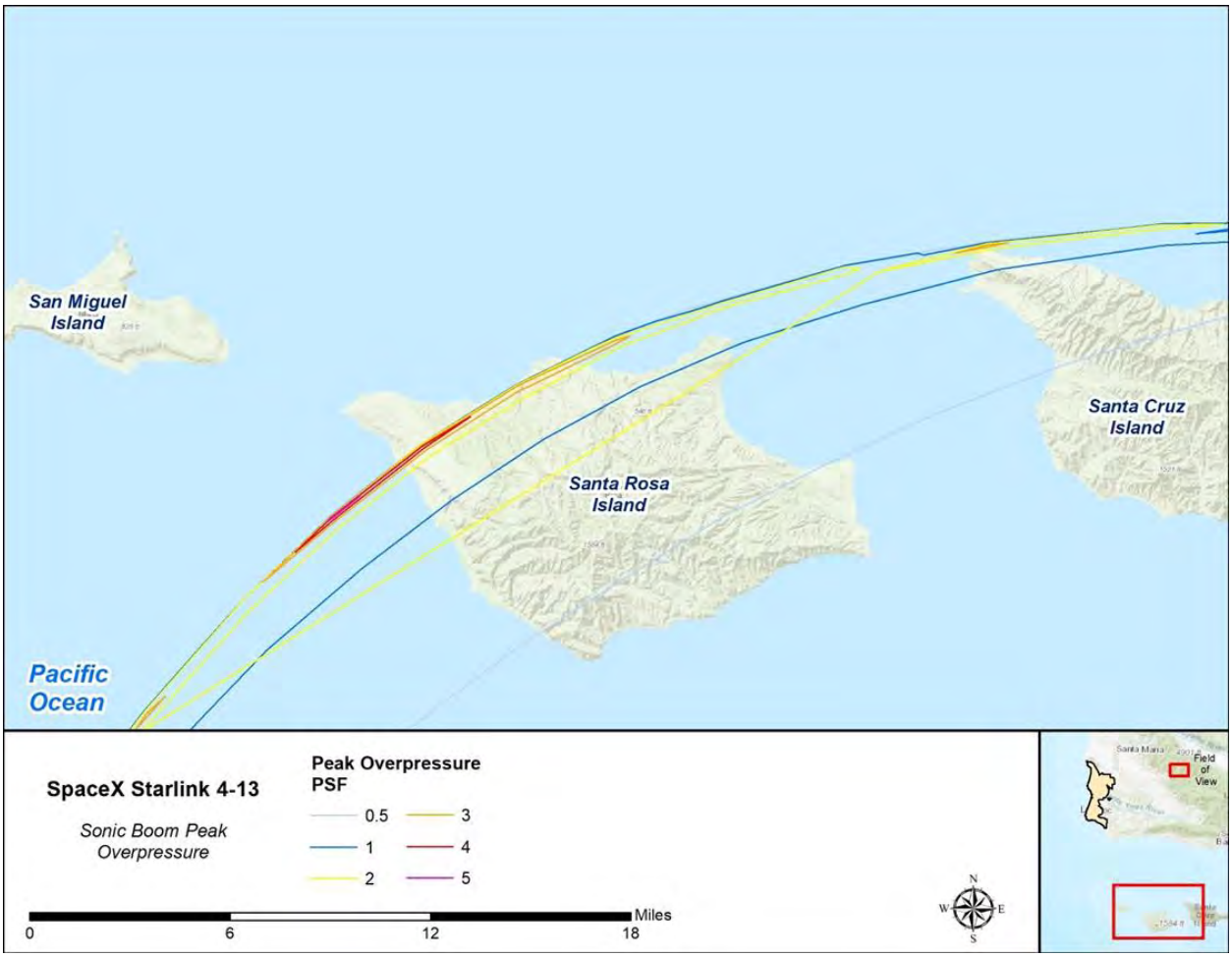


Figure 2H. Portion of the Sonic Boom Overpressure Effect Area impacting Northern Channel Islands during launch ascent.

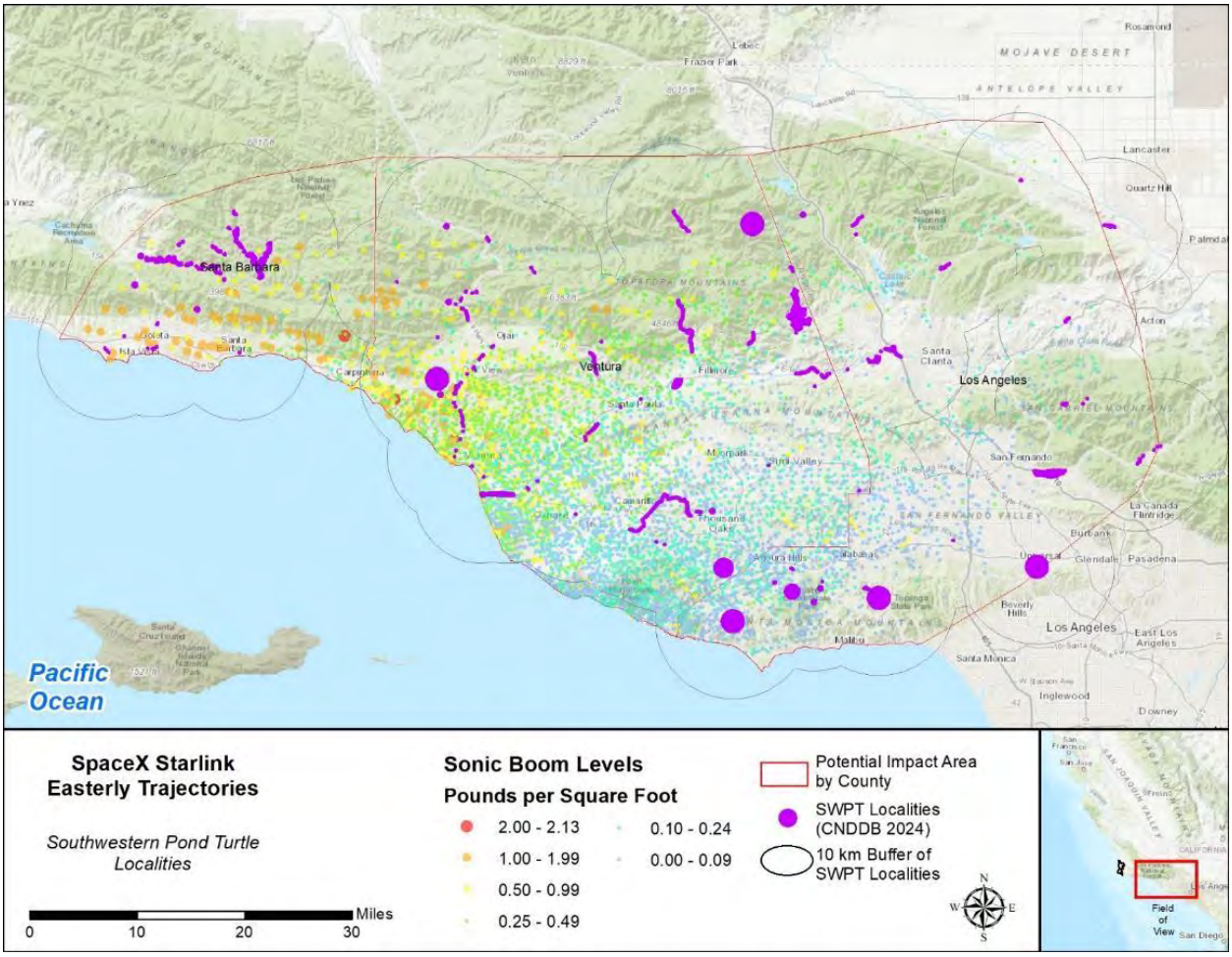


Figure 2I. Southwestern pond turtle occurrences and the Sonic Boom Overpressure Effect Area impacting Mainland California during launch ascent.

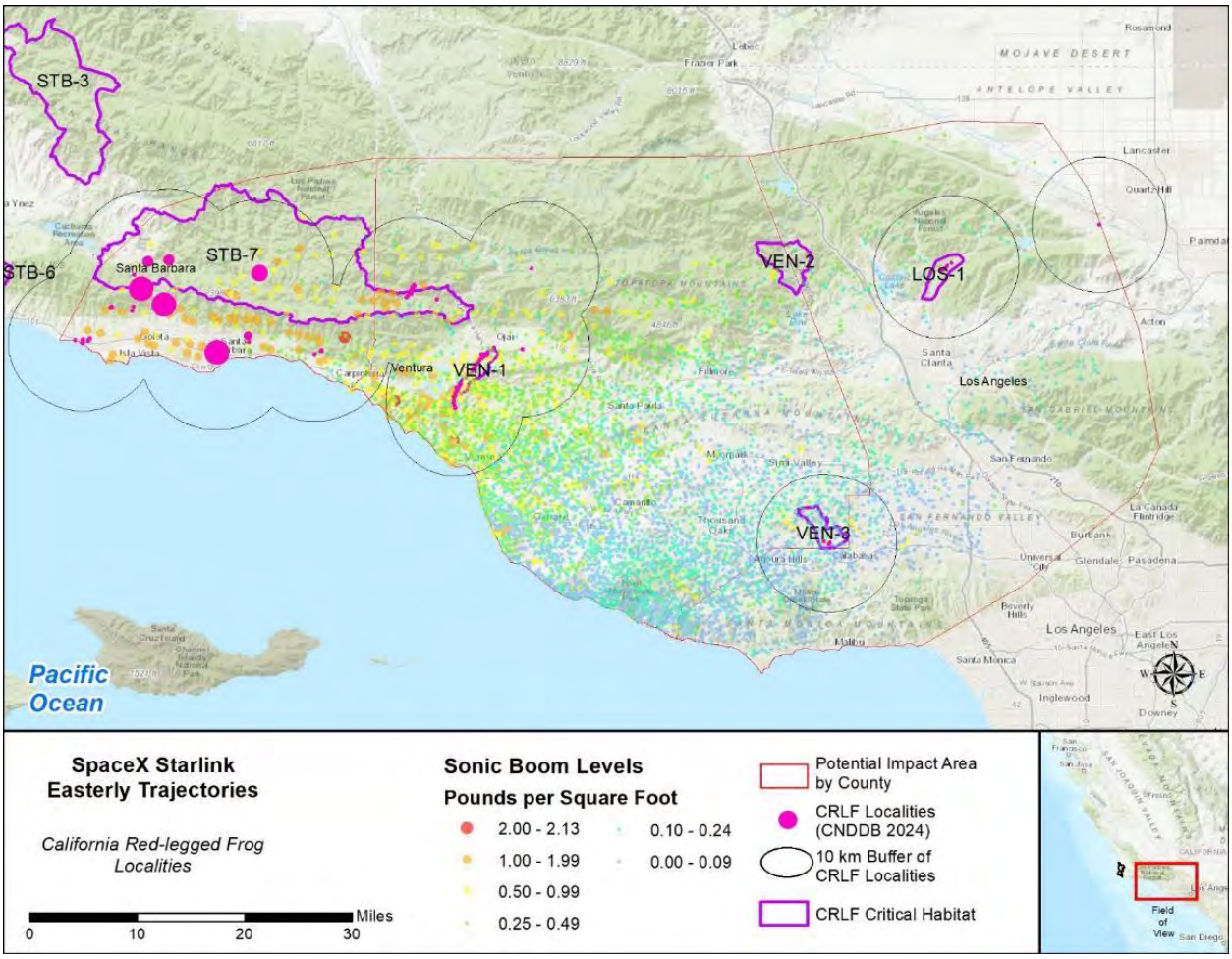


Figure 2J. California red-legged frog occurrences and the Sonic Boom Overpressure Effect Area impacting Mainland California during launch ascent.

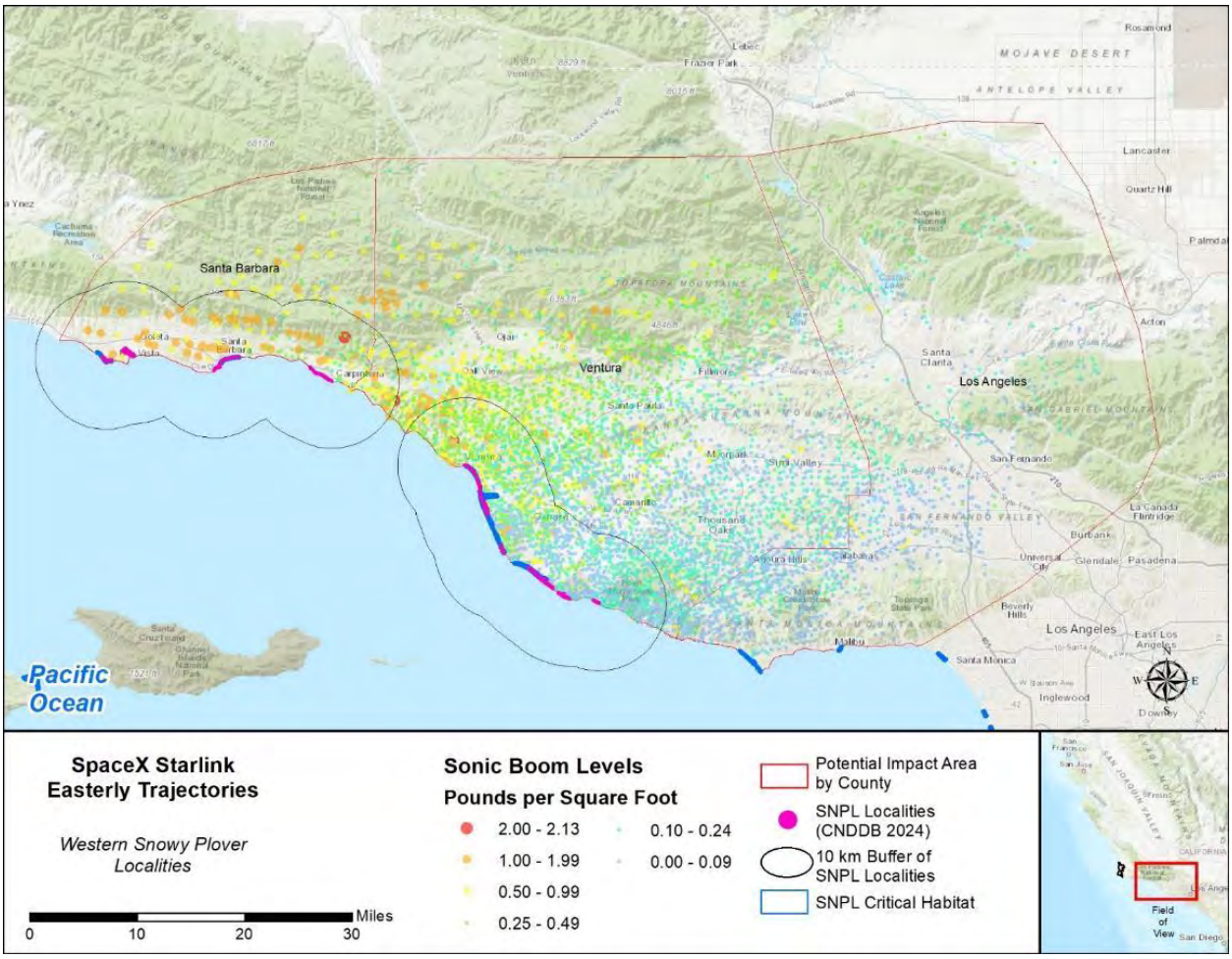


Figure 2K. Western snowy plover occurrences and the Sonic Boom Overpressure Effect Area impacting Mainland California during launch ascent.

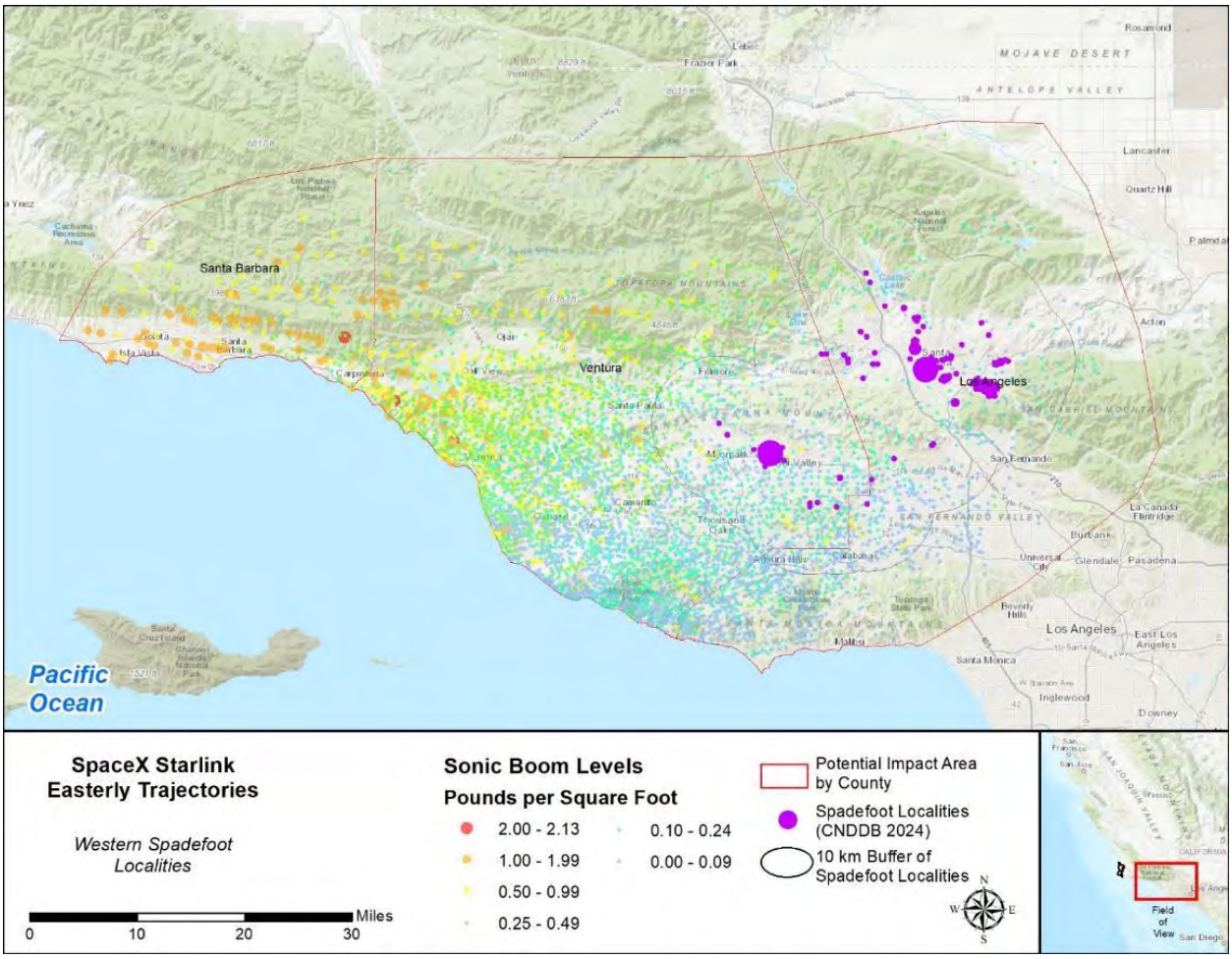


Figure 2L. Western spadefoot occurrences and the Sonic Boom Overpressure Effect Area impacting Mainland California during launch ascent.

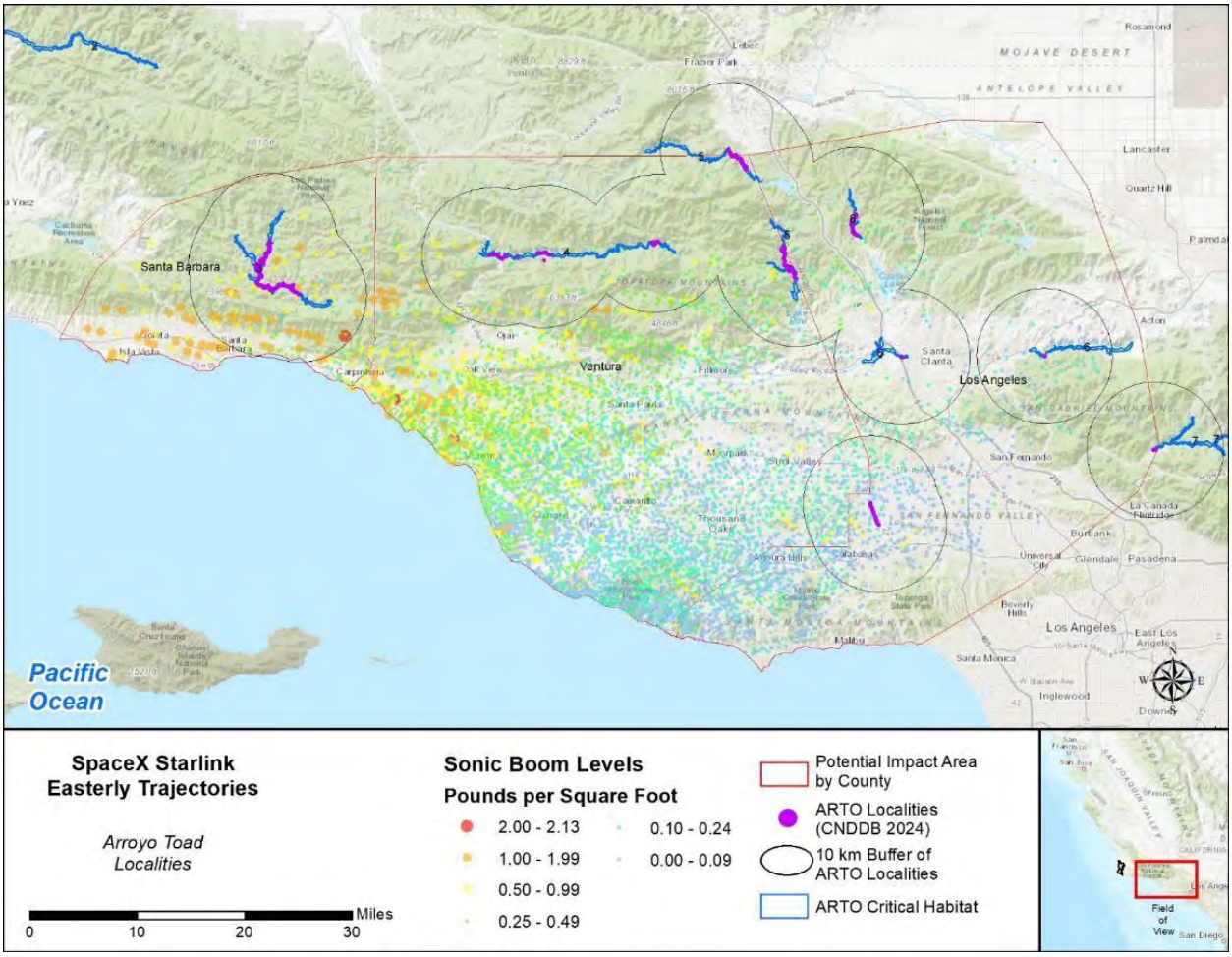


Figure 2M. Arroyo toad occurrences and the Sonic Boom Overpressure Effect Area impacting Mainland California during launch ascent.

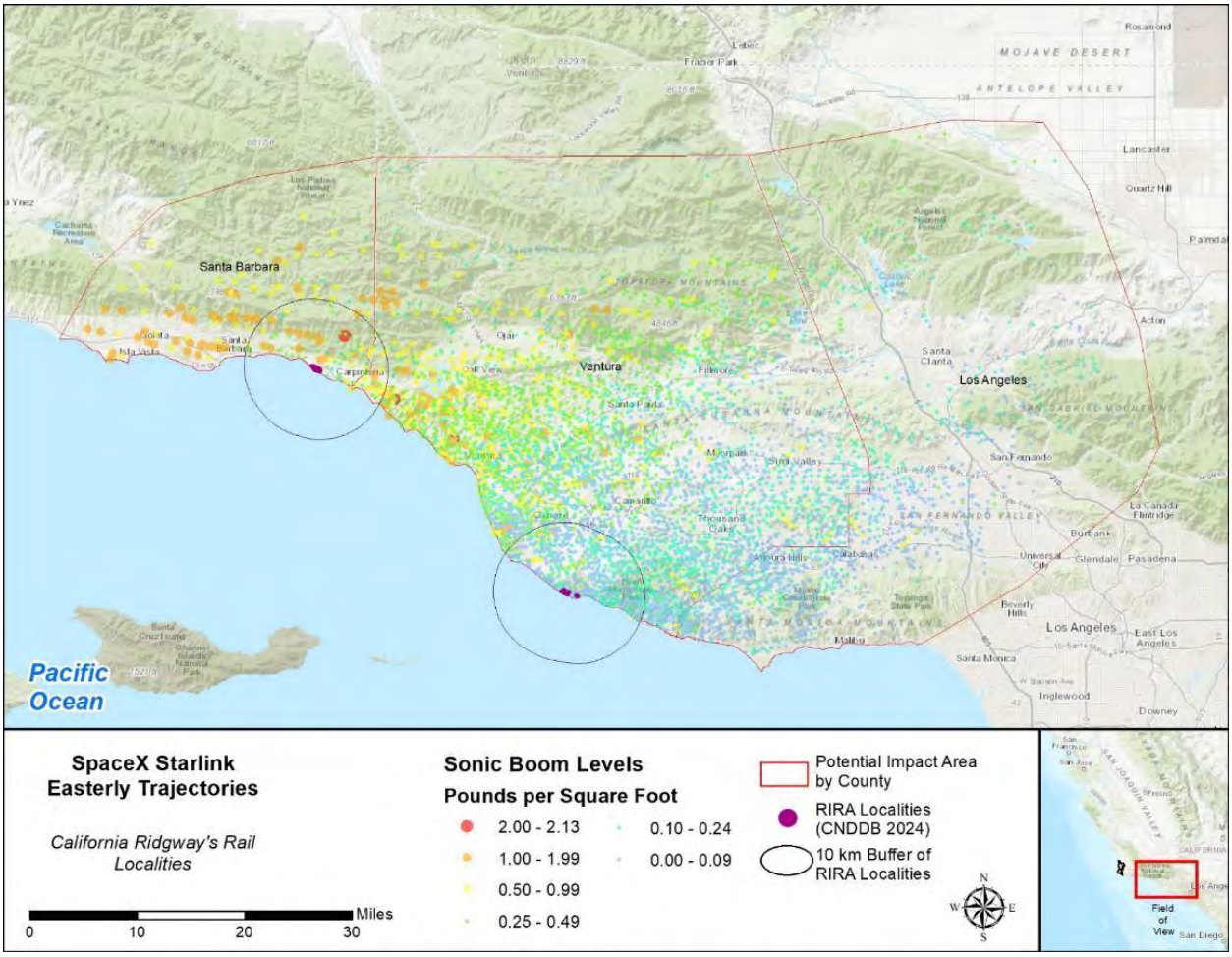


Figure 2N. Light-footed ridgway's rail occurrences and the Sonic Boom Overpressure Effect Area impacting Mainland California during launch ascent.

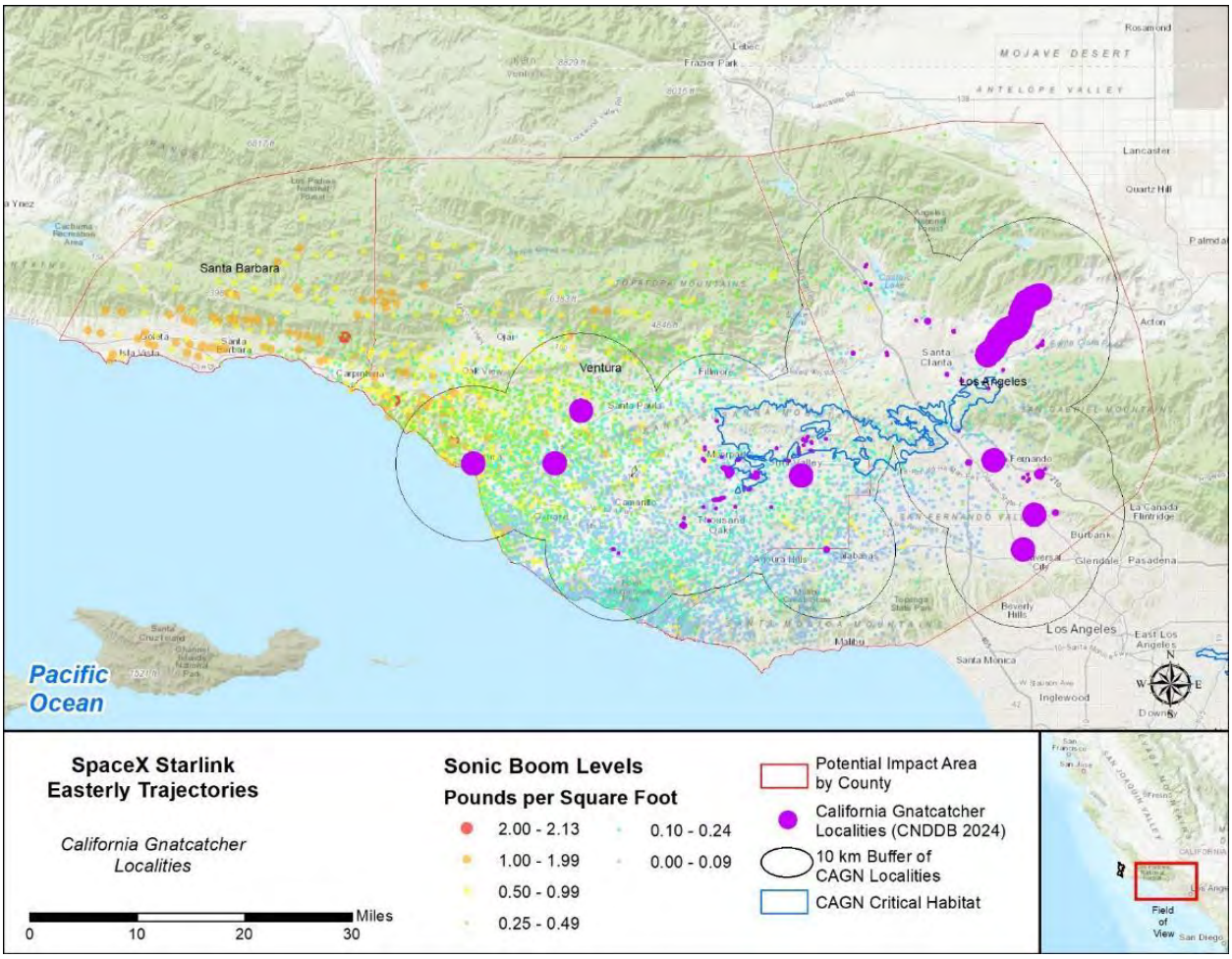


Figure 2O. Coastal California gnatcatcher occurrences and the Sonic Boom Overpressure Effect Area impacting Mainland California during launch ascent.

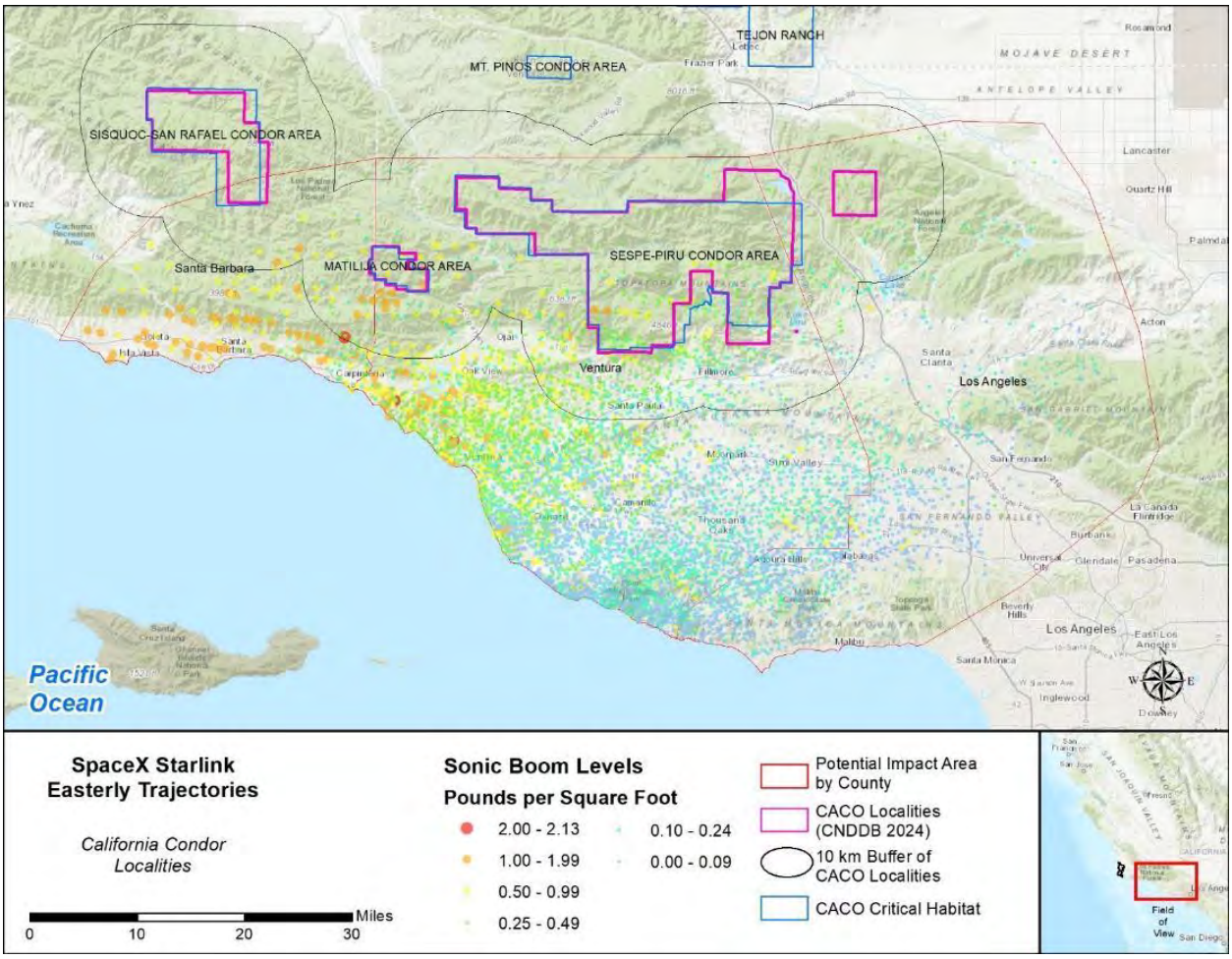


Figure 2P. California condor occurrences and the Sonic Boom Overpressure Effect Area impacting Mainland California during launch ascent.

Vehicle Landing Effect Area

Pacific Ocean and SLC-4E



Figure 3. Vehicle Landing Effect Area within the Pacific Ocean on a mobile barge ship and at SLC-4E.

Space Force proposed Potential Mitigation Areas

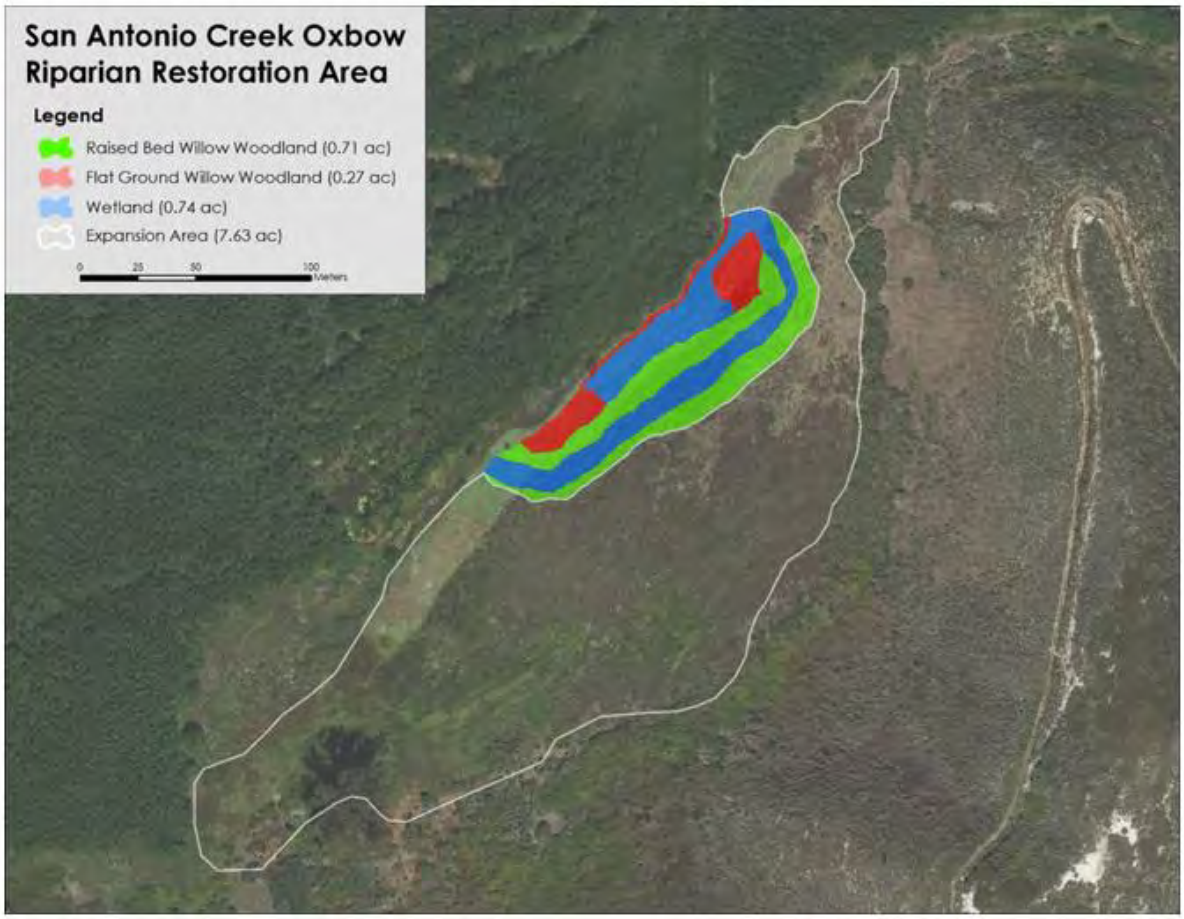


Figure 4A. Space Force proposed potential mitigation area (San Antonio Creek Oxbow Restoration Area) for California red-legged frog and southwestern pond turtle. Current restoration efforts depicted in green, red, and blue.

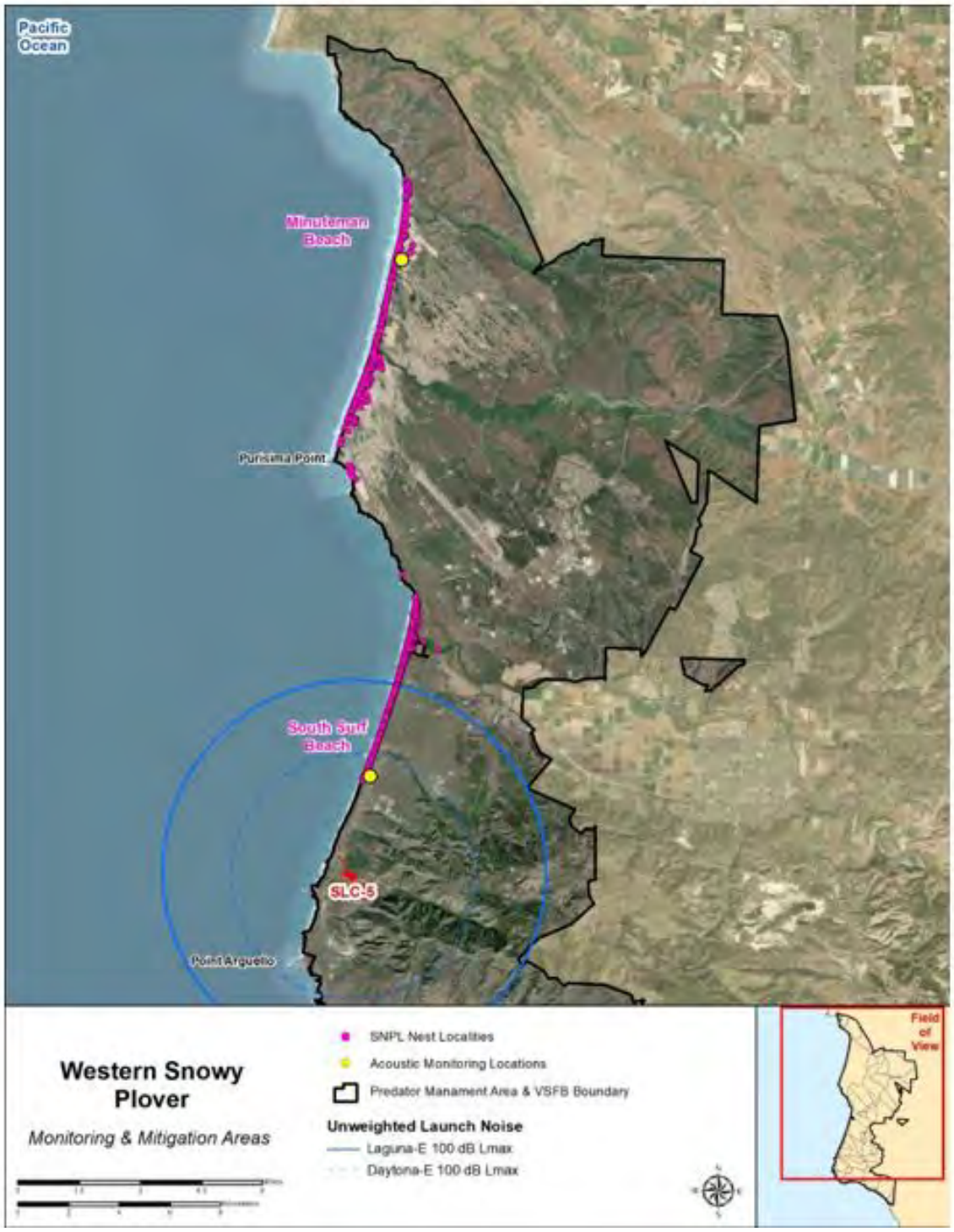


Figure 4B. Space Force proposed potential mitigation area (Predator Management Area) for western snowy plover. Note that the figure references a separate project's (Phantom) launch noise effect area to be disregarded (Kaisersatt, pers. comm, 2023c; MSRS 2022d).

APPENDIX B – Biologist Authorization Request, Field Experience Tracking Form

Biologist Authorization Request

Field Experience Tracking Form

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

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

Biologist Name

Activity Authorization Request Type (For Each Species Requested)

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

Project Name and Biological Opinion #

Relevant Experience

Please Enter Recovery Permit:

<u>OR</u> populate table below as necessary to demonstrate adequate experience.

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

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

Service Assessment (to be completed by the Service)

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

Description of additional information needed and/or clarifying remarks

Electronic Signatures and Authorizations

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

APPENDIX C - Western Monarch Butterfly Conservation Recommendations

Western Monarch Butterfly Conservation Recommendations:

Purpose: Section 7(a)(1) of the Endangered Species Act of 1973 (ESA), directs federal agencies to use their authorities to further the purpose of the ESA, by conducting conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary activities that an action agency may undertake to avoid and minimize the adverse effects of a proposed action, implement recovery plans, or to develop information that is useful for the conservation of listed species. The purpose of the following conservation recommendations is to encourage federal agencies to incorporate monarch butterflies as applicable into their Environmental Assessments and Biological Assessments associated with Section 7 Biological Opinions, when in consultation with the U.S. Fish & Wildlife Service.

Background: The western migratory monarch butterfly population has declined by more than 99 percent since the 1980s. An estimated 4.5 million monarchs overwintered on the California coast in the 1980s, whereas in 2020, the population estimate for overwintering monarchs was less than 2,000 butterflies. This extreme population decline is likely due to multiple stressors across the monarch's range, including the loss and degradation of overwintering groves; pesticide use, particularly insecticides; loss of breeding and migratory habitat; climate change; parasites and disease. Historically, the majority of western monarchs spent the winter in forested groves near the coast from Mendocino County, California, south into northern Baja California, Mexico. In recent years, monarchs have not clustered in the southern-most or northern-most parts of their overwintering range, and there are year-round residents in some areas of the coast. This resident phenomenon is likely due to a combination of climate change and an abundance of residential-planted non-native, tropical milkweed that is available for monarchs year-round. Migratory western monarchs depart the overwintering groves in mid-winter to early-spring. Throughout the spring and summer, monarchs breed, lay their eggs on milkweed, and migrate across multiple generations within California and other states west of the Rocky Mountains. In an attempt to reverse the severe population decline of western monarch butterflies, and to protect other pollinators as well, we encourage implementation of the conservation recommendations listed below. Please see Figure 1 for suggested areas to focus voluntary conservation actions in California. Western monarch conservation actions outside of California are also important, especially for the larger pollinator community. Recommendations for other western states are addressed in the "All Breeding and Migratory Zones" section of this document.

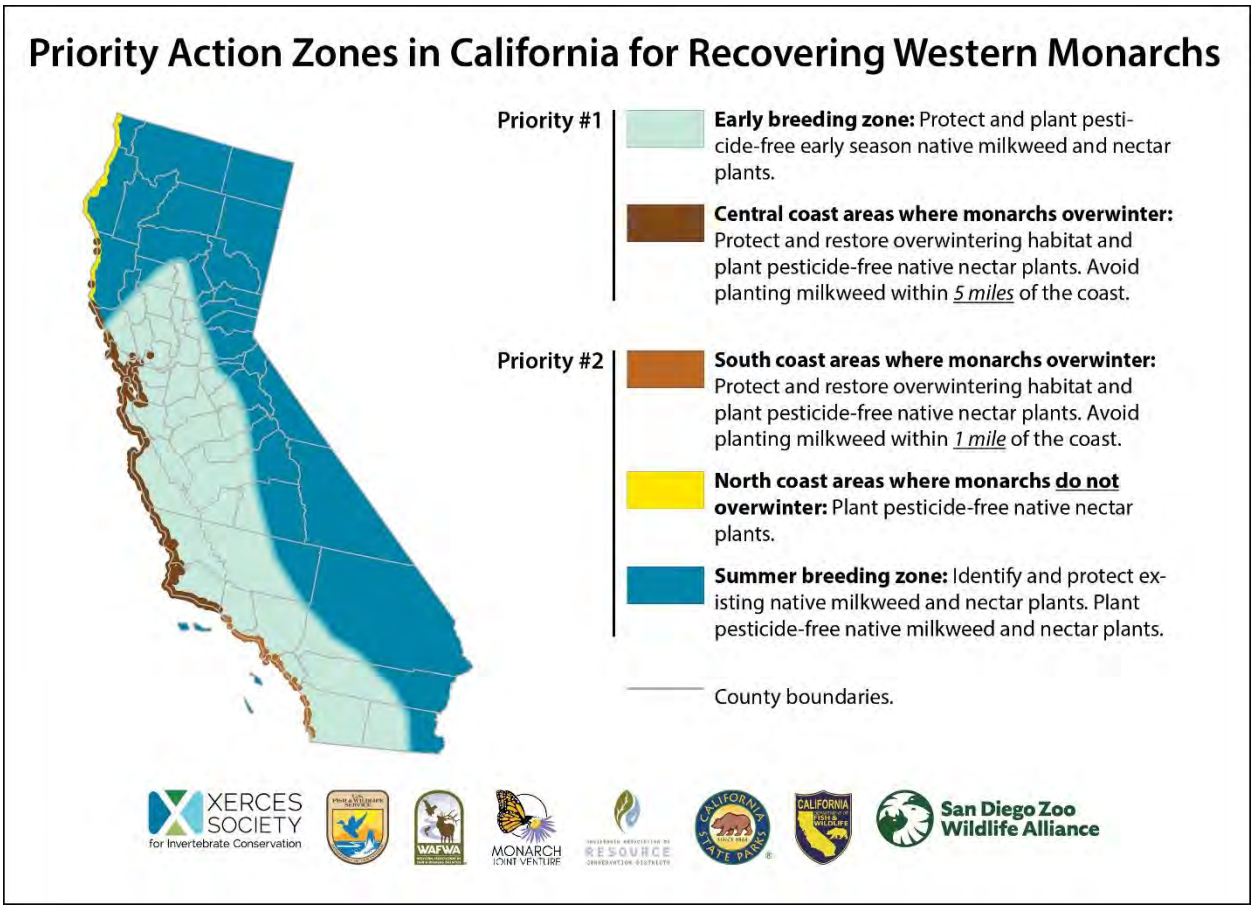


Figure 1. Priority Monarch Habitat Restoration Areas in California.

Coastal California Overwintering Habitat: Western monarchs migrate to the California coast, and cluster in a specific set of forested tree groves during the fall and winter each year. Overwintering groves provide protection from inclement weather and possess suitable vegetation and microclimate conditions for monarchs (e.g., roosting trees, wind protection, dappled sunlight, nectar sources, water and/or dew for hydration, high humidity, and an absence of freezing temperatures). In the overwintering zone of the coast (i.e., within five miles of the coast from Mendocino County south through Santa Barbara County, and within one mile of the coast from Ventura County south through San Diego County), we recommend the following:

0. Protect, manage, enhance and restore monarch butterfly overwintering groves (Find An Overwintering Site).
1. Use only native, insecticide-free plants for habitat restoration and enhancement actions.
2. Conduct overwintering grove habitat assessment(s), and develop and implement long-term grove management plans, as applicable. Management plan actions for groves may include, but are not limited to:
    a. Enhance roosting trees within overwintering groves and within 1/2 mile of groves by planting trees (e.g., Monterey pine (Pinus radiata), Monterey cypress

(Cupressus macrocarpa), Coast redwood (Sequoia sempervirens), coast live oak (Quercus agrifolia), Douglas fir (Pseudotsuga menzesii), Torrey pine (Pinus torreyana), western sycamore (Platanus racemosa), bishop pine (Pinus muricata) and others, as appropriate for location).

b. Avoid the removal of trees or shrubs within 1/2 mile of overwintering groves, except for specific grove management purposes, and/or for human health and safety concerns. The maintenance of trees and shrubs within a 1/2 mile of these sites provides a buffer to preserve the microclimate conditions of the winter habitat.

c. Conduct management activities (e.g., tree trimming, mowing, burning and grazing) in monarch overwintering groves from March 16-September 14 (outside of estimated timeframe when monarchs are likely present), in coordination with a monarch biologist and arborist.

d. Enhance nectar sources by planting fall/winter blooming forbs or shrubs within overwintering groves and within one mile of the groves (Nectar Planting Lists).
e. Provide a minimum 125-foot buffer zone for new development from the outermost trees identified as a monarch butterfly roost site, unless larger buffer zones are necessary.

3. Protect monarchs, other pollinators, and their habitats from pesticides (i.e., insecticides and herbicides). Specific recommendations may vary by site.

a. Avoid the use pesticides within one mile of overwintering groves, particularly when monarchs may be present. If pesticides are used, then conduct applications from March 16-September 14, when possible.

b. Screen all classes of pesticides for pollinator risk to avoid harmful applications, including biological pesticides such as Bacillus thuringiensis (UC Integrated Pest Management).

c. Avoid the use of neonicotinoids or other systemic insecticides, including coated seeds, any time of the year in monarch habitat due to their ecosystem persistence, systemic nature, and toxicity.

d. Consider non-chemical weed control techniques, when possible (Cal-IPC Non-chemical BMPs).

e. Avoid herbicide application on blooming flowers. Apply herbicides during young plant phases, when plants are more responsive to treatment, and when monarchs and other pollinators are less likely to be nectaring on the plants.

f. Whenever possible, use targeted application herbicide methods, avoid large-scale broadcast applications, and take precautions to limit off-site movement of herbicides (e.g., drift from wind and discharge from surface water flows).

g. Separate habitat areas from areas receiving chemical treatments with a pesticide-free spatial buffer and/or evergreen vegetative buffer of coniferous, non-flowering trees to capture chemical drift. The appropriate monarch and pollinator habitat spatial buffer size depends on several factors, including weather and wind conditions, but at a minimum, the habitat should be at least 40 feet from ground-based pesticide applications, 60 feet from air-blast sprayers, and 125 feet from any systemic insecticide applications or seed-treated plants.

4. To minimize the spread of the pathogen Ophryocystis elektroscirrha (OE), and to encourage natural monarch migration, do not plant non-native tropical milkweed (Asclepias curassavica). OE is able to build up on tropical milkweed, because these plants are evergreen, and they do not die back in the winter. OE can be debilitating and/or lethal to monarchs.

5. Remove tropical milkweed that is detected, and replace it with nectar plants suitable for the location (Nectar Planting Lists).

6. To assist in maintaining normal migration behavior, do not plant any type of milkweed within five miles of the coast from Mendocino County south through Santa Barbara County, and within one mile of the coast south of Santa Barbara County.

7. After appropriate training, conduct grove monitoring for butterflies during the Western Monarch Counts each fall and winter. When possible, report when monarchs arrive and depart the groves each year (Western Monarch Count).

8. To provide benefits for monarchs and other pollinators anywhere on the landscape within the overwintering zone, install a mosaic of nectar plants that bloom throughout the year, as is feasible (Nectar Planting Lists).

Breeding and Migratory Habitat: Monarch butterflies breed and migrate across multiple generations each year throughout the western U.S. The early breeding zone (i.e., Priority 1) is an estimated area in California where monarchs are likely to breed and/or lay their eggs on milkweed after departing the overwintering groves in mid-winter to early spring each year (See Figure 1, above). Early emerging milkweed species are likely a limiting factor on the landscape in the early breeding zone and may be associated with the severe population decline of western monarchs, and these plants are essential to successfully create the next generation of migratory butterflies. For monarch breeding and migratory habitat, we recommend the following:

Priority 1 Zone:

1. Enhance and maintain habitat in the Priority 1 early breeding zone of California, (Figure 1, above), by identifying and protecting existing habitat, and planting native, insecticide-free early-emerging milkweed species (e.g., Asclepias vestita, A. californica, A. eriocarpa, A. cordifolia, A. erosa), and flowering plants that are available to monarchs from January-April, as appropriate for the project location (Nectar Planting Lists; Milkweed Seed Finder).

For All Breeding and Migratory Zones:

2. Use only native, insecticide-free plants for habitat restoration and enhancement actions.

3. Enhance and maintain habitat in the Priority 2 zone of California (Figure 1, above) and in other western States, by identifying and protecting existing habitat, and planting milkweed species and flowering plants that are appropriate for the location (Nectar Planting Lists; Milkweed Seed Finder).

4. Conduct management activities such as mowing, burning and grazing in monarch breeding and migratory habitat outside of the estimated timeframe when monarchs are likely present (Figure 2, Recommended Management Timing Map, below).

5. Protect monarchs, other pollinators, and their habitats from pesticides (i.e., insecticides and herbicides).

    a. Avoid the use of pesticides when monarchs may be present, when feasible (Figure 2, Recommended Management Timing Map, below).

    b. Screen all classes of pesticides for pollinator risk to avoid harmful applications, including biological pesticides such as Bacillus thuringiensis (UC Integrated Pest Management).

    c. Avoid the use of neonicotinoids or other systemic insecticides, including coated seeds, any time of the year in monarch habitat due to their ecosystem persistence, systemic nature, and toxicity.

    d. Consider non-chemical weed control techniques, when feasible (Cal-IPC Non-chemical BMPs).

    e. Avoid herbicide application on blooming flowers. Apply herbicides during young plant phases, when plants are more responsive to treatment, and when monarchs and other pollinators are less likely to be nectaring on the plants.

f. Whenever possible, use targeted application herbicide methods, avoid large-scale broadcast applications, and take precautions to limit off-site movement of herbicides (e.g., drift from wind and discharge from surface water flows).

g. Separate habitat areas from areas receiving treatment with a pesticide-free spatial buffer and/or evergreen vegetative buffer of coniferous, non-flowering trees to capture chemical drift. The appropriate monarch and pollinator habitat spatial buffer size depends on several factors, including weather and wind conditions, but at a minimum, the habitat should be at least 40 feet from ground-based pesticide applications, 60 feet from air-blast sprayers, and 125 feet from any systemic insecticide applications or seed-treated plants.

6. To minimize the spread of the pathogen Ophryocystis elektroscirrha (OE), do not plant non-native tropical milkweed (Asclepias curassavica). OE can build up on tropical milkweed and infect monarchs, because these plants are evergreen and do not die back in the winter. OE can be lethal to monarchs.

7. Remove tropical milkweed that is detected, and replace it with milkweed and nectar plants appropriate for the location (Nectar Planting Lists; Milkweed Seed Finder).

8. Report milkweed and monarch observations from all life stages, including breeding butterflies, to the Monarch Milkweed Mapper or via the project portal in the iNaturalist smartphone app.

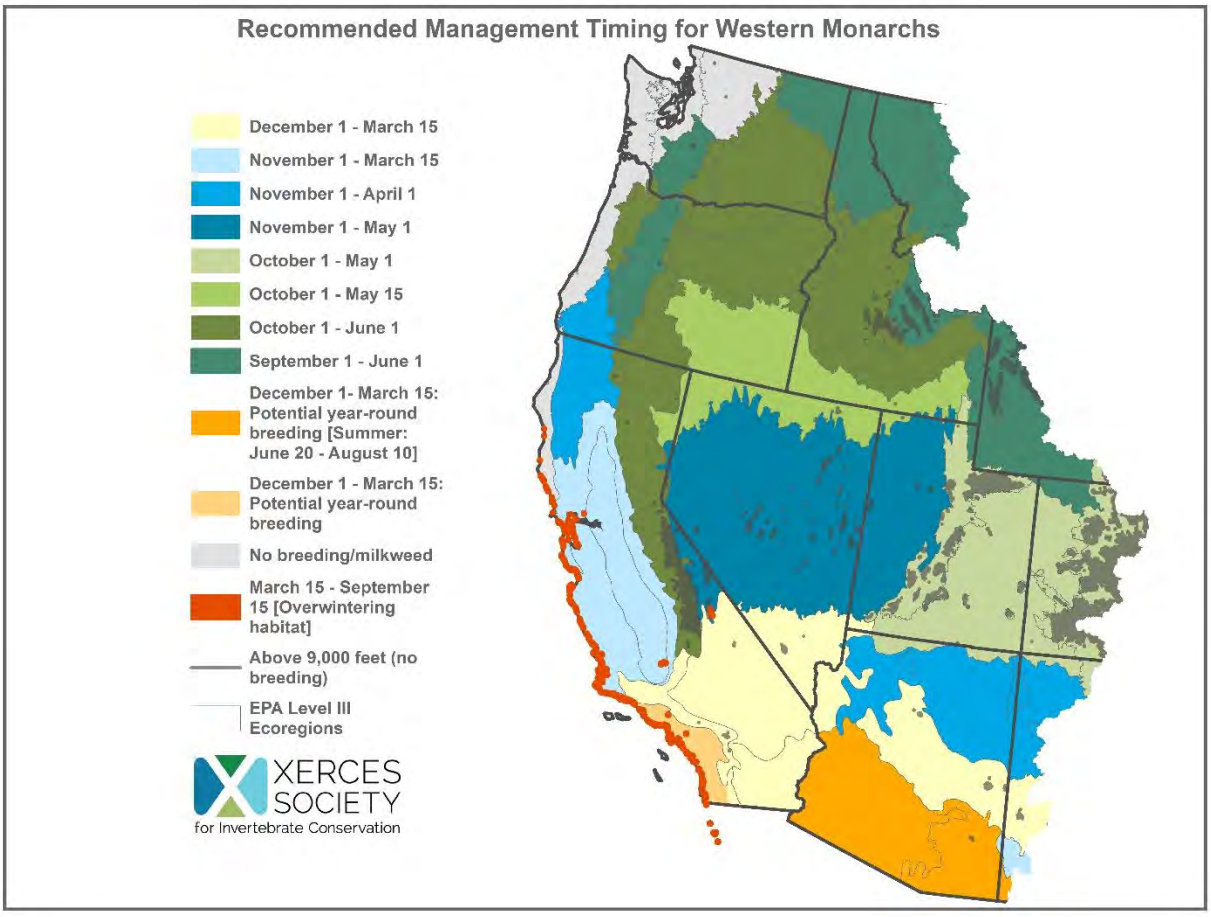


Figure 2. Recommended Management (i.e., mowing, burning, grazing, pesticide applications) Timing Window in the western U.S. by Zone.

Notes: The management timing windows illustrated in Figure 2 represent approximate recommendations of timeframes to conduct management actions. These timeframes are based upon the best available current information and may be updated in the future. Each year and site is different, so when possible, please consider surveying milkweed plants for the early life stages of monarchs prior to burning, mowing, grazing or applying pesticides.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
1315 East-West Highway
Silver Spring, Maryland 20910

DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NATIONAL MARINE FISHERIES SERVICE

Letter of Authorization

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

1. This Letter of Authorization (LOA) is valid April 10, 2024, through April 9, 2029.

2. This Authorization is valid only for the unintentional taking of the species and stocks of marine mammals identified in Condition 4 incidental to rocket and missile launches and supporting operations originating at VSFB.

3. This Authorization is valid only if USSF or any person(s) operating under its authority implements the mitigation, monitoring, and reporting required pursuant to 50 CFR §§ 217.64 and 217.65 and implements the Terms and Conditions of this Authorization.

4. General Conditions

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

   (b) The incidental take of marine mammals under the activities identified in Condition 2 and 50 CFR § 217.60 of the regulations, by Level B harassment only, is limited to the species and stocks and number of takes shown in Table 1.

Species	**Stock**	**Annual Take by Level B harassment**	**5-Year Total Take by Level B harassment**
Harbor seal	California	11,135	38,591
California sea lion	United States	84,870	281,021
Northern elephant seal	California Breeding	9,438	29,590
Steller sea lion	Eastern	550	1,900
Northern fur seal	California	5,909	18,383
Guadalupe fur seal	Mexico	23	71

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

5. Mitigation

USSF, and any persons operating under its authority, must implement the following mitigation measures when conducting the activities identified in Condition 2 of this Authorization.

(a) USSF must provide pupping information to launch proponents at the earliest possible stage in the launch planning process and direct launch proponents to, if practicable, avoid scheduling launches during pupping seasons on VSFB from 1 March to 30 April and on the Northern Channel Islands from 1 June- 31 July. If practicable, rocket launches predicted to produce a sonic boom on the Northern Channel Islands >3 pounds per square foot (psf) from 1 June – 31 July will be scheduled to coincide with tides in excess of +1.0 ft (0.3 m), with an objective to do so at least 50 percent of the time.

(b) For manned flight operations, aircraft must use approved routes for testing and evaluation. Manned aircraft must also remain outside of a 1,000-ft (305 m) buffer around pinniped rookeries and haul-out sites (except in emergencies such as law enforcement response or Search and Rescue operations, and with a reduced, 500-ft (152 m) buffer at Small Haul-out 1).

(c) UAS classes 0-2 must maintain a minimum altitude of 300 ft (91 m) over all known marine mammal haulouts when marine mammals are present, except at take-off and landing. Class 3 must maintain a minimum altitude of 500 ft (152 m), except at take-off and landing. UAS classes 4 and 5 only operate from the VSFB airfield and must maintain a minimum altitude of 1,000 ft (305 m) over marine mammal haulouts except at take-off and landing. USSF must not fly class 4 or 5 UAS below 1,000 ft (305 m) over haulouts.

6. Monitoring

USSF is required to conduct marine mammal and acoustic monitoring as described below:

(a) Monitoring at VSFB and NCI must be conducted by at least one NMFS-approved Protected Species Observer (PSO) trained in marine mammal science. PSOs must have demonstrated proficiency in the identification of all age and sex classes of all marine mammal species that occur at VSFB and on NCI. They must be knowledgeable of approved count methodology and have experience in observing pinniped behavior, especially that due to human disturbances.

(b) In the event that the PSO requirements described in paragraph (a) of this section cannot be met (*e.g.*, access is prohibited due to safety concerns), daylight or nighttime video monitoring must be used in lieu of PSO monitoring. In certain circumstances where the daylight or nighttime video monitoring is also not possible (*e.g.*, USSF is unable to access a monitoring site due to road conditions or human safety concerns), USSF must notify NMFS.

(c) At VSFB, USSF must conduct marine mammal monitoring and take acoustic measurements for all new rockets, for rockets (existing and new) launched from new facilities, and for larger or louder rockets (including those with new launch proponents) than those that have been previously launched from VSFB during their first three launches and for the first three launches from any new facilities during March through July.

i. For launches that occur during the harbor seal pupping season (March 1 through June 30) or when higher numbers of California sea lions are present (June 1 through July 31), monitoring must be conducted. At least one NMFS-approved PSO trained in marine mammal science must conduct the monitoring.

ii. When launch monitoring is required, monitoring must begin at least 72 hours prior to the launch and continue through at least 48 hours after the launch. Monitoring must include multiple surveys each day, with a minimum of four surveys per day.

iii. For launches within the harbor seal pupping season, USSF must conduct a follow-up survey of pups.

iv. For launches that occur during daylight, USSF must make time-lapse video recordings to capture the reactions of pinnipeds to each launch. For launches that occur at night, USSF must employ night video monitoring, when feasible.

v. When possible, PSOs must record: species, number, general behavior, presence and number of pups, age class, gender, and reaction to launch noise, or to natural or other human-caused disturbances. PSOs must also record environmental conditions, including visibility, air temperature, clouds, wind speed and direction, tides, and swell height and direction.

(d) USSF must conduct sonic boom modeling prior to the first three small or medium rocket launches from new launch proponents or at new launch facilities, and all heavy or super-heavy rocket launches.

(e) USSF must conduct marine mammal monitoring and take acoustic measurements 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.

i. The monitoring site must be selected based upon the model results, prioritizing a significant haulout site on one of the islands where the maximum sound pressures are expected to occur.

ii. USSF must estimate the number of animals on the monitored beach and record their reactions to the launch noise and conduct more focused monitoring on a smaller subset or focal group.

iii. Monitoring must commence at least 72 hours prior to the launch, during the launch and at least 48 hours after the launch, unless no sonic boom is detected by the monitors and/or by the acoustic recording equipment, at which time monitoring may be stopped.

iv. For launches that occur in darkness, USSF must use night vision equipment.

v. Monitoring for each launch must include multiple surveys each day that record, when possible: species, number, general behavior, presence of pups, age class, gender, and reaction to sonic booms or natural or human-caused disturbances.

vi. USSF must collect photo and/or video recordings for daylight launches when feasible, and if the launch occurs in darkness night vision equipment will be used.

vii. USSF must record environmental conditions, including visibility, air temperature, clouds, wind speed and direction, tides, and swell height and direction.

(f) USSF must continue to test equipment and emerging technologies, including but not limited to night vision cameras, newer models of remote video cameras and other means of remote monitoring at both VSFB and on the NCI.

(g) USSF must evaluate UAS based or space-based technologies that become available for suitability, practicability, and for any advantage that remote sensing may provide to existing monitoring approaches.

(h) USSF must monitor marine mammals during the first three launches of the missiles for the new Ground Based Strategic Defense program during the months of March through July across the 5-year duration of this LOA.

i. When launch monitoring is required, monitoring must include multiple surveys each day, with a minimum of four surveys per day.

ii. When possible, PSOs must record: species, number, general behavior, presence and number of pups, age class, gender, and reaction to launch noise, or to natural or other human-caused disturbances. PSOs must also record environmental conditions, including visibility, air temperature, clouds, wind speed and direction, tides, and swell height and direction.

(i) USSF must conduct semi-monthly surveys (two surveys per month) 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. If a VSFB or area closure precludes monitoring on a given day, USSF must monitor on the next best day.

i. PSOs must gather the following data at each site: species, number, general behavior, presence and number of pups, age class, gender, and any reactions to natural or human-caused disturbances. PSOs must also record environmental conditions, including visibility, air temperature, clouds, wind speed and direction, tides, and swell height and direction.

7. Reporting

(a) USSF must submit an annual report each year to NMFS Office of Protected Resources and West Coast Region on March 1st of each year that describes all activities and monitoring for the specified activities during that year. This includes launch monitoring information in Condition 7(a)(i) through (iii) for each launch where monitoring is required or conducted. The annual reports must also include a summary of the documented numbers of instances of harassment incidental to the specified activities, including non-launch activities (*e.g.*, takes incidental to aircraft or helicopter operations observed during the semi-monthly surveys). Annual reports must also include the results of the semi-monthly sentinel marine mammal monitoring described in Condition 6(i), results of tests of equipment and emerging technologies described in condition 6(f), and results of evaluation of UAS based or space-based technologies described in condition 6(g).

i. Launch information, including:

1) Date(s) and time(s) of the launch (and sonic boom, if applicable);

2) Number(s), type(s), and location(s) of rockets or missiles launched;

ii. Monitoring program design; and

iii. Results of the launch-specific monitoring program, including:

1) Date(s) and location(s) of marine mammal monitoring;

2) Number of animals observed, by species, on the haulout prior to commencement of the launch or recovery;

3) General behavior and, if possible, age (including presence and number of pups) and sex class of pinnipeds hauled out prior to the launch or recovery;

4) Number of animals, by species, age, and sex class that responded at a level indicative of harassment. Harassment is characterized by:

A. Movements in response to the source of disturbance, ranging from short withdrawals at least twice the animal's body length to longer retreats over the beach, or if already moving a change of direction of greater than 90 degrees; or

B. All retreats (flushes) to the water.

5) Number of animals, by species, age, and sex class that entered the water, the length of time the animal(s) remained off the haulout, and any behavioral responses by pinnipeds that were likely in response to the specified activities, including in response to launch noise or a sonic boom;

6) Environmental conditions including visibility, air temperature, clouds, wind speed and direction, tides, and swell height and direction; and

7) Results of acoustic monitoring, including the following:

A. Recorded sound levels associated with the launch (in SEL, SPL_{peak}, and SPL_{rms});

B. Recorded sound levels associated with the sonic boom (if applicable), in psf; and

C. The estimated distance of the recorder to the launch site and the distance of the closest animals to the launch site.

iv. Results of the semi-monthly sentinel marine mammal monitoring described in Condition 6(i), including:

1) Number of animals observed, by species;

2) General behavior and, if possible, age (including presence and number of pups) and sex class of pinnipeds hauled out;

3) Any reactions to natural or human-caused disturbances;

4) Environmental conditions including visibility, air temperature, clouds, wind speed and direction, tides, and swell height and direction.

(b) USSF must submit a final, comprehensive 5-year report to NMFS Office of Protected Resources within 90 days of the expiration of this LOA. This report must:

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

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

iii. Assess the cumulative impacts on pinnipeds and other marine mammals from the activities specified in Condition 2.

(c) If the activity identified in Condition 2 likely resulted in the take of marine mammals not identified in Condition 4(b), then the USSF must notify the NMFS Office of Protected Resources and the NMFS West Coast Region stranding coordinator within 24 hours of the discovery of the take.

(d) In the event that personnel involved in the activities discover an injured or dead marine mammal, USSF must report the incident to the Office of Protected Resources (OPR), NMFS (PR.ITP.MonitoringReports@noaa.gov and itp.davis@noaa.gov) and to the West Coast regional stranding network (866-767-6114) as soon as feasible.

The report must include the following information:

i. Time, date, and location (latitude/longitude) of the first discovery (and updated location information if known and applicable);

ii. Species identification (if known) or description of the animal(s) involved;

iii. Condition of the animal(s) (including carcass condition if the animal is dead);

iv. Observed behaviors of the animal(s), if alive;

v. If available, photographs or video footage of the animal(s); and

vi. General circumstances under which the animal was discovered.

(e) If real-time monitoring during a launch shows that the activity identified in Condition 2 is reasonably likely to have resulted in the mortality or injury of any marine mammal, USSF must notify NMFS within 24 hours (or next business day). NMFS and USSF must then jointly review the launch procedure and the mitigation

requirements and make appropriate changes through the adaptive management process, as necessary and before any subsequent launches of rockets and missiles with similar or greater sound fields and/or sonic boom pressure levels.

8. This Authorization may be modified, suspended or withdrawn if USSF fails to abide by the conditions prescribed herein or if the authorized taking is having more than a negligible impact on the species or stock of affected marine mammals.

9. Renewals and Modifications of Letter of Authorization

(a) A LOA issued under 50 CFR §§ 216.106 and § 217.66 for the activity identified in Condition 2 of this Authorization and 50 CFR § 217.60(a) and (b) shall be modified upon request by USSF, provided that:

i. The specified activity and mitigation, monitoring, and reporting measures, as well as the anticipated impacts, are the same as those described and analyzed for this subpart (excluding changes made pursuant to the adaptive management provision in paragraph (c) of this section); and

ii. NMFS determines that the mitigation, monitoring, and reporting measures required by the previous LOA under these regulations were implemented.

(b) For LOA modification or renewal requests by the applicant that include changes to the activity or the mitigation, monitoring, or reporting measures (excluding changes made pursuant to the adaptive management provision in paragraph (c) of this section) that do not change the findings made for the regulations or that result in no more than a minor change in the total estimated number of takes (or distribution by species or stock or years), NMFS may publish a notice of proposed changes to the LOA in the *Federal Register*, including the associated analysis of the change, and solicit public comment before issuing the LOA.

(c) An LOA issued under 50 CFR §§ 216.106 and 217.66 for the activity identified in Condition 2 of this Authorization and 50 CFR § 217.60(a) and (b) may be modified by NMFS under the following circumstances:

i. After consulting with the USSF regarding the practicability of the modifications, NMFS, through adaptive management, may modify (including adding or removing measures) the existing mitigation, monitoring, or reporting measures if doing so creates a reasonable likelihood of more effectively accomplishing the goals of the mitigation and monitoring.

ii. Possible sources of data that could contribute to the decision to modify the mitigation, monitoring, or reporting measures in an LOA include:

1) Results from the USSF's monitoring from the previous year(s);

2) Results from other marine mammal and/or sound research or studies; or

3) Any information that reveals marine mammals may have been taken in a manner, extent or number not authorized by these regulations or a subsequent LOA.

iii. If, through adaptive management, the modifications to the mitigation, monitoring, or reporting measures are more than minor, NMFS will publish a notice of the proposed changes to the LOA in the *Federal Register* and solicit public comment.

(d) If NMFS determines that an emergency exists that poses a significant risk to the well-being of the species or stocks of marine mammals specified in the regulations and this Authorization, an LOA may be modified without prior notice or opportunity for public comment. Notice would be published in the *Federal Register* within 30 days of the action.

_____

For Kimberly Damon-Randall, Director
Office of Protected Resources

Letter of Authorization

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

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

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

3. General Conditions

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

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

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

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

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

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

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

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

Exhibit 11
CD-0007-24

(d) Unmanned aerial systems (UAS) operations.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ii. Design of the monitoring program, and

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

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

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

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

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

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

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

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

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

ii. Design of the monitoring program;

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

A. Dates and times of all monitoring activities;

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

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

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

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

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

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

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

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

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

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

iv. State the date(s), location(s), and findings of any research activities related to monitoring the effects of launch noise and sonic booms on marine mammal populations.

(e) Submit a final comprehensive report, within 60 days of receipt of any recommendations made by NMFS following review of the draft comprehensive report by the Permits and Conservation Division, Office of Protected Resources, NMFS, and the West Coast Regional Administrator, NMFS.

(f) Reporting of injured or dead marine mammals:

i. In the event that the specified activity clearly causes the take of a marine mammal in a manner not authorized by this LOA, such as serious injury or mortality, the USAF shall immediately cease the specified activities and immediately report the incident to the NMFS Office of Protected Resources ((301) 427-8401) and the NMFS West Coast regional stranding coordinator ((562) 980-3230). The report must include the following information:

A. Time, date, and location (latitude/longitude) of the incident;
B. Description of the incident;
C. Status of all sound source use in the 24 hours preceding the incident;
D. Environmental conditions (*e.g.*, wind speed and direction, cloud cover, and visibility);
E. Description of all marine mammal observations in the 24 hours preceding the incident;
F. Species identification or description of the animal(s) involved;
G. Fate of the animal(s); and
H. Photographs or video footage of the animal(s).

Activities shall not resume until NMFS is able to review the circumstances of the prohibited take. NMFS will work with the USAF to determine what measures are necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. The USAF may not resume their activities until notified by NMFS.

ii. In the event that the USAF discovers an injured or dead marine mammal, and determines that the cause of the injury or death is unknown and the death is relatively recent (*e.g.*, in less than a moderate state of decomposition), the USAF shall immediately report the incident to the NMFS Office of Protected Resources ((301) 427-8401) and the NMFS West Coast regional stranding coordinator ((562) 980-3230). The report must include the same information identified in condition 7(f)(i) of this LOA. Activities may continue while NMFS reviews the circumstances of the incident. NMFS will work with the USAF to determine whether additional mitigation measures or modifications to the activities are appropriate.

iii. In the event that the USAF discovers an injured or dead marine mammal, and determines that the injury or death is not associated with or related to the specified activities (*e.g.*, previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), the USAF shall report the incident to the NMFS Office of Protected Resources ((301) 427-8401) and the NMFS West Coast regional stranding coordinator ((562) 980-3230), within 24 hours of the discovery. The USAF shall provide photographs, video footage or other documentation of the sighting to NMFS.

8. This Authorization may be modified, suspended or withdrawn if the USAF fails to abide by the conditions prescribed herein or if the authorized taking is having more than a negligible impact on the species or stock of affected marine mammals.

Donna S. Wieting, Director
Office of Protected Resources

APR 10 2019
Date

Table 1. Numbers of takes authorized annually.

Species (stock)	2019	2020	2021	2022	2023	2024
Harbor seal	19,524	22,733	27,652	35,466	43,489	16,742
California sea lion	28,187	36,019	51,307	63,805	83,385	21,756
Northern elephant seal	4,170	5,283	7,434	9,253	12,036	5,481
Steller Sea Lion	134	168	221	302	387	105
Northern fur seal	1,190	1,530	2,210	2,721	3,571	26
Guadalupe fur seal	46	59	85	104	137	36

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

January 20, 2023

Refer to NMFS No: WCRO-2023-00002

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

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

Dear Mr. Kephart:

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

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

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

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

This concludes the ESA consultation.

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

Sincerely,



Dan Lawson
Long Beach Branch Chief
Protected Resource Division

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

Administrative Record Number: 151422WCR2023PR00013

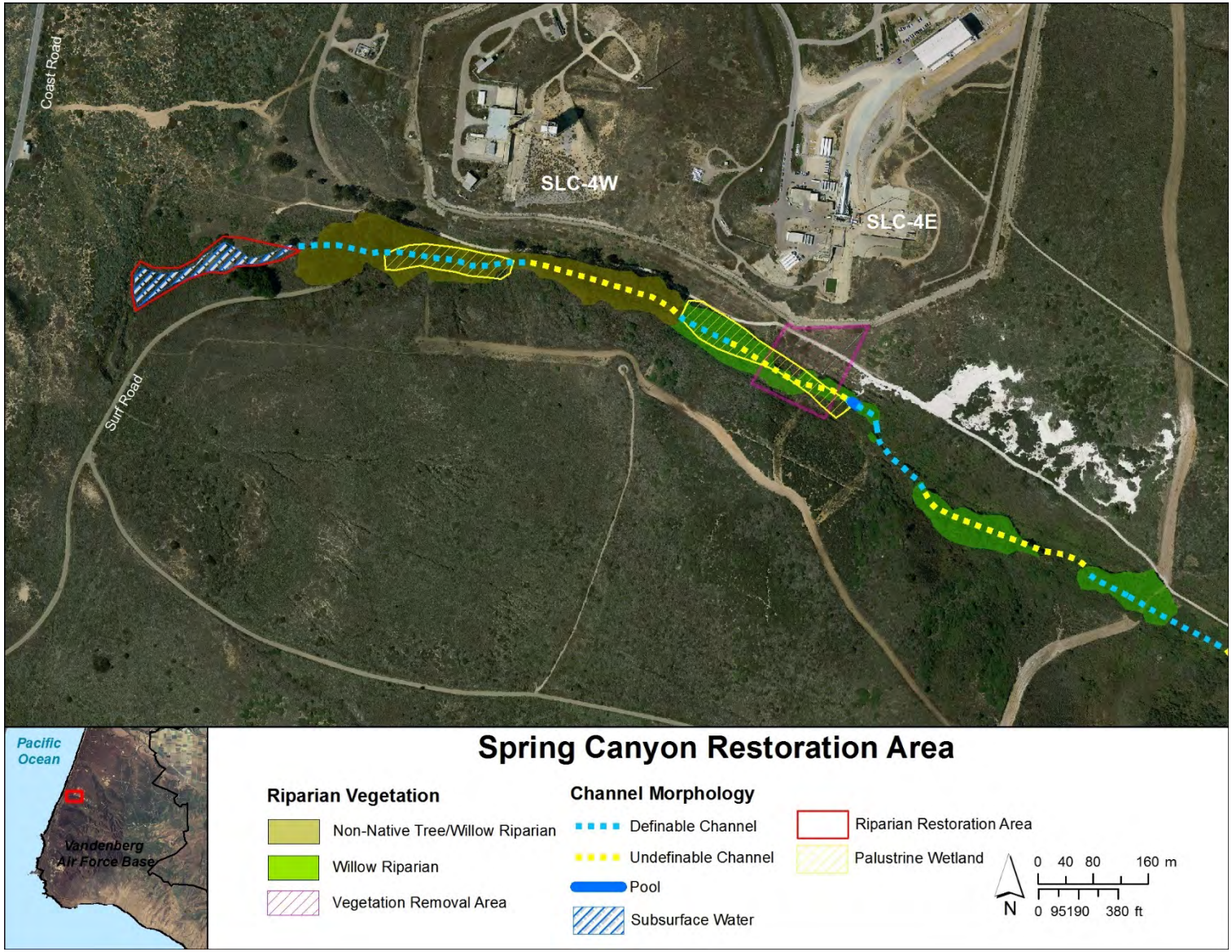


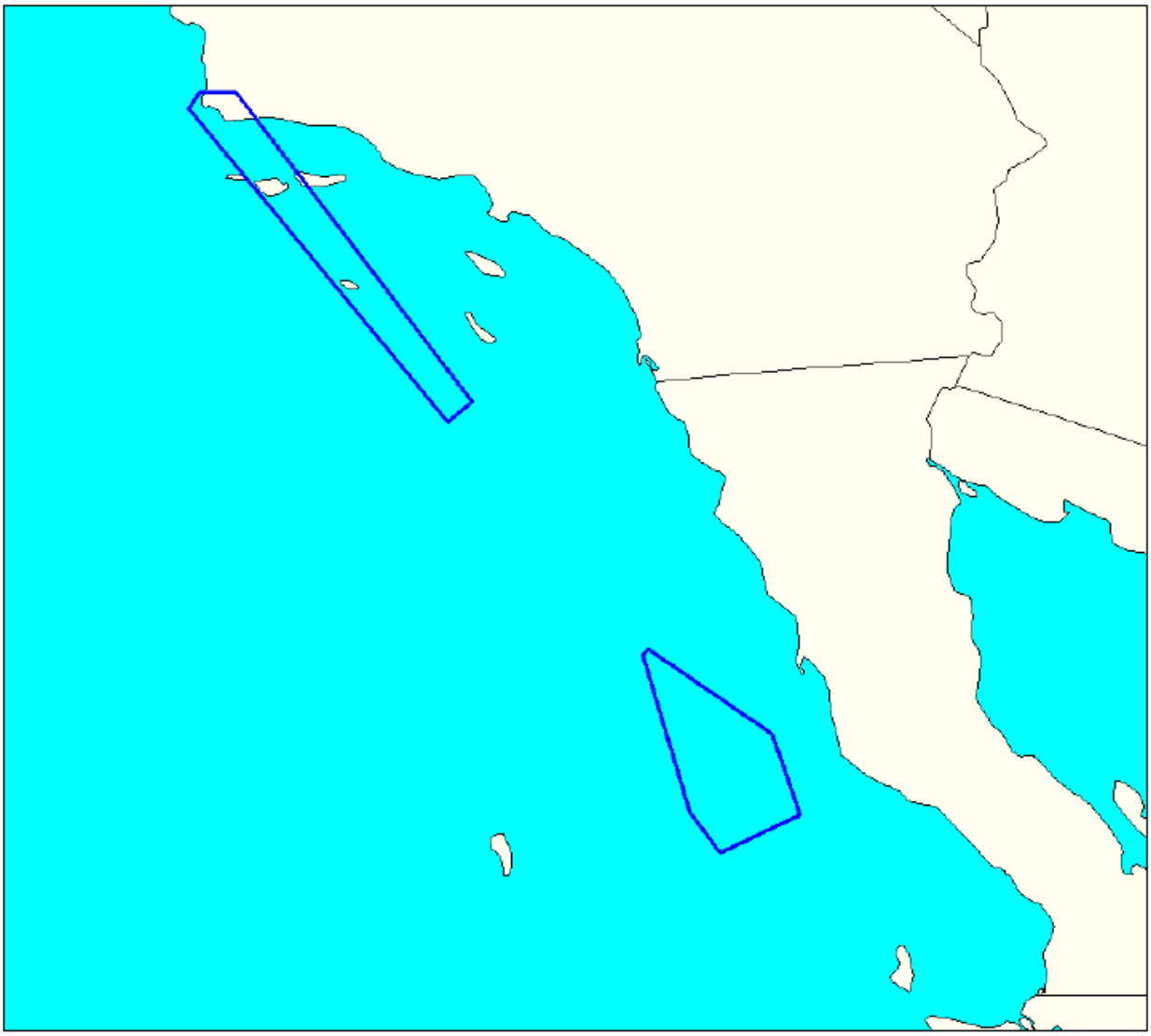
Figure 1-3. Spring Canyon Restoration Area. Note: "Definable" versus "Undefinable" channel were primarily estimated during an assessment performed in 2013 (ManTech SRS Technologies, Inc. 2013).

Exhibit 12
CD-0007-24



Source: https://www.vandenberg.spaceforce.mil/News/Photos/igphoto/2000912917/
(U.S. Air Force photo/Airman Yvonne Morales)

Exhibit 13
CD-0007-24



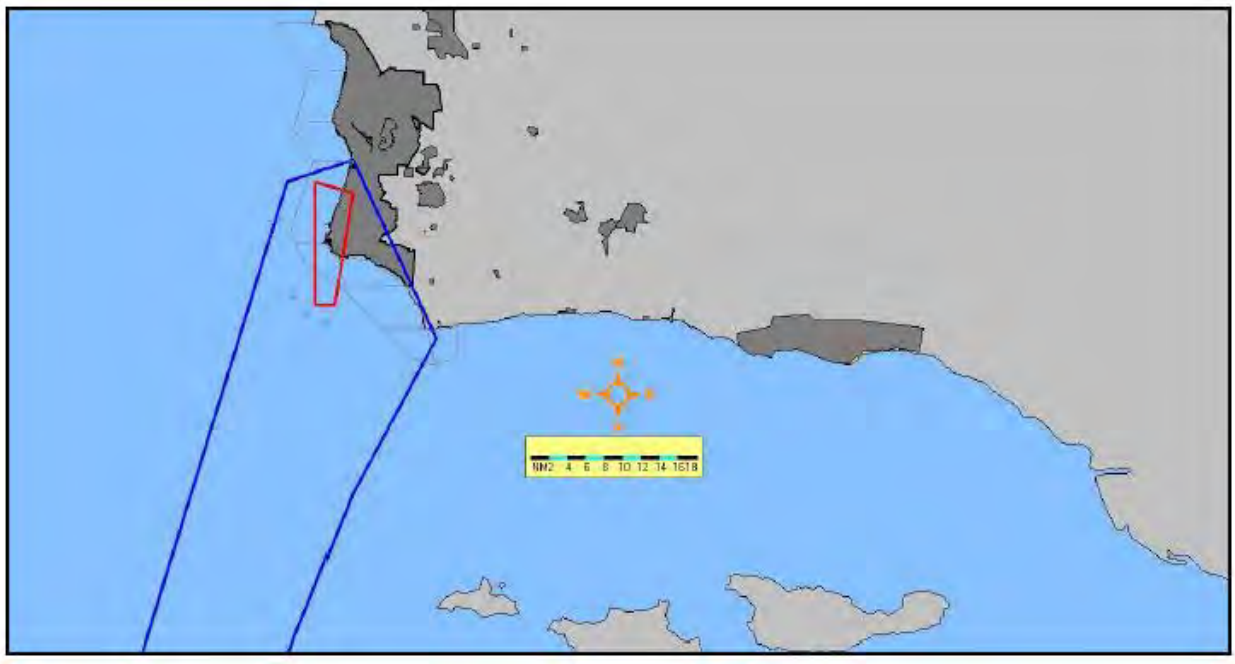


Exhibit 14
CD-0007-24