DOE (U.S. Department of Energy), 2018a, *Santa Susana Field Laboratory Simi Valley, California, Biological Assessment Reference Document*, October 2018.

Errata: the correct date for this reference is January 2018.

This reference includes the following supporting documentation:

1. Letter dated January 31, 2018 from J. Jones, Director, Energy Technology Engineering Center, Simi Valley, California, to Mr. S. Henry, Field Supervisor, Ventura Fish and Wildlife Office Ventura, California, RE: Revised request for the initiation of formal consultation under Section 7, Santa Susana Field Laboratory, Ventura County California.
2. Letter dated March 8, 2018 from Ms. L. Chang, Acting Assistant Field Supervisor, Ventura Fish and Wildlife Office, to J. Jones, PMP, Director, Energy Technology Engineering Center, RE: Acknowledgement of Request to Initiate Formal Consultation for the Cleanup of Area IV of the Santa Susana Field Laboratory, Ventura County, California (2017-F-0632)
3. Letter dated July 20, 2018 from J. Jones, Director, Energy Technology Engineering Center, Simi Valley, California, to Mr. S. Henry, Field Supervisor, Ventura Fish and Wildlife Office, Ventura, California, RE: Clarification of DOE's request for formal consultation based on DOE's Biological Assessment under Section 7, Santa Susana Field Laboratory, Ventura County California).

Santa Susana Field Laboratory Remediation: Biological Assessment

U.S. Department of Energy
Office of Environmental Management
Simi Valley, CA

January 30, 2018

Table of Contents

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Acronyms

amsl	above mean sea level
AOC	Administrative Order on Consent
BA	Biological Assessment
BCG	biota concentration guide
BMPs	Best Management Practices
BO	Biological Opinion
Boeing	The Boeing Company
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	*Code of Federal Regulations*
CMI WP	Corrective Measures Implementation Work Plan
CMS	Corrective Measures Study
CNDDB	California Natural Diversity Database
CO	Consent Order
COC	chemicals of concern
CRF	California red-legged frog
CRPR	California Rare Plant Rank
CWA	Clean Water Act
DOE	Department of Energy
DTSC	California Department of Toxic Substances
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FR	*Federal Register*
GETS	Groundwater Extraction and Treatment System
GIS	geographic information system
HWMF	Hazardous Waste Management Facility
ITP	Incidental Take Permit
LOX	liquid oxygen
LUT	Look-Up Table
MBTA	Migratory Bird Treaty Act
MCV2	Manual of California Vegetation, 2nd edition
NASA	National Aeronautics and Space Administration
NBZ	Northern Buffer Zone
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NPPA	Native Plant Protection Act
OS	Open Space
OU	Operable Unit
PAHs	polycyclic aromatic hydrocarbons
PCEs	Primary Constituent Elements

PEIR	Programmatic Environmental Impact Report
PFRS	Potential Focused Removal Sites
QCB	Quino Checkerspot Butterfly
RA-5	Rural Agriculture
RBSL	risk-based screening level
RCRA	Resource Conservation and Recovery Act
RHRP	Revegetation and Habitat Restoration Plan
RMHF	Radioactive Materials Handling Facility
SBZ	Southern Buffer Zone
SCE	Southern California Edison
SCS	soil cleanup standard
SR	State Route
SRAIP	Soil Remedial Action Implementation Plan
SRE	Sodium Reactor Experiment
SSFL	Santa Susana Field Laboratory
SWMU	Solid Waste Management Unit
SWPPP	Storm Water Pollution Prevention Plan
TPH	total petroleum hydrocarbon
U.S.	United States
USACE	U.S. Army Corps of Engineers
U.S.C.	*United States Code*
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service

1.0 Introduction

This Biological Assessment (BA) has been prepared by the Department of Energy's (DOE) Energy Technology Engineering Center and provides the information necessary to initiate and support formal consultation on DOE's proposed cleanup activities at the Santa Susana Field Laboratory (SSFL). Preparation of this document supports the requirements of Section 7 of the Endangered Species Act (ESA); Public Law 93-205; 18 United States (U.S.) Code Section 1536, as amended; and Title 50 of the *Code of Federal Regulations* (CFR) 402.14(c). Preparation of this BA is additionally intended to provide compliance with the California laws and regulations related to the California Endangered Species Act (CESA); Fish and Game Code, Sections 86 and 2050-2085; California Code of Regulations, Title 14, Sections 783-783.8 and 786.0-786.8. This document was prepared with input from The Boeing Company (Boeing) and the National Aeronautics and Space Administration (NASA); however, this BA does not address the effects of NASA's proposed activities because they have previously undergone consultation, as described below.

Section 7(a) of the ESA of 1973, as amended, requires Federal agencies to consult with the U.S. Fish and Wildlife Service (USFWS) to ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat of such species. Section 7(c) of the ESA requires Federal agencies to prepare a BA in compliance with Section 7(a) by identifying any endangered or threatened species, designated critical habitat, or species or habitat proposed as such, which are likely to be affected by the proposed action. Information provided in this BA incorporates a review of the best available scientific and biological information on listed species that may occur within the project footprint. The proposed action includes the implementation of conservation measures described in detail in Section 3.6.

CESA states that all native species of animals and plants threatened with extinction and those experiencing a significant decline, which, if not halted, would lead to a threatened or endangered designation, will be protected or preserved along with their habitats. Because CESA protects not only listed species but also species "experiencing a significant decline which could lead to listing as threatened or endangered" and because the California Environmental Quality Act (CEQA) has a mandatory finding of significance for projects having a substantial adverse effect, either directly or through habitat modification, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations or by the California Department of Fish and Game (now the California Department of Fish and Wildlife [CDFW]) or USFWS, this BA addresses species recognized as sensitive by a variety of authorities in addition to species already listed, proposed, or under review as rare, threatened, or endangered under CESA and ESA.

Meetings with the CDFW and USFWS have been ongoing since 2009 as described in Section 2 of this BA and are indicative of the early and ongoing consultation emphasized by CESA and ESA to avoid potential impacts to rare, threatened, and endangered species and to develop appropriate measures to avoid or offset project-caused losses of listed species populations and their essential habitats.

While section 2080 of the Fish and Game Code prohibits take of any species that the California Fish and Game Commission determines to be endangered or threatened, CESA allows for take incidental to otherwise lawful activity through section 2081(b) of the Fish and Game Code. For those state-listed species that are also listed under the Federal ESA, CESA also allows for consistency determinations with Federal incidental take statements under section 2080.1 of the Fish and Game Code.

The purpose of this BA is to review the proposed cleanup of the SSFL in sufficient detail to determine to what extent the proposed action may affect any of the threatened, endangered, rare, proposed, or sensitive species and designated or proposed critical habitats. The purpose of the proposed action is to clean up soil and groundwater on SSFL site in a manner consistent with the California Department of Toxic Substances (DTSC) 2007 Consent Order (CO) for Corrective Action and the 2010 Administrative Orders on Consent (AOCs) (DTSC 2007, 2010a, 2010b), and to implement other activities associated with the termination of operations at SSFL including dismantling and removing buildings at the project site. Past activities at SSFL have resulted in the release of contaminants to soil and groundwater. DTSC has directed the Responsible Parties (DOE, Boeing, and NASA) to investigate the nature and extent of the releases and implement corrective actions to clean up the affected areas. In addition, the following information is provided to comply with statutory requirements to use the best scientific and commercial information available when assessing the risks posed to listed and/or proposed species and designated and/or proposed critical habitat by proposed Federal actions. This BA is prepared in accordance with legal requirements set forth under regulations implementing Section 7 of the ESA and California laws and regulations related to CESA.

As described under Section 2.0, Consultation to Date, NASA prepared a BA on their proposed Demolition and Cleanup Project at SSFL (NASA 2013, 2014a). NASA's BA concluded with the determinations that the proposed project may affect, but is not likely to adversely affect, federally listed species including the least Bell's vireo (*Vireo bellii pusillus*), California red-legged frog (CRF) (*Rana draytonii*), Braunton's milk-vetch (*Astragalus brauntonii*), Riverside fairy shrimp (*Streptocephalus woottoni*), and vernal pool fairy shrimp (*Branchinecta lynchi*), mainly based on lack of documented occurrence or breeding in NASA's action area (NASA 2013). NASA indicated in their BA that they would conduct protocol surveys for listed species prior to any clean up action. In response, the USFWS provided a written concurrence letter to NASA (USFWS 2013a), stipulating that NASA undertake surveys for listed species and implement certain impact avoidance measures indicated in the BA.

1.1 Federally Listed, Proposed, or Candidate Threatened or Endangered Species

In response to a request from DOE, the USFWS identified the 15 federally listed and proposed species (see **Table 1–1**) having the potential to occur in Areas I through IV and adjacent undeveloped lands of the SSFL in Ventura County (USFWS 2015a, Appendix A), in a letter dated December 7, 2015, from Jeff Phillips (USFWS Deputy Field Supervisor) to Stephanie Jennings (DOE Deputy Federal Project Director).

Critical habitat for two species occurs on SSFL.

Table 1–1. Federally Listed, Proposed, and Candidate Species Having the Potential to Occur at SSFL and their Status under the ESA

Common Name	*Scientific Name*	*Status*
Braunton's Milk-vetch	*Astragalus brauntonii*	FE, CH
Lyon's pentachaeta	*Pentachaeta lyonii*	FE
Spreading navarretia	*Navarretia fossalis*	FT
Conejo dudleya	*Dudleya abramsii* subsp. *parva*	FT
Santa Monica Mountains dudleya	*Dudlyea cymosa* subsp. *ovatifolia*	FT
Marcescent dudleya	*Dudleya cymosa* subsp. *marcescens*	FT
San Fernado Valley spineflower	*Chorizanthe parryi* var. *fernandina*	PT
California Orcutt grass	*Orcuttia californica*	FE
Coastal California gnatcatcher	*Polioptila californica*	FT
Least Bell's vireo	*Vireo bellii pusillus*	FE
California condor	*Gymnogyps californianus*	FE
California red-legged frog	*Rana draytonii*	FT, CH
Quino checkerspot butterfly	*Euphydryas editha quino*	FE
Vernal pool fairy shrimp	*Branchinecta lynchi*	FT
Riverside fairy shrimp	*Streptocephalus woottoni*	FE

CH = critical habitat, FE = federally listed as endangered, FT = federally listed as threatened, PT = proposed for federal listing as threatened.
Source: USFWS 2015a.

1.2 State Listed Species and Species Meeting State Criteria for Listing as Endangered or Threatened

State-listed species (not including those that are already federally listed) and species meeting state criteria for listing as endangered or threatened, including California Rare Plant Rank (CRPR) List 1B species, that are known or have the potential to occur within SSFL are included in **Table 1–2**.

Table 1–2. State-listed Species and Species Meeting State Criteria for Listing under CESA Having the Potential to Occur at SSFL

Common Name	*Scientific Name*	*Status*
Santa Susana tarplant	*Deinandra minthornii*	SR
Malibu baccharis	*Baccharis malibuensis*	CRPR 1B.1
Slender mariposa lily	*Calochortus clavatus* var. *gracilis*	CRPR 1B.1
Late-flowered mariposa lily	*Calochortus fimbriatus*	CRPR 1B.1
California screw moss	*Tortula californica*	CRPR 1B.2
Swainson's hawk	*Buteo swainsonii*	ST
Bank swallow	*Riparia riparia*	ST

State Listed: SR = state listed as rare; ST = state listed as threatened.
CRPR: 1B = California Rare Plant Rank 1B (rare, threatened, or endangered in California or elsewhere; .1 = seriously threatened in California; .2 = moderately threatened in California).

1.3 Project Location

The proposed action would be implemented at SSFL, which is in the southeastern part of Ventura County, adjacent to Los Angeles County, and approximately 29 miles northwest of downtown Los Angeles, California. The city of Simi Valley is located approximately one mile to the north of the project site. To the west is open space associated with the Upper Las Virgenes Canyon Open Space Area and Cheeseboro/Palo Comado Canyons. The residential community of Bell Canyon is located

directly south of the project site. San Fernando Valley communities, including Canoga Park, West Hills, and Chatsworth are east and Sage Ranch Park is northeast adjacent to SSFL. **Figure 1–1** shows the regional location of the project site and surrounding communities.

The proposed project involves the approximately 2,850-acre SSFL site and adjacent offsite locations (see **Figure 1–2**). As noted above, this BA does not address the proposed activities of NASA, which have already been consulted on. Boeing, NASA, and DOE are the Responsible Parties for the investigation and cleanup of contaminants released from past activities at the project site. The SSFL property is owned by Boeing and the Federal Government (under the administrative jurisdiction of NASA). As shown in Figure 1–2, the project site has been divided into Administrative Areas I through IV and the Northern and Southern Undeveloped Areas (also referred to as buffer zones in other documents). The Responsible Parties have been investigating their respective areas to identify the nature and extent of the required cleanup. In addition, the Responsible Parties have been investigating contiguous areas to which contaminants may have migrated. As described in greater detail in Chapter 3, Table 3–1, although Boeing is the Property Owner for most of the administrative areas, DOE and NASA are the Responsible Parties for cleanup of Area IV, the Northern Buffer Zone (NBZ), Area II, and a 42-acre portion of Area I, whereas Boeing is the Responsible Party for Areas I and III and most of the Southern Buffer Zone [SBZ]). These administrative areas are referenced in this document to provide approximate location information for cleanup requirements. Nearly, 2,400 acres of the property owned by Boeing at SSFL has been permanently restricted as open space habitat by a conservation easement.

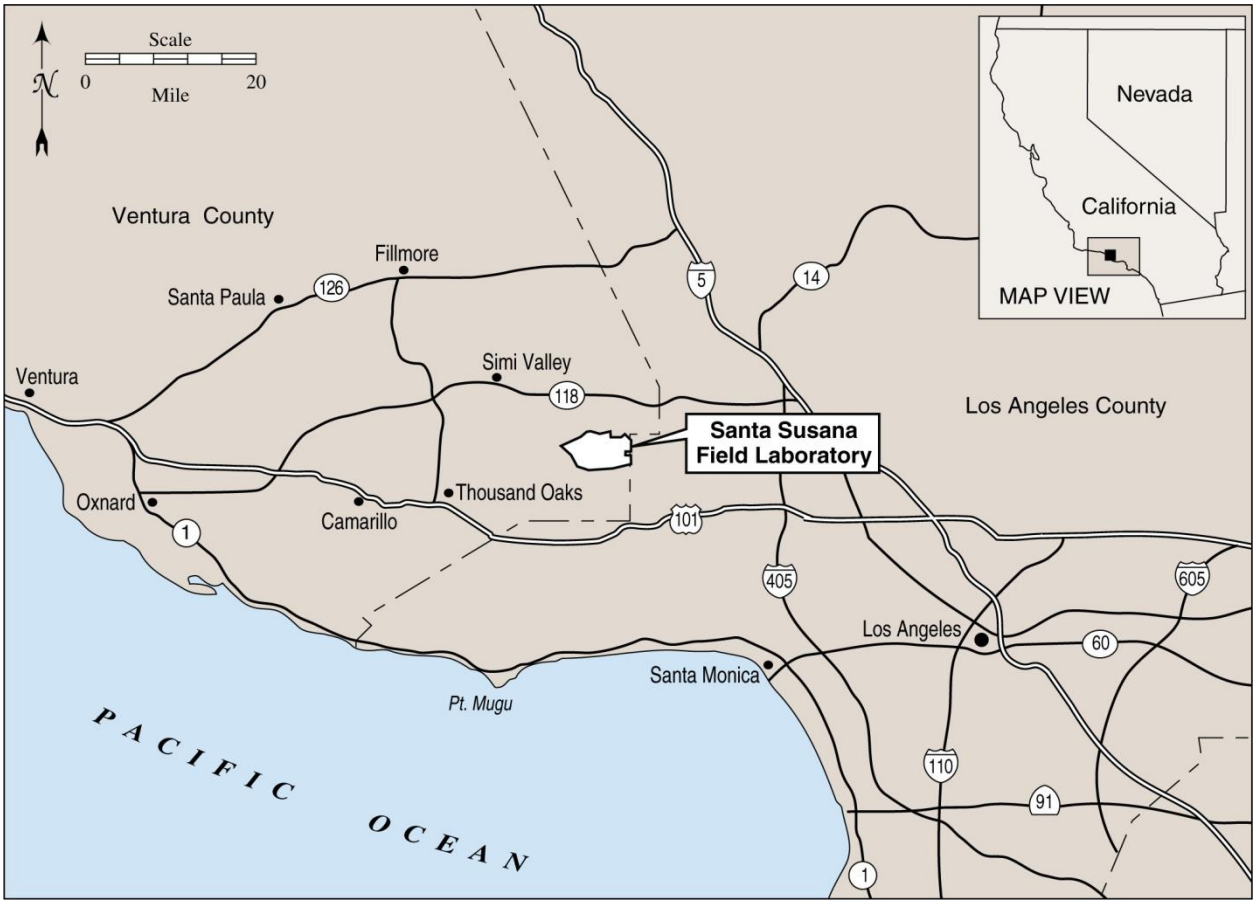

Figure 1–1. Project Location, SSFL

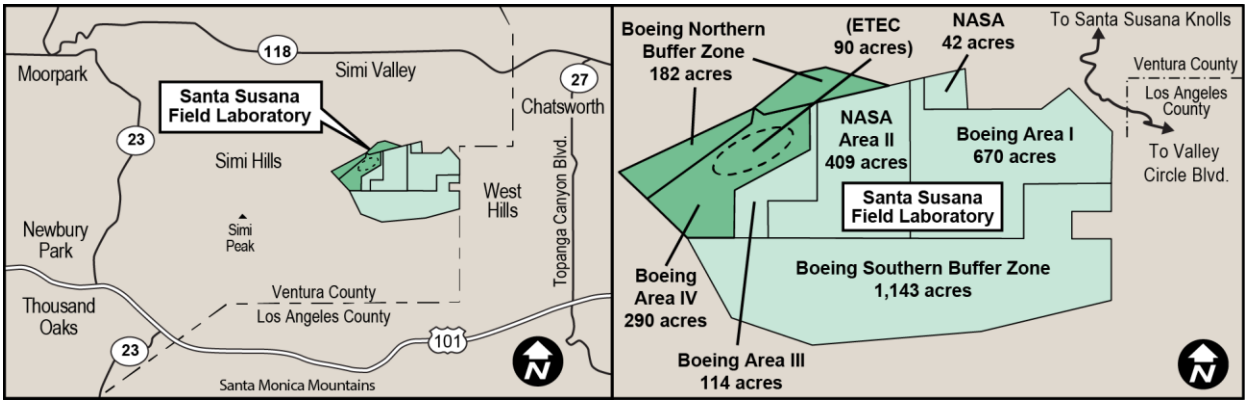

Figure 1–2. SSFL and Surrounding Communities

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2.0 Consultation to Date

2.1 EPA Gamma Scanning BA/BO (EPA 2010; USFWS 2010a)

A BA was prepared and a request to initiate formal Section 7 consultation was submitted by the EPA to the USFWS on February 12, 2010, for the SSFL Area IV Radiological Study. The proposed action was the radiological characterization of portions of the SSFL Area IV and the NBZ to determine the presence of potential radioactive contamination in surface and subsurface soils, groundwater, surface water, and sediment. The separate components of the Action included vegetation cutting, gamma scanning, geophysical survey, surface and subsurface soil sampling, groundwater monitoring well sampling, surface water and sediment sampling, and support activities, which were expected to occur from January 2010 through September 2011 (EPA 2010). The USFWS issued a Biological Opinion (BO) for the SSFL Area IV Radiological Study Project on May 25, 2010 (USFWS 2010a).

2.2 NASA Site Area II Remediation BA/Letter of Concurrence

NASA prepared a BA for the Demolition and Cleanup Project at SSFL and submitted it to the USFWS on November 6, 2013 (NASA 2013, 2014a). The proposed action included demolition of existing structures and remediation of soil and groundwater contamination on NASA-administered properties within the SSFL (NASA Area I and Area II). NASA (2013) determined that the proposed project may affect, but is not likely to adversely affect, the least Bell's vireo, CRF, Braunton's milk-vetch, Riverside fairy shrimp and vernal pool fairy shrimp. These determinations were based on the lack of documented occurrence or breeding in NASA's action area as well as NASA's commitment to do further protocol surveys and undertake certain impact avoidance and minimization measures (NASA 2013). On December 13, 2013 the USFWS issued a letter of concurrence for the Demolition and Cleanup Project at SSFL (USFWS 2013a), stipulating that if the proposed action changes in any manner or if new information reveals that listed species in the project area may be affected by the proposed action, NASA should contact the USFWS immediately and suspend all activities that may affect listed species until the appropriate level of consultation is completed. NASA has participated in recent DOE-organized consultation meetings with USFWS and CDFW concerning preparation of this BA (see **Table 2–1**) but analysis of their proposed action was not to be included in this BA based on their previous consultation with USFWS.

2.3 Boeing

Boeing has participated in DOE-organized consultation meetings with USFWS and CDFW during 2015 and 2016 concerning preparation of this BA (Table 2–1). Boeing has also consulted with CDFW regarding the protection-in-place and/or mitigation of Santa Susana tarplant (*Deinandra minthornii*) located within Interim Measure soil remediation areas, and at Boeing Area I Canyon facilities demolition areas dating back to 2003, as well as regarding maintenance and operation work for other species. Boeing is actively participating in the development of this BA, which evaluates the effects of both Boeing's and DOE's cleanup actions.

2.4 DOE Meetings and Coordination with USFWS and CDFW

Informal coordination for the proposed action has been ongoing among DOE, USFWS, CDFW, and the U.S. Army Corps of Engineers (USACE) through periodic meetings and teleconferences since 2009. Table 2–1 summarizes informal biological consultation meetings and teleconferences held since September 2009.

156 **Table 2–1. Biological Resources Meetings and Teleconferences**

Date	*Event*	*Participants*
September 16, 2009	Biological Survey Meeting: SSFL Area IV and the Northern Undeveloped Land (i.e., the Northern Buffer Zone) (included office meeting and site visit) Discussion of Study Plan for Fall Biological Surveys	– USFWS: Jenny Marek, Mark Elvin – CDFG (now CDFW):[a] Mary Meyer – California Native Plant Society: Betsey Landis, Snowdy Dodson – EPA: Craig Cooper, Gregg Dempsey – DOE: Stephanie Jennings, Lance Martin, Thomas Johnson – Boeing: Ravnesh Amar, Paul Costa, Randy Ueshiro – CDM Smith: John Wondolleck – SAIC (now Leidos): Tom Mulroy, Debra Barringer – HydroGeoLogic, Inc.: Eric Evans
November 4, 2009	SSFL Biological Survey Meeting at USFWS Offices in Ventura, California Discussion of Fall Biological Survey Results	– USFWS: Jenny Marek, Mark Elvin, Chris Dellith – CDFG: Mary Meyer – EPA: Craig Cooper, Mary Aycock – DOE: Stephanie Jennings – CDM Smith: John Wondolleck – HydroGeoLogic, Inc.: Eric Evans – SAIC (now Leidos): Tom Mulroy
June 26, 2013	Biological resource meeting and field trip at DOE Simi Valley and SSFL Area IV	– USFWS: Jenny Marek, Mark Elvin – CDFW (formerly CDFG): Mary Meyer – San Fernando Valley Audubon: Mark Osokow – CNPS: Mark Osokow – Southwestern Herpetological Society: Mark Osokow – Santa Susana Mountain Park Association: John Luker, (Vice-President) – DTSC: Brian Faulkner (Ecological Risk Assessor), Laura Rainey (Project Manager) – DOE: Stephanie Jennings, John Jones, Jazmin Bell – CDM Smith: John Wondolleck – Leidos: Tom Mulroy, Tara Schoenwetter
March 3, 2014	Biological scoping meeting held at DOE Simi Valley and via teleconference	– USFWS: Jenny Marek, Mark Elvin – CDFW: Mary Meyer – MWH Americas, Inc.: David Collins, Dixie Hambrick – DOE: Stephanie Jennings, John Jones – CDM Smith: John Wondolleck – Leidos: Tom Mulroy, Tara Schoenwetter
November 6, 2014	Meeting with USFWS, CDFW, and USACE, at USFWS office, Ventura, California Topics: Exclusion zones, including California Rare Plant Rank Species, and coast live oak areas Mapping of vegetation and wetlands/waters of the U.S.	– USFWS: Jenny Marek, Mark Elvin – CDFW: Mary Meyer, Christian Van Jackson – USACE: Antal Szijj, Jeff Phillips – MWH Americas, Inc.: David Collins, Dixie Hambrick – DTSC: Brian Faulkner, Laura Rainey – DOE: Stephanie Jennings, John Jones – CDM Smith: John Wondolleck – Leidos: Tom Mulroy, Tara Schoenwetter
November 4, 2015	Meeting with USFWS, CDFW, and USACE, at USFWS office, Ventura, California Topics: SSFL site-wide BA, provide updates, ask questions and determine next steps, proposed 2010 AOC exemption areas in Area IV, annotated outline and action area, site-wide habitat map status update, species to be covered, schedule for next meeting	– USFWS: Jenny Marek – CDFW: Mary Meyer – DOE: Stephanie Jennings, John Jones, Steve Tetreault – CDM Smith: John Wondolleck – USACE: Antal Szijj, – DTSC: Brian Faulkner, Laura Rainey, Roger Paulson, Matt Wetter – Leidos: Tom Mulroy, Tara Schoenwetter, Lauren Brown – NASA: Allen Elliott – CH2M Hill (for NASA): Steven Long, Gary Santolo – Padre (for Boeing): Chris Dunn

Date	Event	Participants
December 9, 2015	Meeting with USFWS, CDFW, DTSC, DOE, NASA, Boeing, at DOE office Simi Valley, California Topics: Discuss the SSFL site-wide BA and chemicals of concern. To provide a preliminary overview of chemicals in relation to the proposed AOC exemption areas. Review of chemicals of concern, perform a GIS exercise, address questions and provide the next step	– USFWS: Jenny Marek – DOE: John Jones, Stephie Jennings – CDM Smith: John Wondolleck – DTSC: Brian Faulkner, Roger Paulson, Matt Wetter, Laura Rainey – CDM Smith: Rebecca Farmer, Catherine Love – CDFW: Jeff Humble, Christine Found-Jackson – ESA: May Lau, Deanna Hansen – NASA: Allen Elliott – CH2M: Randy Dean – DTSC: Kim Hudson – Boeing: Paul Costa – Leidos: Tom Mulroy, Tara Schoenwetter
June 16, 2016	Meeting with USFWS, DOE, DTSC, Boeing, NASA at USFWS office, Ventura, California Topics: Discuss the SSFL site-wide BA, AOC and application of Exemptions, format of the Biological opinion, identification of species and their habitats, cleanup criteria being evaluated, identification of chemicals of concern and cleanup criteria DOE Area IV, evaluation of locations possibly requiring a cleanup action, Soils Remedial Action Implementation Plan, Status and discussion	– USFWS: Jenny Marek – DOE: John Jones, Stephie Jennings – CDM Smith: John Wondolleck – DTSC: Brian Faulkner, Kim Hudson, Matt Wetter – NASA: Peter Zorba – DTSC: Mark Malinowski – MWH Americas, Inc.: Dixie Hambrick – ESA: May Lau, Jason Ricks – CH2M: Steve Long – Boeing: Paul Costa – Leidos: Mike Barta, Tom Mulroy, Tara Schoenwetter
July 6, 2016	Meeting with the CDFW and DOE, via teleconference Topics include: Discuss the BA, discuss how the AOC, DOE Interpretation of AOC intent for application of Exemptions, species and habitats being evaluated for protection under the AOC exemptions, identification and mapping of species and their habitats, exercise of comparing strict AOC cleanup with cleanup based on exemption criteria, protection of oaks, result of exemptions evaluation process will be presented in the Soils Remedial Action Implementation Plan, how the exemption protocols will be implemented will be in the DOE BA, next steps for the DOE BA	– CDFW: Mary Meyer – CDFW: Jeff Humble – DOE: John Jones, Stephie Jennings – CDM Smith: John Wondolleck, Wardah Azhar – NASA: Pete Zorba – Boeing: Paul Costa, Mark Zeller – DTSC: Matt Wetter, Brian Faulkner, Mark Malinowski – ESA: Jason Ricks, Greg Ainsworth – CH2M: Beth Vaughn, Steve Long, Gary Santolo, Mike Bedan, Kelly Teplitsky – Leidos: Lauren Brown, Tom Mulroy, Mike Barta, Tara Schoenwetter

Date	***Event***	***Participants***
September 26, 2017	Meeting with USFWS, DOE, DTSC, Boeing, NASA at USFWS office, Ventura, California Topics include: Overview of the BA, Discussion about Draft BA, Braunton's milk vetch critical habitat and southern buffer zone, golden eagle, migratory birds and California species of special concern, vernal pools, exemption areas, process for Section 7 consultation, process for species listed under the California Native Plant Protection Act and California Endangered Species Act, Migratory Bird Treaty Act and Streambed Alteration Agreement and approach to Army Corps of Engineers 404 permitting and CDFG Section 1600 Streambed Alteration Agreement.	– USFWS: Jenny Marek, Lena Chang, Rick Farris, Mark Elvin, Steve Henry – DOE: John Jones, Stephie Jennings – CDM Smith: John Wondolleck – DTSC: Brian Faulkner, Roger Paulson, Matt Wetter, Laura Rainey, Ray Leclerc – CDFW: Andrew Valand, Christine Found-Jackson, Mary Meyer – USACE: Antal Szijj – NASA: Pete Zorba, Keith Thomsen – CH2M: (for NASA) Beth Vaughn – Padre (for Boeing): Chris Dunn – Leidos: (for DOE) Tom Mulroy, Katelyn Nyberg, Catrina Gomez

AOC = *Administrative Order on Consent for Remedial Action*; BA = Biological Assessment; CDFG = California Department of Fish and Game; CDFW = California Department of Fish and Wildlife; CNPS = California Native Plant Society; DTSC = Department of Toxic Substances Control; EPA = U.S. Environmental Protection Agency; GIS = geographic information system; NASA = National Aeronautics and Space Administration; SAIC = Science Applications International Corporation; USACE = U.S. Army Corps of Engineers; USFWS = U.S. Fish and Wildlife Service.

[a] Effective January 1, 2013, the California Department of Fish and Game changed its name to California Department of Fish and Wildlife.

Topics discussed during the meetings included the following:

- Methods for vegetation mapping, assessment, and classification
- Wildlife assessment and protection measures
- Methods and timing for vegetation trimming and protection of listed species during assessment activities
- Evaluation criteria for analyzing environmental effects
- Cleanup methods and technologies
- Current surveys for special status species, including federally and state-listed species, as well as other special status species, including CRPR plants, CDFW California Species of Special Concern, migratory birds, bats, and any local species of concern
- Avoidance, minimization of impacts, and mitigation for federally and state-listed rare, threatened, and endangered species or their habitats, including federally designated critical habitat
- Best management practices (BMPs) to prevent or minimize displacement and death to wildlife during construction
- Revegetation methods, including using only native plant species currently present on the site and locally collected plant materials (i.e., seed, cuttings) for propagation
- Development of restoration performance standards
- BMPs to prevent or minimize erosion
- Issues associated with spread and control of invasive plant species

- Concerns associated with the protection of coast live oak (*Quercus agrifolia*) trees and oak woodlands
- Sustaining wildlife movement corridors and habitat connectivity (on site and within offsite movement corridors)
- Alternatives analysis

Pursuant to discussions with USFWS and CDFW during meetings in June and July 2016, DOE additionally requested technical assistance from both agencies. This correspondence is included in Appendix A.

In addition to coordination with USFWS, CDFW, and USACE, DOE has actively sought input from agencies and groups regarding biological resources. Representatives of USACE and various groups, including the California Native Plant Society, Audubon Society, Southwest Herpetological Society, and Santa Susana Mountain Park Association, have participated in meetings and onsite reviews of proposed project actions and onsite biological resources.

In addition to agency consultation, permits and other approvals that are expected to be required for implementation of the proposed action are presented in Appendix B.

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3.0 Description of the Proposed Action

3.1 Proposed Action

The proposed action is to clean up and/or treat radiologically and chemically impacted soil and groundwater on SSFL, to remove/demolish existing buildings and infrastructure, to dispose of resulting waste, and to restore the affected environment in accordance with applicable laws, orders, regulations, and agreements with the State of California. Boeing, NASA, and DOE are the Responsible Parties for the investigation and cleanup of contaminants released from past activities at the project site. For the purpose of this BA, the project description focuses on the elements of Boeings and DOE's proposed action that are most relevant to predicting impacts to endangered, threatened, or sensitive species and their habitats. The proposed action does not include NASA activities on SSFL, as NASA activities were already consulted on. As the landowner, Boeing plans to permanently preserve the property as open space and to impose legal restrictions on the property to bar any future development, including residential or agricultural use. This is done through a legally binding conservation easement held by North American Land Trust that permanently preserves as open space habitat the nearly 2,400 acres Boeing owns at Santa Susana. Recreation is thus the only future use of the property (Boeing 2017a). The activities and methodologies are described in varying levels of detail based upon current information and what is reasonably foreseeable. As required by the California Health and Safety Code, the California DTSC is preparing a Programmatic Environmental Impact Report (PEIR) under CEQA to evaluate the potential impacts of proposed remedial actions at SSFL from the combined actions of Boeing, NASA, and DOE. The PEIR is being developed concurrently with this BA and the PEIR will need to be completed before Boeing, NASA, and DOE can begin their cleanup.

3.2 Project Location

The proposed action would be implemented at SSFL, which is in the southeastern part of Ventura County, adjacent to Los Angeles County, and approximately 29 miles northwest of downtown Los Angeles, California. The city of Simi Valley is located approximately one mile to the north of the project site. To the west is open space associated with the Upper Las Virgenes Canyon Open Space Area and Cheeseboro/Palo Comado Canyons. The residential community of Bell Canyon is located directly south of SSFL. San Fernando Valley communities, including Canoga Park, West Hills, and Chatsworth are to the east of SSFL and Sage Ranch Park is northeast adjacent to SSFL. Runkle Canyon lies to the northwest of SSFL and the Brandeis-Bardin campus of the American Jewish University lies to the north of SSFL. **Figure 3–1** shows the regional location of SSFL and surrounding communities. Regional access to SSFL is provided via east-west State Route (SR) 118 and the east-west U.S. Route 101. Topanga Canyon Boulevard (SR 27) is located approximately 3.5 miles east of the project site and links SR 118 and US 101. Local access to the project site is limited, and provided by Service Area Road at the northeast corner of SSFL, which can only be accessed by Woolsey Canyon Road from Chatsworth to the east or by Black Canyon Road from Simi Valley to the north.

The SSFL property is owned by Boeing and the Federal Government (under the administrative jurisdiction of NASA); however, the SSFL project site has been divided into Administrative Areas I through IV, and the Northern and Southern Undeveloped Areas (also referred to as Northern Buffer Zone and Southern Buffer Zone, NBZ and SBZ, respectively) (Figure 3–1). These Administrative Areas are referenced in this document to provide approximate location information and responsibility for cleanup requirements. Boeing, NASA, and DOE are the Responsible Parties for the Administrative Areas and each party has been investigating their respective areas to identify the nature

and extent to which contaminants are present or may have migrated and are required for cleanup. **Table 3–1** summarizes the project site ownership and the responsible party acreages.

The proposed action would take place on the 2,850-acre SSFL site and adjacent offsite locations. The focus of the effects analysis in this BA is on the activities of DOE (in Area IV and the NBZs) and Boeing (on Areas I, III, and the SBZ). These areas account for about 2,400 acres of the 2,850-acre SSFL total. NASA has consulted on the approximately 451 acres under their control and the effects of NASA's activities are not addressed in this BA as described in Section 2.2, above. Offsite areas that may require cleanup include several drainages or adjacent areas located to the north and northwest of SSFL.

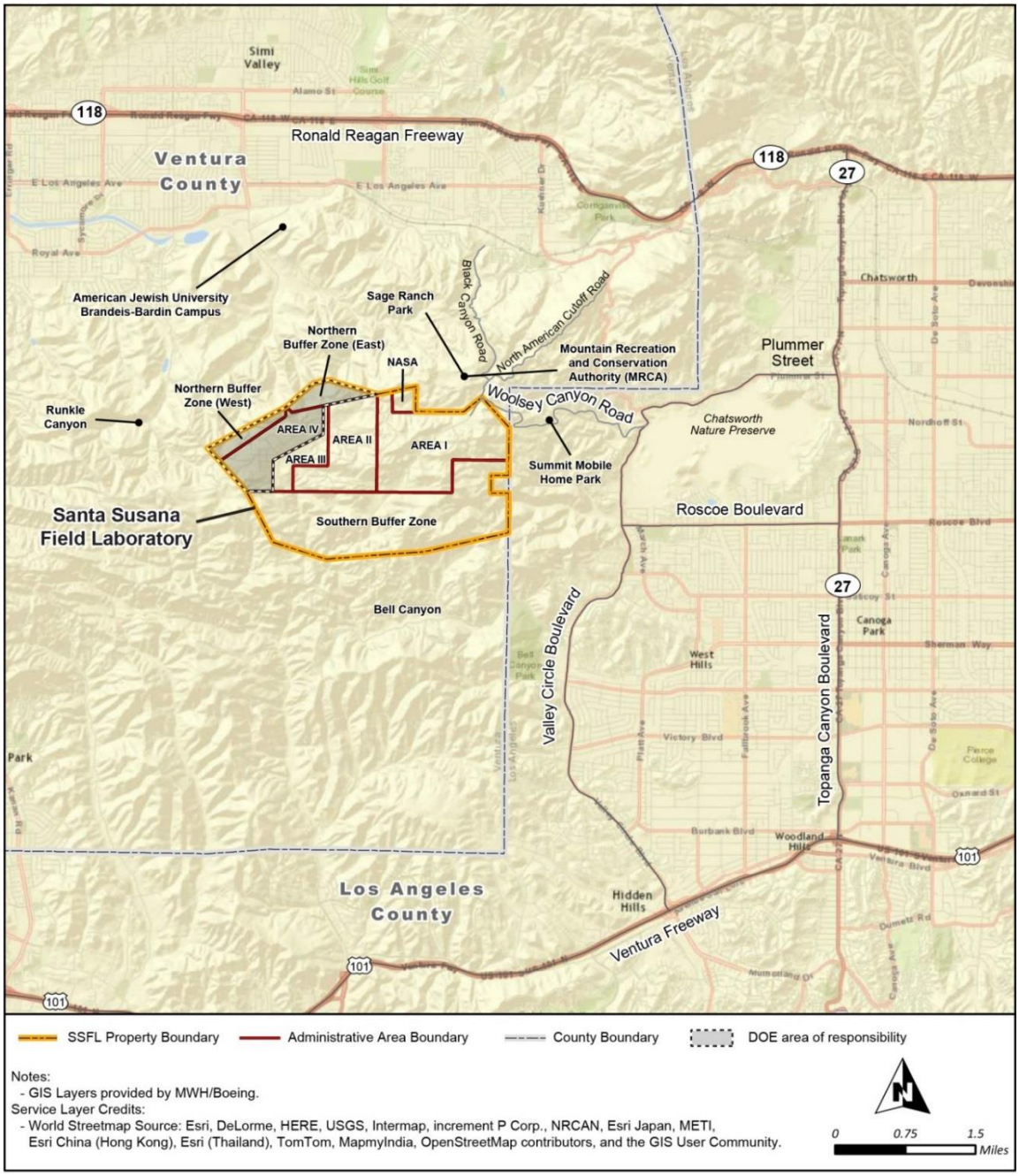


Figure 3–1. Regional Location Map

The purpose of the proposed action is to clean up and/or treat contaminated soils and groundwater, in accordance with the requirements prescribed by the DTSC in the 2007 CO (DTSC2007) and the 2010 AOCs (DTSC 2010a, 2010b), and to complete other site closure activities, including removal of buildings and infrastructure on SSFL property. Past activities at SSFL have resulted in the release of contaminants to soil, groundwater, buildings, and infrastructure and corrective actions are required to clean up the affected areas. Thus the proposed action is needed to remove remaining contaminants from SSFL while maintaining highly valued resources (i.e., human life, property, sensitive vegetation and habitat, federally and state-listed species, cultural resources, and off-site resources). Environmental media subject to cleanup activities on SSFL include soil, sediment, surface water, and weathered bedrock as well as groundwater (both near surface and deep groundwater) and unsaturated, unweathered bedrock. A planning cycle of 2 to 18 years may be needed to provide increased flexibility in implementing soil cleanup activities. As described below in Section 3.5 (Site Cleanup), soil remediation could require 10 years or more.

Table 3–1. Summary of Project Site Ownership and Responsible Party Acreages

Administrative Area	*Property Owner*	*Responsible Party* [a]	*Administrative Area Acreage*	*Cleanup Requirement*
SSFL				
I	Boeing	Boeing	670	Risk-based
I	Federal Government	NASA[a]	42	AOC
II	Federal Government	NASA[a]	409	AOC
III	Boeing	Boeing	114	Risk-based
IV	Boeing	DOE	290	AOC
Northern Undeveloped (NBZ)	Boeing	DOE	182	AOC
Northern Undeveloped (NBZ)	Boeing	NASA [a,b]	0	AOC
Southern Undeveloped (SBZ)	Boeing	NASA [a,b]	0	AOC
Southern Undeveloped (SBZ)	Boeing	Boeing	1,143	Risk-based
Subtotal – SSFL Acreage			**2,850** [c]	
Offsite Areas				
Drainage Areas to the north	American Jewish University	DOE	–	AOC [d]
Drainage Areas to the north	American Jewish University	NASA	–	AOC [d]
Drainage Areas to the north [e]	Mountains Recreation and Conservation Authority	Boeing	–	Risk-based [d]
Former Rocketdyne Employee Shooting Range	Mountains Recreation and Conservation Authority	Boeing [f]		Risk-based [d]
Subtotal – Offsite Areas			**0**	
Total Project Site			**2,850** [c]	

AOC = Administrative Order on Consent; NBZ = Northern Buffer Zone; SBZ = Southern Buffer Zone.

[a] The Responsible Party designations refer to soil cleanup. Areas where NASA has been identified as the responsible party have previously been consulted upon and effects of NASA's proposed activities are not addressed in this BA.

[b] NASA proposed cleanup on Northern and Southern Undeveloped Areas (NBZ and SBZ) is due to contiguous chemical impacts emanating from former NASA operations, see NASA (2013) for further information. NASA does not, and never has, owned any portion of either undeveloped area. Cleanup levels for these areas will be determined based on applicable cleanup orders and property owner rights.

[c] The administrative area acreage incorporates small changes in the acreages of Areas I, II, and III reflecting an updated boundary survey.

[d] Cleanup requirements dependent on property owner consent.

[e] The Northern and Southern Undeveloped Areas are also referred to as Northern and Southern Buffer Zones (NBZ and SBZ, respectively) in this BA. Boeing soil cleanup in the vicinity of the Northern Drainage includes impacts from operations and cleanup required under the 2007 CO.

[f] Lead shot removal cleanup activities to be performed by Boeing under DTSC oversight. Acreage provided based on approximate extent of potential lead shot and clay target material; if soil remediation is required, locations will be determined based on ongoing characterization work and approval of cleanup plan.

3.3 Regulatory Background

As previously mentioned the focus of this BA is on the activities of DOE (in Area IV and the NBZs) and Boeing (Area I, III and the SBZ) but NASA's areas of responsibility and activities are not addressed in this BA; however, for the purpose of understanding the site as whole NASA is discussed in this background section. In 2007, DTSC, DOE, NASA, and Boeing signed the 2007 CO, which was issued pursuant to DTSC's authority over hazardous waste under the California hazardous waste law provisions in the California Health and Safety Code, Section 25187. The 2007 CO requires the Responsible Parties to clean up all chemically impacted soils and groundwater at SSFL to risk-assessment-based level. Each Responsible Party was required to further characterize the nature and extent of contamination at SSFL. The 2007 CO also identified the Resource Conservation and Recovery Act (RCRA) studies and work plans that would be prepared and required the cleanup of chemically contaminated soils using a risk-based approach; completion of DTSC-approved groundwater and unsaturated zone cleanup remedies in the Chatsworth Formation Operable Unit (OU); and completion of construction of the DTSC-approved long-term soil cleanup remedy in the surficial media OU by June 30, 2017, or earlier. The proposed risk-assessment methodology for determining the areas that would need remediation is based on human and ecological receptors identified in the SSFL *Standardized Risk Assessment Methodology* (SRAM, Rev. 2 Addendum) (MWH Americas, Inc. 2014), including future hypothetical residents, workers, recreational users, and representative mammals and birds. In April 2017, Boeing recorded a Conservation Easement over nearly 2,400 acres of the SSFL that it owns in favor of the North American Land Trust that expressly prohibits the Boeing-owned property from ever being developed or used for residential, commercial, industrial or agricultural purposes. The conservation easement establishes the legal future use of the property as protected open space habitat and identifies the wildlife and habitat values of the property as one of six conservation values of importance. The conservation easement provides that any use of the property must forever be consistent with the conservation protection and maintenance of these conservation values.

The 2007 CO separates the project site into two OUs, the Surficial Media OU and the Chatsworth Formation OU. The primary components of the Surficial Media OU include soil, sediment, and weathered bedrock. The Surficial Media OU also includes surface water, near-surface groundwater, air, and biota. The primary component of the Chatsworth Formation OU is deep groundwater. The Chatsworth Formation OU also includes unsaturated, unweathered bedrock.

In 2010, DOE and NASA entered into separate AOCs with the DTSC (DTSC 2010a, 2010b) with respect to soil remediation. The 2010 AOCs changed the framework for the soils characterization and cleanup process for DOE and NASA.[1] The 2010 AOCs stipulated that the soils cleanup standard will be based on "Look-Up Table" (LUT) values, which are: for chemicals, local background concentrations or method detection limits for those chemicals for which the method detection limit exceeds local background concentrations, and, for radionuclides, local background concentrations or minimum detection limits for radionuclides whose detection limits exceed local background concentrations. The soil cleanup requirements based on the LUT values are derived from background levels or laboratory method reporting limits.[2] Per the 2010 AOCs, "Detection Limit" is the method reporting limit that is the lowest concentration at which an analyte can be confidently detected in a sample and its concentration can be reported with a reasonable degree of accuracy and precision.

The AOCs signed in 2010 superseded the requirements in the 2007 CO for soils and added building demolition, but the requirements for groundwater under the 2007 CO remained valid. Chemicals and

[1] The 2007 CO (DTSC 2007) remains in effect for groundwater remediation.

[2] Method reporting limits for chemicals, minimum detectable concentration for radionuclides.

radionuclides in the backfill soil must meet the same LUT values. Moreover, verification of cleanup levels and the acceptability of the backfill soil are required by DTSC for chemicals and by the U.S. Environmental Protection Agency (USEPA) for radioactive contaminants. No "leave-in-place" alternative (onsite burial or landfill) is allowed under the AOCs (which apply to DOE and NASA but not to Boeing). Both the 2007 CO and 2010 AOCs state that actions taken pursuant to the orders must be taken in accordance with local, state, and Federal laws, which involve laws and regulations related to protecting biological resources (habitat or species protected under the Federal and/or California ESAs) or cultural resources (e.g., Native American artifacts that are formally recognized as cultural resources). In this BA, areas identified for the protection of biological and cultural resources are described as "exemptions"; however, the term "exceptions" is also used in the 2010 AOCs. The exercise of these "exemptions" and constraints on remedial activities are subject to DTSC's oversight and approval. An additional exemption (not to exceed 5 percent of the total soil volume) is allowed in the AOCs for other unforeseen circumstances, but only to the extent that the cleanup cannot be achieved through technologically feasible measures.

The 2010 AOCs call for DOE and NASA each to develop a Soil Remedial Action Implementation Plan (SRAIP) that clearly describes a schedule for implementation of the planned remedial actions, and the 2007 CO requires Boeing to develop a Corrective Measures Study (CMS) and Corrective Measures Implementation Work Plans (CMI WP) that will identify proposed remedial actions for evaluation and approval by DTSC.

While Boeing is not subject to the AOCs, similar constraints with regard to biological and cultural resources will apply to Boeing's activities. Boeing's potential remediation activities are to be performed in accordance with the 2007 CO, as directed by the DTSC on Boeing-owned parcels at SSFL, (Administrative Areas I and III and where contaminants have migrated into the SBZ and outside the northern boundary). The objective of the Boeing Remediation Project is to remove, treat, or contain contaminants in soil/sediment, surface water, groundwater, and vadose zone bedrock. The goal of the remediation is to achieve risk-based soil/sediment contaminant levels that are required for the future use of the property as protected open space habitat under a conservation easement and to address groundwater quality.

3.4 Cleanup Requirements

For the purposes of this BA, cleanup methods for soil, sediment, surface water, and weathered bedrock are grouped together, and groundwater (both near surface and deep groundwater) and unsaturated, unweathered bedrock are grouped together. These groupings are made for readability because cleanup technologies for these media are similar; as opposed to grouping by OU.

In short, soil cleanup requirements for DOE are based on the 2010 AOCs and require that soil and sediment be cleaned up to LUT values, whereas, Boeing's areas soil cleanup requirements are based on risk-based levels following methods outlined in the DTSC-approved Standardized Risk Assessment Methodology Work Plan Addendum (MWH Americas, Inc. 2014). Preliminary risk-based screening levels (RBSLs) for soil and related media are provided in Chapter 7 of this BA.

The proposed cleanup standards for DOE in the 2010 AOCs are more restrictive than those proposed under the 2007 CO for Boeing. In the event that one Responsible Party is required to perform soil cleanup in an area owned by another (e.g., where contaminants have migrated beyond the area's administrative boundary), the cleanup activities will be performed in a manner agreed upon by the affected Responsible Parties and DTSC. The 2010 AOCs specifically provide that DOE is responsible for remediation of any contiguous radiologic or chemical contamination of soil emanating from within

Area IV or the NBZ.[3] Any such cleanup activity will require an access agreement from the relevant property owner. Similar arrangements will be required to address the migration of contaminants onto property owned by another entity or person (e.g., American Jewish University for drainage areas to the north).

The biological and cultural resources constraints or "exceptions" described above in Section 3.3.1 are termed "proposed AOC exemption areas" in this BA and are areas in which cleanup will be to risk-based criteria and not strictly to LUT values in areas where DOE is the Responsible Party.

As stated above, Boeing is not subject to the AOCs and will be cleaning up soil to risk-based criteria. Nonetheless, Boeing is also subject to the applicable laws and regulations protecting biological and cultural resources, and its risk-based cleanup activities will be evaluated in DTSC's PEIR and the CMS for any potential impacts to biological and cultural resources. If impacts to biological or cultural resources are potentially significant, the PEIR and CMS will evaluate any feasible mitigation measures to address those potentially significant effects. In addition, the 2010 AOCs have requirements that place limitations on remedial approaches. Specifically, the 2010 AOCs prohibit "leave-in-place" approaches such as onsite burial and onsite landfilling of soil/sediments with contaminant concentrations above cleanup requirements; this limits cleanup options for areas under the responsibility of DOE. Areas subject to an "exemption" are not considered a "leave-in-place" approach, which is prohibited under the 2010 AOCs.

3.4.1 Groundwater

Groundwater at the project site has been contaminated from surficial releases and spills, and dissolved contaminants have subsequently been transported by groundwater flow. As mentioned above, DOE and Boeing have the same risk-based groundwater cleanup requirements (under the 2007 CO) for all areas throughout the project site. Cleanup requirements for radionuclides are derived from USEPA as well as DOE regulations under authority of the Atomic Energy Act, and are based on USEPA-promulgated drinking water standards (maximum contaminant levels) as well as site-specific risk assessment values.

3.4.2 Buildings and Infrastructure

The proposed action includes removal (over the course of 5 years) of existing facilities, buildings, support structures, and infrastructure no longer in use at the SSFL properties.

Demolition and removal of some of the SSFL facilities, buildings, and infrastructure will require the mobilization and operation of heavy construction equipment and the generation, transportation, and disposal of large volumes of debris and waste to offsite treatment, storage, and/or disposal facilities. The scale of these operations will depend on the size of the facility and area affected by facility operations (for example, some of the hazardous material or waste handling and treatment facility may include removal of multiple structures and associated infrastructure). The schedules for these activities may overlap with portions of the soil and groundwater cleanup program, exacerbating the biological impacts of these activities. These features include:

- RCRA-permitted hazardous waste facilities regulated by DTSC under the RCRA Hazardous Waste Facility Permitting Program, including:
  - The Thermal Treatment Facility located in the southwestern portion of Area I
  - The Radioactive Materials Handling Facility (RMHF) located in Area IV

[3] Such areas include the drainages leading into various ponds and the ponds themselves, e.g., Silvernale Pond.

  - The Hazardous Waste Management Facility (HWMF) located in Area IV
  - Surface Impoundment (Storable Propellant Area I)
  - Five Area I/III Surface Impoundments (Engineering Chemistry Laboratory, Advanced Propulsion Test Facility 1, Advanced Propulsion Test Facility 2, System Test Laboratory–IV 1, and System Test Laboratory–IV 2)
- Removal of buildings and infrastructure not subject to corrective action requirements under state or Federal law fall under the general building and permitting authority of Ventura County. Area IV building removals are the subject of a 2007 court order and an ongoing legal suit filed in 2013.

The following is a brief description of the current status and planned removal/disposal actions for the non-DTSC regulated DOE, and Boeing-owned buildings and infrastructure. The March 2014 SSFL Final Environmental Impact Statement (EIS), prepared by NASA under the requirements of the National Environmental Policy Act (NEPA), includes a full analysis and description of the planned NASA demolition program for SSFL Area II.

The remaining DOE buildings in Area IV include the Sodium Pump Test Facility (B4462, B4463), the Energy Technology and Engineering Center Office (B4038), the sodium test/warehouse (B4057), the HWMF (B4029, 4133), the RMHF (Buildings B4021, 4022, and 4034 and sheds B4044, B4075, B4563, B4621, B4658, B4665, and B4688, as well as the remaining concrete slab of B4663), and former reactor buildings (B4019, B4024). The RMHF is in a standby status and is no longer handling or processing radioactive or hazardous materials; B4057 is still used for storage; and the remaining buildings are unoccupied and unused. The DOE buildings associated with the HWMF and RMHF are permitted under the RCRA Hazardous Waste Permitting Program and their closure and removal falls within DTSC's discretionary authority and are included as part of the proposed action.

Boeing has completed the demolition and removal of all buildings and other structural features in Areas I and III, except for the guard shack, fire station, and Groundwater Extraction and Treatment System (GETS) building located within Area I), which may be left for future use. In Area IV, Boeing has also completed the removal of all of its non-radiological buildings. The remaining Boeing structures in Area IV include the former Fast Critical Experiment Lab/Advanced Epithermal Thorium Reactor building (B4100), the former Organic Moderated Reactor/Sodium Graphite Reactor (B4009), the former Nuclear Materials Development Facility (B4055, B4155), the former Instrument Calibration Lab (B4011 Low Bay), and the remaining concrete slab from the former Uranium Carbide Manufacturing Building (B4005). There are no existing or former buildings or test stands in Boeing-owned Northern and Southern Undeveloped Areas.

Other Infrastructure

- Roads: The project site includes a network of paved and unpaved roads with dirt roads that will be used to access remote, undeveloped areas during wildfires and to conduct monitoring activities. It is expected that most roads will remain in place for the duration of the proposed action, except for those associated with specific buildings or facilities that can be removed without affecting ongoing access needs for remediation, monitoring, and safety.
- Water Supply: Water is supplied from municipal sources via pipeline to SSFL at the main gate and is supplied to the Boeing offices in Area I. Potable water needs for Area, III, and IV are supplied by truck. As part of site closure activities, the majority of formerly used water supply wells on site will be properly abandoned by their owners, in accordance with existing

regulations. Some existing water wells may be used for ongoing monitoring, extraction, or injection as part of the final groundwater cleanup.

- Electrical: Southern California Edison (SCE) will provide electricity to the project site from the Chatsworth Substation, located in Area IV, and electricity is distributed to smaller substations in Area I via aboveground transmission lines. At the present time, electricity is not supplied to or has been disconnected from most buildings; however, the majority of the existing transmission lines and transformers are still in service and/or energized. The SCE substation, along with easements for its electrical system, would remain until SCE decides otherwise. Prior to and following cleanup activities, unneeded electrical infrastructure may be removed.
- Sewer Pipelines: Onsite sewage treatment plants have been removed. Remaining sewer pipelines are vitreous clay and cast iron, with ductile iron and steel force mains. Pipeline diameters range from 2 to 10 inches, with the majority of the segments 4 and 6 inches in diameter. The depth of the pipelines is generally 3 to 5 feet below grade, with some pipelines up to 10 feet deep in portions of the project site. Some sewer system pipelines are also above the ground surface. All aboveground sewer pipelines would be removed, and below ground sewer pipelines would be either removed or decommissioned in place.
- Leach fields: Several inactive sanitary leach fields are located within Boeing Areas I and III. If these leach fields are co-located with soil requiring cleanup, they would be removed during site cleanup requirements; otherwise, the leach fields would be left in place. Nineteen inactive leach fields have been identified (known and potentially occurring) within Areas I and III. Boeing is currently attempting to locate 8 of the 19 inactive leach fields for which location information is uncertain. The site of the former RMHF leach field in Area IV has been affected by Strontium-90 and remediation is currently under investigation by DOE. Investigation of other leach fields has been completed and those with impacts above applicable cleanup requirements will be addressed. Specific cleanup methods will be defined in the remediation planning documents.
- Existing GETS: GETS is located in the southern portion of Area I and began operation in January 2010 by Boeing. Since November 2012 operation has been halted because of lowered groundwater levels and to allow for groundwater characterization under non-pumping conditions. Options for managing the treated groundwater include discharge to Outfall 19 in accordance with the existing National Pollutant Discharge Elimination System (NPDES) permit and in compliance with applicable regulatory requirements, reinjection into the groundwater aquifer, and discharge to the sanitary sewer.
- Existing Surface Water Treatment Systems: Stormwater treatment at the project site is governed by the Waste Discharge Requirements and NPDES permit issued to Boeing by the Los Angeles Regional Water Quality Control Board. Although the current NPDES permit is issued to Boeing, it governs the entire SSFL area and DOE support compliance with its provisions as discharges from their activities are also covered by the permit. Active treatment is performed on water collected in the onsite ponds using two surface water treatment systems that employ filters and chemical treatment. A passive biofilter system has been implemented that uses soil, naturally occurring bacteria, and native plants to filter the surface water. Each Responsible Party has implemented drainage culvert modifications, stream bank stabilization, revegetation of disturbed soil areas, installation of detention bioswales, and placement of smaller-scale erosion control measures to comply with NPDES requirements. Surface drainage that would lead offsite into the NBZ is captured at the outfalls and piped

back to Silvernale Pond for detention and treatment. It is expected that this system would remain in place for the duration of onsite remediation and treatment. Each Responsible Party would implement separate surface water control and monitoring measures established by the NPDES or other regulatory program in the watersheds where they are performing the activities.

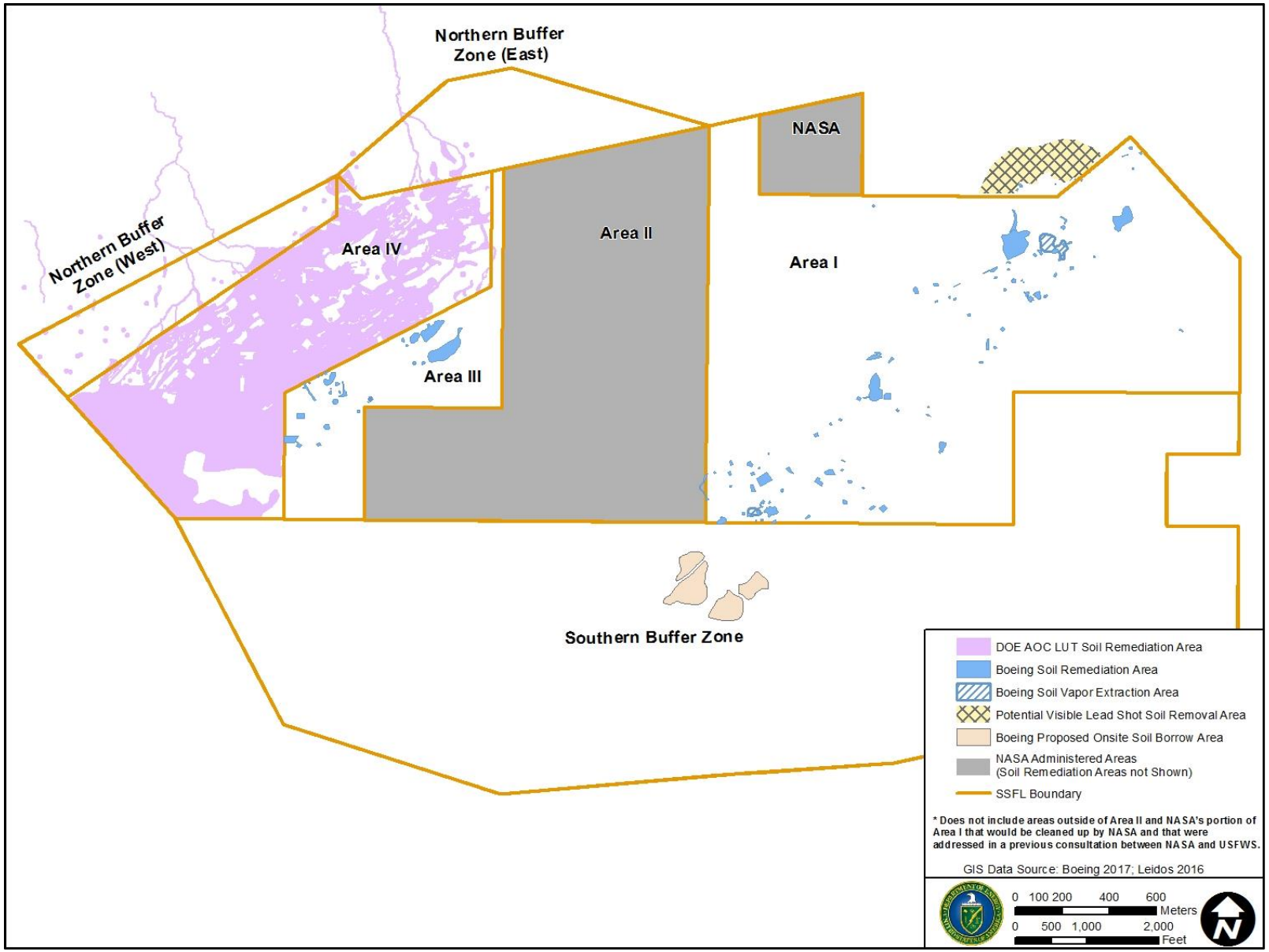
3.4.3 Lead Shot Removal Activities

North and adjacent to the project site is the former Rocketdyne-Atomics International Rifle and Pistol Club Trap and Skeet shooting range area, located on the Mountains Recreation and Conservation Authority Sage Ranch property. The former shooting range was used by former Rocketdyne-Atomics International employees for recreational shooting and target practice using lead shot and clay pigeons between 1972 and 1991. Visible lead shot in portions of the former shooting range area has been addressed through several periodic cleanup operations conducted by Boeing (or its predecessor companies) since 1992.

This area is identified as the "Former Rocketdyne Employee Shooting Range" (Solid Waste Management Unit [SWMU] 4.20) in the RCRA Facility Assessment by USEPA, and is listed as such in the 2007 CO. In Attachment 4 of the 2007 CO, the Former Shooting Range is listed as a SWMU. However, no responsible party is listed and it is noted as "NA" (not applicable) for "Regulatory Jurisdiction," "Current Regulatory Program," and "Current Status" with the comment "Included in RCRA Facility Assessment but property belongs to Santa Monica Mountains Conservancy." The investigation and any future cleanup activities for the Former Rocketdyne Employee Shooting Range will be conducted under DTSC oversight.

3.5 Site Cleanup

Each Responsible Party has conducted an initial screening of various potential remedial approaches and technologies that would clean up contaminated soil and groundwater at SSFL. The approaches and technologies continue to be evaluated as the Responsible Parties complete characterizing the nature and extent of the contaminants. A variety of remedial technologies may be needed to address the multiple affected media and the wide variety of contaminants present. As mentioned above, NASA has prepared a separate BA and held informal consultation with USFWS. Site cleanup actives in NASA's areas of responsibility (Area II and a portion of Area I), as well as adjacent portions of Area I, Area II, Area IV, and the NBZ to which NASA's contaminants could have migrated are not illustrated in **Figure 3–2** or evaluated in this BA. **Table 3–2** provides a quantitative summary of information concerning the cleanup on SSFL for DOE and Boeing. **Table 3–3** provides an overview of the proposed projects including activities, estimated duration, and associated construction equipment. The descriptions of cleanup projects in this BA are based on current information and are expected to become more detailed over time as follow-on sampling, plans, and analyses develop. These projects would be implemented as soon as possible after regulatory agency approval. Figure 3–2 shows the locations of soil cleanup areas for DOE and Boeing, which are subject to modification with additional planning and analysis. As mentioned above, soil contamination attributable to NASA is not included in this figure.



517 **Figure 3–2. Soil Cleanup Areas**

518 **Table 3–2. Information for the DOE, and Boeing Remediation Activities at SSFL**

Impacts Information	*Responsible Party*		*Totals*
	Boeing	*DOE*	
Land Disturbed (acres)			
Area Disturbed for Soil Removal	17 [a]	227	**244**
Area Disturbed for Building Removal	3	8	**11**
Total	20	235	**255**
Employment (persons)			
Onsite Employees	100	25 to 26 Building removal activities = 26 Soil excavation = 25 Groundwater treatment = < 1	**125-126**
Resources Used			
Backfill for Soil Excavation (cubic yards)	50,000 [b]	1,060,000	**1,110,000**
Backfill for Building Removal (cubic yards)	1,300	13,500	**14,800**
Backfill for Bedrock Removal (cubic yards)	None expected	1,280	**1,280**
Total	51,300 [a]	1,074,780	**1,126,080**
Resources Used			
Water (gallons/day)	20,000 [d]	16,000	**36,000**
Waste Generated (cubic yards)			
Soil Excavation	150,000 [c]	1,413,000	**1,563,000**
Building Removal	112,000 [c]	15,500	**127,500**
Bedrock Removal	Not expected	1,700	**1,700**
Groundwater Remediation	2,000	36	**2,036**
Total	264,000	1,430,236	**1,694,236**

Impacts Information	*Responsible Party*		*Totals*
	Boeing	*DOE*	
Truck Trips			
Soil Disposal	9,800 [f]	106,000	**115,800**
Backfill, Equipment, and Supplies	3,300 [g]	70,200	**73,500**
Building Demolition Debris	1,000 [h]	1,500	**2,500**
Bedrock Disposal	Not expected	130	**130**
Groundwater Remediation	300 [i]	260	**560**
Other deliveries	400		**400**
Total	14,800	178,090	**192,890**

[a] Boeing has identified four potential soil borrow areas in the SBZ that could be used as sources of clean backfill for Boeing remediation activities. The areas total approximately 11 acres of undeveloped land and are estimated to contain approximately 100,000 cubic yards of clean backfill. The analyses in this BA assume Boeing would obtain backfill from both onsite and offsite sources and that use of the onsite sources would remove vegetation and habitat from 11 acres. Offsite sources include Santa Paula Materials, Inc., Grimes Rock, Tapo Rock and Sand Inc. P.W. Gillibrand Company and Simi Valley landfill. It is assumed that these offsite sources are operating under existing land use permits and therefore the biological impacts of obtaining backfill from offsite sources are not addressed in this BA.

[b] Estimates assume that approximately 33 percent of excavated soil volume will be needed as backfill obtained from other sources to supplement surrounding soils used as backfill to restore the soil remediation area.

[c] Estimated *in situ* soil excavation volume for cleanup to protect future recreational and ecological receptors for DOE EIS planning.

[d] Water use estimated based on generalized data regarding water use for prior soil removal activities at SSFL and comparable information for other MWH/Stantec soil remediation projects.

[e] Building debris cubic yard volume based on 1.5 cubic yards per ton to maintain consistency with soil volume estimates. Actual debris volume will be dependent on type of material.

[f] Estimates assume 1.5 cubic yards per ton of soil, and 23 tons per truck average.

[g] Trucking estimates for backfill delivery provided for conservative planning estimates. To minimize truck trips, Boeing plans to use the trucks that bring clean backfill to the site from offsite sources for subsequent off-haul of contaminated soil. Also, Boeing may use onsite sources of backfill. In both of these cases, the truck trips estimated here would be minimized or eliminated.

[h] Trucking estimate for building debris removal based on an average truck volume of 17 cubic yards based on prior Boeing demolition projects.

[i] Groundwater waste and trucking estimates assume 1.5 cubic yards per ton of soil and 23 tons per truck average.

Notes:
Sums presented in the table may differ from those calculated from table entries due to rounding.
Responsible party values generally rounded to three significant figures.
Source: Draft EIS for remediation of Area IV (DOE 2017); Boeing 2017b.

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520 **Table 3–3. Construction Details for Site Cleanup**

Project	Activities	Duration	Construction Equipment
Soil			
Soil Excavation and Disposal	Vegetation removal, grubbing, road improvements, excavation, stockpiling, truck loading/transport, backfilling, restoration	10 years or more	Dozers, loaders, excavators, scrapers, on- highway haul trucks, vacuum trucks, compactors, a mobile centrifuge dewatering unit, water trucks, street sweepers, light duty and support trucks
Soil Vapor Extraction	Install 10 extraction wells (10–35 feet deep), and associated piping/treatment system monitoring, well removal, restoration	3 years	Drill rigs, excavators, loaders, scrapers, trenchers, compactors, pavers, street sweepers, cement trucks, blower/vacuum, piping, light duty and support trucks
Soil Bio Treatment – Bioventing	Well installation/removal, monitoring, restoration	3 years	Well materials, drill rig, blower/vacuum, piping, light duty and support trucks
Soil Bio Treatment – Gaseous Electron Donor Injection	Similar to Soil Vapor Extraction and bioventing	3 years	Well materials, drill rig, blower/vacuum, piping, light duty and support trucks
Soil Bio Treatment – Ex Situ Biological Treatment	Clearing, grubbing, excavation, stockpiling, add water and chemical amendment, monitoring, restoration	3 years	Dozers, loaders, excavators, scrapers, vacuum trucks, compactors, mobile centrifuge dewatering unit, water trucks, street sweepers
Monitored Natural Attenuation (soil)	Soil monitoring	TBD	Drill rig, light duty trucks and support trucks
Physical Remediation – Soil Solidification / Stabilization (Boeing only)	Drill holes with augers to inject and mix reagent or excavate and process soil ex situ	TBD	Excavators, loaders, pug mill, light duty and support trucks
Physical Remediation – Thermal Desorption (Boeing only)	Insert conductive wiring into media and apply electricity	TBD	Excavators, drill rigs, will require electric power from the grid and generators
Capping (Boeing only)	Physically place clean fill over contaminated soils	TBD	Excavators, loaders, scrapers, dozers, haul trucks, light duty and support trucks
Building and Infrastructure Activities			
Buildings and Infrastructure Demolition and Removal	Demolition and removal, excavation, transport, disposal,	2 years	Demolition equipment including cranes, impact chisels, grapplers in addition to equipment listed under excavation and disposal.
Lead Shot Removal Activities			
Removal of Lead Shot and Clay Pigeons	Physically remove lead shot and clay pigeons debris	2 years	Shovels, hand rakes, screens/sifters, or backpack-mounted or truck-mounted vacuums; some localized excavation
Groundwater			
Groundwater Extraction & Treatment Systems	Drill extraction and treated water injection wells (as necessary), install wellheads treatment equipment, trenching and installation of piping	Minimum of 10 years	Drill rigs, water trucks, loaders, excavators, loader compactors, haul trucks, light duty and support trucks
Enhanced Groundwater Treatment	Injection of chemicals or nutrients into groundwater, monitoring	Monitor for several years	Drill rigs, support trucks, light duty and support trucks
Air Sparging and Vapor Extraction	Site-specific treatability study, install vapor extraction wells, monitoring	1 to 5 years	Drill rig, blower/vacuum, piping, well materials, backhoe, light duty and support trucks

Project	Activities	Duration	Construction Equipment
Monitored Natural Attenuation Groundwater	Monitoring (periodic water quality sampling to confirm contaminant degradation)	Ongoing	Drill rigs, support trucks, light duty and support trucks
Passive Treatment at Seeps (Boeing)	Access road modification, clearing and grubbing, soil and rock excavation, soil/rock stockpiling, transfer to haul trucks, placement of materials, recontouring, seeding and planting	Ongoing	Backhoes, excavators with hydraulic breakers, haul trucks, vacuum trucks, compactors, water trucks, concrete trucks, light duty and support trucks
Bedrock Removal for Strontium-90 (DOE)	Excavate bedrock, break bedrock, haul away and dispose of bedrock	6 to 12 months	Excavator, support vehicle, hydraulic breaker, dust suppression system, water truck, light duty and support trucks
Bedrock Vapor Extraction	Install extraction wells, monitoring, well removal, restoration	1 to 5 years	Well materials, drill rig, blower/vacuum, piping, light duty and support trucks
Decommissioning Water Supply Wells (Boeing)	Overdrill wells, grout wells	6 months to 1 year	Drill rig, excavator, loader, haul truck, roller compactor, support trucks, light duty and support trucks

TBD = to be determined.

Groundwater cleanup will be required to some extent in each of the administrative areas but the locations of localized surface facilities required for groundwater cleanup have not been determined. It is assumed for this analysis that existing wells and infrastructure will be used whenever available. Additionally, there is some flexibility in siting new wells and pipelines enabling them to be placed in previously disturbed areas with existing access. Any environmental review for such facilities will include avoidance of impacts to sensitive species and habitats to the greatest extent feasible.

The combined soil excavation activities of DOE and Boeing would cause profound direct disturbance (removal of vegetation and soils) over an estimated 254 acres (Table 3–2). A variety of remedial technologies will be considered for soil cleanup, depending on the results of the treatability studies. These technologies include excavation and offsite disposal, soil vapor extraction, biological treatment, onsite management, phytoremediation, and physical remediation methods (soil washing/partitioning, soil solidification/stabilization, thermal desorption).

The effects of vegetation and soil removal will result in long-term impacts due to the time and intense effort needed to restore the habitat. Up to an estimated 192,290 truck trips would be required to dispose of soil and debris and to import backfill, equipment, and supplies (Table 3–2). Sources of suitable backfill, which must meet AOC LUT values on DOE's property and should be similar in parent material and physical properties to the soils removed, have not been identified. As discussed later in this document, the lack of suitable identified sources of backfill for DOE creates substantial uncertainty concerning the feasibility of revegetation after the soils have been excavated and removed from the project site. Boeing has identified potential backfill sources as noted in footnote "a" in Table 3–2, including four onsite borrow areas located in the SBZ (see Figure 3–2).

The environmental analysis and evaluation of potential impacts regarding each of the proposed remedial technologies is based on current information regarding remedial activities. DOE will prepare a SRAIP, which will provide more detailed and site-specific plans for remediation at their sites. Boeing will conduct a CMS evaluating remedial alternatives, including consideration of potential environmental impacts on biological resources, and recommend the selected corrective action following DTSC and public review. Once the cleanup standards and approach is finalized and approved by DTSC, Boeing will prepare CMI Work Plans detailing their site-specific plans. The final remediation methods may be adjusted based on factors such as changing site conditions, new technologies, additional information, and presence of sensitive resources (e.g., federally listed species, sensitive species, keystone habitats, culturally significant areas).

It is anticipated that the approval by DTSC of the initial CMI WP and SRAIPs would occur subsequent to completion of the Final PEIR. It is estimated that building removal and soil excavation and disposal activities would begin within approximately 30 days of DTSC's decision on the PEIR. It is anticipated that building removal could be accomplished within about two years. Soil removal to AOC LUT standards would take more than 10 years. Monitoring of natural attenuation may occur over a longer period of time (to be determined based on confirmation sampling). Any single cleanup technology or a combination of cleanup technologies could be used to achieve the proposed action's remedial objectives.

Most activities at the project site would occur 5 days per week (Monday through Friday), 8 hours per day, and during daylight hours (7:00 a.m. to 6:00 p.m.). Longer work hours during the summer and work on Saturdays may occur. Numbers of employees onsite will vary over time according to the project phasing by DOE and Boeing (see Table 3–2).

Future development of the project site beyond that for recreational open space is not contemplated and is not a part of the proposed project. The AOCs and 2007 CO only require cleanup of the project

site. The soil and groundwater remedies may include a restrictive land use covenant as appropriate. Boeing has recorded a Conservation Easement on the nearly 2,400 acres of property it owns at the SSFL that permanently preserves the property as open space habitat.

3.6 Conservation Measures Proposed to Avoid, Minimize, and Compensate for Effects to Listed (and/or Proposed) Species and/or Critical Habitat to be Incorporated into the Proposed Action

The proposed action incorporates a number of general and species-specific measures DOE and Boeing would implement to avoid, minimize, and/or compensate for adverse effects on federally listed and proposed species and designated critical habitat. NASA's previous consultation with USFWS provides specific avoidance and minimization measures that would be implemented in their areas of responsibility.

Collectively, the measures provided in this section are termed "conservation measures" and were developed based on a review of potential project effects and include applicable terms and conditions from previous consultations with the USFWS. Applicable measures are incorporated from (1) measures provided in the Draft EIS prepared by DOE for remediation of SSFL Area IV (DOE 2017); and (2) measures considered in documents prepared on behalf of Boeing. Measures to avoid or minimize effects on state-listed and other sensitive species and their habitats as well as general measures to avoid or minimize impacts to and to restore habitats whose functions are important for the long-term ability of the site to support listed species are included. The experience of the preparers in key roles on major projects with implementation and monitoring of conservation measures and designing, implementing, and monitoring habitat restoration is reflected in the details of the measures in this section.

3.6.1 General Conservation Measures

Conservation Measure 1. *Biological Monitoring during Project Construction and Pre-Project Clearance Surveys.* One or more qualified Project Biologist(s), approved by USFWS, CDFW, and the USACE will be retained by Boeing and DOE for the duration of construction activities. The Project Biologist will have experience with sensitive species that occur or have the potential to occur on the project site. The Project Biologist will be on site as needed during building demolition and clearing and grubbing of vegetation in habitats that have the potential to support sensitive species, including federally or state-listed species. Given the scope of the project, level of potential impacts, and number of sensitive resources potentially affected by project activities, it is expected that a monitoring team may be required to adequately cover simultaneously-occurring project activities and provide the expertise needed to ensure protection of all environmental resources at the SSFL. The monitoring team will include a Project Biologist and staff members qualified to perform particular tasks under the direction of the Project Biologist.

a) The Project Biologist will identify work areas, monitor work activity, and provide "tailgate" sessions/education program (see Measure 3) for construction contractor personnel, and will oversee and execute the conservation protection measures pertaining to biological resources.

b) Prior to the ground disturbance associated with the initial phases of building demolition, soil remediation, and ground-disturbing aspects of ground water activities, the Project Biologist will conduct pre-project clearance surveys to ascertain the buildings are not being used by bats and native bird species, including owls and raptors. Vegetated areas will be surveyed for active bird nests (see Measure 5) and sensitive plant (see Measure 12) and wildlife species (see Measures 5, 13, 14, 15 and 16). Humane methods will be used to haze owls, raptors, native songbirds, and bats out of the structures prior to initial phases of construction. Effective

methods of deterrence may include the use of exclusionary netting, reflective flagging and/or flight diverters, sonic bird control devices, or a falconry service program. Building demolition will be conducted outside the breeding seasons of birds protected by the Migratory Bird Treaty Act (MBTA) and bats unless the buildings can be completely confirmed for the absence of nesting birds or roosting bats.

Wildlife will be protected during work activities. Direct impacts to general wildlife species, such as snakes, other reptiles, and small mammals will be minimized during remediation.

a) Prior to clearing and grubbing in a remediation area, the Project Biologist will walk through the area and attempt to locate and capture or otherwise humanely move out of harm's way sedentary species such as reptiles and amphibians, with special attention paid to species of conservation concern such as silvery legless lizards (*Anniella pulchra pulchra*) and coast horned lizards (*Phrynosoma blainvillii*).

b) A Project Biologist will be on-site to monitor work zones for presence of wildlife periodically during work activities (such as vegetation removal or earth moving). Should an endangered, threatened, or sensitive animal species be observed in harm's way, the contractor will stop work until the Project Biologist can move the animal to a safe location, when work can resume.

Conservation Measure 2. *Site Access Restrictions to Minimize Impacts to Sensitive Biological Resources.*

a) The project work areas will be accessed using existing roads to the extent possible. Parking, driving, lay-down, stockpiling, and vehicle and equipment storage will be limited to previously compacted and developed areas, or non-sensitive habitat areas (see Measure 8), and the designated staging areas as much as feasible.

b) The demolition, remediation, and restoration contractors will stage equipment in areas that will create the greatest distance practical between demolition- and remediation-related noise sources and noise-sensitive receptors (e.g., sensitive habitat areas for endangered species or species of special concern) during all project demolition and remediation activities.

c) Where access must be through native habitats, such as within the 2010 AOC (DTSC 2010a) proposed biological exemption areas (discussed in Section 4.2.2 and 4.2.3 below), the Project Biologist will be consulted to determine the least environmentally damaging and safe access route to the site. This access route will be clearly marked and will be considered part of the construction zone/action area.

d) Limits of the action area will be clearly marked and delineated in the field by the biologist. No unauthorized personnel or equipment (including off-road vehicle access) will be allowed in native habitats outside the construction limits or designated access routes.

e) Disturbance in the 2010 AOC proposed biological exemption areas, or similar areas identified in Boeing areas of responsibility, would be kept to a minimum, including consideration of using special methods such as the use of balloon-tired, all-terrain-vehicles to access sites and remove affected soil.

f) Biologically sensitive areas (discussed in Section 4.2.2, below) will be clearly marked on plans and on site and avoided by personnel and equipment.

g) Before project initiation, the project boundary, including temporary features such as staging areas, will be clearly marked with flagging, fencing, or signposts. All project-related activities will occur within the designated construction boundary.

h) Boeing and DOE will cease all construction activities (e.g., confirmation sampling, vegetation removal, mapping, surveying, sample analysis, excavation and stockpiling) from sunset and to

sunrise. If night work is required, the Responsible Party will implement the following minimization measures:

1. Exterior lighting will be of the lowest illumination allowed for human safety, selectively placed, shielded, and directed away from native habitat to the maximum extent practicable. The number of sites subject to night work at any given time and the total work area affected will be minimized to the maximum extent possible.
2. Project vehicle traffic will proceed at minimum speed to avoid impacts on nocturnal wildlife.
3. The on-site Project Biologist will inspect the surrounding area to ensure that illumination is limited to within 250 feet of the work area.

i) All trash will be disposed of properly. All food-related trash will be placed in sealed bins or removed from the site regularly. Following initial project construction, all equipment, waste, and construction debris will be removed from the site, and the soil will be re-contoured prior to habitat restoration.

Conservation Measure 3. *Environmental Education Program.* All members of action related crews will participate in an Environmental Education Program to be administered by the Project Biologist. The Education Program will be conducted during all project phases for any new crew personnel brought to the site and will cover the potential presence of listed species; the requirements and boundaries of the project; the importance of complying with avoidance, minimization, and compensation measures; and problem reporting and resolution methods. Species-specific training will be administered to crews who will be performing activities within areas occupied, or presumed to be occupied, by listed species.

Conservation Measure 4. *Vehicle and Operation Restrictions to Prevent Unintentional Fire.* To ensure fire does not commence due to project activities, trucks will carry water and shovels or fire extinguishers in the field. Shields, protective mats, or other fire prevention equipment will be used during grinding and welding, and wildfires will be prevented by exercising care when driving and by not parking vehicles in grass or other dry vegetation where catalytic converters can ignite it. Procedures for changing or halting operations when the fire hazard reaches a critical level will be developed by the remediation contractor. No smoking or disposal of cigarette butts or other smoking materials will take place within vegetated areas.

Conservation Measure 5. *Conduct Vegetation Removal or Heavy Equipment Operation Adjacent to Vegetated Habitat Outside of Nesting Season for Those Species Protected by the Migratory Bird Treaty Act.*

a) The Responsible Party and their contractors will comply with the requirements of the MBTA. Due to the presence of habitat for MBTA species within and adjacent to the project site and access routes, any grubbing, mowing, removal of surface vegetation, excavation, or other activity involving heavy equipment in or adjacent to vegetated areas will not be scheduled during the nesting season for song birds, between February 15 and August 31 to avoid potential impacts on nesting birds, whenever feasible. Nesting season for owls, hawks, and eagles may begin earlier than songbirds, as early as October. Areas within the project site where these birds roost or nest, including dead trees with snags and natural cavities, will be surveyed by qualified biologist prior to vegetation removal. If MBTA-protected nesting birds are identified that may be affected by the proposed activities, then an appropriate work buffer will be established or work will be delayed until nesting activity has been completed to ensure that the nesting bird activity is not adversely impacted.

b) A qualified biologist, hired by the Responsible Party will perform a nesting bird survey and confirm that active nests would not be affected. The results of the survey would be submitted

to the, CDFW and USFWS, as appropriate. See Conservation Measures 15 and 16 for further measures to avoid effects on least Bell's vireo and coastal California gnatcatcher (*Polioptila californica californica*).

3.6.2 Habitat Protection and Restoration Measures

***Conservation Measure* 6.** *Minimize the Potential for Establishment of Invasive Plant Species.* Project activities will minimize the potential for invasive plant species (i.e., weeds) or soil pathogens to become established in disturbed areas and spread into restoration areas or natural areas. Weeds generally include those species listed by the California Invasive Plant Council and any species that can invade natural or restoration areas, and replace or preclude the establishment of native or other more desirable species. Equipment and/or vehicles used for remediation activities in off-road locations will utilize dry-truck cleaning measures (e.g., rumble strips, brushing) upon entering SSFL and/or the project site.

Conservation Measure 7. *Avoid, Minimize, and Mitigate for Disturbance to USACE Jurisdictional Wetlands and Waters of the U.S.* and wetlands and waters under CDFW jurisdiction. This measure is included in this BA because proper functioning of drainages and wetland features is necessary to support overall ecosystem functioning, including the SSFL's ability to support endangered, threatened, and sensitive species. Additionally, some of these features may have potential to provide habitat for threatened and endangered species.

a) No dumping or fill will be placed in any Clean Water Act (CWA) Section 404 Waters of the U.S. except as authorized by a permit from the USACE in support of the CWA (33) *United States Code* (U.S.C.) 1251 – 1387 Section 404, 33 CFR 328.3, 40 CFR 122.2, the Soil and Water Conservation Act (16) U.S.C. 2001 – 2009, and MCO P5090.2A, 11201.3.

b) Implement erosion BMPs for erosion and sediment control during soil remediation, building demolition, and any other ground disturbance activities in order to stop excess sediment flow into drainages, Waters of the U.S., and wetland features.

c) When soil disturbance occurs during the rainy season (November 1 to May 1), erosion and sedimentation BMPs will be installed and maintained immediately downslope of work areas until work is completed and disturbed areas have been re-contoured and physically stabilized.

d) Natural ephemeral drainages that are within the soil disturbance areas will be reconstructed as soon as possible to restore drainage patterns.

e) Man-made drainage features that are impacted by project activities may not need to be restored to pre-disturbance condition, but may need to be replaced to restore the drainage patterns from the site. If drainage needs to be restored, it will be done in a manner that mimics the natural drainage on the site.

f) In accordance with the USACE requirements, mitigation measures include a sequence of (1) seeking to avoid impacts, (2) minimizing impacts in space and/or time, and (3) providing compensation for impacts that are unavoidable. A Storm Water Pollution Prevention Plan (SWPPP) will be prepared and will incorporate BMPs, such as silt fences, silt basins, and gravel bags, or other measures to control erosion and prevent the release of sediment and contaminants that have the potential to move downstream or could be harmful to aquatic resources, such as vernal pools that may support listed species.

Conservation Measure 8. *Avoid and Minimize Disturbance to Sensitive Upland Vegetation.* Disturbance to Venturan coastal sage scrub, dipslope grassland, sandstone outcrops (including vegetated sandstone outcrops), chaparral, southern California walnut woodland, coast live oak woodland, southern willow

scrub, mulefat scrub, and coast live oak riparian woodland, will be avoided and minimized to the extent practicable. Avoiding or minimizing adverse impacts to these relatively undisturbed native habitats is emphasized because of the difficulty and time involved in restoring their function, once the soil has been removed. Although restoration has been done on some interim remediation sites within SSFL, these sites were restored using topsoil obtained from elsewhere on SSFL. Boeing has identified onsite borrow areas suitable for providing backfill for their remediation activities and the effects of using the onsite borrow areas are addressed in this BA. For remediation to be performed pursuant to the AOC, DOE is required to use suitable backfill soil; however, offsite sources of soils to be used as backfill and in restoration by DOE have not been identified. Proper functioning of these habitats is necessary to support overall ecosystem functioning on SSFL including the site's ability to support endangered, threatened, and sensitive species and designated critical habitat.

a) Design the final project to avoid or minimize impacts to sensitive native habitats by reducing disturbance footprints to the maximum extent practicable. Staging areas, laydown areas, and/or other temporary construction-related requirements will be located within already disturbed areas or non-sensitive habitat types.

b) Restore sensitive habitats that are temporarily disturbed as a result of project implementation to pre-project conditions as soon as possible to prevent net loss of habitat. Areas that cannot be restored within a short period of time (long-term impact) or are permanently impacted by project activities may require additional measures to compensate for temporary or permanent loss of sensitive habitats.

c) Topsoil below allowable chemical and radionuclide levels, if available, will be salvaged if practicable for eventual use in onsite habitat restoration.

Conservation Measure 9. *Develop a Revegetation and Habitat Restoration Plan.* A qualified biologist will prepare a site-specific Revegetation and Habitat Restoration Plan (RHRP), in consultation with USFWS and CDFW that includes a description of existing conditions in the action area, areas of impact, site preparation and revegetation methods, maintenance and monitoring criteria, performance standards, and adaptive management practices. Cover standards will be developed for each plant community target, and cover values will be established for each layer (i.e., herb, shrub, and/or tree layers).

The RHRP will be developed and approved by appropriate agencies prior to the initiation of ground disturbance or construction activities. The RHRP will address all revegetation efforts associated with the soil disturbances. It will include specific erosion control measures, irrigation requirements, species composition, seed mix origins and ratios for that particular habitat, weed control, water regimes, maintenance activities, success criteria, and monitoring requirements. The RHRP will, at a minimum, include the following:

a) Specification of revegetation methods, including seeding and/or planting of container stock, salvaged plants, cuttings, or other propagules collected or propagated from onsite sources, including any sensitive plant species that would be impacted during soil disturbance or other construction activities.

b) Establishment of an onsite nursery and use of onsite sources for growing medium (i.e., clean, weed-free soil) and propagules to avoid risk of introducing foreign pathogens, such as water mold (*Phytophthora* spp.), and unwanted pests, such as Argentine ants (*Linepithema humile*), into restoration areas that may subsequently disperse and establish in undisturbed natural areas adjacent to restoration areas.

c) A schedule for seed and propagule collection for use in revegetation, as well as a schedule for construction and operation of the onsite propagation and growing facility. Propagule

collection and propagation of plants in the growing facility will need to be initiated sufficiently in advance of remediation activities (a minimum of two growing seasons prior to the initial need for post-remediation revegetation) in order to generate adequate seed stock and container stock for use in revegetation.

d) Seed mixes will include only species native to the site and will be collected from onsite or nearby sources. The species mix to be used will contain species capable of providing self-sustaining native vegetation; for example, a suggested seed mix for Venturan coastal sage scrub could include the following species: California sagebrush (*Artemisia californica*), California buckwheat (*Eriogonum fasciculatum*), coyote brush (*Baccharis pilularis*), black sage (*Salvia mellifera*), purple sage (*S. leucophylla*), and deerweed (*Acmispon glaber*).

e) Topsoil below allowable chemical and radionuclide levels, if available, will be salvaged if practicable using two lifts: the first to salvage the seed bank and the second to salvage the soil biota in the root zone. The topsoil will be saved in two separate covered stockpiles close to the project site and replaced accordingly after final reconfiguration of disturbed areas.

f) Salvage uncontaminated and pest- or disease-free organic debris, including trees and shrubs downed during site clearing, for use as fill, mulch, compost, or habitat creation.

g) After completion of topsoil replacement and related grading and prior to initiation of restoration, graded areas will be inspected by a Project Biologist (or revegetation specialist) to determine whether any remedial measures are required prior to initiation of revegetation. Remedial measures may include re-grading, installation of erosion control methods, weed control, and installation of irrigation, if needed.

h) Revegetation of disturbed areas will be initiated the first fall after completion of final grading activities and before the winter rainfall season if feasible to minimize the need for watering and encourage early establishment of plants to reduce the potential for erosion associated with rain events. Supplemental watering may be required if reseeding/replanting must be conducted after the start of the rainy season.

i) Incorporate monitoring procedures, including periodic qualitative and quantitative assessments and minimum performance criteria, for revegetation and erosion control. The performance criteria and remedial actions need to consider the uncertainties of revegetation and restoration of sensitive habitats and sensitive plant species.

j) Appropriate remedial measures will be identified if the restoration is not progressing as expected. At a minimum, remedial measures may include invasive species control (e.g., hand removal, mechanical and herbicide control), reseeding/replanting, supplemental irrigation, and erosion control. The use of pesticides will be minimized through the use of green alternatives (for example, non-chemical solarizing technique) and an integrated pest management plan.

k) The monitoring and maintenance program duration and frequency will be specified to ensure the restoration sites are successful. RHRP Progress Reports will be submitted annually to all approval agencies. The progress reports will include an introduction, methods, results, and a summary of activities, findings, trends, and recommendations. There will be a period of monitoring, with no maintenance (including irrigation and weed control) to ensure the project site is self-sustaining and will not fail without maintenance (including supplemental water) or will not decline due to the presence of aggressive weedy species.

l) Minimize removal of existing vegetation during remediation.

Conservation Measure 10. *Develop a Tree Management and Preservation Plan*. A Tree Management and Preservation Plan will be developed using a certified arborist. The goal of the plan is to offset tree

impacts through a sustainable, customized plan that is suitable for the site's unique opportunities for tree preservation, enhancement, and establishment. The plan will identify trees protected by Ventura County, including coast live oak, sycamore (*Platanus racemosa*), historical and heritage trees (protected trees), or special-status trees (i.e., southern California black walnut [*Juglans californica*]) that could be impacted within or adjacent to remediation areas, as well as those located outside of the project footprint that would be preserved. The plan will define direct and indirect impacts and include protection measures and options (such as tree relocation or replacement) within and outside of cleanup areas and the locations of mitigation areas within the project area boundary. Some flexibility will be required in applying protection measures to allow necessary contamination removal, and it is recognized that it is preferable to retain a tree rather than removing it even when contamination needs to be removed within its protective zone. The following protection measures may be used:

a) Fencing of oak and other protected trees adjacent to demolition and remediation activities areas.
b) Placement of fill, storage of equipment, and grading prohibited within the protective zone (minimum of 5 feet from the drip line or 15 feet from the trunk of the tree, whichever distance is greater) of a tree proposed for preservation.
c) Limit grade changes near the protective zones of trees.
d) Temporary retaining walls may be built to protect trees proposed for preservation from surrounding cut and fill. Retaining walls may be placed outside of the protective zone of the tree to be preserved.

For trees impacted by project activities, where mitigation is required, the Tree Management and Preservation Plan, which may be separate from or incorporated into the RHRP (see Conservation Measure 9), will specify performance measures, maintenance and monitoring requirements, adaptive management, and regulatory authorities.

Conservation *Measure 11.* *Soil Stabilization.* In conjunction with reseeding and when topsoil is unavailable, soil stabilization BMPs will be used, including soil binders, erosion mats, gabion walls (outside of stream channels), and erosion control check dams, where applicable. An updated SWPPP will guide erosion control measures for all activities (e.g., demolition and remediation activities). Dust control measures would be developed and implemented to minimize fugitive dust and limit soil losses due to wind. The SWPPP will require all structural and non-structural BMPs to be installed and implemented in accordance with approved plans and specifications prior to the beginning of demolition and remediation activities. The project plans specified above will incorporate the following specific measures when and if applicable:

a) Use geotextile bags or nets to contain excavated sediment, facilitate sediment drying, and increased ease of sediment placement or transport, when appropriate.
b) Utilize erosion control products such as silt fences, sand bags, straw wattles, basins, and fiber rolls to aid in capturing sediment runoff, particularly along the bases of slopes, runoff pathways, and drainage ditches.
c) Provide contaminant control by using de-watering, runoff controls, tire washes, containment for chemical storage areas, demolition and remediation equipment decontamination, stockpile management, spill prevention and control measures, and protective sheeting or tarps on steep slopes prior to rain events.
d) Restore and maintain surface water banks that mirror natural conditions.
e) Install and maintain basins to capture sediment runoff along sloped areas and use excavated areas to serve as temporary retention basins; develop rain water retention basins or a collection

system with barrels or cisterns to capture precipitation for potential onsite use. Retention basins should be designed in a way and appropriately treated to avoid creating mosquito breeding grounds.

f) Install earthen berms that utilize onsite/local materials to manage run-on and/or runoff stormwater.

g) Use gravel roads, porous pavement, and separated pervious surfaces rather than impermeable materials to maximize infiltration.

h) Cover filled excavations with an appropriate erosion control fabric (preferably biodegradable) or mulch to stabilize soil (prevent erosion) and serve as a substrate for ecosystems.

i) Use soil stabilization BMPs to help in reseeding success, including soil binders, erosion mats, and erosion control check dams.

j) Use captured rainwater, uncontaminated wastewater, or treated water for building demolition and soil and groundwater remediation activities or site restoration activities when possible (e.g., for wash water, irrigation, dust control, constructed wetlands, or other uses).

k) Establish protocols for proper storage and use of hazardous materials during the building demolition and soil and groundwater remediation phase.

l) Establish spill response procedures.

m) Use dust control measures to prevent soil erosion during the remediation phases.

n) Provide for erosion control through planting and maintenance of native vegetation within the disturbed areas.

Include design features that replicate the natural site drainage patterns to the extent possible, with minimal constructed features to allow for long-term erosion control and successful revegetation.

3.6.3 Special Conservation Measures for Listed and Sensitive Plant and Wildlife Species

Conservation Measure 12. *Avoidance and Minimization of Impacts to Braunton's milk-vetch, Santa Susana tarplant, other Sensitive Plant Species and Associated Critical Habitat.*

a) Prior to access, excavation, demolition, remediation, installation of equipment, or any other activity associated with the proposed project, the Project Biologist will survey all proposed remediation, staging, and access areas, plus a buffer of 100 feet, for presence of federally and state-listed threatened or endangered plants, including Braunton's milk-vetch and Santa Susana tarplant, and other sensitive plant species such as Malibu baccharis (*Baccharis malibuensis*), Catalina mariposa lily (*Calochortus catalinae*), slender mariposa lily (*Calochortus clavatus* var. *gracilis*, Plummer's mariposa lily (*Calochortus plummerae*), or other mariposa lily (*Calochortus* spp.), California screw moss (*Tortula californica)*, and any *Dudleya* species (other than chalk dudleya [*Dudleya pulverulenta*] or lance-leaved dudleya [*D. lanceolata*]). Plants will be mapped and clearly marked, and numbers of individuals and their condition will be determined and recorded.

b) Remediation access routes will be adjusted as needed to maximize avoidance of impacts to individuals or populations of Braunton's milk-vetch or any other sensitive plant species and associated critical habitat. The Project Biologist will be responsible for overseeing demolition and remediation to ensure compliance with the conservation measures for preventing unanticipated impacts to Braunton's milk-vetch and any other sensitive plant species. The

Project Biologist will be on site during access, vegetation removal, and any other remediation activities with the potential to impact sensitive plant species.

c) Dust migration in or adjacent to areas that support sensitive species will be minimized by lightly spraying areas of exposed soil with water during excavation activities when weather conditions require the use of dust control measures.

d) If any sensitive plants occur within 100 feet of a proposed demolition or remediation area, the Project Biologist will flag their locations and work with the project team to avoid or minimize impacts to the species.

e) Where impacts to Braunton's milk-vetch or other sensitive plant species are unavoidable, a salvage, propagation, and replanting program will be developed and implemented as part of the RHRP, that includes the following:

- Utilize both seed and salvaged (excavated) plants, constituting an ample and representative sample of each colony of the species that would be impacted. The program should consider perpetuating the genetic lines represented on the impacted sites by obtaining an adequate sample prior to construction, propagating them, and using them in the restoration of that site. The program should also consider that the salvage and transplant of listed species is experimental and often has low success.
- Incorporate provisions for recreating suitable habitat and measures for re-establishing self-sustaining colonies of Braunton's milk-vetch and other sensitive plant species on the site.
- Include provisions for monitoring and performance assessment, including standards that will allow annual assessment of progress and provide for remedial action should the species fail to re-establish successfully.
- The program will require approval from USFWS and CDFW prior to its implementation, and activities involving handling of sensitive plant species will require appropriate permits from CDFW.

Conservation Measure 13. *Avoidance of Vernal Pools and Vernal Rock Pools Potentially Occupied by Listed Vernal Pool Species including Riverside Fairy Shrimp and/or Vernal Pool Fairy Shrimp.*

a) Prior to any work within 250 feet of vernal pools or vernal rock pools, and depressional features that support a hydroperiod sufficient to complete the fairy shrimp lifecycle, surveys should be conducted during the appropriate season(s) to determine the presence of federally listed Riverside and vernal pool fairy shrimp. Surveys must be conducted by a USFWS-permitted fairy shrimp biologist. If listed fairy shrimp are identified, USFWS will be notified by the permitted biologist within 10 working days of the discovery and work within 250 feet of occupied habitat (other than protective measures identified below) will not proceed until Responsible Party consultation with USFWS on how to proceed has concluded.

b) To avoid impacts to federally listed fairy shrimp, occupied vernal pools and vernal rock pools, and depressional features that support a hydroperiod sufficient to complete the fairy shrimp lifecycle, within 250 feet of the project boundary will be identified on project construction plans. Occupied fairy shrimp habitat (vernal pools and vernal rock pools) within 250 feet of the project footprint will be clearly identified in the field with flagging or exclusion fencing. Pools occupied by fairy shrimp and vernal pool features in the proposed AOC biological exemption areas, or similar locations identified in Boeing's areas of responsibility, will be monitored by the Project Biologist during construction; the Project Biologist will be

responsible for ensuring compliance with conservation measures and preventing unanticipated impacts to vernal pools, rock pools and vernal pool species.

c) Any demolition or remediation that could indirectly affect vernal pools or potential suitable habitat for federally listed fairy shrimp associated with vernal pools, rock pools, and vernal pool watersheds will occur outside of the rainy season (about November 1 to June 1) and in dry conditions only. Following the initial clearing of features, ongoing demolition and remediation activities can occur in the wet season by incorporating specific measures to protect surface water quality in vernal pools (e.g., use of jute netting into the SWPPP, geotextiles, wattling, and other materials), as determined by the Project Biologist, to avoid an increase or decrease of water quantity, sediment transport, and change in water quality runoff to pool basins. Sedimentation into basins will be prevented and soil-disturbing activities during the rainy season or when ground is wet (about November 1 to June 1) will be minimized.

d) Fueling of equipment and vehicle washing will be allowed only in designated areas and will not occur within 100 feet of any vernal pool or vernal rock pool or other aquatic habitat, including intermittent drainages.

e) Stockpiled soils will be placed on top of heavy-duty plastic sheeting on areas with an impervious surface. All stockpiles will be covered with material adequate to prevent soil transport by wind or rainwater. Covers will be maintained in good condition.

Conservation Measure 14. *Avoidance of California Red-legged Frog and associated Critical Habitat.* To ensure that the unlikely event of the CRF migrating into the proposed work areas does not result in an impact to the species, a qualified biologist will conduct pre-demolition and pre-remediation surveys within work areas containing suitable habitat, as well as biological monitoring during demolition and remediation activities. USFWS (2005) guidance on habitat assessment and field surveys will be followed to determine presence/absence of the species and suitable habitat. If the CRF is discovered in work zones before or during demolition and remediation activities, the species will be avoided; demolition and remediation activities will be immediately halted; and consultation will be initiated with USFWS to determine an appropriate response before demolition and remediation activities can begin/restart.

Conservation Measure 15. *Avoidance of Least Bell's Vireo.* Any required clearing of woody riparian vegetation will take place outside of the breeding season for the least Bell's vireo (March 15 to August 31). When avoidance is not practicable, the following measures will be implemented:

a) If activities cannot occur outside of the breeding season, then pre-activity surveys will be conducted by a qualified biologist for all individual active nests of listed species in all suitable habitats within 300 feet of the proposed activities.

b) If an active nest occurs within 300 feet of the proposed activity, then project activities other than the use of existing roads will be delayed until after young fledge from the nest.

c) A qualified biologist will monitor nest progress and activities in and adjacent to riparian habitats to ensure compliance.

Pre-project surveys, when applicable, will adhere to USFWS (2001) least Bell's vireo survey guidelines as a recognized method to determine presence or absence of the species and its habitat and be conducted during the April 10 to July 31 ideal survey window within one year in advance of construction activity.

Conservation Measure 16. *Avoidance of Coastal California Gnatcatcher*. Prior to any clearing of vegetation or soil removal in Venturan coastal sage scrub or other suitable habitat for the coastal California gnatcatcher the USFWS presence/absence survey protocol (USFWS 1997a) will be implemented. Suitable habitat for coastal California gnatcatcher includes sage scrub communities dominated by species of sagebrush (*Artemisia* spp.), sage (*Salvia* spp.), buckwheat (*Eriogonum* spp.), and bush sunflower (*Encelia* spp.) as described in Section 4.2.1.1, below. Because surveys could be required years from now, the identification of suitable habitat to be surveyed will be made by individuals permitted to conduct coastal California gnatcatchers presence/absence surveys and will be based on conditions existing at the time of the survey. If surveys are conducted during the ideal survey window (March 15 to June 30) with a negative finding, they will be valid for a period of 1 year.

a) Pre-activity surveys in all suitable coastal California gnatcatcher habitats will be conducted by a qualified biologist. If an active nest occurs within 300 feet of the proposed activity, the biologist will immediately notify the Responsible Party, and the project activities in the vicinity of the nest other than the use of existing roads will be delayed until after young fledge from the nest. If active nests are observed, the biologist, in coordination with the USFWS, will determine adequate set-backs from nests to prevent nest disturbance.

b) A qualified biologist will monitor nest progress and activities in and adjacent to coastal California gnatcatcher habitat to ensure compliance.

Conservation Measure 17. *Environmental Mitigation Requirements and Monitoring Program.* DOE and Boeing will be in consultation with oversight agencies including USFWS, CDFW, USACE, DTSC, and County of Ventura, as appropriate, and will be responsible for coordinating and implementing the conservation and protection measures and permit requirements. Each respective Responsible Party will consult with their project biologist and other qualified staff as appropriate.

4.0 Existing Conditions and Description of the Specific Area Affected by the Action

4.1 Action Area

The Action Area includes areas where listed species or critical habitat could be directly or indirectly affected by the action, including:

- SSFL Project Site (including Areas I, II, III, and IV; the NBZ; and the SBZ)
- Offsite areas where listed, proposed, or candidate species could be adversely affected by noise, dust, nighttime lighting, sedimentation, and changes in water quality or quantity. These include:
  - Areas near SSFL
  - Offsite transportation routes near SSFL (in which SSFL oriented traffic will make a substantial increase in traffic)

Established off-site disposal areas and existing sand and gravel operations operating under existing permits will not be analyzed.

As noted above, this BA does not address the proposed activities of NASA given their previous consultation described in Section 2.2., but resources on NASA's Area II and NASA's Portion of Area I are incorporated into the existing conditions described below, because they could be indirectly affected by other activities.

4.2 SSFL Project Site

The SSFL is an open area with hilly terrain, much of which is in an undisturbed natural condition, and developed areas that include roads, buildings, and other infrastructure associated with its past use as a scientific research and test facility. The site is designated as Open Space (OS) in the Ventura County General Plan and zoned as Rural Agriculture (RA-5) (Administrative Area I through IV) and Open Space (OS-160) (Northern and Southern Undeveloped Areas) in the Ventura County General Plan, which governs current use of the site.

The elevation at SSFL ranges from approximately 2,245 feet (685 meters) above mean sea level (amsl), which occurs near the center along two ridges that trend northeast to southwest, to approximately 1,175 feet (358 meters) amsl, which is along the eastern property boundary in Dayton Canyon. The lower elevations at the project site occur primarily along the eastern, southern, and north-central to northwestern perimeters of the property. A broad, relatively flat area exists within the northwestern portion of the project site and is referred to as the Burro Flats area.

The geologic units within the project site are predominantly the Chatsworth Formation, which forms conspicuous tilted sandstone outcrops jutting upward from the landscape, with smaller areas of sedimentary rock representing the Santa Susana, Simi Conglomerate, Las Virgenes, and Calabasas formations. All are composed mostly of sandstone with some siltstone, shale, and conglomerate. The rocks in the vicinity of the project site have undergone folding and faulting since deposition. Alluvial sediments have accumulated over about 11 percent of the project site, generally limited to topographic lows and ephemeral streams.

Vegetation throughout the project site, which is described in more detail below, is composed mainly of shrub-dominated plant communities, oak woodland and savanna, and annual grassland. Substantial portions of the site are located within areas of exposed bedrock or previously developed areas with sparse vegetation; in particular, where paved and unpaved roads are maintained or various structures

are present. Other portions of the project site have undergone demolition, interim cleanup actions, and restoration activities, including hydroseeding, and, in some locations, replanting with native species.

Numerous ephemeral stream channels and drainages are present throughout the project site. Most surface water is intermittently present only during the winter rainy season and is conveyed offsite via one of four drainage areas: the Northwestern, Northern, Happy Valley, and Southern. Operational water from cooling and rinsing during past engine tests and extracted groundwater was historically discharged to the southern drainages, which are monitored as required by the NPDES permit. The majority of the surface water (estimated at greater than 60 percent) from the SSFL runs off the southern property boundary through several southern drainages into Bell Creek, which eventually discharges into the Los Angeles River. In addition, there are seven surface water ponds within the project site, identified as the R-1 Pond, Perimeter Pond, two R-2 Ponds (R2A and R2B), Silvernale Pond, Sodium Reactor Experiment (SRE) Pond, and Coca Pond. Note the R-2 Pond and Coca Pond occur within NASAs area of responsibility. In addition to these seven ponds, there is surface water contained within the Building 4056 excavation site. Vegetation and wildlife habitat associated with the ephemeral streams and ponds are discussed in greater detail in the next section.

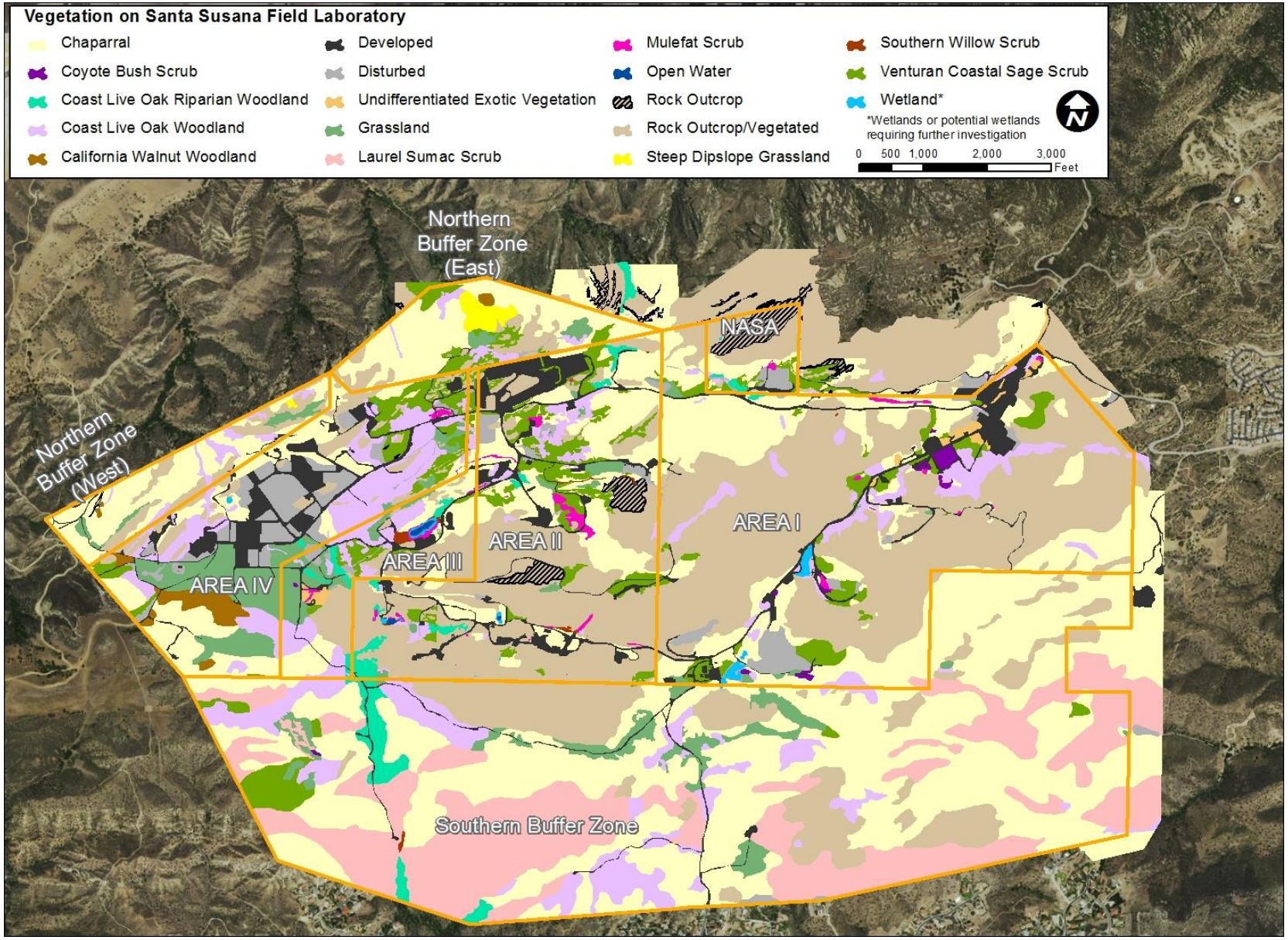
4.2.1 Vegetation and Wildlife Habitat

Vegetation and wildlife habitat on SSFL includes widespread plant community's characteristic of the region such as chaparral, grasslands, oak and walnut woodlands, as well as communities that are localized in distribution and are associated with the prominent sandstone outcrops on SSFL and nearby areas. The vegetation/land cover on the SSFL property is presented in **Figure 4–1**, and **Table 4–1**, and is described in detail below.

4.2.1.1 Shrublands

Chaparral

Chaparral is well-developed in the NBZ and SBZ and other undeveloped portions of the SSFL. Chaparral consists of large woody shrubs that form a dense canopy. The dominant species vary in different portions of the site depending on how much time has passed between disturbances, such as fire or vegetation removal, as well as slope aspect and soil conditions. Large portions of the SSFL site burned in 2005 with variable intensity in different areas of the site and some areas that did not burn at all. Chaparral is a fire-adapted community with many of the dominant species able to resprout following a fire. The result of the fire combined with the natural variability of dominant species in chaparral communities has resulted in a mosaic of chaparral in various stages of maturity with dominant species that may include one or more species. The plant species associated with chaparral at the SSFL include chamise (*Adenostoma fasciculatum*), laurel sumac (*Malosma laurina*), sugar bush (*Rhus ovata*), several species of ceanothus (hoaryleaf ceanothus [*Ceanothus crassifolius*], hairy ceanothus [C. *oliganthus*], buckbrush [*C. cuneatus*], and big pod ceanothus [C. *megacarpus*]), birch-leaf mountain mahogany (*Cercocarpus betuloides*), thick leaf yerba santa (*Eriodictyon crassifolium*), holly-leaf cherry (*Prunus ilicifolia*), holly leaf redberry (*Rhamnus ilicifolia*), bigberry manzanita (*Arctostaphylos glauca*), chaparral yucca (*Hesperoyucca whipplei*), and poison oak (*Toxicodendron diversilobum*). Smaller shrub species that are also typical of scrub communities are often associated or co-dominant with the chaparral species. These include black sage (*Salvia mellifera*), purple sage (*Salvia leucophylla*), bush mallow (*Malacothamnus fasciculatus*), and California sagebrush (*Artemisia californica*). Other subshrubs and perennials mixed with the chaparral species include deerweed (*Acmispon glaber*) and sticky snapdragon (*Antirrhinum multiflorum*). Braunton's milk-vetch, a federally listed endangered species,



1118 **Figure 4–1. Vegetation on SSFL**

Table 4–1. Vegetation/Land Cover on the SSFL Property (site-wide)

Vegetation Type (Code)	*Acres*	*Percent*
Shrublands		
Chaparral (C)	960.7	33.7
Laurel Sumac Scrub (LSS)	307.8	10.8
Venturan Coastal Sage Scrub (VCSS)	128.6	4.5
Coyote Brush Scrub (CBS)	4.7	0.2
Rock Outcrop/Vegetated (ROV)	810.1	28.4
Foothill Woodlands (Upland)		
Coast Live Oak Woodland (CLOW)	217.6	7.6
Southern California Walnut Woodland (CWW) [a]	13.3	0.5
Grasslands		
Grassland (GR)	111.6	3.9
Steep Dipslope Grassland (SDG) [b]	7.8	0.3
Riparian		
Coast Live Oak Riparian Woodland (CLORW)	30.9	1.1
Southern Willow Scrub (SWS) [a]	2.5	0.1
Mulefat Scrub (MS)	9.2	0.3
Aquatic		
Wetland (W)	4.6	0.2
Open Water (OW)	1.2	<0.1
Other Land Cover		
Rock Outcrop (RO)	22.7	0.8
Disturbed (Dis)	69.2	2.4
Developed (Dev)	141.3	5.0
Undifferentiated Exotic Vegetation (ExV)	5.9	0.2
Total	**2,849.7**	**100**

[a] Considered a rare or high priority vegetation type (CDFW 2010).

[b] Described in SAIC (2009) as an equivalent to the *Selaginella bigelovii* herbaceous alliance considered rare and threatened in California (Sawyer et al. 2009).

became one of the dominant plants in localized portions of burned chaparral in Area IV following the 2005 Topanga fire. Chaparral is one of the most abundant habitat types on the SSFL property occupying 33.7 percent of the land cover.

Manual of California Vegetation, 2nd edition (MCV2) equivalent (Sawyer et al. 2009): ***Adenostoma fasciculatum* shrubland alliance** (chamise chaparral), ***Adenostoma fasciculatum-Salvia mellifera* shrubland alliance** (chamise-black sage chaparral), ***Cercocarpus betuloides* shrubland alliance** (birch-leaf mountain mahogany chaparral), ***Ceanothus spinosus* shrubland alliance** (green-bark ceanothus chaparral), ***Prunus ilicifolia*[4] shrubland alliance** (holly-leaf cherry chaparral), ***Eriodictyon crassifolium* Provisional Shrubland Alliance** (yerba santa scrub), and possibly other alliances depending on which species are dominant or co-dominant. In addition, the *Adenostoma fasciculatum* shrubland alliance (chamise chaparral) may include several plant species associations where chamise is co-dominant with one or a combination of species or plant types that occur at the SSFL including laurel sumac, thick leaf yerba santa, several species of ceanothus or manzanita (*Arctostaphylos*

[4] Considered a rare or high priority vegetation type (CDFW 2010).

spp.), California buckwheat (*Eriogonum fasciculatum),* Bigelow's spikemoss (*Selaginella bigelovii),* annual grasses, forbs, or mixed herbs and moss.

Laurel Sumac Scrub

Laurel Sumac Scrub is visually dominated by laurel sumac, a large evergreen shrub that resprouts vigorously after fire or other disturbance. Much smaller, mostly drought-deciduous shrubs and grasses occupy the relatively large interspaces between the individual laurel sumacs. Associated species vary from location to location and at least some of the variability may relate to differential recovery of species after fire or other disturbance (Sawyer et al. 2009). Associated species may include California buckwheat, deerweed, coast bush sunflower (*Encelia californica*), wishbone bush (*Mirabilis laevis* var. *crassifolia*), chaparral yucca, with the occasional chamise, black sage, purple sage, California sagebrush, and introduced annual grasses. At a few sites, introduced annual grasses occupy the intervening spaces with few or no shrubs. The disparity in size between the laurel sumac and the much smaller plants in the intervening spaces as well as the spacing between individual laurel sumacs gives Laurel Sumac Scrub a savanna-like appearance. Laurel Sumac Scrub occupies 10.8 percent of the land cover of the SSFL and is prevalent in the SBZ, where it dominates steep to relatively gentle slopes with a southerly exposure. Laurel sumac is sensitive to cold temperatures at higher elevations and inland sites (Davis et al. 2007; Rundel 2007), which likely causes it to be most prevalent at SSFL on warmer southerly exposures. Laurel sumac is also prevalent in chaparral on SSFL.

MCV2 equivalent: ***Malosma laurina* shrubland alliance** (laurel sumac scrub), although the MCV2 indicates membership in this type applies where the relative cover of laurel sumac is greater than 50 percent when dominant in the shrub canopy, or greater than 30 percent when co-dominant with California buckwheat or black sage. Some SSFL areas currently included as laurel sumac scrub may have lower cover of laurel sumac, but received that classification because of laurel sumac's strong visual dominance.

Venturan Coastal Sage Scrub

Areas dominated by native soft-leaved (malacophyllous) shrub species including black sage, purple sage, other *Salvia* species, California sagebrush, California buckwheat, other *Eriogonum* species, *Encelia californica*, as well as deerweed, chaparral yucca, bush mallow, and giant wild rye (*Elymus condensatus*) are included in the Venturan Coastal Sage Scrub vegetation type (which may be more commonly classified as coastal sage scrub, sage scrub, or coastal scrub). This type appears to be associated with gradual south facing slopes as well as areas that may be transitional to recovering chaparral or between chaparral and other vegetation types, such as woodland habitats. Venturan coastal sage scrub occupies 4.5 percent of land cover of the SSFL, although there may be more areas occupied by Sage Scrub, especially in remote portions of the site that have not been surveyed.

MCV2 equivalent: ***Salvia mellifera* shrubland alliance** (black sage scrub), ***Malacothamnus fasciculatus* shrubland alliance** (bush mallow scrub), ***Artemisia californica* shrubland alliance** (California sagebrush scrub), and possibly other types depending on which species are dominant or co-dominant.

Coyote Brush Scrub

Areas identified as coyote brush scrub are dominated by coyote brush (*Baccharis pilularis*), which can be relatively dense forming nearly pure stands or relatively sparse in more disturbed sites. On the SSFL property, this vegetation type is often observed in areas recovering from disturbance, including those undergoing active revegetation. Coyote brush is also found in the understory or in the buffer between uplands and riparian and wetland areas. Coyote brush scrub occupies 0.2 percent of the land cover on the SSFL.

MCV2 equivalent: ***Baccharis pilularis* shrubland alliance** (coyote brush scrub).

Rock Outcrops/Vegetated

Very large sandstone outcrops of the Chatsworth Formation (Squires 1997; Dibblee 1992) conspicuously dominate portions of the SSFL landscape, especially in Areas I-III and the undeveloped areas of the NBZ. In the northern portion of Area IV, some outcrops extend across the landscape at or near the soil level and others reach up to 40 or more feet above the soil level. In general, these occur as wide, linear features, as the outcrops form in natural rows. Vegetation occurs on and around the edges as well as in the interspaces between outcrops. In Areas I-III, much of the elevated terrain of the site is composed of Chatsworth Formation sandstone outcrops and is classified as Rock Outcrops/Vegetated. Plants growing on the outcrops consist of shrubs common to the chaparral or Venturan coastal sage scrub vegetation types and may also include native or non-native grasses and herbaceous species. There is also an occasional coast live oak tree present. The Santa Susana tarplant, a state-listed rare species, is very closely associated with this vegetation type and is commonly found in crevices in the bedrock outcrops. Rock outcrops (vegetated) is the second most common habitat type representing 28.4 percent of the land cover of the SSFL.

MCV2 equivalent: There is no MCV2 equivalent, although parts of the areas currently mapped as rock outcrops/vegetated could be assigned a vegetation category based on the dominant or co-dominant plant species. This may require a qualifier to depict the difference between the same vegetation types not on rock outcrops (for example, *Adenostoma fasciculatum-Salvia mellifera* shrubland alliance on rock outcrops). The rock outcrops, both vegetated and unvegetated, provide a unique and important habitat type because of their potential to support sensitive plant and wildlife species, which is why they were classified separately in the vegetation map for this BA.

4.2.1.2 Foothill Woodlands (Upland)

Coast Live Oak Woodland

Coast live oak woodland is dominated by coast live oak trees with a variable understory, depending on the surrounding habitat. Around the developed areas of the SSFL, coast live oak woodlands generally occur with an understory of mostly introduced annual grasses and forbs such as ripgut brome (*Bromus diandrus*), wild oats (*Avena* spp.), and tocalote (*Centaurea melitensis*), and, occasionally, native perennial needlegrass (*Stipa* spp.). In the undeveloped areas, shrub species from adjacent chaparral or other vegetation types may also be present in the oak woodland understory. Small groups and individual oak trees are also included in this vegetation type. Coast live oak woodlands represent 7.6 percent of the land cover of the SSFL.

MCV2 equivalent: ***Quercus agrifolia* woodland alliance** (coast live oak woodland).

Southern California Walnut Woodland

Southern California walnut woodland is defined by the presence of Southern California black walnut (*Juglans californica*) trees, which is a CRPR List 4 species due to its limited distribution and vulnerability to development. In some areas, coast live oaks are co-dominant with the Southern California black walnuts and the understory is characterized by shrubs and subshrubs, including poison oak, snowberry (*Symphoricarpos mollis*), and purple sage. Southern California Walnut Woodland represents 0.5 percent of the total land cover of the SSFL.

MCV2 equivalent: ***Juglans californica*[5] woodland alliance** (California walnut groves).

[5] Considered a rare or high priority vegetation type (CDFW 2010).

4.2.1.3 Grasslands

Grassland

This vegetation category is applied to areas dominated by annual and perennial graminoid species. Many areas are characterized by non-native annual grasses such as bromes (*Bromus* spp.) and wild oats. Other areas are dominated or co-dominated by native perennial grasses, such as needlegrass. Vegetation cover is typically dense and soils are relatively deep. This type occurs in scattered locations throughout the SSFL providing 3.9 percent of the land cover.

MCV2 equivalent: ***Bromus-Brachypodium distachyon*** **semi-natural herbaceous stands** (annual brome grassland)—on SSFL this is dominated by ripgut brome, soft brome (*Bromus hordeaceus)*, and foxtail brome (*B. madritensis)* with other introduced annual grasses; false brome (*Brachypodium distachyon)* is infrequent or absent), ***Avena*** **semi-natural herbaceous stands** (wild oats grassland), ***Nassella pulchra***[5] **herbaceous alliance** (purple needlegrass grassland), and possibly others.

Steep Dipslope Grassland

Steep dipslope grassland occurs on steep north-facing slopes in the northern undeveloped area and may occur in other areas of the SSFL site where suitable soil conditions exist. These sites have sandstone bedrock which follows the slope angle and is overlain by a thin (one to several inches) layer of soil. In some places vegetation is characterized by relatively stunted non-native annual grasses and herbs including wild oats, ripgut brome, and tocalote. In other areas the vegetation is characterized by a prevalence of native species including Bigelow's spike-moss, shooting stars (*Dodecatheon clevelandii*), wild onion (*Allium* sp.), common goldenstar (*Bloomeria crocea*), blue dicks (*Dichelostemma pulchellum*), lance-leaf dudleya (*Dudleya lanceolata*), chalk dudleya, and mariposa lily. Native mosses, liverworts, and lichens may also be prevalent. This is considered a unique habitat type because of the assemblage of native plant species, including mariposa lilies, which are special status species. Bigelow's spikemoss, a rhizomatous perennial, in combination with lichens and mosses help trap and anchor the soil as well as seeds, providing niches for plant establishment on the steep underlying rock faces. It occupies about 0.3 percent of the land cover of the SSFL.

MCV2 equivalent: ***Selaginella bigelovii***[6] **herbaceous alliance** (bushy spikemoss mats).

4.2.1.4 Riparian

Coast Live Oak Riparian Woodland

Areas assigned the coast live oak riparian woodland category typically occur along ephemeral streams on SSFL and support coast live oak trees associated with scattered riparian species such as willow (*Salix* spp.), cottonwood (*Populus* spp.), and mulefat (*Baccharis salicifolia*). Stands of oaks trees associated with ephemeral drainages that did not appear to support other riparian species were classified as coast live oak woodland. Coast live oak woodland riparian habitat occupies 1.1 percent of SSFL land cover and is more common along the larger drainages in the SBZ.

MCV2 equivalent: ***Quercus agrifolia*** **woodland alliance** (coast live oak woodland), previous studies added a qualifier (i.e., riparian) to indicate an association with ephemeral streams.

Southern Willow Scrub

Southern willow scrub is scattered in areas around Silvernale Pond, along ephemeral drainages, and other areas where water flow may be temporarily detained. On SSFL, southern willow scrub is characterized by scattered to dense willows, such as arroyo willow (*S. lasiolepis*) and red willow (*S. laevigata*), mulefat, with the occasional western sycamore and coast live oak. California bay laurel

[6] Considered a rare or high priority vegetation type (CDFW 2010).

(*Umbellularia californica*) has been occasionally noted in the most mesic habitats. Plants typical of the understory where soils are best developed include California wild rose (*Rosa californica*) and California blackberry (*Rubus ursinus*). Southern willow scrub provides 0.1 percent of the land cover of the SSFL.

MCV2 equivalent: ***Salix lasiolepis***[7] **shrubland alliance** (arroyo willow thickets), although in some areas of the SSFL, the cover of arroyo willow may be less than what is defined for membership in this category due to very sparse cover of riparian trees resulting from suboptimal hydrologic conditions associated with scarce groundwater and very ephemeral stream flows. These conditions result in a very open community with scattered willows interspersed with patches of mulefat and coyote brush in the channel, and scattered oak trees on the banks.

Mulefat Scrub

Areas identified as mulefat scrub are dominated by mulefat. As with the coyote brush scrub on SSFL, this vegetation type is often observed in disturbed areas, particularly where additional surface or groundwater is available to support this normally riparian species. Mulefat is also found around Silvernale Pond and in association with coast live oak (riparian) or southern willow scrub, as well as around the R2 ponds near Outfall 18. With the recent drought, the cover of mulefat may be increasing in some areas where willows or other trees have declined, yet may be decreasing in other areas that are becoming drier. Mulefat scrub occupies 0.3 percent of the land cover on the SSFL.

MCV2 equivalent: ***Baccharis salicifolia*** **shrubland alliance** (mulefat thickets).

4.2.1.5 Aquatic Vegetation and Land Cover

Wetland

SSFL is at the summit of the Santa Susana Mountains in a semiarid environment, thus water is scarce and the development of natural wetlands and associated aquatic vegetation or habitat is limited. Man-made features such as Silvernale Pond and the Building 56 (=4056) Excavation (a deep excavated pit in Area IV intended for a building that was not constructed) support emergent perennial wetland vegetation such as cattails (*Typha* spp.) and bulrush (*Schoenoplectus* sp.). The SRE pond has supported emergent perennial vegetation in the past, but currently is dominated by rabbitsfoot grass (*Polypogon monspeliensis*), a non-native hydrophytic annual species. The annual drying of this man-made habitat over the past several years is probably a consequence of the current protracted drought coupled with the improvement of an adjacent catchment structure that intercepts drainage and sends it to treatment facilities near Silvernale Pond prior to its release from SSFL. Silvernale, Perimeter and R1 are considered potential wetlands and require further investigation to confirm classification as wetland areas. Emergent wetland vegetation can also develop in man-made stormwater basins, such as the R2A pond and R2B pond adjacent to Outfall 18, and other areas of the SSFL.

Vernal pools, observed in previously disturbed (cleared, compacted soils) areas (e.g., Area IV) contain annual vernal pool plant species such as woolly marbles (*Psilocarphus* sp.) when suitable wet conditions occur. In total, about 4.6 acre (0.2 percent) of wetland vegetation cover occurs on the SSFL property.

MCV2 equivalent: ***Schoenoplectus californicus*** **herbaceous alliance** (California bulrush marsh), no equivalent for the sparsely vegetated vernal pools that have been characterized on the SSFL.

Open Water

Open water is scarce at the SSFL and includes the unvegetated areas of the man–made ponds as described in wetlands. These ponds are capable of holding water for an extended period of time.

[7] Considered a rare or high priority vegetation type (CDFW 2010).

Silvernale Pond typically has open water year round, although the surface water can change depending on water availability (i.e., precipitation and run-off), as dry conditions occur periodically. The Building 4056 excavation, also a man-made feature, has nearly vertical walls that lead to permanent surface water about 50 feet below ground level. Stormwater detention basins, such as the R2 Ponds and other areas of SSFL, may also hold water for extended periods if conditions are right. Vernal rock pools are present in depressions in unvegetated rock outcrops in the NBZ and likely occur in similar conditions elsewhere on the SSFL. These small, shallow rock basins are typically only a few feet wide and were not mapped separately from the rock outcrop areas. They generally lack vascular plants. In total, about 1.2 acre (less than 0.1 percent) of open water land cover occurs on the SSFL property.

MCV2 equivalent: None, unvegetated areas.

4.2.1.6 Other Land Cover

Rock Outcrops

This land cover type includes areas of sandstone that appear nearly devoid of vegetation (although scattered plant species may be present, often rooted in crevices). These outcrops are typically higher, less fissured, or more steeply sloping, compared with the previously described rock outcrops/vegetated. The conditions restrict the ability of soil to deposit on the rock surface and plants to take root. Although limited on the site, this is an important land cover type as there is the potential for crevices, caves, and natural depressions that seasonally hold water that provide habitat for wildlife, including bats, large mammals, nesting birds, and invertebrates such as fairy shrimp species. Scattered individuals of Santa Susana tarplant may be found in crevices in this land cover type, especially if adjacent to more vegetated outcrops that support this species. Rock outcrops occupy 0.8 percent of the SSFL land cover.

MCV2 equivalent: There is no MCV2 equivalent, unvegetated areas.

Disturbed

Areas classified as disturbed cover type support a variety of native and non-native plants and include weed-dominated or ruderal areas, areas in the process of being revegetated but have not yet reached the level of maturity to be classified as the target vegetation type, and areas that are unvegetated as a result of recent disturbance or maintenance. About 2.4 percent of the land cover of the SSFL is classified as disturbed.

Weed-dominated disturbed sites may include both non-native and native species that are easily able to disperse to and establish in open habitats. These areas often include invasive species (species rapidly expanding their range and dominance in the area) as well as naturalized species (species already widespread and dominant in disturbed habitats in the area). Extensive stands of invasive and naturalized non-native species such as Italian thistle (*Carduus pycnocephalus*), milk thistle (*Silybum marianum*), Russian-thistle (*Salsola tragus*), Mediterranean mustard (*Hirschfeldia incana*), tamarisk (*Tamarix* sp.), tree tobacco (*Nicotiana glauca*), tree of heaven (*Ailanthus altissima*), and others have been noted in areas of the SSFL.

Revegetated sites occur in various locations where buildings and other structures have been removed and the soil has been seeded with a mix of native species. These areas are typically somewhat open shrub-dominated areas with annual grasses in the space between shrubs. Many of these sites support stands of mulefat or coyote brush that probably established without being seeded. Coast goldenbush (*Isocoma menziesii*), coast bush sunflower, deerweed, and sometimes stands of native perennial needlegrass may be present or prevalent on these sites.

MCV2 equivalent: Several herbaceous alliances may be applied to weed-dominated disturbed sites based on dominant or co-dominant species. For sites undergoing active revegetation, the dominant species is likely to change until the site has reached a sustainable habitat condition. It is likely the final vegetation types will be reflective of what was planted, soil conditions, and adjacent vegetation types.

Developed

This mapping category is applied to areas with existing buildings, storage tanks, various structures, paved parking lots, or roads. Unpaved roads or tracks (e.g., "two tracks") are not included in this category, but rather that of the surrounding vegetation. About 5 percent of the land cover of the SSFL is classified as developed.

MCV2 equivalent: There is no MCV2 equivalent, unvegetated areas.

Undifferentiated Exotic Vegetation

Areas of undifferentiated exotic vegetation include eucalyptus (*Eucalyptus* spp.) stands, planted windrows, or non-native ornamental species associated with buildings and occupy 0.2 percent of the land cover of the SSFL.

MCV2 equivalent: None. MCV2 includes ***Eucalyptus* semi natural woodland stands** (eucalyptus groves), but this type typically applies to large stands and groves that have become naturalized in the landscape and not individual or groups of trees planted for landscaping purposes. Eucalyptus stands and windrows large enough to map could be classified as this type.

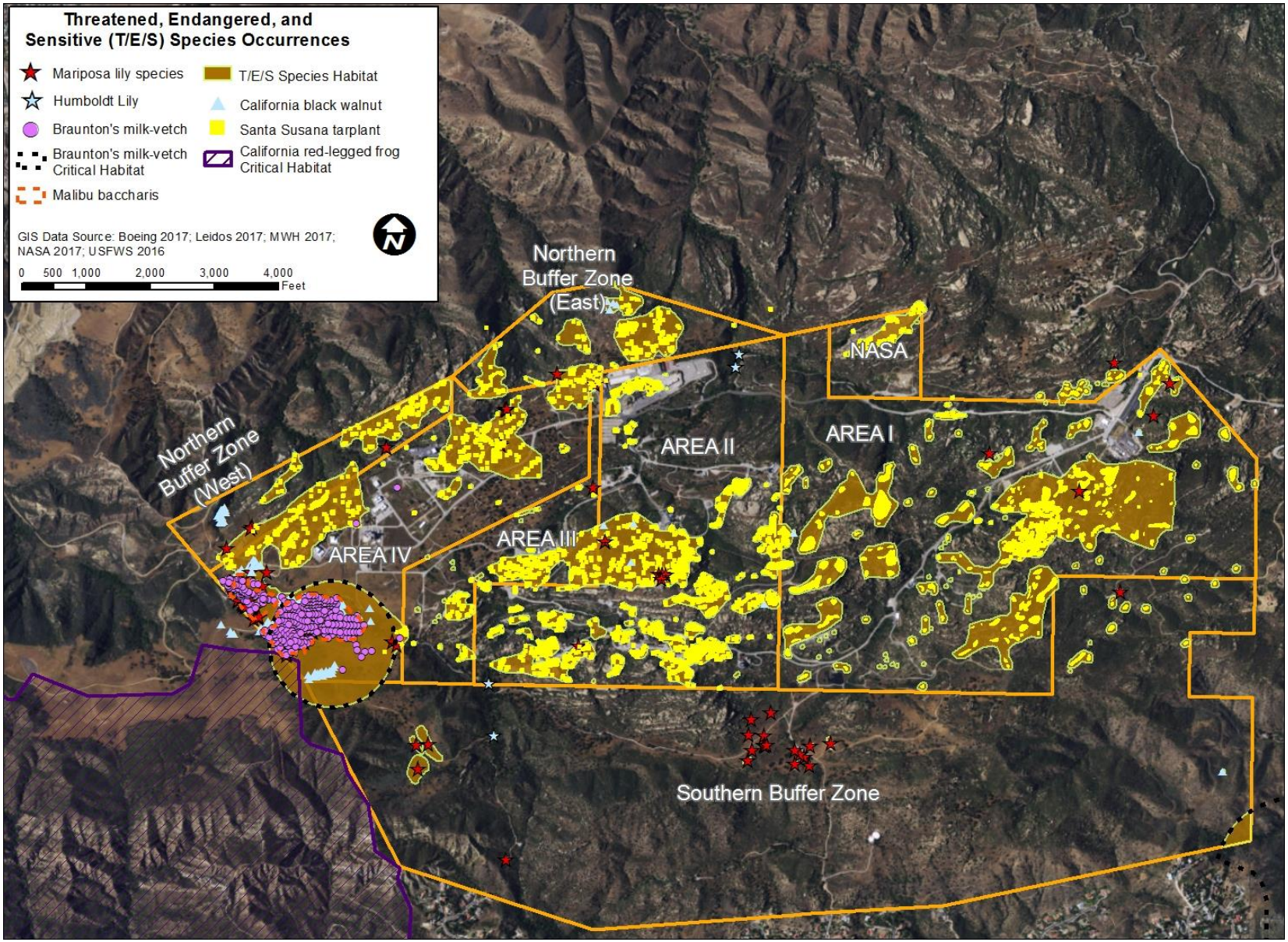
4.2.2 Key Habitat Areas

The most important habitats on SSFL fall into two categories: (1) areas where threatened, endangered, or sensitive species (T/E/S) are present; and (2) areas providing essential and wide-ranging biological and environmental functions at SSFL. These categories, which are not mutually exclusive, are described below.

4.2.2.1 Threatened, Endangered, or Sensitive Species Habitat

These areas are defined by presence of Threatened, Endangered, or Sensitive (T/E/S) Species documented to be resident on SSFL (**Figure 4–2**). T/E/S species habitat includes designated critical habitat protected by the ESA and habitat occupied by: a) listed and proposed endangered or threatened species protected under the Federal ESA; b) species protected as endangered, threatened, or rare under CESA; and c) other sensitive (special-status) native plant and wildlife species. Other sensitive (special-status) species include California Fully-Protected Species, CRPR Lists 1, 2, 3, and 4 plant species, California Species of Special Concern, and species on Ventura County's lists of locally important plant and animal species (County of Ventura 2014a, 2014b).

T/E/S species habitat is identified as polygons in Figure 4–2 along with points or polygons showing the documented occurrence of T/E/S species on SSFL.



1379 **Figure 4–2. Locations of Threatened, Endangered, and Sensitive (T/E/S) Species Habitat on SSFL**

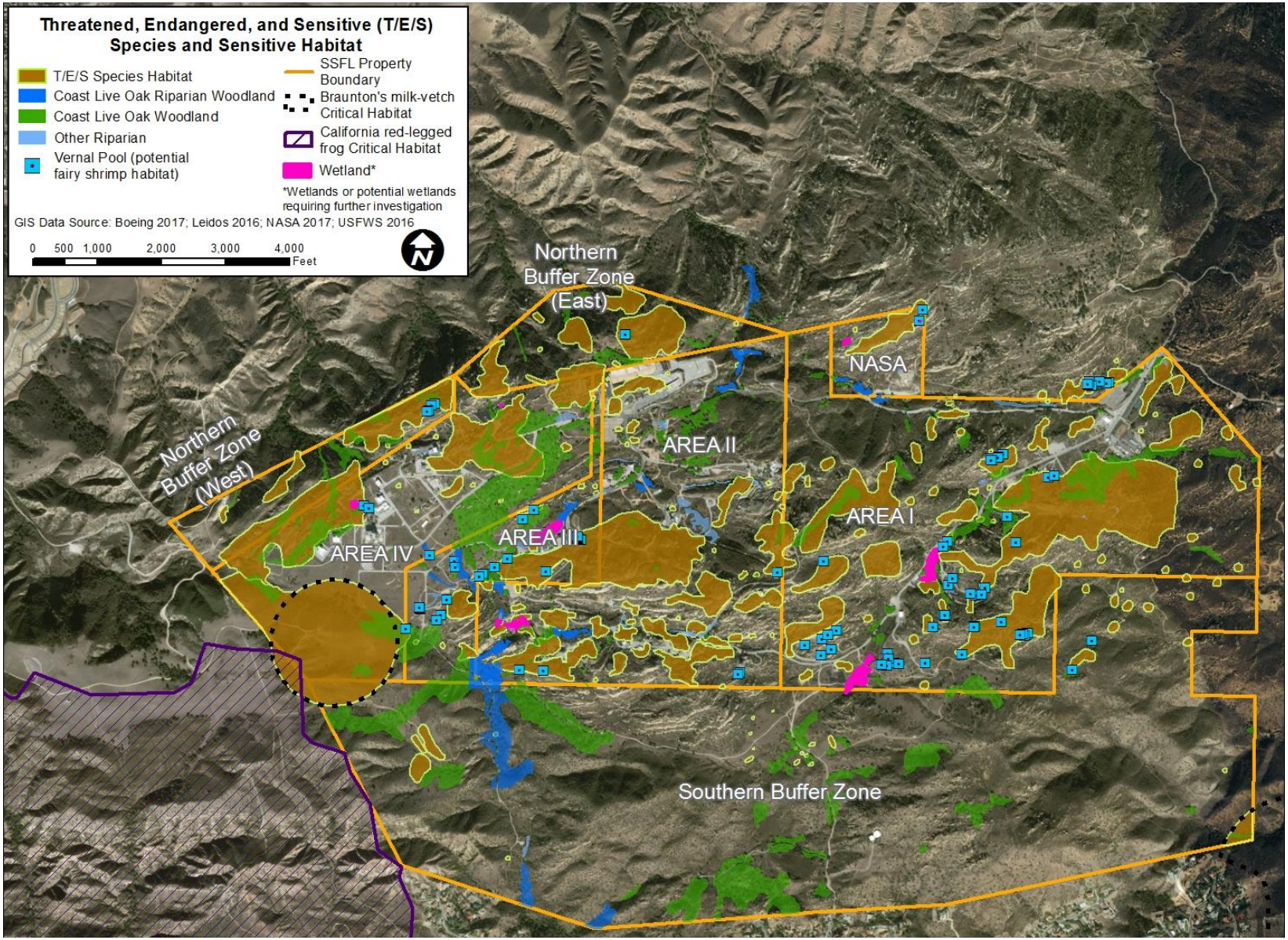
4.2.3 Habitat Types Providing Essential and Wide-ranging Environmental Functions at SSFL (Sensitive Habitats)

Included in this category are habitats that provide essential environmental functions typically extending to areas beyond the actual boundaries of their mapped habitats. These include major watercourses (such as Bell Creek and the Northern Drainage) and their associated riparian vegetation, comprised mostly of coast live oak on SSFL (**Figure 4–3**). They also include wetlands (ponds, springs, and seeps) and oak woodlands outside of riparian zones. Areas of riparian and oak vegetation are recognized for their ecological importance in providing cover, habitat structure, food, water, and nesting habitat for wildlife as well as for protecting the structural integrity of waterways and protecting water quality. Oaks were particularly important to Native Americans as a food resource and oak woodlands are regarded as a culturally significant resource. Riparian corridors support springs and seeps, which are important for plants, vertebrates, insects, and other invertebrates, especially when the remainder of the habitat is dry. Additionally, oak woodlands and riparian corridors are likely to support endangered or threatened bird species that may migrate through SSFL. By offering cover, food, and water, these habitats provide pathways for wildlife movement (wildlife migration corridors) and habitat linkages. The vegetation along the riparian corridors helps maintain water quality by stabilizing banks and filtering sediment, thereby reducing the potential for sedimentation.

Oaks are a keystone[8] species on SSFL. These trees and their associated habitat provide food, shelter, shade, and foraging areas for a wide variety of organisms (e.g., plants, wildlife, invertebrates) across the entire site. Mature oaks provide acorn crops, which are key to the survival of many species including acorn woodpeckers (*Melanerpes formicivorus*), band-tailed pigeons (*Patagioenas fasciata*), scrub jays (*Aphelocoma californica*), and mule deer (*Odocoileus hemionus*). Cavities and crevices in trees are used by a variety of birds, mammals, reptiles, and amphibians. A single tree can support numerous arthropod individuals and species (e.g., gall-forming insects). Leaf litter provides cover and supports a diverse web of soil organisms, including mycorrhizae. Root systems of a mature oak tree are capable of redistributing ground water from deep to shallow soils (via "hydraulic lift") and stabilizing slopes and stream banks. The time necessary for replacement oaks to mature sufficiently to replace values provided by a mature oak would be measured in terms of several to many decades even under ideal conditions. These considerations underscore the importance of avoiding or minimizing the removal of mature oaks and other trees.

Seasonally inundated habitats, including basins in the sandstone bedrock and other vernal pools (which are included above under threatened/endangered species habitat), are important to a variety of species and may support federally listed endangered or threatened branchiopods (e.g., fairy shrimp). These features also provide dispersed sources of drinking water for wildlife in upland habitats that are spatially removed from other water sources (e.g., in drainageways). Sandstone rock outcrops provide habitat for the state-listed rare Santa Susana tarplant and other sensitive plant species, including Plummer's mariposa lily and sheathed Wright buckwheat (*Eriogonum wrightii* var. *membranaceum*), which are on the Ventura County list of locally important plant species as well as sensitive plant communities such as bushy spikemoss mats/dipslope grasslands. Sandstone rock outcrops also provide nesting and roosting sites for many species that range widely over the SSFL such as golden eagle (*Aquila chrysaetos*) and other raptors, barn owls (*Tyto alba*), white-throated swifts

[8] Keystone species are species that have a disproportionately large effect on the biological communities in which they occur. Typically many other species in an ecosystem largely depend on keystone species and if a keystone species is removed the ecosystem would be dramatically different.



1422 **Figure 4–3. Locations of Threatened, Endangered, and Sensitive (T/E/S) Species Habitat and other Key Habitat on SSFL**

(*Aeronautes saxatalis*), bats, ringtail (*Bassariscus astutus*), and other medium-sized to large mammals. Crevices in the rocks are also important habitat for the San Diego desert woodrat (*Neotoma lepida intermedia*).

Removal or trimming of vegetation associated with the bed, bank, or channel of drainages (including ephemeral drainages) will require notification under California Fish and Game Code Section 1600 *et seq*. and may require issuance of a streambed alteration agreement by CDFW as well as notification of the USACE and permitting under the CWA for sites that meet Federal criteria to qualify as wetlands or jurisdictional waters. Additionally, any tree or sandstone rock outcrop with an active bird nest will be protected under the Federal MBTA and CDFW. Ventura County recognizes the importance of native trees, including oaks, sycamores, bay laurel, walnuts, and elderberry trees (*Sambucus* spp.), by protecting them under the Ventura County Tree Protection Ordinance (County of Ventura 2013). They regulate the removal of trees exceeding 9.5 inches in girth at 4.5 feet aboveground and require permits for pruning and earthmoving activities in proximity of the trunks of specified trees (including oaks and sycamores exceeding 9.5 inches in girth at 4.5 feet aboveground).

4.2.3.1 Proposed Biological Exemption Areas

The 2010 AOC (DTSC 2010a) prescribed the framework for the soils characterization and cleanup process for Area IV and the NBZ.[9] The 2010 AOC, applicable to DOE but not to Boeing, stipulates that the soils cleanup standard will be based on LUT values for chemicals and radionuclides. The LUT values for chemicals are the local background concentrations or method detection limits[10] (for those chemicals for which the method detection limit exceeds local background concentrations). The LUT values for radionuclides are the local background concentrations or minimum detection limits (for radionuclides whose detection limits exceed local background concentrations). Furthermore, the 2010 AOC indicates that the concentration in each individual soil sample (not an average of samples in an area) is to be compared to the chemical or radionuclide LUT values. Soil sampling (characterization) activities within Area IV resulted in the collection of more than 8,000 soil samples, many of which were analyzed for over 300 chemicals. Chemical results were compared against their respective AOC LUT values to determine the locations of all LUT exceedances.

The AOC provides exemptions to cleanup to LUT values for species and habitat protected under the ESA. More specifically, the AOC states that steps will be taken to protect biological and archaeological (cultural) resources, including limiting the amount of soil disturbance in biologically or culturally sensitive areas defined as exemption areas (DTSC 2010a, 2010b). Cleanup will be to human health and ecological risk-based remediation standards within established exemption areas.

The first step in implementing the AOC exemption process was the identification and mapping of locations of habitat and individuals of protected animal and plant species. Proposed exemption areas can be subsequently modified, if necessary, based on discussions with USFWS and CDFW and/or new knowledge based on field investigation. Proposed AOC exemption areas are based on presence of endangered or threatened species and designated critical habitat. They also contain state-listed species protected under CESA, other sensitive native plant and wildlife species and essential habitat, vernal pools, and habitats providing essential and wide-ranging biological and environmental functions at SSFL such as coast live oak woodlands and riparian woodlands. The habitats and species distributions were entered into the geographic information system (GIS) database and plotted on site

[9] The 2007 CO (DTSC 2007) remains in effect for groundwater remediation.

[10] Per the 2010 AOC, "Detection Limit" means the method reporting limit (or MRL) that is the lowest concentration at which an analyte can be confidently detected in a sample and its concentration can be reported with a reasonable degree of accuracy and precision.

maps. The maps illustrate the areas within which considerations for protection of biological resources are being assessed.

Boeing's cleanup is not governed by an AOC, but by the 2007 CO, which requires a risk-based approach to soil cleanup values. Although the 2007 CO does not provide exemptions for protected species, habitat, or cultural resources, Boeing is also subject to the applicable laws and regulations protecting biological and cultural resources, and its risk-based cleanup activities will be evaluated in DTSC's PEIR and the CMS for potential impacts to biological and cultural resources. If impacts to biological or cultural resources are potentially significant, the PEIR and CMS will evaluate any feasible mitigation measures to address those potentially significant effects. For the purposes of this BA, we have identified and mapped locations of habitat and individuals of protected animal and plant species on Areas I, III, and the SBZ using the same approach described above for Area IV.

The habitats and species distributions identified under the categories described in Section 4.2.2.1 above were delineated in the GIS database and plotted on site maps (Figures 4–2 and 4–3, above) and their areas quantified (**Table 4–2**). For purposes of discussion and analysis for this BA, we used a consistent approach across SSFL to identify T/E/S Species Habitat and Other Key Habitat on Areas I, II, and III and the SBZ, within which considerations for protection of biological resources are being assessed. These areas are described in Sections 4.2.2 above and are also illustrated in Figures 4–2 and 4–3. They include the most important habitats on SSFL, which fall into two categories: (1) areas where threatened, endangered, or sensitive species (T/E/S) are present; and (2) areas providing essential and wide-ranging biological and environmental functions at SSFL such as coast live oak woodlands and riparian woodlands. At this time, only T/E/S Species Habitat identified in Area IV and the NBZ has been proposed as exemption areas (DOE 2017). The BA includes T/E/S Species Habitat and Other Key Habitat for DOE's and Boeing's areas of responsibility, Area III, its portion of Area I and the SBZ. As mentioned above, it is anticipated that potential impacts to these habitats will be further evaluated during the PEIR and CMS for the protection of biological resources. Effects of NASA's activities are not addressed in this BA given their previous consultation described in Section 2.2, but resources on NASA's Area II and NASA's portion of Area I are included because they could be indirectly affected by other activities.

Table 4–2. Areas of Threatened, Endangered, and Sensitive (T/E/S) Species Habitat and Sensitive Habitat by SSFL Sub-Area (acres)

SSFL Sub Area	Acres	Key Habitats					Key Habitats Total	Percent of SSFL Sub-Area	Vernal Pool/Rock Basin Count [c]
		T/E/S Habitat [a]	Sensitive Habitats [a]						
			CLOW	CLORW	OR	Wetland [b]			
Area I (Boeing)	670	178.2	21.3	0.4	1.7	3.0	204.6	31	50
Area I (NASA LOX)	42	6.7	0.4	1	0.3	0.1	8.5	21	2
Area II (NASA)	409	98.7	11.1	8.2	5.7	0.4	124.1	30	5
Area III (Boeing)	114	27.7	18.8	3.8	3.1	0.7	54.1	47	24
Area IV including NBZ [a] (DOE)	472	197.5	38.2	0.2	0.7	0.1	236.7	50	8
Southern Buffer (Boeing)	1,143	22.3	82.9	16.6	0.4	0.1	122.3	11	2

CLORW = coast live oak riparian woodland; CLOW = coast live oak woodland; LOX = liquid oxygen; OR = other riparian.

[a] T/E/S Habitat and Sensitive Habitats in this table are proposed as AOC exemption areas in Area IV. To avoid double counting, acreage presented in this table for Sensitive Habitats is limited to that acreage outside the boundaries of T/E/S Habitat areas.

[b] Wetland acreage totals are approximate and do not reflect jurisdictional determinations.

[c] Survey effort for vernal pools and rock basins (potential listed vernal pool branchiopod habitat) was most concentrated in Areas I and III, but is not considered comprehensive, and additional, unmapped pools or rock basins may be present.

4.2.3.2 Plants of Native American Concern

SSFL is a culturally significant site and was once the site of an important Native American village (King and Parsons 1999). In Area IV alone, there are more than 81 plant species known to have been used by Native Americans. These plants were used medicinally, for building materials, and to make tools as well as an important source of food. For example, the Chumash people utilized plants on SSFL such as coast live oak, Southern California black walnut, chia (*Salvia columbariae*), prickly pear (*Opuntia* spp.), wild onions, and lilies for food; mulefat, mountain mahogany (*Cercocarpus* spp.), and narrow leaved milk weed (*Asclepias fascicularis*) for tools; and purple sage, thick leaf yerba santa, and vinegar weed (*Trichostema lanceolatum*) and wooly blue curls (*T. lanatum*) for medicines (Grant 1978; Landberg 1965). Knowledge about inventories of medicinal plants, including the location and distribution of medicinal plants is scarce. The occurrence of medicinal or culturally significant plants on SSFL within a historic village adds to the importance they serve and increases the need for their protection as conservation of medicinal plants to ensure that culturally significant areas remain intact and are available for future generations. However, there are limited measures to protect medicinal or culturally significant plants. With increasing habitat destruction, the unknown future changes in shifts in plant species distribution and diversity there is increasing need for protection of culturally significant habitats on SSFL.

5.0 Status of the Species and Critical Habitat in the Action Area

This section includes federally listed endangered (FE), threatened (FT), and proposed (PT) species for listing under the ESA identified in the letter from USFWS to DOE's representative (USFWS 2015a). There is one species in the Action Area known to be proposed for Federal listing as endangered or threatened (PT). This section also addresses species listed by the State of California as rare (SR), threatened (ST) or endangered (SE) (not including those that are already federally listed), fully protected (FP), species of special concern (SC) and species meeting state criteria for listing as endangered or threatened under CESA, including CRPR 1B species within the action area.

5.1 Federally Listed or Proposed Threatened or Endangered Species and Critical Habitat

The USFWS identified 15 federally listed and candidate species having the potential to occur in Areas I through IV and adjacent undeveloped lands in Ventura County (USFWS 2015a included in Appendix A). Critical habitat for two species, Braunton's milk-vetch and the CRF, is also identified on SSFL. The species evaluated for any potential to occur within the project areas are listed in **Table 5–1** and described below.

Table 5–1. Federally Listed Species Having the Potential to Occur at SSFL

Common Name	*Scientific Name*	*Status*
Federally Listed, Proposed, and Candidate Species and their Status under the ESA		
Braunton's milk-vetch	*Astragalus brauntonii*	FE, CH
Lyon's pentachaeta	*Pentachaeta lyonii*	FE
Spreading navarretia	*Navarretia fossalis*	FT
Conejo dudleya	*Dudleya abramsii* subsp. *parva*	FT
Santa Monica Mountains dudleya	*Dudlyea cymosa* subsp. *ovatifolia*	FT
Marcescent dudleya	*Dudleya cymosa* subsp. *marcescens*	FT
San Fernado Valley spineflower	*Chorizanthe parryi* var. *fernandina*	PT
California Orcutt grass	*Orcuttia californica*	FE
Coastal California gnatcatcher	*Polioptila californica*	FT
Least Bell's vireo	*Vireo bellii pusillus*	FE
California condor	*Gymnogyps californianus*	FE
California red-legged frog	*Rana draytonii*	FT, CH
Quino checkerspot butterfly	*Euphydryas editha quino*	FE
Vernal pool fairy shrimp	*Branchinecta lynchi*	FT
Riverside fairy shrimp	*Streptocephalus woottoni*	FE

CH = critical habitat; ESA = Endangered Species Act; FE = federally listed as endangered; FT = federally listed as threatened; PT = proposed for Federal listing as threatened.

5.1.1 Plants

5.1.1.1 Braunton's Milk-vetch (*Astragalus brauntonii*), FE, CRPR 1B.1

Description. Braunton's milk-vetch was listed as endangered on January 29, 1997 (62 *Federal Register* [FR] 4172). This short-lived, robust perennial is in the pea family (Fabaceae) and is one of the tallest members of the *Astragalus* genus, reaching a height of 5 feet (1.5 meters). Braunton's milk-vetch has a thick taproot from which numerous woolly stems and leaves arise. The inflorescence is spike-like with lilac flowers clustered in rows of 35 to 60 flowers.

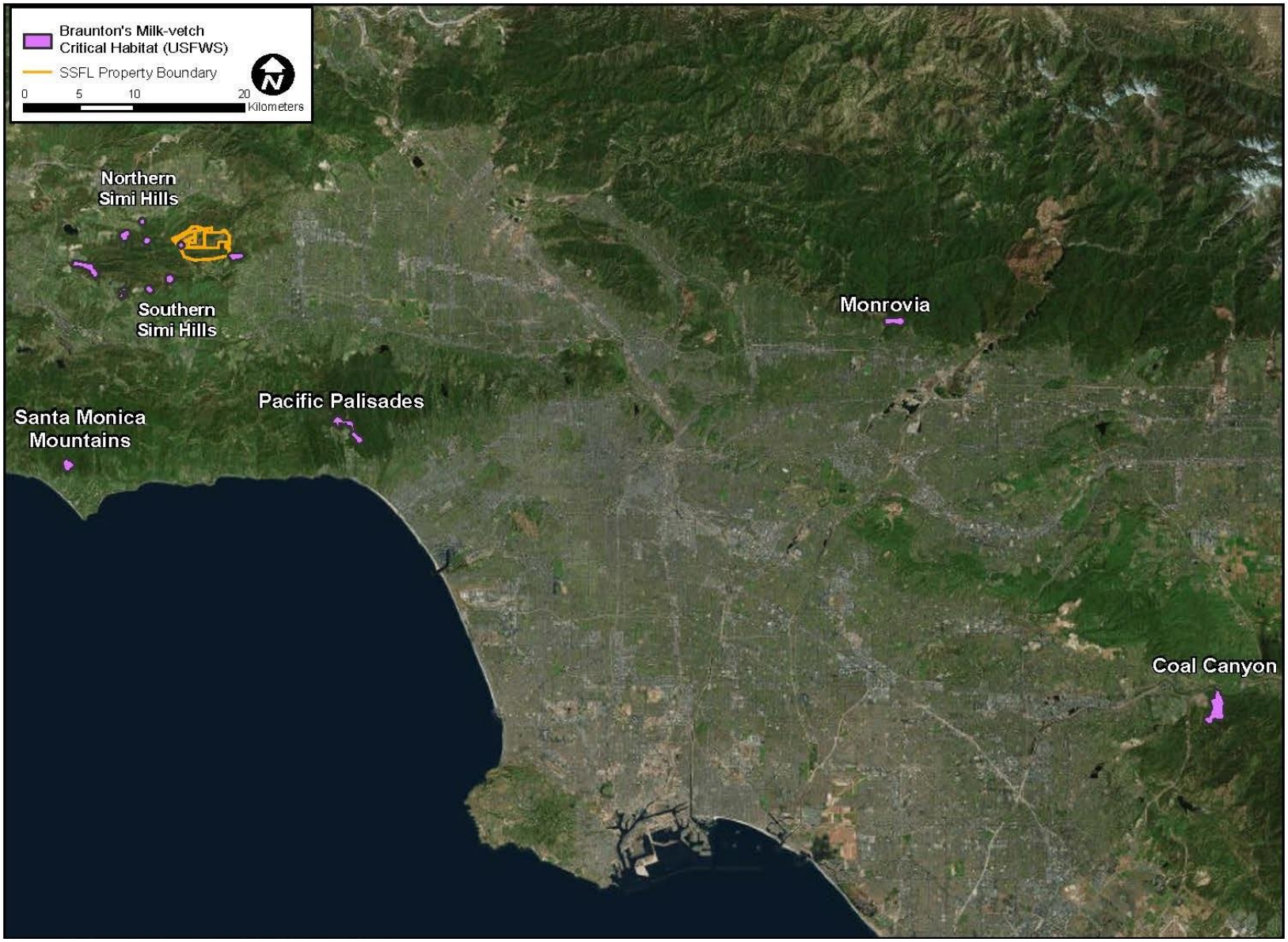
Habitat. Braunton's milk-vetch typically occurs on shallow calcareous soils derived from marine sediments (Landis 2007; USFWS 2006a, 2009a). It is frequently found on outcrops and along the tops of knolls from 800 to 2,100 feet (244 to 640 meters) in elevation (Fotheringham and Keeley 1998; USFWS 2010a). Braunton's milk-vetch often germinates following burns or superficial surface disturbance in chaparral or coastal scrub communities, but is also found in valley grassland and closed-cone pine forest. The species was once thought to be restricted to carbonate and calcareous soils though has also been found on gravelly clay soils overlaying granite sandstone (Landis 2007; EPA 2010; USFWS 2010a).

Critical Habitat. Critical habitat was designated on November 14, 2006 (71 FR 66374) and comprised 3,300 acres (1,337 hectares) in Ventura, Los Angeles, and Orange counties. Critical habitat units have been designated in the northern and southern Simi Hills, each with several subunits in eastern Ventura and western Los Angeles counties; Santa Monica Mountains in Ventura County; Pacific Palisades in Los Angeles County; San Gabriel Mountains in Monrovia, Los Angeles County; and Coal Canyon in the Santa Ana Mountains in Orange County (USFWS 2006a; **Figure 5–1**). These areas are described in Landis 2007, EPA 2010, USFWS 2006a, and USFWS 2010a. Forty-two occurrences have been reported to the CDFW (CDFW 2016a). Braunton's milk-vetch critical habitat is present at two locations on SSFL (Units 1d and 2f – **Figure 5–2**). Unit 1d is situated primarily along the western side of SSFL Area IV along a ridge system located southwest of Burro Flats; Unit 2f is on a ridge system between Dayton and Bell Canyons, and includes the southeastern corner of the SSFL SBZ (USFWS 2006a).

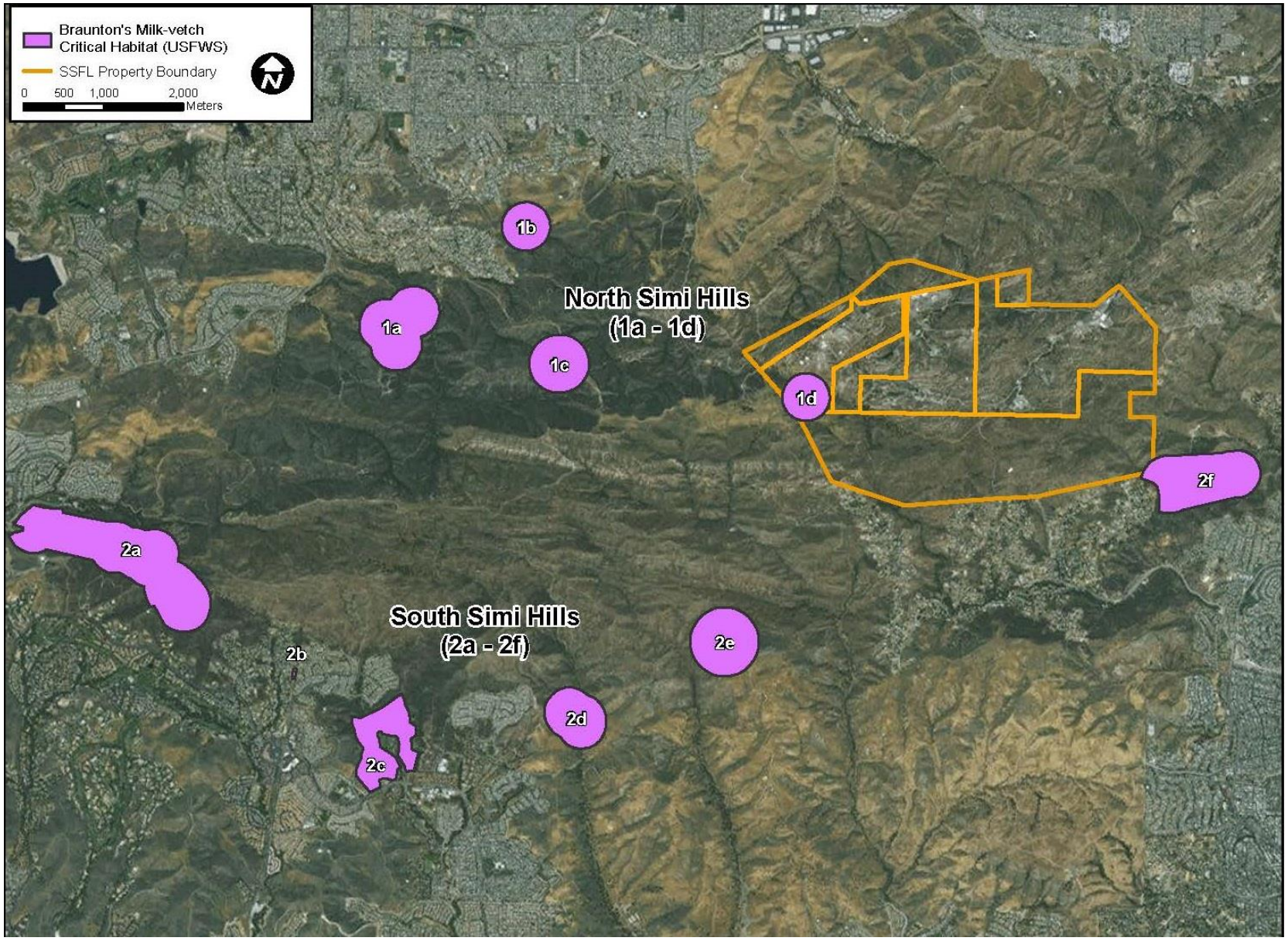
Distribution and Range. Braunton's milk-vetch is known from 20 locations in five disjunct geographic areas in southern California (70 FR 68984). These locations include the Simi Hills in eastern Ventura and western Los Angeles counties; eastern Santa Monica Mountains near Pacific Palisades in Los Angeles County; San Gabriel Mountains in Monrovia, Los Angeles County; and Santa Ana Mountains in Orange County (Landis 2007; EPA 2010; USFWS 2010a).

*Primary Constituent Element*s. The Primary Constituent Elements (PCEs) for Braunton's milk-vetch are (1) calcium carbonate soils derived from marine sediment; (2) low proportion (<10 percent) of shrub cover directly around the plant; and (3) chaparral and coastal sage scrub communities characterized by periodic disturbances that stimulate seed germination (e.g., fire, flooding, erosion) and reduce vegetation cover (USFWS 2006a, 2009a).

Life Cycle. Braunton's milk-vetch is a robust, short-lived perennial herb that typically blooms from March to July, though it has been observed blooming in February on SSFL. It produces two-chambered seed pods. Seeds produced in the front chamber of the pod germinate readily. Seeds produced in the rear chamber of the pod are innately dormant with a thickened seed coat, typical of many chaparral plants. These dormant seeds can persist in the soil for many years until conditions are suitable for germination (e.g., after fire or other disturbance promoting the scarification of the seed coat) (Fotheringham and Keeley 1998). The seeds do not have an apparent dispersal agent and probably rely on water and gravity as primary methods of dispersal. Numbers of individuals in any given year vary depending on the stage of the fire cycle and site disturbance (Landis 2007; EPA 2010). Pollinators are primarily native megachilid (leafcutter) bees and a native bumble bee species (Fotheringham and Keeley 1998).



1575 **Figure 5–1. Braunton's Milk-vetch Critical Habitat (USFWS 2006a)**



1576 **Figure 5–2. Braunton's Milk-vetch Critical Habitat in the Northern and Southern Simi Hills (USFWS 2006a)**

Threats. Threats to Braunton's milk-vetch include urban development, fragmentation of habitat, reduction of necessary pollinators, fire suppression activities, and random, naturally occurring extinction due to disturbances and small population sizes. The Braunton's milk-vetch population and critical habitat in Area IV is extremely important to the overall survival of the species. Braunton's milk-vetch is known from about 20 occurrences (locations) in six disjunct geographic areas in southern California, where critical habitat has been designated (70 FR 68984) (USFWS 1999, 2006a, 2009a). As of 2016, five of these occurrences have been noted as being extirpated and the status of Braunton's milk-vetch at many of the other sites is unknown. Many of the documented locations have been subject to development, and the majority of remaining known extant Braunton's milk-vetch occurrences remains questionable due to threats (CDFW 2016a). The population on SSFL is one of the few remaining occurrences that has not been identified in the California Natural Diversity Database (CNDDB) reports as being vulnerable to encroachment. More than half of the known populations are at risk from development and other threats including urban development, fragmentation of habitat, reduction of necessary pollinators, fire suppression activities, and random, naturally occurring extinction resulting from small population sizes. Furthermore the SSFL population clearly has the highest number of individuals reported (over 30,000), as the next highest occurrence is in Black Star Canyon, Orange County, where 5,092 individuals were recorded in 2003. One of the largest remaining extant locations of Braunton's milk-vetch is in Area IV of SSFL. Of the six designated critical habitat units described in USFWS 2006a, Unit 1d in Area IV has by far the largest population size (based on estimates made after the listing in 2006 and 2009). Moreover, it is coupled with adjacent habitat on SSFL having a recently (2011 to present) documented extant population, described below, that was unknown at the time of critical habitat designation in 2006. The portions of the critical habitat Unit 1d outside the SSFL boundary are on protected land, increasing its importance.

Recovery Plan. The existing recovery plan for Braunton's milk-vetch (USFWS 1999) does not include the population at SSFL because it was not discovered on site until after the 2005 Topanga fire. In the recovery plan, 16 known extant occurrences of Braunton's milk-vetch were identified. Seed has been collected from 6 of the 20 known populations and are being stored in a cryogenic seed storage facility at Rancho Santa Ana Botanic Garden, Claremont, California (USFWS 2009a). Braunton's milk-vetch seeds have been collected from the wild and successfully propagated on several occasions.

Period of Greatest Sensitivity within the SSFL. The period of greatest sensitivity for this species is expected to be during germination, growth, flowering, and seed production, estimated as March–August in the first year following a fall season fire event, and continuing for 3 to 5 years, with the number of individuals usually declining with each successive year. If another disturbance event occurs, there is a chance that this period could be extended, and new individuals could come up after each event. During 2009 and subsequent surveys at SSFL, there was evidence that the plants had been browsed by mule deer, potentially reducing the amount of seed produced there (EPA 2010, observations by the preparers).

Potential for Occurrence at SSFL. In 1949, observations of Braunton's milk-vetch were reported at "Silvernale ranch near Chatsworth" and it was documented on SSFL in June and July 2006 (CDFW 2016a; MWH Global, Inc. 2009) following the October 2005 Topanga Fire. At that time, Braunton's milk-vetch occurred over an area of approximately 16.6 acres (6.7 hectares) within the SSFL property boundary and on adjacent private lands (MWH Global, Inc. 2009). In addition, there were also two isolated occurrences including one individual in the southern portion of Unit 1d and another individual just west of Unit 2f (MWH Global, Inc. 2009). In 2006, a total of 2,000 Braunton's milk-vetch plants were counted in 10 quadrats established within Unit 1d in resprouting chamise-chaparral yucca (or chamise-hoaryleaf ceanothus), and from this sample, the overall total population

size within the SSFL Area IV boundary was estimated to be 33,500 individuals (MWH Global, Inc. 2009).

Subsequent Braunton's milk-vetch surveys were conducted October – November 2009 in critical habitat Unit 1d within Area IV (SAIC 2009). The areas occupied by individual plants were similar to 2006 surveys, though the occupied area expanded slightly to the north in 2009. The extent of occupied Braunton's milk-vetch habitat was approximately 17.5 acres (7.1 hectares) and the population was roughly estimated to be about 18,500 individuals (SAIC 2009). Two isolated plants in formerly developed areas of Area IV were also documented during these surveys. These plants were likely transported when soil from an established borrow area within Braunton's milk-vetch critical habitat was taken to backfill remediated sites.

By 2009, Braunton's milk-vetch plants appeared to be nearing the end of their life span (SAIC 2009). In 2006, most (49.4 percent) of the plants were small (<10 centimeters) and by 2009 the majority of the plants were large (>70 centimeters) and thought to be fully mature (MWH Global, Inc. 2009). During 2009, no seedling recruitment of the stand from the previous spring season was noted and a majority of the plants (> 50 percent) appeared to be dead based on their dried out brittle condition and lack of live tissue; especially those on south-facing slopes in the occupied area.

From 2010 to 2012, the USEPA conducted a radiological study (involving vegetation cutting, gamma scanning, geophysical survey, surface and subsurface soil sampling, groundwater monitoring well sampling, and surface water and sediment sampling) within the critical Habitat Unit 1d. The number of living Braunton's milk-vetch individuals potentially adversely affected by the radiological study was estimated at 5 percent of the estimated 2009 standing live individuals, or approximately 462 individuals (HydroGeoLogic and Envicom 2012). The USFWS issued a BO for the radiological study on May 25, 2010 (USFWS 2010a).

The BO for the radiological study specified that it was likely that a maximum of up to two-thirds of the Braunton's milk-vetch plants on the SSFL project site could be directly adversely affected by the proposed radiological sampling. This would equate to as many as approximately 12,000 to 22,000 Braunton's milk-vetch plants (USFWS 2010a). Furthermore, the BO additionally directed that if one-third or more of the Braunton's milk-vetch plants within the action area needed to be cut to implement the proposed activities, EPA was required to collect, store, and preserve the seed from all of the plants targeted to be cut prior to their removal or trimming. The BO stated the EPA would store the seeds until the radiological study project and all additional ground disturbing activities were completed. The collected seeds were to be sown back to the areas from which they were collected (USFWS 2010a).

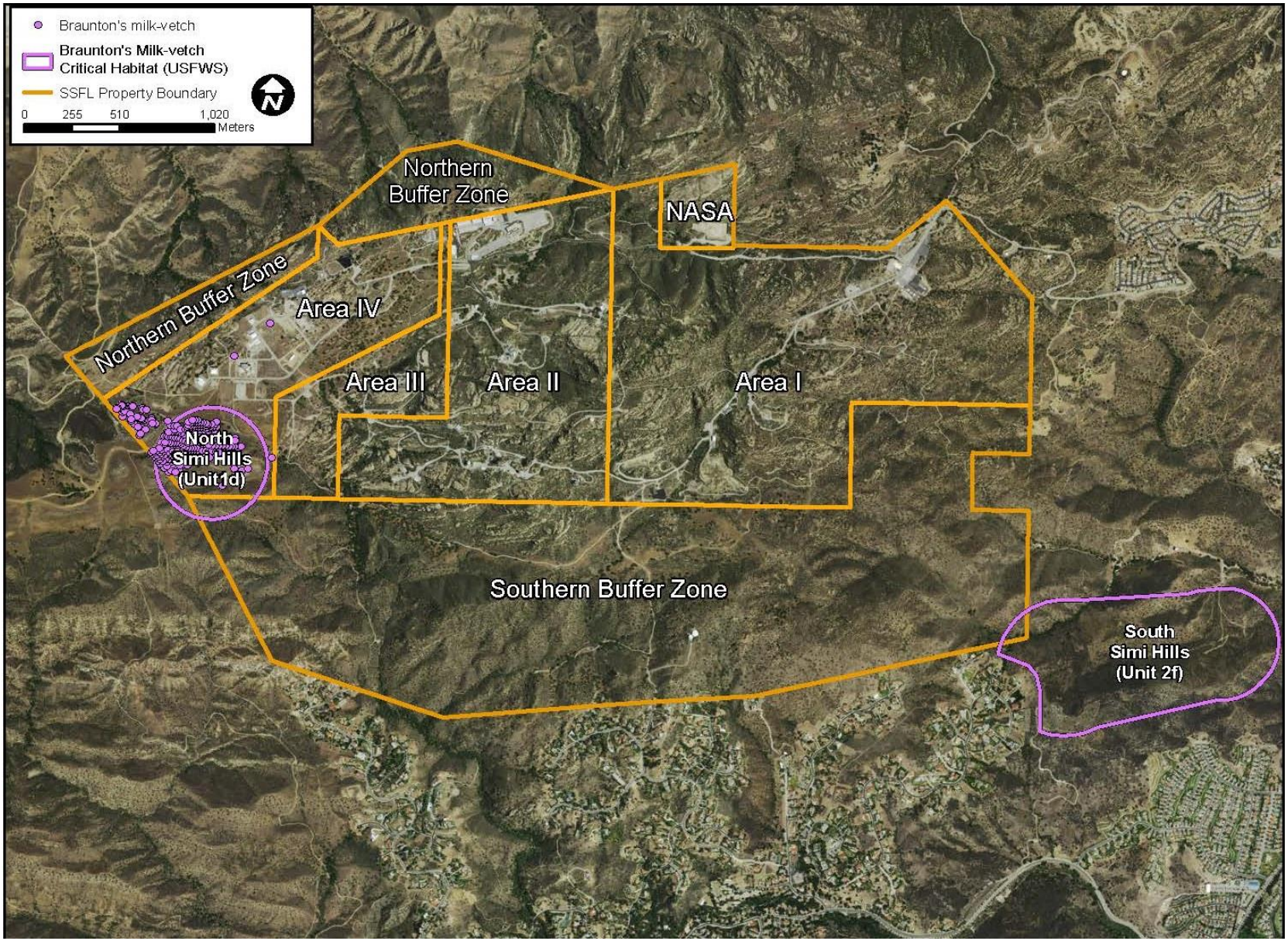
During the two years of the radiological project activities, 129 live Braunton's milk-vetch were directly impacted (HydroGeoLogic and Envicom 2012). Of these impacts, four plants were destroyed by vegetation clearance activities or by mule-mounted gamma scanning. Damage was described as uprooted plants, trimmed, destroyed, stem cuts, damaged root base, or soil disturbed by mule hoof prints. There was no record of any impacts made to plants that were senescent to dead. Evaluating the impacts of project activities on the Braunton's milk-vetch population based on the conclusions of the BO, project activities impacted 0.4 to 0.7 percent of the estimated 18,500 to 33,500 Braunton's milk-vetch individuals on the project site in 2009 and 2006 respectively. Therefore, project impacts to this species were below the amount expected to be affected as reported in the BO and there was no record of any seed collection.

During spring 2011, and subsequently in 2012 and 2013, Braunton's milk-vetch germinated from a previously undocumented location, resulting in hundreds of new emergent plants on a hill along the

property boundary north of critical habitat Unit Id (**Figure 5–3**). The emergence of plants was noticed after the chaparral vegetation had been cleared in late 2010 to facilitate radiological surveys. The hill, unburned by the 2005 Topanga fire, had been covered with dense chaparral, scrub, and woodland (coast live oak woodland) vegetation prior to its clearing. The Braunton's milk-vetch plants that emerged presumably had been in the seedbank and were stimulated to germinate by removal of the thick vegetation and ground disturbance associated with the vegetation clearing and subsequent radiological survey. The number of plants that established on the hill subsequent to clearing in 2011 was estimated to be a few hundred individuals (HydroGeoLogic and Envicom 2012). The remaining Braunton's milk-vetch individuals were visited by Leidos biologists during SSFL biological surveys conducted for soil characterization studies (2012 - 2014) as well as during a site visit with USFWS on June 18, 2013.

In March 2014, about 100 plants were observed by Leidos biologists, and approximately 10 percent were still alive. At least 40 plants (of the 100 observed) had multiple flowering stalks that had not been browsed and appeared to have set seed based on the presence of open bracts (where seed pods were no longer present). Some plants appeared to have been browsed by mule deer (EPA 2010, and observations by the preparers). To minimize further damage to the plants, DOE and Leidos biologists put protective fencing around a total of 13 surviving individuals in 2014 and 2015 (Leidos 2016). Two additional individuals were recorded but not fenced due to the difficulty of isolating the plant without destroying native vegetation. As of November 2015, results suggest the protective fencing was effective in minimizing browsing damage to Braunton's milk-vetch plants. All plants protected did not show any new evidence of browsing, appeared healthy (determined by evidence of new growth), and many showed signs of flowering, suggesting that they set seed; though this was only a visual observation and cannot be confirmed (no collections of seed or soil were made). In June 2017, the remaining Braunton's milk-vetch fenced plants and known suitable habitat in Area IV was surveyed. Based on the information known about the biology of the plant it was expected that most plants had completed their life cycle and had gone dormant and that the next germination would occur after some type of disturbance. However, approximately 70 new individuals were recorded. Most of the plants were located on the hill adjacent to critical habitat, but some were also documented within critical habitat. Over the years, Braunton's milk-vetch on SSFL has been noted mostly in chaparral, coast live oak woodland, and grasslands. In Area IV of SSFL, Braunton's milk-vetch occurs mainly in chaparral habitat and common associated species include chamise, sugar bush, manzanita, Malibu baccharis (*Baccharis malibuensis*), and chaparral yucca. Observations suggest that the cycle of growth, flowering, and production of seed to replenish the seed bank at SSFL is approximately four to five years with some individuals possibly living longer. Plants have been noted on site in all stages of growth. In June 2016, seven plants in Area IV were in protective fencing, four located within critical habitat Unit 1d and the remaining 3 are on the adjacent hill to the north, outside of the designated critical habitat. In 2017, five of the fenced plants remain and an additional 70 individuals are still alive in Area IV. Although select areas of SSFL have been the subject of focused Braunton's milk-vetch surveys, there have been no site wide surveys to determine if Braunton's milk-vetch occurs outside the two known areas (Padre 2014; NASA 2014b). If soil and underlying bedrock conditions are suitable, it is possible that Braunton's milk-vetch could occur elsewhere on SSFL, particularly within the SBZ, the northeastern portion of Area II, and the southern portion of Area I (NASA 2014b).

Additional information on the distribution and possibility of additional occurrences of Braunton's milk-vetch on SSFL is provided in Correspondence 8, Attachment A of Appendix A.



1712 **Figure 5–3. Braunton's Milk-vetch Observations and Critical Habitat near SSFL**

5.1.1.2 Lyon's Pentachaeta (*Pentachaeta lyonii*) FE, SE, CRPR 1B.1

Description. Lyon's pentachaeta (*Pentachaeta lyonii*) was listed as endangered on January 29, 1997 (71 FR 66374). It is an annual herb in the sunflower family (Asteraceae) reaching a height of 1.5 feet (0.46 meters). It has a branched stem with hairy phyllaries, many pappus bristles, reddish branches originating from the upper portion of the plant, linear-round green leaves with ciliate margins, and 30 or more bright yellow florets with curled corollas.

Habitat. Suitable habitat is within rocky and clay soils located in openings of chaparral, coastal scrub, and valley and foothill grassland habitats located on the tops of knolls or at the base in between hills (CNPS 2016). It can be found at the ecotone between grassland and chaparral, on the edge of trails and firebreaks, or anywhere else with bare ground in an area with generally low vegetative cover, due to its low competitive ability against annual grasses and shrubs (Keeley 1995; Fotheringham and Keeley 1998).

Critical Habitat. Approximately 3,396 acres (1,372 hectares) of critical habitat for Lyon's pentachaeta has been designated in Ventura and Los Angeles counties (USFWS 2006a). There is no designated critical habitat present on the SSFL.

Distribution and Range. Lyon's pentachaeta occurs from 98 to 2,067 feet (30 to 630 meters) in elevation and is currently known from fewer than 20 extant occurrences in Santa Monica Mountains and western Simi Hills (CNPS 2016). The nearest known location is the western Simi Hills, about 6 miles (10 kilometers) northwest of the study area.

Primary Constituent Elements. The PCEs for Lyon's pentachaeta are (1) Clay soils of volcanic origin; (2) exposed soils that exhibit a microbiotic crust which may inhibit invasion by other plant competitors; and (3) a mosaic of bare ground (>10 percent) patches in an area with less than 60 percent cover (USFWS 2006a).

Life Cycle. Germination of Lyon's pentachaeta occurs during the rainy season and it typically flowers in March/April through June (USFWS 2008a; Fotheringham and Keeley 1998). The species is not able to self-pollinate and instead relies upon polylectic insect pollinators such as digger bees (Apidae), andrenid bees (*Andrena* sp.), and megachilid bees (Fotheringham and Keeley 1998). Each plant can produce up to 30 or more yellow flower heads. Under favorable conditions, one plant may produce up to 1,000 seeds, which have the ability to persist in the soil for several years during extended dry spells (Fotheringham and Keeley 1998). Unlike many other species in this family, the seeds are not dispersed by wind, but most commonly through consumption and seed caching by small mammals and birds such as squirrels, mice, rats, and quails (Fotheringham and Keeley 1998; Martin et al. 1961; Cain et al. 2000; Sieg 1987).

Threats. Threats to Lyon's pentachaeta include urban development, alteration of fire regimes, trampling, vehicles, and recreational activities. Overall, the most significant threat is when the species becomes outcompeted in the event that disturbance causes a decrease in exposed microbiotic crust soils and an increase in abundance of any other plant competitors (Fotheringham and Keeley 1998).

Recovery Plan. There is a Recovery Plan available for Lyon's pentachaeta (USFWS 1999).

Period of Greatest Sensitivity within the SSFL. From just prior to germination through the end of seed production (roughly December through August).

Potential for Occurrence at SSFL. Very low. Although the species has been documented in the project vicinity, surveys have not identified this species on the site and habitat on SSFL is dissimilar from that at locations where species has been found.

5.1.1.3 Spreading Navarretia (*Navarretia fossalis*) FT, CRPR 1B.1

Description. Spreading navarretia (*Navarretia fossalis*) was listed as threatened on October 13, 1998 (63 FR 54975). It is an annual herb in the phlox family (Polemoniaceae) that is generally low spreading, only reaching up to 4 to 6 inches (10 to 15 centimeters). It has slender, divided, spine-tipped, lobed leaves, glabrous stems, and small compact lavender-white flowers that are arranged in flat-topped heads (USFWS 2009b). The species is distinguished by its linear corolla lobes, spreading or ascending habit, flat topped inflorescences, calyx size and shape (sepals collectively), and the position of the corolla relative to the calyx (Baldwin et al. 2012). The fruit is an ovoid, two-chambered capsule while the seeds are covered by a sticky layer that becomes viscous when inundated (USFWS 2009b).

Habitat. Spreading navarretia is an obligate wetland species commonly associated with seasonally flooded alkali vernal plain habitat that includes chenopod scrub, alkali playa, alkali scrub, alkali vernal pool, and alkali annual grassland habitats. It can also occur in ditches and other artificial depressions associated with degraded vernal pool habitat. The surrounding upland area normally consists of coastal sage scrub or grassland habitat (USFWS 2010b; CNPS 2016).

Critical Habitat. Approximately 6,720 acres (2,720 hectares) of vernal pool habitat, seasonally flooded alkali vernal plain habitat, and irrigation ditches and detention basins in Los Angeles, Riverside, and San Diego counties has been designated as critical habitat (USFWS 2010b). There is no designated critical habitat present on the SSFL. The nearest designated critical habitat units are in Plum Canyon and Cruzan Mesa areas in northwestern Los Angeles County, 18–20 miles (29–32 kilometers) northeast of SSFL, respectively.

Distribution and Range. Spreading navarretia occurs from 98 to 2,149 feet (30 to 655 meters) in elevation and is known from Los Angles, Riverside, San Diego, and San Luis Obispo counties (CNPS 2016). The closest known occurrences are about 20 miles northeast of SSFL in vernal pools in the Cruzan Mesa and Plum Canyon occurrences mentioned above.

Primary Constituent Elements. The PCEs for spreading navarettia are (1) Ephemeral wetland habitat; (2) intermixed wetland and upland habitats that act as the local watershed; and (3) soils that support ponding during winter and spring (USFWS 2010b).

Life Cycle. Spreading navarretia depends on the inundation and drying cycles of its habitat for reproduction and other phases of the life cycle. It is likely that seeds left in the seed bank use temperature and moisture gradients as cues for germination, similar to many other vernal pool plant species. In addition, the indehiscent fruit requires water to expand and break open (Spencer and Rieseberg 1998). The species has the ability to self-pollinate but may also rely on animals for pollination and seed dispersal (Spencer and Rieseberg 1998). While the exact types and species of pollinators is unknown, it was reported that a type of mining bee (Andrenidae) has been observed to make repeated visits to spreading navarretia plants (USFWS 2009b). The species flowers in May and June as the vernal pools dry out, and then produces fruit and ultimately remains senescent in the summer (Glenn Lukos and Sapphos 2000).

Threats. Threats to spreading navarretia include direct habitat loss through the degradation and destruction of vernal pools due to urbanization, development, agriculture, weed abatement, fire suppression, manure dumping, alteration of hydrology, transportation and flood control projects, grading, pipeline projects, and off-highway vehicles (USFWS 1998a).

Recovery Plan. There is a recovery plan for vernal pools of southern California available for spreading navarretia (USFWS 1998a).

Period of Greatest Sensitivity within the SSFL. This annual plant would be most sensitive from germination through seed dispersal, roughly winter through early to mid-summer.

Potential for Occurrence at SSFL. Very low. Not known to occur within the study area or vicinity. The vernal pools within the study area, which are mostly unvegetated basins in sandstone bedrock, do not appear to be suitable for this species and numerous surveys have not reported this species at the site.

5.1.1.4 Conejo Dudleya (*Dudleya abramsii* subsp. *parva* [=*Dudleya parva*]) FT, CRPR 1B.2, Ventura County Locally Important Species

Description. Conejo dudleya (*Dudleya abramsii* subsp. *parva* [=*Dudleya parva*]) was listed as threatened on January 29, 1997 (62 FR 4172). It is a long-lived, perennial herb in the stonecrop family (Crassulaceae). Conejo dudleya is a succulent dicot that grows in a rosette formation with 5 to 18 centimeter (2.0 to 7.1 inch) inflorescence stems displaying pale yellow-green flowers that often exhibit flecks of red on the tips (Baldwin et al. 2012). It has above-ground stems (caudices), five sepals that are erect to slightly spreading at the tips, and erect fruit (follicles) (USFWS 2015b), however its leaves are summer-deciduous.

Habitat. Suitable habitat is found in clay or volcanic soils on rocky or gravelly slopes and grassy hillsides in coastal sage scrub and valley and foothill grassland habitats (CNPS 2016). It is most commonly located on north-facing slopes of approximately 10 degrees (Dorsey 2007). In addition, it tends to occur exclusively in thin-soiled substrate over rocky outcrops derived from the Miocene Conejo volcanics.

Critical Habitat. There has been no designation of critical habitat for Conejo dudleya.

Distribution and Range. Conejo dudleya occurs from 197 to 1476 feet (60 to 450 meters) in elevation in eastern Ventura County. It is known from very few occurrences from the western end of the Simi Hills along Mountclef Ridge to the Conejo Grade (USFWS 2015b).

Primary Constituent Elements. Not applicable (PCEs are only listed as part of a critical habitat listing).

Life Cycle. Conejo dudleya blooms from May to June and is most-likely pollinated by bees and flies due to its small yellow flowers (Aigner 2004). However, due to its low nectar content compared to other dudleya species, conejo dudleya may be prone to pollinator unreliability, short and unpredictable reproductive seasons, small population size, and high population turnover and these factors may select for a higher degree of auto-fertility observed in species with low nectar content (Dorsey 2007; Levin and Mulroy 1985). Conejo dudleya seeds sprout in the winter when there is enough precipitation to continue to grow throughout the rainy season (Dorsey 2007). In addition, there is evidence that mosses and lichens may aid in seed recruitment and germination by providing nutrients, moisture, substrate, and protection against herbivory by snails and slugs (Riefner and Bowler 1995; Riefner et al. 2004). When conditions are moist enough, conejo dudleya will flower within a year, however during dry years very few individuals will bloom.

Threats. Threats include habitat encroachment from new or existing development, fire suppression activities, and human recreational activities, such as hiking, rock climbing, biking, and horseback riding (USFWS 2015b).

Recovery Plan. There is a recovery plan for six plants from the mountains surrounding the Los Angeles Basin available that includes the conejo dudleya (USFWS 1999).

Period of Greatest Sensitivity within the SSFL. This perennial species is most vulnerable to damage during its period of active growth, beginning during the rainy season and continuing through flowering (roughly November through June). It loses its leaves during the summer.

Potential for Occurrence at SSFL. Very low. Although the species has been reported from project vicinity, numerous surveys have not identified this species on the site, which lacks soils derived from volcanic rock with which this species is normally associated.

5.1.1.5 Santa Monica Mountains Dudleya (*Dudleya cymosa* subsp. *ovatifolia* [inclusive of *Dudleya cymosa* subsp. *agourensis*]) FT, CRPR 1B.2, Ventura County Locally Important Species

Description. Santa Monica Mountains dudleya (*Dudleya cymosa* subsp. *ovatifolia* [inclusive of *Dudleya cymosa* subsp. *agourensis*]) was listed as threatened on January 29, 1997 (62 FR 4172). It is a succulent, perennial herb in the stonecrop family (Crassulaceae) that has a rosette formation of evergreen leaves and a thickened rootstock with pale yellow to orange flowers on a 1.6 to 6.0 inch (4.1 to 15.2 centimeter) tall floral steam. The species can be distinguished by ovate leaves with a maroon underside for subspecies *ovatifolia* and glaucous (chalky) leaves and lemon yellow flowers for subspecies *agourensis* (USFWS 2009c).

Habitat. Suitable habitat is located in chaparral, coastal sage scrub, and cismontane (coast live oak) woodland, on rocky volcanic soils and sedimentary and conglomerate rock on canyon bottoms and shaded areas as well as drainages along the south-facing slope of the Santa Monica Mountains (CNPS 2016; Dorsey 2007). In the Santa Ana Mountains, it occurs on shaded sandstone cliffs. In most locations, the topography has prevented deep soil formation, increasing the likelihood of the species being the only flowering plant to occur in an area that is otherwise dominated by mosses, lichens, and ferns (CNPS 2016).

Critical Habitat. There has been no designation of critical habitat for Santa Monica dudleya.

Distribution and Range. Santa Monica Mountains dudleya occurs from 492 to 5,495 feet (150 to 1,675 meters), with Agoura Hills dudleya occurring from 656 to 1,640 feet (200 to 500 meters) in elevation (CNPS 2016). Of the four populations known, two consisting of subspecies *ovatifolia* and one consisting of *agourensis* are in the Santa Monica Mountains and the fourth, consisting of subspecies *ovatifolia* is located in the Santa Ana Mountains (USFWS 2009c). Both subspecies occur in Los Angeles County, while subspecies *ovatifolia* occurs also in Orange County and subspecies *agourensis* occurs also in Ventura County (CNPS 2016).

Primary Constituent Elements. Not applicable (PCEs are only listed as part of a critical habitat listing).

Life Cycle. Santa Monica Mountains dudleya typically flowers from March to May (subspecies *ovatifolia*) and from May to June (subspecies *agourensis*) and is pollinated by bees and flies due to its small yellow to orange flowers (Aigner 2004). However, due to its low nectar content compared to other dudleya species, Santa Monica Mountains dudleya may be prone to pollinator unreliability, short and unpredictable reproductive seasons, small population size, and high population turnover and these factors may select for a higher degree of auto-fertility observed in species with low nectar content (Dorsey 2007; Levin and Mulroy 1985).

Threats. Threats include habitat encroachment from new or existing development and recreational activities such as rock climbing and hiking.

Recovery Plan. There is a recovery plan for six plants from the mountains surrounding the Los Angeles Basin available that includes Santa Monica Mountains dudleya (USFWS 1999).

Period of Greatest Sensitivity within the SSFL. This perennial species would be most vulnerable to damage during its period of active growth, beginning during the rainy season and continuing through flowering (roughly November through June). After maturation of seed there is little above-ground growth and leaves slowly die back during the dry season.

Potential for Occurrence at SSFL. Very low. It is not known to occur within the study area or vicinity. Suitable volcanic soil conditions are not present.

5.1.1.6 Marcescent Dudleya (*Dudleya cymosa* subsp. *marcescens*) FT, SE, CRPR 1B.2, Ventura County Locally Important Species

Description. Marcescent dudleya (*Dudleya cymosa* subsp. *marcescens*) was listed as threatened on January 29, 1997 (62 FR 4172). It is a perennial herb in the stonecrop family (Crassulaceae) with a thickened rootstock, rosette leaves, and thick flowering stems with corollas that are bright yellow with red markings or bright red. It is distinguishable by its marcescent leaves which wither in the summer but remain attached (USFWS 2009d).

Habitat. Suitable habitat is located on the lower reaches of sheer volcanic rock outcrops, canyon walls, and boulder surfaces adjacent to perennial streams and in chaparral and oak woodlands (CNPS 2016; USFWS 1999). In most locations, the topographic relief has prevented deep soil formation, increasing the likelihood of the species being the only flowering plant to occur in an area that is otherwise dominated by mosses, lichens, and ferns (USFWS 1999).

Critical Habitat. There has been no designation of critical habitat for marcescent dudleya.

Distribution and Range. Marcescent dudleya occurs from 492 to 1,706 feet (150 to 520 meters) in elevation. It is known from fewer than 10 occurrences in the Santa Monica Mountains of Ventura and Los Angeles counties located in a stretch of area between Hidden Valley and Malibu Creek State Park.

Primary Constituent Elements. Not applicable (PCEs are only listed as part of a critical habitat listing).

Life Cycle. Marcescent dudleya typically flowers from May to June and is pollinated by hummingbirds and bees, ultimately producing an abundant amount of small seed (Dorsey 2007). Marcescent dudleya seeds germinate in the winter with the onset of winter rains and continue to grow throughout the rainy season (Dorsey 2007). In addition, there is evidence that mosses and lichens may aid in seed recruitment and germination by providing nutrients, moisture, substrate, and protection against herbivory by snails and slugs (Riefner and Bowler 1995; Riefner et al. 2004).

Threats. Threats include potential modification or destruction from recreation, rock climbing, zoning, and development.

Recovery Plan. There is a recovery plan for six plants from the mountains surrounding the Los Angeles Basin available that includes marcescent dudleya (USFWS 1999).

Period of Greatest Sensitivity within the SSFL. As with other dudleyas mentioned above it is most sensitive to damage during its period of active growth. Trampling not only can kill the plants but also can dislodge the veneer of lichens, mosses, and soils within which it grows on the steep rock outcrops.

Potential for Occurrence at SSFL. Very low. It is not known or expected to occur within the action area because rocky volcanic cliffs are not present.

5.1.1.7 San Fernando Valley Spineflower (*Chorizanthe parryi* var. *fernandina*) PT, SE, CRPR 1B.1, Ventura County Locally Important Species

Description. San Fernando Valley spineflower (*Chorizanthe parryi* var. *fernandina*) is currently proposed for listing as threatened under the ESA (81 FR 63454). It is a small, low-growing, herbaceous annual herb in the buckwheat family (Polygonaceae). The leaves are basal, oblanceolate to oblong-lanceolate, narrowing to a short petiole. The inflorescences are open, and the involucres are aggregated at the ends of the branches in small clusters. The flowers are white and glabrous. The distinguishing

characteristics of San Fernando Valley spineflower are its decumbent habit, white flowers, subequal perianth lobes, and the presence of straight involucral awns (Glenn Lukos and Sapphos 2000).

Habitat. Suitable habitat is estimated to include gravel or sand soils located in washes within coastal sage scrub habitat (CNPS 2016). The species tends to prefer acidic, fine-sand colluvium, low in nitrogen, and possibly permeated with mycorrhizal mycelia. It tends to be intolerant of shade and competition (Glenn Lukos and Sapphos 2000). Historic localities include areas occasionally inundated or scoured by streams, lakes, or reservoirs.

Critical Habitat. There has been no designation of critical habitat for San Fernando Valley spineflower.

Distribution and Range. San Fernando Valley spineflower occurs from 492 to 4,003 feet (150 to 1,220 meters) in elevation (CNPS 2016). It was thought to be extinct until it was recently rediscovered in the late spring of 1999 in southeastern Ventura County at Ahmanson Ranch (currently designated as the upper Las Virgenes Canyon Open Space Preserve) and on the Newhall Ranch in southwestern Los Angeles County in May 1999, and is currently only known from these occurrences (CDFW 2016a; USFWS 2014)

Primary Constituent Elements. Not applicable (PCEs are only listed as part of a critical habitat listing).

Life Cycle. San Fernando Valley spineflower typically flowers from April to June. Germination occurs following the onset of late-fall and winter rains and typically represents different cohorts from the seed bank (USFWS 2014). Flowering occurs in the spring, generally between April and June.

Threats. The main threat is destruction, modification, or curtailment of suitable habitat through urban development. However the species is also threatened by cattle grazing and invasive nonnative plants, including grasses, that potentially fragment suitable habitat, displace it from available habitat, reduce survival and establishment, and compete for light, water, and nutrients (USFWS 2014).

Recovery Plan. There is no recovery plan available for San Fernando Valley spineflower.

Period of Greatest Sensitivity within the SSFL. From germination through seed dispersal.

Potential for Occurrence at SSFL. Very low. The San Fernando Valley spineflower has been reported in the project vicinity; however, surveys have not identified this species on the site and habitat on SSFL is dissimilar from that at locations where species has been found.

5.1.1.8 California Orcutt Grass (*Orcuttia californica*) FE, SE, CRPR 1B.1, Ventura County Locally Important Species

Description. California Orcutt grass (*Orcuttia californica*) was listed as endangered on August 3, 1993 (58 FR 41384). It is a small, bright green, tufted annual grass in the grass family (Poaceae) that reaches up to 4 inches (10 centimeters) in height. The inflorescence contains irregularly toothed, pinkish florets. In addition, the plant secretes sticky, bitter droplets. The species can be distinguished by initially prostrate stems, the teeth of the lemma being less than 0.2 inches (5 millimeters) long, 0.06 to 0.07 inch (1.5 to 1.8 millimeter) fruit, soft and straight spreading hairs, and spikelets below the axis, crowded toward the apex (USFWS 1993).

Habitat. California Orcutt grass is an obligate vernal pool species that is closely associated with deep vernal pools underlain by clay soils. It is often associated with other federally listed vernal pool taxa, including species of fairy shrimp (USFWS 2011).

Critical Habitat. There has been no designation of critical habitat for California Orcutt grass.

Distribution and Range. California Orcutt grass occurs from 49 to 2,165 feet (15 to 660 meters) in elevation and is known from fewer than 30 occurrences in Ventura, Los Angeles, Riverside, and

San Diego counties, with a few occurrences in northern Baja California, Mexico (CNPS 2016; USFWS 2011).

Primary Constituent Elements. Not applicable (PCEs are only listed as part of a critical habitat listing).

Life Cycle. California Orcutt grass typically flowers from April to June, but has been recorded flowering as late as August. During initial growth, the plant spreads out in a low lying formation. As the pool dries out the plant will produce more erect stems and subsequently flowers and produces seeds. Like most grasses, its flowers are wind pollinated. It may rely on fungi to stimulate germination (Keeley 1988). Its seeds strictly require saturated or submerged soil to germinate.

Threats. Threats include urban and agricultural development, off-road vehicles, habitat trampling associated with humans or cattle, mowing or plowing, highway construction, drainage or watershed alterations, and military activities (USFWS 2011).

Recovery Plan. There is a recovery plan for vernal pools of southern California available that includes California Orcutt grass (USFWS 1998a).

Period of Greatest Sensitivity within the SSFL. Between germination and seed dispersal.

Potential for Occurrence at SSFL. Very low. Surveys have not identified this species on the site or nearby. The vernal pools identified at SSFL are primarily small, unvegetated basins on sandstone and shallow depressions in disturbed areas, which are not characteristic of the vernal pools that support this species.

5.1.2 Birds

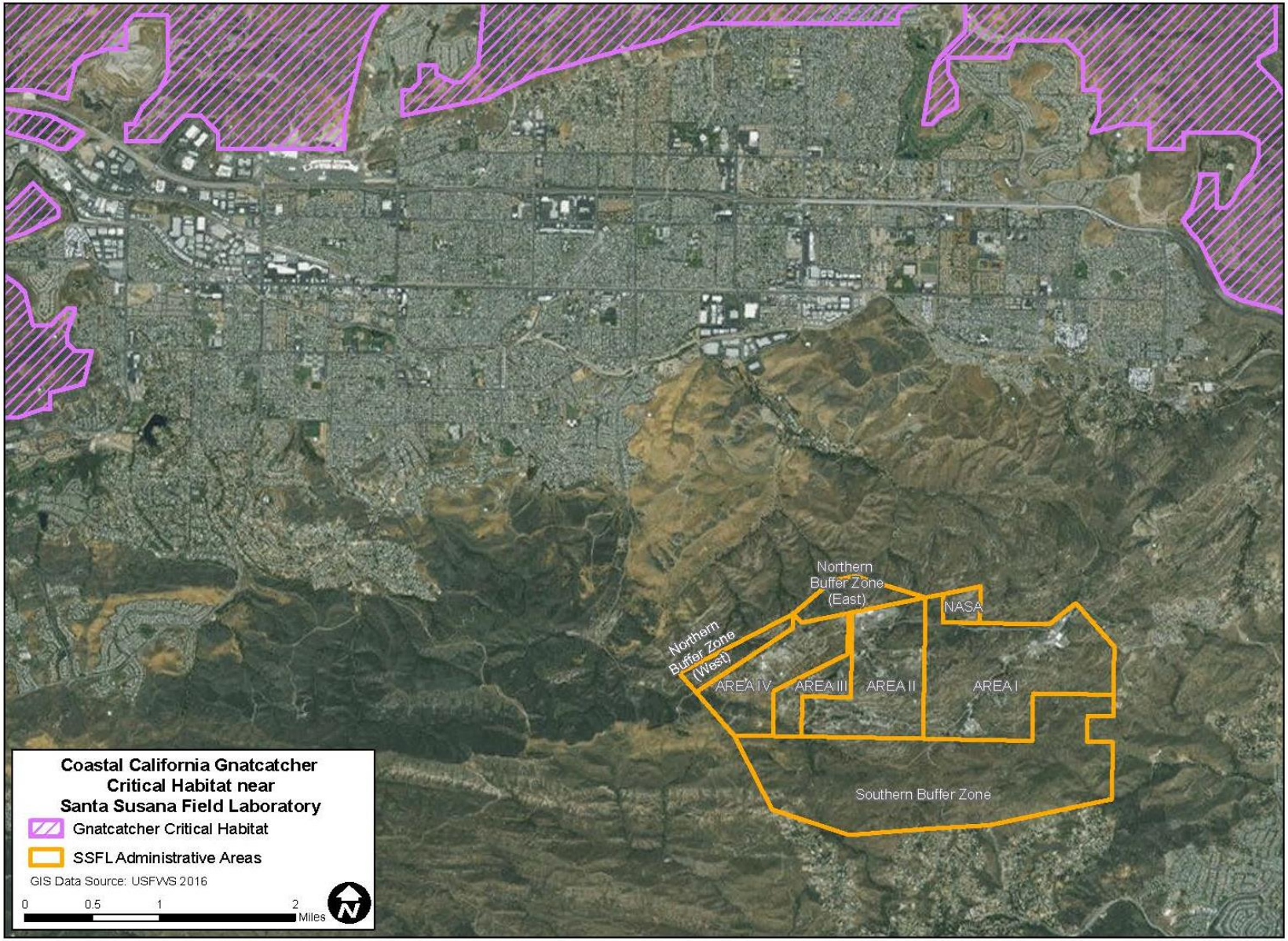
5.1.2.1 Coastal California Gnatcatcher (*Polioptila californica californica*) FT, SC

Description. The coastal California gnatcatcher was listed as threatened on March 30, 1993 (58 FR 16742). This small, blue-gray, non-migratory songbird has dark blue-gray feathers on its back, grayish-white feathers on its underside, and a white eye ring. The wings are a brownish color while the long tail is mostly black with white outer tail feathers. During the spring and summer, males have a black cap (USFWS 2010c).

Habitat. Suitable habitat is almost exclusively coastal sage scrub, but can also include chaparral and riparian areas in proximity to sage scrub. The vegetation is typically dominated by low, drought-deciduous shrub species such as California sagebrush, California buckwheat, and mulefat. Gnatcatchers usually rely on habitat with greater than 50 percent shrub cover for nest material and foraging (Beyers and Wirtz 1995).

Critical Habitat. Approximately 197,303 acres (79,846 hectares) of land in San Diego, Orange, Riverside, San Bernardino, Los Angeles, and Ventura counties has been designated as critical habitat (USFWS 2007a). However, no critical habitat occurs within the boundaries of SSFL (USFWS 2010c). The nearest designated critical habitat is about 2.5 miles northeast of SSFL (**Figure 5–4**).

Distribution and Range. The coastal California gnatcatcher occurs from Ventura County, east to San Bernardino County, and south to Baja California until a latitude of about 30 degrees north (USFWS 2010c). SSFL lies near the northern (western) limit of the known distribution of coastal California gnatcatcher.



2009 **Figure 5–4. Coastal California Gnatcatcher Critical Habitat near SSFL**

Primary Constituent Elements. The PCEs for coastal California gnatcatcher are (1) dynamic and successional sage scrub habitats, including Venturan coastal sage scrub, which provides space for individual and population growth, breeding, dispersal, and foraging; and (2) non-sage scrub habitats, such as chaparral, grassland, and riparian areas, in proximity to sage scrub habitats, which provide space for dispersal, foraging, and nesting (USFWS 2007a).

Life Cycle. The breeding season for the coastal California gnatcatcher extends from late February through July, with nesting activities occurring from mid-March through May. The gnatcatcher's breeding territory ranges from 2 to 14 acres (1 to 6 hectares), and can vary seasonally and geographically. The nests are composed of grasses, bark strips, small leaves, spider webs, down, and other materials (USFWS 2010c; Hubbs-SeaWorld Research Institute 2006). They average four eggs per clutch and the incubation and nestling periods last about 14 to 16 days.

Feeding. The gnatcatcher diet includes mostly insects such as tree bugs, beetles, caterpillars, ants, flies, moths, and grasshoppers. While foraging, birds move about actively in shrubs, low trees and low-lying vegetation (USFWS 2010c).

Threats. Threats include the loss and fragmentation of coastal scrub habitat due to urban and agricultural development, wildland fire, and nest parasitism by the brown-headed cowbird (*Molothrus ater*) (USFWS 2010c).

Recovery Plan. There is no recovery plan available for the coastal California gnatcatcher.

Period of Greatest Sensitivity within the SSFL. During breeding season (Mid-March through May).

Potential for Occurrence at SSFL. Based on the current conditions of the Venturan coastal sage scrub habitat, it is unlikely that this species would breed on the SSFL site but it may be an occasional visitor. Based on existing mapping, SSFL supports approximately 128.6 acres classified as Venturan coastal sage scrub habitat (Table 4-1; Figure 4-1; see also Appendix A, Correspondence 8, Attachment D). Because the Topanga fire burned much of Area IV and the NBZ in September 2005, several other plant communities on SSFL including chaparral, coast live oak woodland, steep dipslope grassland, and Southern California walnut woodland are recovering from this fire and contain aspects of habitat suitable for coastal California gnatcatchers (USFWS 2010a). Additional changes would be expected between the present and the period of project implementation which could occur ten to twenty or more years into the future. Prior to 2010, focused surveys for coastal California gnatcatcher had not been conducted on the SSFL site (USFWS 2010a). On December 2, 2009 coastal California gnatcatcher was reported on Area IV of the SSFL site during a site visit by a USFWS biologist (USFWS 2010a). Subsequently, protocol surveys encompassing Area IV and the NBZ were conducted during 2010, 2011, and 2012 in support of EPA vegetation clearing and gamma scanning activities (Griffith Wildlife Biology 2010, 2011, and 2012). These surveys did not observe any coastal California gnatcatchers. Additionally, in 2014, protocol-level surveys were conducted in Boeing Areas I and III proposed soil and groundwater remediation areas, and in the proposed soil borrow areas within the SBZ and also did not detect any coastal California gnatcatchers (Forde 2014).

5.1.2.2 Least Bell's Vireo (*Vireo bellii* subsp. *pusillus*) FE, SE

Description. The least Bell's vireo was listed as endangered on May 2, 1986 (51 FR 16474). It is a small gray-green songbird with a white to yellow underside, a faint white ring around the eyes, and two wingbars, a fainter one above and a more prominent one below. The juveniles have a whiter underside and more distinct wingbars.

Habitat. The least Bell's vireo is a riparian-dependent species, requiring dense, low-growing thickets of willows, cottonwood, mulefat, mugwort (*Artemisia douglasiana*), and California wild rose (USFWS 2006b). Least Bell's vireos often inhabit areas with an overstory consisting of taller willows,

cottonwoods, and sycamores. However, nesting and foraging sometimes takes place in adjacent chaparral and coastal sage scrub during a flood season or where laurel sumac and blue elderberry (*Sambucus nigra* subsp. *caerulea*) may provide food for birds in marginal habitat (Kus and Miner 1989). During the winter, they are not limited to willow-dominated riparian areas, but may occupy a variety of habitats including mesquite scrub within arroyos, palm groves, and hedgerows bordering agricultural and residential areas (Franzreb 1989), none of which are present in the SSFL.

Critical Habitat. Approximately 36,000 acres at 10 localities in portions of Santa Barbara, Ventura, Los Angeles, San Bernardino, Riverside, and San Diego counties has been designated as critical habitat (USFWS 1994).

Distribution and Range. The least Bell's vireo was once widespread with a summer range from northern California all the way to Baja California, Mexico, extending as far east as Death Valley. The vireo today inhabits a variety of locations from Santa Barbara to San Diego counties generally in or near major riparian corridors (USFWS 2006b). Least Bell's vireos winter in southern Baja California, Mexico. Based on CNDDB and USFWS records, the species has been observed at several locations within Ventura County, including the Santa Clara River (approximately 14 miles from Area IV), Arroyo Simi (9 miles from Area IV), and at Hansen Dam in Los Angeles County (16 miles from Area IV) (USFWS 1998b; CDFW 2016a).

Primary Constituent Elements. The PCEs for least Bell's vireo are (1) riverine and floodplain habitats (particularly willow-dominated riparian woodland with dense understory vegetation maintained, in part, in a non-climax stage by periodic floods or other agents) and adjacent coastal sage scrub, chaparral, or other upland plant communities (USFWS 1994).

Life Cycle. The breeding season for this species is from mid-March when the vireos arrive on their breeding grounds, and extending through late September when they leave for Baja California, although there have been some vireos recorded to have stayed and wintered in California (USFWS 2006b). The males establish breeding territories that range from 0.5 to 4.2 acres (0.2 to 1.7 hectares) (Franzreb 1989). The least Bell's vireo prefers areas with openings where the exposure to sunlight allows for the development of shrubs to build their nests. They usually choose a shrub or low tree with a horizontal twig fork averaging about 1 meter above the ground. In addition, they usually return to the same nesting area during the next breeding seasons (Franzreb 1989). Clutch size is normally 3-5 eggs and incubation lasts 14 days. Juveniles leave the nest after 10 to 12 days but remain with their parents for an additional 25 to 30 days.

Feeding. The least Bell's vireo preys on a wide variety of insect types including bugs, beetles, grasshoppers, moths, and caterpillars. It forages mostly by gleaning and sometimes hovering. Foraging occurs within all levels of the canopy, however it tends to be more concentrated in the middle to lower areas, particularly when there is an active nest (Kus 2002).

Threats. Threats include the loss of riparian breeding habitat due to agricultural and urban development, alteration of hydrology through channelization and other flood control projects, non-native invasive plants such as giant reed (*Arundo donax*), livestock grazing, and nest parasitism by the brown-headed cowbird (USFWS 2006b).

Recovery Plan. A draft recovery plan is available for the least Bell's vireo (USFWS 1998b).

Period of Greatest Sensitivity within the SSFL. During the breeding season (April through July), if they are present.

Potential for Occurrence at SSFL. Based on following information it appears that the least Bell's vireo may be an occasional visitor to the SSFL but is unlikely to breed there under current conditions.

Least Bell's vireo has been documented at SSFL. A single individual, which was believed to be a migrating individual, was sighted during August 2011 in Area II by NASA consultants (USFWS 2013a [NASA BO]). The sighting was in coyote brush adjacent to coast live oak woodland near the Ash Pile in Area II (NASA 2014a). About 2.5 acres of Area IV and the NBZ in seasonal drainages, which have limited riparian habitat, and 2.1 acres of fragmented mulefat riparian scrub within NASA's portion of SSFL may support potentially suitable least Bell's vireo habitat (USFWS 2010a; NASA 2014a). Other areas characterized as "formerly disturbed areas dominated by mulefat," amounting to 0.9 acres in Area IV (SAIC 2009), also may provide some habitat for this species. SSFL-wide there are approximately 45.1 acres of riparian habitat, including coast live oak riparian woodland, southern willow scrub, and mulefat scrub that could support least Bell's vireos moving through the area (Table 4–1). Subsequent to the BO for the EPA radiological survey (USFWS 2010a), a protocol survey (Werner 2012) conducted on Area IV did not find least Bell's vireos, nor have any additional individuals been observed during other field surveys and monitoring conducted on SSFL.

5.1.2.3 California Condor (*Gymnogyps californianus*) FE, SE-FP

Description. The California condor (*Gymnogyps californianus*) was listed as endangered on March 11, 1967 (32 FR 4001). It is among the largest flying birds in the world, with a wingspan of up to 9.5 feet (2.9 meters). Both males and females are black with prominent white underwing linings in adult birds. The head and neck are mostly naked gray skin, occasionally with various shades of red, yellow, and orange (USFWS 2013b).

Habitat. While suitable nesting habitat is found in isolated mountainous or canyon terrain on cliffs and occasionally large trees, foraging areas are oftentimes separated from nesting habitat and are typically located in open grasslands and oak savannas that support populations of deer, elk, and cattle, or along the coast where they can feed on fish, marine mammals, and marine birds (USFWS 2013b). In addition, foraging locations tend to be seasonal, with areas of preferred activity at different locations throughout the year (USFWS 2013b).

Critical Habitat. Area of land, water, and airspace to an elevation of 3,000 feet in Ventura and Los Angeles counties has been designated as critical habitat (USFWS 1977). This area encompasses several back country locations in central and southern California. No critical habitat occurs within or near the boundaries of Area IV or the NBZ.

Distribution and Range. Extirpated from nearly all of their historic range in western North America by the early 1900s, by the 1980s the California condor had been reduced to just a few dozen individuals occupying the mountainous regions of southern California (USFWS 2013b). Ongoing recovery efforts and a captive breeding program beginning in 1987 have increased the condor's total wild population to 228 free flying birds as of 2014. Today small populations persist in southern and central California (128 free flying birds), along the Grand Canyon in Arizona and Utah, and in Baja California, Mexico.

Primary Constituent Elements. None identified.

Life Cycle. The breeding season for this species is very long, lasting from November to as long as the following year. Condors prefer to build their nest on steep rock formations or hollows in old growth conifers, but may also choose cliff ledges or broken conifer tops (Snyder et al. 1986; USFWS 1996). They do not build nests, but rather move sand, twigs, rocks, and other materials around to create a properly shaped substrate required for an egg (USFWS 2013b). A clutch only consists of a single egg that can be produced anywhere between January and April, with incubation lasting approximately 56 days. The juveniles fledge after 5 to 7 months but may not become independent from the parents until a full year after hatching (USFWS 1996). Because of this long nesting period, many condor pairs can only nest every other year, however there have been records of juveniles fledging early enough to allow the parents to nest again the following year (Snyder and Hamber 1985). The species is generally

slow to mature and they will typically begin to breed at around 6 to 8 years of age, although a few have been known to breed at 5 years of age (USFWS 2013b).

Feeding. California condors are obligate scavengers that only feed on carrion (USFWS 1996). Their diet consists of large mammals such as mule deer, pronghorn antelope (*Antilocapra americana*), feral hogs, carcasses of domestic ungulates such as cattle and sheep, and smaller mammals when foraging more inland on open terrain in foothill grassland and oak savanna habitat. On the coast, they feed on carcasses of whales (Order Cetacea), sea lions (*Zalophus californianus*), and other marine species (USFWS 1996). They can only locate their food by sight or by following other scavenging birds (USFWS 2013b). Typical foraging behavior includes long-distance scouting flights, lengthy circling, and hours of waiting at a perch or on the ground near a carcass, possibly watching for predators (USFWS 2013b).

Threats. Threats include loss of habitat, illegal shooting, egg collecting, human disturbance at nesting and foraging areas, starvation, microtrash, fires, powerlines, and lead poisoning (USFWS 2013b).

Recovery Plan. A recovery plan is available for the California condor (USFWS 1996).

Period of Greatest Sensitivity within the SSFL. Not applicable.

Potential for Occurrence at SSFL. Very Low. Condors frequent backcountry wilderness areas such as Hopper Canyon in Ventura County and Bitter Creek National Wildlife Refuge in Kern County and are not known or expected to occur in or near the SSFL site in the foreseeable future.

5.1.3 Amphibians

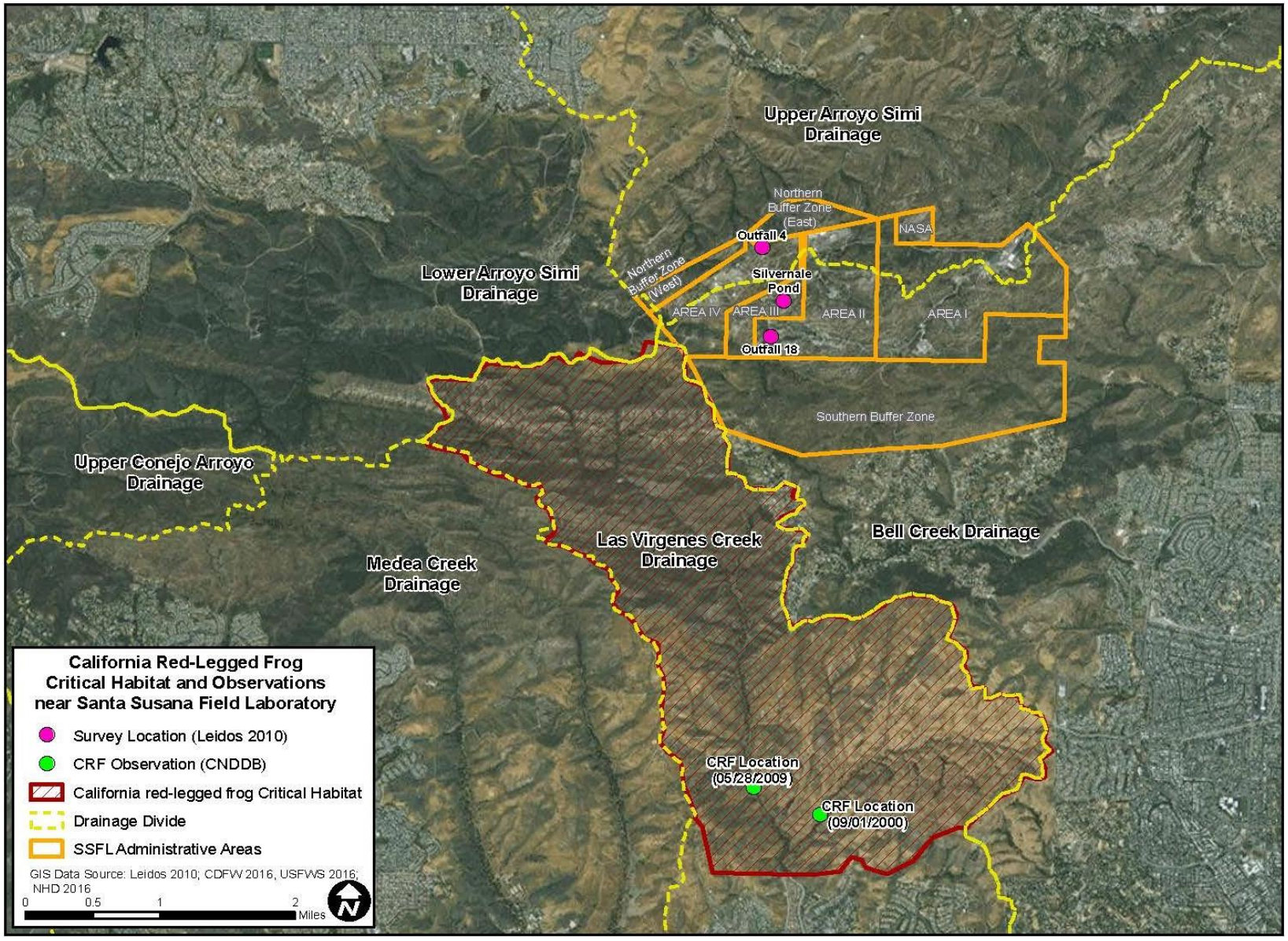
5.1.3.1 California Red-legged Frog (*Rana draytonii*) FT, SC

Description. The CRF was listed as endangered on May 23, 1996 (61 FR 25813). It is the largest native frog in the western United States, ranging from 1.5 to 5 inches (3.81 to 12.7 centimeters) in length. An adult frog is distinguished by its unique coloring: an olive, brown, gray or reddish back marked by small black flecks and larger dark blotches and a rusty-red hue to its belly and the undersides of its hind legs.

Habitat. The CRF prefers aquatic habitat such as ponds, marshes, and creeks with still water for breeding. It requires riparian and upland areas with dense vegetation and open areas for cover, aestivation, food, and basking. Frogs in cooler areas may hibernate in burrows for the winter (USFWS 2010d). The species requires 11-20 weeks of permanent water for larval development and must have access to estivation habitat.

Critical Habitat. In 2010, USFWS updated the revised critical habitat for the CRF under the ESA. In total, approximately 1,636,609 acres (662,312 hectares) of critical habitat in 27 California counties fall within the boundaries of the final revised critical habitat designation (USFWS 2010d). The Las Virgenes Creek (VEN-3) critical habitat boundary extends slightly onto the southwestern portion of Area IV of SSFL which is arid upland habitat at the upper limit of the Las Virgenes Creek drainage area. This amounts to approximately 0.6 acres of CRF critical habitat on SSFL, all of which overlaps designated CH for Braunton's milk-vetch on Area IV (**Figure 5–5**).

Distribution and Range. Historically the CRF were once common throughout California's Central Valley, as well as more coastal areas from Point Reyes National Seashore down to northwestern Baja California. Today the CRF occupy Sonoma and Butte counties in the north to Riverside County in the south, mostly in the western counties. They reside in about 238 streams or drainages in 23 counties, with Monterey, San Luis Obispo, and Santa Barbara counties supporting the most frogs. The CRF now exist in about 30 percent of their historic range.



2188 **Figure 5–5. Locations of California Red-legged Frog Critical Habitat and Populations near SSFL**

According to the CNDDB, the nearest recorded CRF observations are in pools of East Las Virgenes Creek and in the mainstem of Las Virgenes Creek (CDFW 2016a). Las Virgenes Creek is a tributary of Malibu Creek. During surveys conducted on August 15 through November 1, 1999, East Las Virgenes Creek observations included 21 adults and 200 metamorphs. 21 adults, 10 juveniles, and 30 to 60 metamorphs were also observed on September 1, 2000. The Las Virgenes Creek observation included one adult CRF within a plunge pool of the mainstem of the creek in 2009 (CDFW 2016a).

Although they are capable of longer-distance movements, CRFs have been tracked using radio telemetry in East Las Virgenes Creek, Ventura County, which is characterized by a well-defined creek and riparian zone with permanent deep pools and highly variable rainfall. The maximum distance moved in this study was 48 feet (15 meters) (USFWS 2010d). In contrast, CRF movements in Santa Cruz County in similar habitat were found to be substantially less, with typical movements of 9 to 16 feet (3 to 5 meters) from the water's edge (USFWS 2010d).

As the crow flies, the CRF location in the mainstem of Las Virgenes Creek is approximately 4 miles (6.5 kilometers) from the Outfall 4 pond in SSFL Area IV, 3.6 miles (5.9 kilometers) from Silvernale Pond in SSFL Area III, and 3.4 miles (5.4 kilometers) from the Outfall 18 ponds in SSFL Area II. Figure 5–5 shows these locations. The CRF location in East Las Virgenes Creek is slightly farther away from these sites. Actual overland distances would be considerably longer due to topography and deviations from straight line travel.

Most of SSFL drains toward Simi Valley (Arroyo Simi) on the north and toward Bell Canyon, a tributary of the Los Angeles River, on the south. The extreme southwestern corner of Area IV falls within the Las Virgenes Creek drainage, which is tributary to Malibu Creek. Although CRF critical habitat is located within Area IV, this area is separated from the mainstem and East Las Virgenes Creek locations by drainage divides between tributaries of Las Virgenes Creek and has a total elevation difference of about 1,000 feet (with multiple gains and losses in elevation between the two sites). Actual overland distances would be considerably longer due to topography and deviations from straight line travel. Other potential barriers for the CRF between the East Las Virgenes Creek location and SSFL include steep terrain, dry falls, and suburban development. No evidence of the CRF was found during a habitat assessment for the species conducted in February 2010 (SAIC 2010).

Primary Constituent Elements. The PCEs for the CRF are (1) Aquatic breeding habitat of standing bodies of fresh water, including natural and manmade stock ponds, slow-moving streams or pools within streams, and other ephemeral or permanent water bodies that typically become inundated during the winter rains and hold water for a minimum of 20 weeks in all but the driest years; (2) non-breeding aquatic habitat of freshwater and wetted riparian habitats that provide shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult CRFs; (3) upland habitat adjacent to or surrounding breeding and non-breeding aquatic and riparian habitat up to a distance of 1 mile (1.6 kilometers) in most cases (depending on surrounding habitat and dispersal barriers) comprised of various vegetation such as grasslands, woodlands, wetland, or riparian plant species that provides shelter, forage, and predator avoidance; and (4) dispersal habitat including accessible upland or riparian habitat within and between occupied or previously occupied locations within 1 mile (1 kilometer) of each other that support movement between such sites (USFWS 2010d).

Life Cycle. The CRF generally breed from November through March (with earlier breeding records occurring in southern localities). CRF are often prolific breeders, typically laying their eggs during or shortly after large rainfall events in late winter and early spring. Embryos hatch 6 to 14 days after fertilization and larvae require 3.5 to 7 months to attain metamorphosis. Larvae probably experience the highest mortality rates of all life stages, with less than 1 percent of eggs laid reaching metamorphosis. Sexual maturity normally is reached at 3 to 4 years of age; frogs may live 8 to 10 years.

Juveniles have been observed to be active diurnally and nocturnally, whereas adults are mainly nocturnal.

Feeding. Diet includes various terrestrial and aquatic invertebrates, mainly invertebrates of shoreline or water surface. Diet of large adults also includes small vertebrates. Larvae eat algae, organic debris, plant tissue, and other minute organisms (NatureServe 2016).

Threats. Threats include wetland destruction and degradation/fragmentation, urbanization, residential development, reservoir construction, stream channelization, livestock grazing of riparian vegetation, off-road vehicle activity, drought, overharvesting, airborne contaminants (pesticide drift), disease, non-native fishes, such as bass and mosquitofish, and possibly bullfrogs (NatureServe 2016).

Recovery Plan. A recovery plan is available for the CRF (USFWS 2002). The existing recovery plan for the CRF has not been implemented at the SSFL, because this species is not known to occur at the site.

Period of Greatest Sensitivity within SSFL. During the breeding season, which is estimated to be November through April, CRF may move through upland habitats during or after rainfall.

Potential for Occurrence at SSFL. Not expected. The CRF was not identified within Area IV and vicinity of SSFL during a habitat assessment for the species conducted in February 2010 (SAIC 2010). The habitat assessment surveys focused on three ponds SRE Pond in Area IV, Silvernale in Area III, and R-2 ponds near outfall 18 in Area II and the two adjacent undeveloped land areas. All three of the pond habitats investigated have some physical characteristics suitable for supporting the CRF, at least seasonally, but their distance and isolation from existing CRF locations and aspects of the habitat make occupation by CRF unlikely. Additionally, the CRF has not been recorded during previous surveys on the SSFL (Padre 2013; NASA 2014b; Ogden Environmental and Energy Services 1998; MWH Americas, Inc. and AMEC Earth and Environmental, Inc. 2003/2005; MWH Global, Inc. 2009; DOE 2003).

5.1.4 Invertebrates

5.1.4.1 Quino Checkerspot Butterfly (*Euphydryas editha quino*) FE

Description. The Quino Checkerspot Butterfly (QCB) (*Euphydryas editha quino*) was listed as endangered on January 16, 1997 (62 FR 2313). It is a medium-sized butterfly of the family Nymphalidae, with a wingspan of about 1.5 inches (4 centimeters) (USFWS 2009e). The butterfly's coloration includes red stripes across the top of the abdomen and a patchwork of brown, red, black, and cream spots on the top sides of the wings and a checkered red and cream pattern on the bottom sides (USFWS 2009e). Distinguishing features include size, wing coloration, and larval and pupal phenotypes, with the QCB generally darker and redder in coloration than the other subspecies of Edith's checkerspot butterflies (*Euphydryas editha*) (Mattoni et al. 1997).

Habitat. The QCB is restricted to open grassland and sunny openings within shrubland habitats of the interior foothills of southwestern California and northwestern Baja California, Mexico. Its distribution is defined primarily by that of its larval host plant, dwarf plantain (*Plantago erecta*), although the larvae may also use other plants. The host plants occur in or near meadows, vernal pools, and lake margins, and spread to upland shrub communities of sparse chaparral and coastal sage scrub, and the butterfly is generally found where high densities of host plants occur (USFWS 1997b).

Critical Habitat. Approximately 62,125 acres (25,141 hectares) of habitat in San Diego and Riverside counties have been designated as critical habitat for the QCB (USFWS 2009f). This final revised designation constitutes a reduction of approximately 109,479 acres (44,299 hectares) from the 2002 designation of critical habitat.

Distribution and Range. Historically, range for QCB included much of non-montane southern California including southwestern Ventura; southwestern San Bernardino; Los Angeles; western Riverside; and San Diego counties. Today, more than 75 percent of the QCB's historical range has been lost, including more than 90 percent of its coastal mesa and bluff distribution. All currently known extant populations of the QCB are in Riverside and San Diego counties, and in northern areas of Baja California Norte, Mexico (CDFW 2016a; USFWS 2003, 2009e).

Primary Constituent Elements. The PCEs for QCB are (1) Open areas within scrublands at least 21.5 square feet (2 square meters) in size that a) contain no woody canopy cover; and b) contain one or more of the host plants dwarf plantain, woolly plantain (*Plantago patagonica*), white snapdragon (*Antirrhinum coulterianum*), or white collinsia (*Collinsia concolor*) used for QCB growth, reproduction, and feeding; or c) contain one or more of the host plants thread-leaved bird's beak (*Cordylanthus rigidus*) or owl's-clover *(Castilleja exserta*) that are within 328 feet (100 meters) of the host plants listed above; or d) contain flowering plants with a corolla tube less than or equal to 0.43 inches (11 millimeters) used for QCB feeding; (2) open scrubland areas and vegetation within 656 feet (200 meters) of the open canopy areas (PCE 1) used for movement and basking; and (3) hilltops or ridges within scrublands that contain an open, woody-canopy area at least 21.5 square feet (2 square meters) in size used for QCB mating (hilltopping behavior) and are contiguous with (but not otherwise included in) open areas and natural vegetation described in PCEs 1 and 2 above (USFWS 2009e).

Life Cycle. When host plants become desiccated, larvae seek shelter among leaf litter until the following winter. Fall and winter rains spark the germination of the host plant, which in turn causes the larvae to come out of dormancy. These butterflies may spend several years in an intermittently dormant condition, briefly breaking and reentering dormancy over and over before reaching maturity, largely in response to rainfall patterns. QCB larvae may undergo as many as seven molts prior to pupation. The periods between molts (shedding skin) are called instars.

During the first two instars, prediapause larvae cannot move more than a few centimeters and are usually restricted to the plant on which eggs were laid (the primary host plant species). Prediapause larvae spin a web and feed in groups. Webs are fairly conspicuous and associated with visible feeding damage to the plant. During the third instar (about 10 days after hatching), larvae are able to move to new individual host plants. Third instar larvae usually wander independently in search of food, and may switch from feeding on the plant on which they hatched to another plant of the same species (primary host plant), or another host plant species (secondary host plant). During larval development, the host plants age, eventually drying out and becoming inedible (senescence). At the time of host plant senescence, if larvae are old enough and have accumulated sufficient reserves, they are able to enter diapause. There is typically one generation of adults per year, with a 4 to 6 week flight period beginning from late January to early March and continuing as late as early May, depending on weather conditions. If sufficient rain falls in late summer or early fall, a rare second generation of reduced numbers may occur. Females are usually mated on the day they emerge from pupae, and lay one or two egg clusters per day for most of their adult life. Adults live from 10 to 14 days; however, adult emergence from pupae is staggered, resulting in a 1 to 2 month flight season. From the perspective of judging whether a population has been extirpated, it is important to know that a normally robust population may generate no adults at all in a given year if poor environmental conditions preclude an adult flight period (USFWS 2003).

Feeding. Most QCB ovipositing has been documented on dwarf plantain; the primary host plant. Another species of *Plantago* that was documented as a primary host plant for the QCB is woolly plantain. Woolly plantain is the only species of *Plantago* found in the Silverado Occurrence Complex, and numerous egg and larval clusters were documented on this plant species during the 2000 season. Thread-leaved bird's beak, a partially parasitic plant often found at high densities in disturbed areas, is perhaps the most widely distributed of all the primary host plants. Other possible primary host plants

include owl's-clover, white snapdragon, and other native plantain species. Adults feed on plant nectar. Edith's checkerspot butterflies use a much wider range of plant species for adult nectar feeding than for larval foliage feeding. Edith's checkerspot has a short tongue and cannot feed on flowers that have deep corolla tubes or flowers that have evolved to be opened by bees. Edith's checkerspot prefers flowers with a platform-like surface on which they can remain upright while feeding. The butterflies frequently take nectar from lomatium (*Lomatium* spp.), muilla (*Muilla* spp.), milfoil or yarrow (*Achillea millefolium*), fiddleneck (*Amsinckia* spp.), goldfields (*Lasthenia* spp.), popcornflower (*Plagiobothrys* and *Cryptantha* spp.), gilia (*Gilia* spp.), California buckwheat, wild onion, yerba santa (*Eriodictyon* spp.), chia, and blue dicks (USFWS 2003).

Threats. Threats include loss and modification of habitat due to development, displacement of larval host plants and adult nectar sources, the spread of invasive plants, pesticide spraying, unauthorized trash dumping, off-road vehicles, livestock grazing, and changes in fire regimes.

Population Trends. Formerly one of the most common butterflies in southern California, the QCB now inhabits only eight areas in southwestern Riverside and southern San Diego counties and four in Baja California, Mexico. Of these, all but three populations contained fewer than five individual butterflies in 2000. Currently, the butterfly is known from high, inland elevations such as Dictionary Hill, Otay Lakes, and San Miguel Mountain in San Diego County, as well as the Gavilan Hills in Riverside County. It has not been seen in Orange County, Los Angeles County, or coastal San Diego County for nearly 30 years and has been extirpated from San Bernardino County as well. Wildfires in Southern California in 2003 burned 19 percent of the QCB's critical habitat and eliminated 27 percent of its known occurrences. The prolonged drought in California in the 1980's is credited as being largely responsible for near-extirpation of the QCB. Historical accounts and precipitation records also suggest that a severe flood was at least partially responsible for extirpation of lower elevation QCB populations in Orange County.

Recovery Plan. A recovery plan is available for the QCB (USFWS 2003). The existing recovery plan for the QCB has not been implemented at the SSFL, because this species is not known to occur at the site (USFWS 2003).

Period of Greatest Sensitivity within SSFL. During growth of the larval host plants, as well as the peak of adult egg-laying activity, estimated February through May.

Potential for Occurrence at SSFL. Not expected. Historically, the QCB has not been recorded in Ventura County. It would be highly unlikely the QCB would be able to establish new colonies onsite given the distances from extant populations (including high inland elevations such as Dictionary Hill, Otay Lakes, and San Miguel Mountain in San Diego County, and the Gavilan Hills in Riverside County) and the very limited areas of suitable habitat present within SSFL (Faulkner 2010). No life stages of the QCB were detected during 2010 Habitat Assessment Surveys conducted in Area IV (Faulkner 2010) or Habitat Assessment Surveys conducted within Areas I and II at SSFL during 2012 (Arnold 2012).

In 2010, the USFWS did not rule out the species' presence within SSFL and proposed avoidance measures in the BO (USFWS 2010a) for the EPA's proposed vegetation management activities in Area IV and the NBZ; however, no life stages of the QCB were detected during a subsequent 2010 habitat assessment of Area IV and the NBZ (Faulkner 2010) or during the 2012 habitat assessment surveys conducted within Areas I and II at SSFL (Arnold 2012). The 2010 habitat assessment surveys of Area IV and the NBZ noted presence of dwarf plantain in eight small and scattered locations onsite, which were typically in isolated situations where a thin layer soil had accumulated on the surfaces of exposed sandstone outcrops. Other potentially favorable QCB conditions were noted including areas of open soils, dirt roads, adult nectar sources, rock outcrops, and larval host plants. While these physical and biological factors may support QCB colonies elsewhere, much of these SSFL site

conditions are unfavorable for the species (e.g., dense chaparral) or severely degraded by prior construction and remediation efforts. Primary larval host plant observations were few in number, limited in area and with low numbers of potential host plants, fragmented by roads, and often widely separated from each other. The 2012 habitat assessment surveys noted dwarf plantain was observed growing at small patches of thin soils situated on north facing rock outcrops within a localized portion of Area I, but was not observed anywhere else. With the exception of adult nectar plant goldfields, no other known larval food plants of the QCB were observed during the 2012 habitat assessment. The total mapped area of dwarf plantain measured 0.36 acre. The density of host plants growing within these locations was extremely low, typically less than 5 percent of the total vegetative cover within a patch and often less than 1 percent of the vegetative cover. All observed occurrences of dwarf plantain and goldfields were on rock outcrops, which are not generally considered suitable habitat for QCB.

5.1.4.2 Vernal Pool Fairy Shrimp (*Branchinecta lynchi*) FT

Description. The vernal pool fairy shrimp was listed as threatened on September 19, 1994 (59 FR 48136). It is a small freshwater crustacean in an ancient order of branchiopods, the Anostraca. Vernal pool fairy shrimp are 0.12 to 1.5 inches (0.3 to 3.8 centimeters) long with stalked compound eyes and eleven pairs of phyllopods. The distinguishing characteristics of the species are the male's second antenna and the female's third thoracic segment located on the middle part of its body (Belk and Fugate 2000).

Habitat. The vernal pool fairy shrimp occupies a variety of different cool water pools, from small, clear, sandstone rock pools to large, turbid, alkaline, grassland valley floor pools, but tends to occur primarily in smaller pools less than 0.05 acre (0.02 hectare) in area. Throughout its range, the vernal pool fairy shrimp is typically found in small and shallow pools (generally about 6 inches deep) with relatively short periods of inundation (Helm 1998) and relatively low to moderate total dissolved solids and alkalinity (Eriksen and Belk 1999). However, at the southernmost extremes of the range, the shrimp is present in large, deep pools (USFWS 2007b).

Critical Habitat. On February 10, 2006, approximately 597,821 acres (241,929 hectares) in Jackson County, Oregon; and Alameda, Amador, Butte, Contra Costa, Fresno, Kings, Madera, Mariposa, Merced, Monterey, Napa, Placer, Sacramento, San Benito, San Joaquin, San Luis Obispo, Santa Barbara, Shasta, Solano, Stanislaus, Tehama, Tulare, Ventura, and Yuba Counties, California were designated as critical habitat for the vernal pool fairy shrimp (USFWS 2006c).

Distribution and Range. This species is currently found in 28 counties across the Central Valley and coast ranges of California, and in Jackson County of southern Oregon. The vernal pool fairy shrimp has one of the widest geographic ranges of the federally listed vernal pool branchiopods, but it is seldom abundant where found (Eriksen and Belk 1999). Occurrences in Los Angeles County include the Cruzan Mesa vernal pools, and occurrences in Ventura County include the Carlsberg vernal pools and two locations within the Los Padres National Forest (USFWS 2007b).

Primary Constituent Elements. The PCEs for vernal pool fairy shrimp are the habitats that provide (1) Topographic features characterized by mounds and swales and depressions within a matrix of surrounding uplands that result in complexes of continuously, or intermittently, flowing surface water in the swales connecting the pools, providing for dispersal and promoting hydroperiods of adequate length in the pools; (2) depressional features including isolated vernal pools with underlying restrictive soil layers that become inundated during winter rains and that continuously hold water for a minimum of 18 days, in all but the driest years; thereby providing adequate water for incubation, maturation, and reproduction. As these features are inundated on a seasonal basis, they do not promote the development of obligate wetland vegetation habitats typical of permanently flooded emergent

wetlands; (3) sources of food, expected to be detritus occurring in the pools, contributed by overland flow from the pools' watershed, or the results of biological processes within the pools themselves, such as single-celled bacteria, algae, and dead organic matter, to provide for feeding; and (4) structure within the pools consisting of organic and inorganic materials, such as living and dead plants from plant species adapted to seasonally inundated environments, rocks, and other inorganic debris that may be washed, blown, or otherwise transported into the pools, that provide shelter (USFWS 2006c).

Life Cycle. Vernal pool fairy shrimp hatch from cysts during cold-weather winter storms, requiring temperatures of 50 degrees Fahrenheit (10 degrees Centigrade) or lower to hatch (Helm 1998; Eriksen and Belk 1999). The time from hatching to maturity (and reproduction) depends on the temperature and may vary between 18 and 147 days, with an average of about 39.7 days (Helm 1998). Juvenile and adult shrimp have been known to die off when water temperatures rise above approximately 75 degrees Fahrenheit (23.8 degrees Centigrade) (USFWS 2007b). Long-distance dispersal is thought to be enabled by waterfowl and other migratory birds that ingest cysts and by animals that provide movement of mud and cysts in feathers, fur, and feet or hooves (Eriksen and Belk 1999; USFWS 2007b).

Feeding. Vernal pool fairy shrimp feed on algae and plankton growing in vernal pools, using their legs to filter feed or scrape food from hard substrates. They produce a thick, glue-like substance to digest their meal.

Threats. Threats include loss or modification of habitat due to urban development, water supply and other flood control projects, landfill projects, road development, and agricultural land conversion (USFWS 2007b).

Recovery Plan. There is a recovery plan for vernal pool ecosystems of California and southern Oregon available for the vernal pool fairy shrimp (USFWS 2006d).

Period of Greatest Sensitivity within the SSFL. During the wet season when vernal pools are inundated or soils are moist.

Potential for Occurrence at SSFL. Moderate. There are no known records of vernal pool fairy shrimp on SSFL (USFWS 2010a). The nearest documented occurrence is approximately nine miles northwest of the project site at the Carlsberg vernal pools in Ventura County. However, this species is wide spread and because cysts are dispersed by other animals, they can be dispersed into locations that might not be considered suitable habitat, or into water that provide conditions allowing individuals to hatch in some years, but where conditions are not suitable for maintaining viable populations (USFWS 2007b). Limited vernal pool fairy shrimp surveys have been conducted on SSFL. During 2010 and 2011 surveys were conducted on several basins and depressions on rock outcrops within the NASA-administered property; however, the basins were not wet and positive identification was not possible (NASA 2014c). In 2010, nine vernal pools were identified in Areas I and IV and documented versatile fairy shrimp (*Branchinecta lindhali*), an unlisted species (Padre 2010). Subsequent surveys were conducted in 2014 that noted fairy shrimp presence in select pools but protocol surveys were not conducted and fairy shrimp species were not identified. Additionally, in 2014, a habitat assessment was conducted to identify potential suitable habitat for listed vernal pool branchiopods within 250 feet of proposed remediation impact areas in Boeing's Areas I, III, and portions of the SBZ (Padre 2015). These surveys identified 86 potential habitat features; however, only 77 were considered potential habitat for fairy shrimp. Potential vernal pool habitat occurs on SSFL, particularly in the sandstone outcrops. Pools generally occur in (1) eroded sandstone features ranging from small and shallow solitary pools to large and deep pool and chute complexes, (2) man-made habitat features including excavated areas or footprints remaining from a structure that had previously been removed and became inundated, and (3) topographic low points in recent remediation/restoration areas (Padre 2015). It is possible that not all of the vernal pools or vernally inundated areas on SSFL have

been mapped, and any additional ponded areas that could provide habitat for listed vernal pool branchiopods would need to be mapped and surveyed (USFWS 2010a).

5.1.4.3 Riverside Fairy Shrimp (*Streptocephalus woottonii*) FE

Description. The riverside fairy shrimp was listed as endangered on August 3, 1993 (58 FR 41384). It is a small, 0.56 to 0.92 inch (14 to 23 millimeters) long, aquatic crustacean in an ancient order of branchiopods, the Anostraca. The females carry their eggs in an oval or elongate ventral brood sac while the males can be distinguished by their second pair of antennae (Eriksen and Belk 1999).

Habitat. Suitable habitat is restricted to vernal pools and other non-vegetated ephemeral pools greater than 12 inches (30.5 centimeters) in depth. These pools retain water through the warmer weather of late spring and may hold water from as early as November continuing into April or May. Historically these crustaceans preferred vernal pool complexes with groups of 5 to 50 pools. However, now most of the complexes containing Riverside fairy shrimp have only 1 to 2 pools (USFWS 2008b).

Critical Habitat. Approximately 1,724 acres (698 hectares) of land in Ventura, Orange, and San Diego counties has been designated as critical habitat for the Riverside fairy shrimp (USFWS 2012).

Distribution and Range. This fairy shrimp is endemic to vernal pools from southwestern Riverside County, inland areas of Orange County and San Diego County, coastal areas of San Diego County, and northwestern Baja California, Mexico (USFWS 2008b). There is one recorded occurrence in Ventura County, just west of Simi and approximately 8 miles from SSFL (CDFW 2016a).

Primary Constituent Elements. The PCEs for Riverside fairy shrimp are (1) Ephemeral wetland habitat consisting of vernal pools and ephemeral habitat that have wet and dry periods appropriate for the incubation, maturation, and reproduction of the Riverside fairy shrimp in all but the driest of years; (2) intermixed wetland and upland habitats that function as the local watershed, including topographic features characterized by mounds, swales, and low-lying depressions within a matrix of upland habitat that result in intermittently flowing surface and subsurface water in swales, drainages, and pools; and (3) soils that support ponding during winter and spring which are found in areas characterized in PCEs 1 and 2 that have a clay component or other property that creates an impermeable surface or subsurface layer (USFWS 2012).

Life Cycle. Riverside fairy shrimp are usually observed from January to March. However, the hatching period may be extended in years with early or late rainfall. Individuals hatch, mature, and reproduce within 7 to 8 weeks of rainfall, depending on water temperature (Hathaway and Simovich 1996; Simovich and Hathaway 1997). Only a portion of the cysts may hatch when the pools refill in the same of subsequent rainy seasons. This partial hatching of cysts allows Riverside fairy shrimp to persist in extremely variable environments (USFWS 2008b).

Feeding. Riverside fairy shrimp feed on algae, bacteria, protozoa, rotifers, and bits of detritus (Eng et al. 1990; Eriksen and Belk 1999). They receive most of their required nutrients from detritus (decaying organic matter) that washes into pools from the adjacent upslope habitat (Eriksen and Belk 1999).

Threats. Threats include the loss of vernal pool habitat, urbanization, off-road vehicles, trash dumping, grazing and cattle trampling, and alteration of hydrology (USFWS 2008b).

Recovery Plan. A recovery plan for vernal pools of southern California is available for the riverside fairy shrimp (USFWS 1998a).

Period of Greatest Sensitivity within the SSFL. During the wet season when vernal pools are inundated or soils are moist.

Potential for Occurrence at SSFL. Moderate. Area IV includes limited vernal pool habitat, and there are no known records of riverside fairy shrimp within SSFL. The nearest documented occurrence is west of Simi Valley at Tierra Rejada Preserve (USFWS 2008b). Limited vernal pool fairy shrimp habitat assessments have been conducted on SSFL. During 2010 and 2011 surveys were conducted on several basins and depressions on rock outcrops within the NASA-administered property; however, the basins were not wet and positive identification was not possible (NASA 2014c). In 2010, nine vernal pools were identified in Areas I and IV and documented versatile fairy shrimp. Subsequent habitat surveys were conducted in 2014 that noted fairy shrimp presence in select pools but protocol surveys were not conducted and species were not identified. Additionally, in 2014, a habitat assessment was conducted to identify potential suitable habitat for listed vernal pool branchiopods within 250 feet of proposed remediation impact areas in Boeings Areas I, III, and portions of the SBZ (Padre 2015). These surveys identified 86 potential habitat features; however, only 77 were considered to provide potential habitat for fairy shrimp. Potential vernal pool habitat occurs on SSFL, particularly in the sandstone outcrops. Pools generally occur in (1) eroded sandstone features ranging from small and shallow solitary pools to large and deep pool and chute complexes, (2) man-made habitat features including excavated areas or footprints remaining from structures that had previously been removed and became inundated, and (3) topographic low points in recent remediation/restoration areas (Padre 2015).

5.2 State-listed Species (not including those that are already federally listed) and Species Meeting State Criteria for Listing as Endangered or Threatened, Including CRPR List 1B Species

Three State-listed species and four CRPR List 1B species evaluated for any potential to occur within the project areas are listed in **Table 5–2** and described below.

Table 5–2. State-Listed Species Having the Potential to Occur at SSFL

Common Name	*Scientific Name*	*Status*
Santa Susana tarplant	*Deinandra minthornii*	SR
Malibu baccharis	*Baccharis malibuensis*	CRPR 1B.1
Slender mariposa lily	*Calochortus clavatus* var. *gracilis*	CRPR 1B.1
Late-flowered mariposa lily	*Calochortus fimbriatus*	CRPR 1B.1
California screw moss	*Tortula californica*	CRPR 1B.2
Swainson's hawk	*Buteo swainsonii*	ST
Bank swallow	*Riparia riparia*	ST

SR = State listed as Rare; ST = State listed as Threatened; CRPR 1B = California Rare Plant Rank 1B (rare, threatened, or endangered in California or elsewhere .1 (seriously threatened in California); .2 (fairly endangered in California).

5.2.1 Plants

SSFL is known to support one plant species protected as "Rare" under the California Native Plant Protection Act of 1977 (Fish and Game Code Section 1900 *et seq.*) and additionally supports between 1 and 4 species with the CRPR of 1B (rare, threatened or endangered in California and elsewhere). The California Native Plant Protection Act (NPPA) was enacted in 1977 and allows the Fish and Game Commission to designate plants as rare or endangered. There are 64 species, subspecies, and varieties of plants that are protected as rare under the NPPA.

The NPPA generally prohibits the import into the state or take, possession or sale of NPPA-listed species. Some specific activities are exempt from regulation under the NPPA (Fish and Game Code Section 1913). The Fish and Game Commission has adopted regulations governing the take or possession of NPPA-listed native plants (CDFW 2015a). Incidental take may be authorized under

these regulations, unless CDFW determines that issuance of an Incidental Take Permit (ITP) would jeopardize the continued existence of the species.

The CESA was enacted in 1984 to parallel the Federal Endangered Species Act of 1983 and allows the Fish and Game Commission to designate species, including plants, as threatened or endangered. CESA makes it illegal to import, export, "take," possess, purchase, sell, or attempt to do any of those actions to species that are designated as threatened, endangered, or candidates for listing, unless permitted by CDFW (through an ITP). There are 156 species, subspecies, and varieties of plants that are protected as threatened or endangered under CESA. Plants listed as Rare under the NPPA retain their Rare status under NPPA and were not subsequently relisted under CESA.

During CEQA review, public agencies must evaluate and disclose impacts to the 220 plant species protected under the NPPA and CESA and in most cases must mitigate all significant impacts to these species to a level of less than significant. In the case of an ITP, impacts of the taking must be minimized, fully mitigated, and not jeopardize the continued existence of the species, while maintaining the applicant's objectives to the maximum extent possible.

In addition, during the CEQA process, public agencies must also address plant species that may not be listed under CESA or the NPPA, but that may nevertheless meet the definition of endangered, rare or threatened provided in CEQA (Section 15380) (e.g., plants with CRPR 1B status). CDFW works in collaboration with the California Native Plant Society and with botanical experts throughout the state to maintain an Inventory of Rare and Endangered Plants, and the similar Special Vascular Plants, Bryophytes, and Lichens List. Species on these lists (most notably those on CRPR Lists 1 and 2) may meet the CEQA definitions of rare, threatened or endangered (CDFW 2017). Regionally or locally rare species (e.g., Ventura County Locally Important Plant and Animal Species) may also meet these criteria and those species potentially occurring on SSFL are addressed in Appendix C.

5.2.1.1 Santa Susana Tarplant (Deinandra minthornil) SR, CRPR 1B.2

Description. Santa Susana tarplant was state-listed as Rare under the California NPPA in November 1978 and also has a CRPR of 1B.2 (rare, threatened, or endangered in California and elsewhere; fairly endangered in California) (CNPS 2016). Santa Susana tarplant is a perennial shrub in the sunflower family (Asteraceae) that grows up to 3.3 feet (1 meter) high and 10 feet (3 meters) wide, but is frequently much smaller. This drought deciduous plant has numerous stiff stems ascending from the base, with linear, glandular leaves and yellow flowers (Baldwin et al. 2012).

Habitat. Santa Susana tarplant is associated with sandstone rock outcrops within coastal sage scrub and chaparral habitats, which are common on the SSFL. In addition, on the SSFL, individuals are found rooting in rock crevices and in previously disturbed or sparsely vegetated areas (including cracks in paved areas) that are in very close proximity to occupied rock outcrops.

Critical Habitat. Not Applicable.

Distribution and Range. Santa Susana tarplant occurs at elevations that range from 919 to 2,493 feet (280 to 760 meters) and has been documented from about 30 locations in portions of the Simi Hills, Santa Susana Mountains, and Santa Monica Mountains of Los Angeles and Ventura counties (CDFW 2016a; **Figures 5–6** and **5–7**). An occurrence on west-facing cliffs on Conejo volcanic breccias in one location in the Santa Monica Mountains, north of Lake Sherwood is the only occurrence not associated with sandstone (EPA 2010).

Primary Constituent Elements. Not Applicable.

Life Cycle. Santa Susana tarplant blooms from July through October or November and reproduces by seed, although during surveys in November 2009 the tarplant was observed to be re-sprouting from the base following a fire (EPA 2010). It often dies back and re-sprouts when conditions are suitable.

Its distribution on the SSFL suggests good seed dispersal and establishment on suitable sites but it may have a low tolerance for competing vegetation.

Threats. Santa Susana tarplant is known from about 30 locations in Ventura and Los Angeles counties (CDFW 2016a). As of 2016, all of these occurrences are presumed to be extant; however, many are threatened by development, road construction, and possibly by nonnative species (CNPS 2016). Additionally, a large portion of known sites are also at risk from fragmentation of habitat, reduction of necessary pollinators, fire suppression activities, and random, naturally occurring extinction due to disturbances in small populations. The population trend at many of the sites is unknown and is decreasing at others. The Santa Susana tarplant population on SSFL is extremely important to the overall survival of the species.

Recovery Plan. Research studies on its reproductive biology, germination and growth, and habitat requirements are needed to develop a conservation strategy and recovery plan for this species (EPA 2010). Select areas of SSFL have been the subject of focused Santa Susana tarplant pollination studies conducted by the Pollinator Partnership, a San Francisco-based non-profit, on behalf of Boeing. Pollinator exclusion experiments (through the use of exclusionary netting on individual stalks) indicate that Santa Susana tarplant is highly dependent on pollinators for seed set (seed viability = 4.1% ± 7.4 when pollinators were excluded; seed viability = 65.5% ± 19.5 when flowers were open to pollinators) (Galea et al. 2016).

Period of Greatest Sensitivity within the SSFL. Year round.

Potential for Occurrence at SSFL. Present. Santa Susana tarplant is known to occur in substantial numbers (estimates range from about 10,000 to over 13,500 plants) in suitable habitat throughout the SSFL (**Figure 5–8**). Focused special-status species surveys on NASA administered properties (Area II and small portion of Area I) conducted in 2010 and 2011 identified more than 3,600 Santa Susanna tarplant individuals. The majority of the plants were found in Area II, with just over 300 plants recorded in the northern portion of NASA Area I (NASA 2014c). Surveys on Boeing managed properties (the majority of Area I and eastern portion of the SBZ) were conducted in 2008, 2010, and 2014 and estimated 4,635 to 8,000 individuals (Padre 2014). In 2014, a comprehensive survey of Area III mapped no less than 1,183 individuals and in 2015 2,922 individuals were documented in the Canyon in Area I (Padre 2016). In Area I, Santa Susana tarplant has colonized many formerly developed areas that have undergone removal of facilities followed by interim restoration where at least a few mature individuals were already locally present and were protected in place, providing a seed source for the species to colonize bare areas. Focused surveys for rare plants have not been conducted for the entire SBZ but a few Santa Susana tarplant locations have been identified there. However, limited suitable habitat is expected in the SBZ (Padre 2014).

Surveys on DOE managed properties in Area IV and the NBZ were conducted in 2009 and recorded 679 locations of Santa Susana tarplant, with many locations representing multiple plants. Based on preliminary analysis of the data recorded, the total amount of Santa Susana tarplant recorded in Area IV and the NBZ was roughly 850 individuals (SAIC 2009). Since 2009, additional locations have been identified and to date all observations cover approximately 66 acres in Area IV with an additional 61 acres in the NBZ (Figure 5–8). Nearly all of the Santa Susana tarplant in Areas I to IV and the NBZ occurred on sandstone bedrock outcrops, the plants typically rooting in fissures in the rock. On SSFL, Santa Susana tarplant individuals are frequently observed in cracks in pavement or on remediated sites near sandstone or rock outcrops populated by tarplants, which act as a seed source.

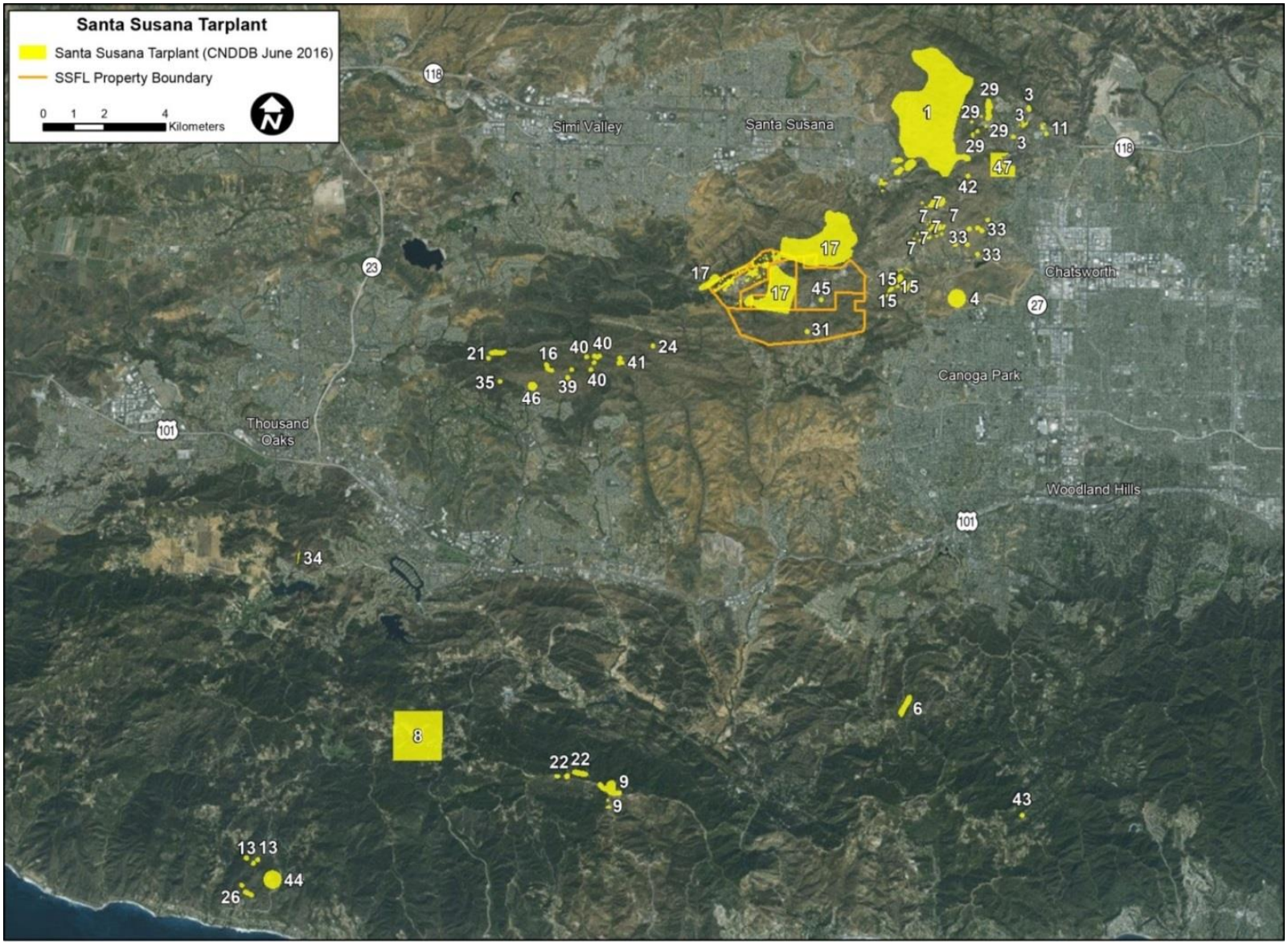
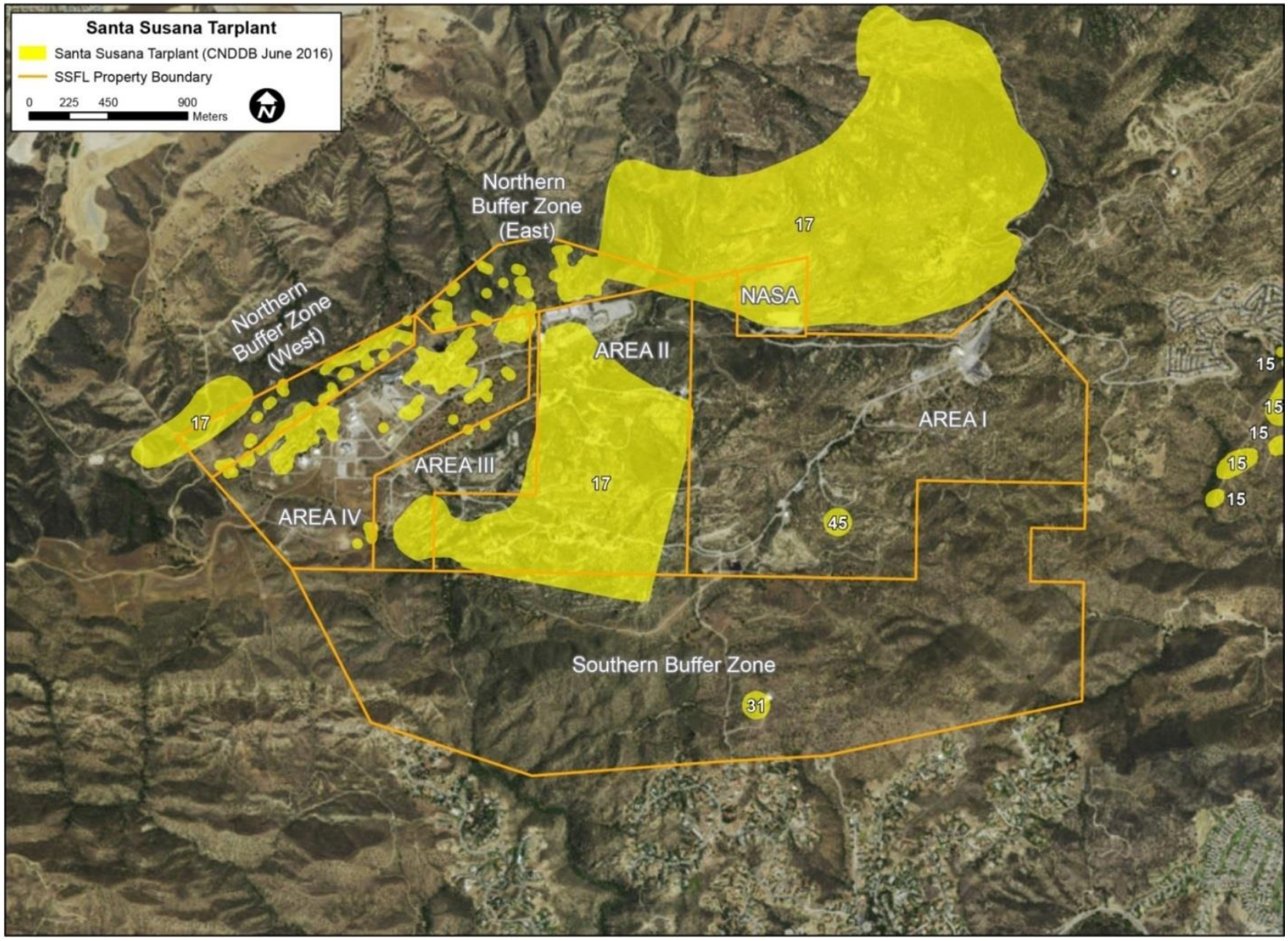
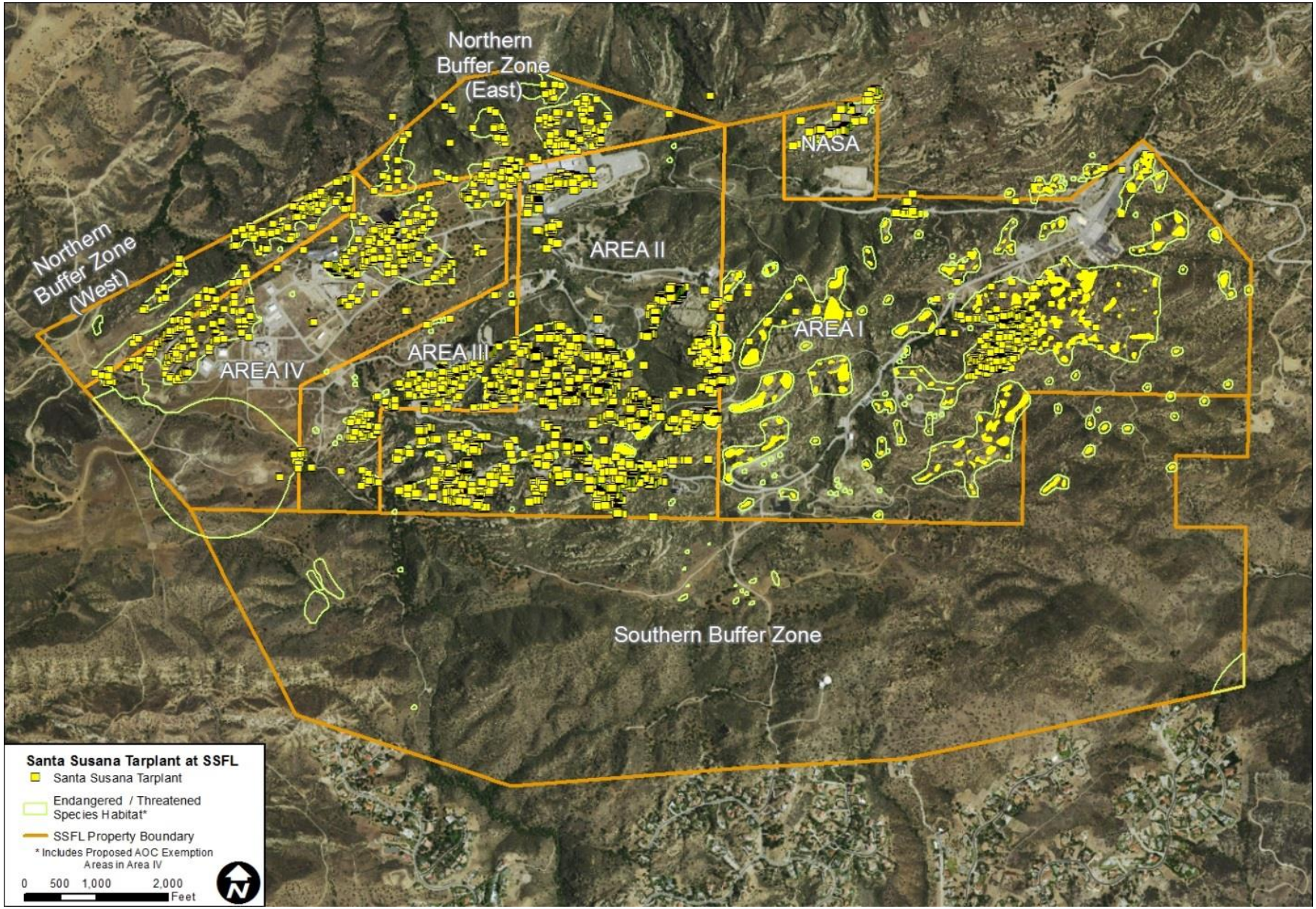


Figure 5–6. Santa Susana Tarplant Element Occurrences Rangewide (CDFW 2016a). Numbers correspond to individual element occurrences contained in the CNDDB.



2635 **Figure 5–7. Santa Susana Tarplant Element Occurrences in the SSFL Vicinity (CDFW 2016a)**



2636 **Figure 5–8. Santa Susana Tarplant Observations on SSFL**

Observations between 2009 and about 2012 suggested the population on the SSFL to be stable or possibly increasing. There is concern that subsequent unprecedented drought conditions may be causing recent increased mortality and reduced reproduction, however, this has not been evaluated in the field. Santa Susana tarplant has colonized many formerly developed areas, particularly in Area I, that have undergone removal of facilities followed by interim restoration in recent years where at least a few mature individuals were already locally present and were protected in place, providing a seed source for the species to colonize bare areas (Padre 2014). In Area IV, some plants were also observed in cracks in pavement or remediated sites near rock outcrops populated by tarplants, which act as a seed source. It is uncertain to what extent the Santa Susana tarplant will continue to persist in these formerly disturbed habitats as cover of competing vegetation increases over time.

The Santa Susana tarplant population on SSFL is the largest documented occurrence of the species and has the highest number of individuals reported (over 13,500). Substantial populations of Santa Susana tarplant on SSFL occur in Areas I, II, III, and IV and the NBZ (**Table 5–3**). The likely future land use of SSFL as open space increases the importance of SSFL to the conservation of this endemic species because most locations of occupied habitat outside the SSFL boundary are on unprotected land.

Table 5–3. SSFL Areas Occupied by Santa Susana Tarplant

Santa Susana Field Lab Area	*Total Area (acres)*	*Estimated Number of Santa Susana Tarplant Individuals*	*Suitable Habitat Occupied by Santa Susana Tarplant* [a] *(acres)*	*Percentage of Suitable Habitat Occupied by Santa Susana Tarplant*	*Estimated Density of Tarplants in Suitable Habitat (plants/acre)*
Area I	672	4,635-8,000	173	26	36
Area II	409	3,300	98	24	34
Area III	114	1,180	25	22	47
NASA (LOX site)	42	300	7	16	43
Area IV	290	850 [c]	66	23	13 [c]
Northern Buffer Zone (West)	79	See note c	29	37	See note c
Northern Buffer Zone (East)	102	See note c	32	32	See note c
Southern Buffer Zone [b]	1,143 [c]	No data	8	< 1	No data

LOX = liquid oxygen.

[a] Occupied suitable habitat is determined by drawing polygons around groups of tarplant locations encompassing similar habitat. Isolated individual points were buffered by 10 meters. On Area IV, polygons drawn in this manner were proposed as AOC exemption areas.

[b] The SBZ has not been fully surveyed but most of the SBZ lacks the distinctive sandstone outcrops occupied by Santa Susana tarplant.

[c] Total for Area IV includes plants from the NBZ (East and West).

5.2.1.2 Malibu Baccharis (*Baccharis malibuensis*) CRPR 1B.1, Ventura County Locally Important Species

Description. Malibu baccharis is a shrub with a CRPR of 1B.1 (rare, threatened, or endangered in California and elsewhere; seriously endangered in California) and a species of local concern (CNPS 2016; County of Ventura 2014a). It is a dioecious, deciduous shrub in the sunflower family (Asteraceae) that can reach up to 2 meters in height. The largest individuals have a basal woody trunk with gray, corky bark that can grow up to 35 millimeters in diameter. While other nearby baccharis

species share its glabrous, narrow leaves and long fruit, Malibu baccharis is distinguished by its thicker stems, larger number of flowers, and receptacles strongly alveolate only near the center (Beauchamp and Henrickson 1995).

Habitat. When originally described, Malibu baccharis was known from sedimentary (Calabasas Formation) and Conejo volcanic substrates in the central Malibu Creek drainage (Beauchamp and Henrickson 1995).

Critical Habitat. Not applicable.

Distribution and Range. Malibu baccharis occurs from about 492 to over 1,600 feet (150 to 305 meters) in elevation (CNPS 2016). In addition to the location on SSFL, it is currently known from about seven occurrences in Los Angeles County near Malibu, one occurrence in Orange County (Boyd 2002, CNPS 2016), and one location in Ventura County (ridgeline south of Oakbrook Regional Park in the Simi Hills [west of SSFL] at 1,617 feet in elevation) (Consortium of California Herbaria 2016). The Ventura County location is about 5 miles west of SSFL. On SSFL, Malibu baccharis is relatively abundant in the western part of Area IV where it occurs in relatively sparse chaparral in the same general area as Braunton's milk-vetch. The occurrence on SSFL is further inland and at higher in elevation than other known populations (**Figure 5–9**). The population size on SSFL is roughly estimated at about 200 individuals, although a formal count has not been made. Population estimates for the occurrences listed in the CNDDB are less than 25 individuals each. No population estimate was given in the Consortium of California Herbaria (2016) report for the Ventura County location west of SSFL.

Primary Constituent Elements. Not applicable.

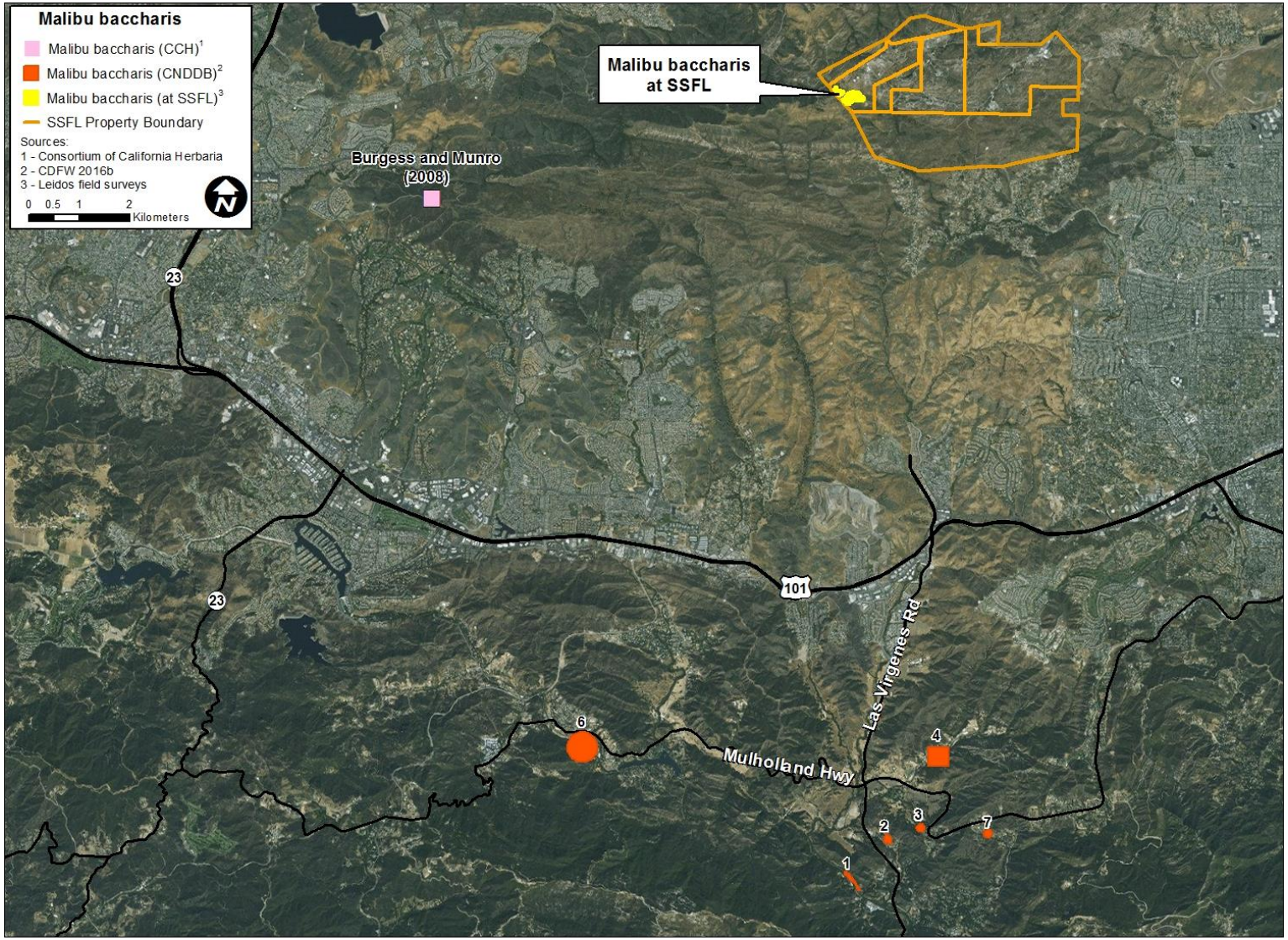
Life Cycle. Malibu baccharis blooms in August. In the late fall, there may be so few leaves that the plant appears broom-like. This is especially common with the male plants (Beauchamp and Henrickson 1995). In chaparral openings, Malibu baccharis grows in a radiating shrub form with many braches extending from the base, whereas in dense chaparral stands it is more limited in growth, consisting of only a few branches (Beauchamp and Henrickson 1995).

Threats. Threats include off-road vehicles and urban development, with urbanization being the biggest threat to the species (CNPS 2016).

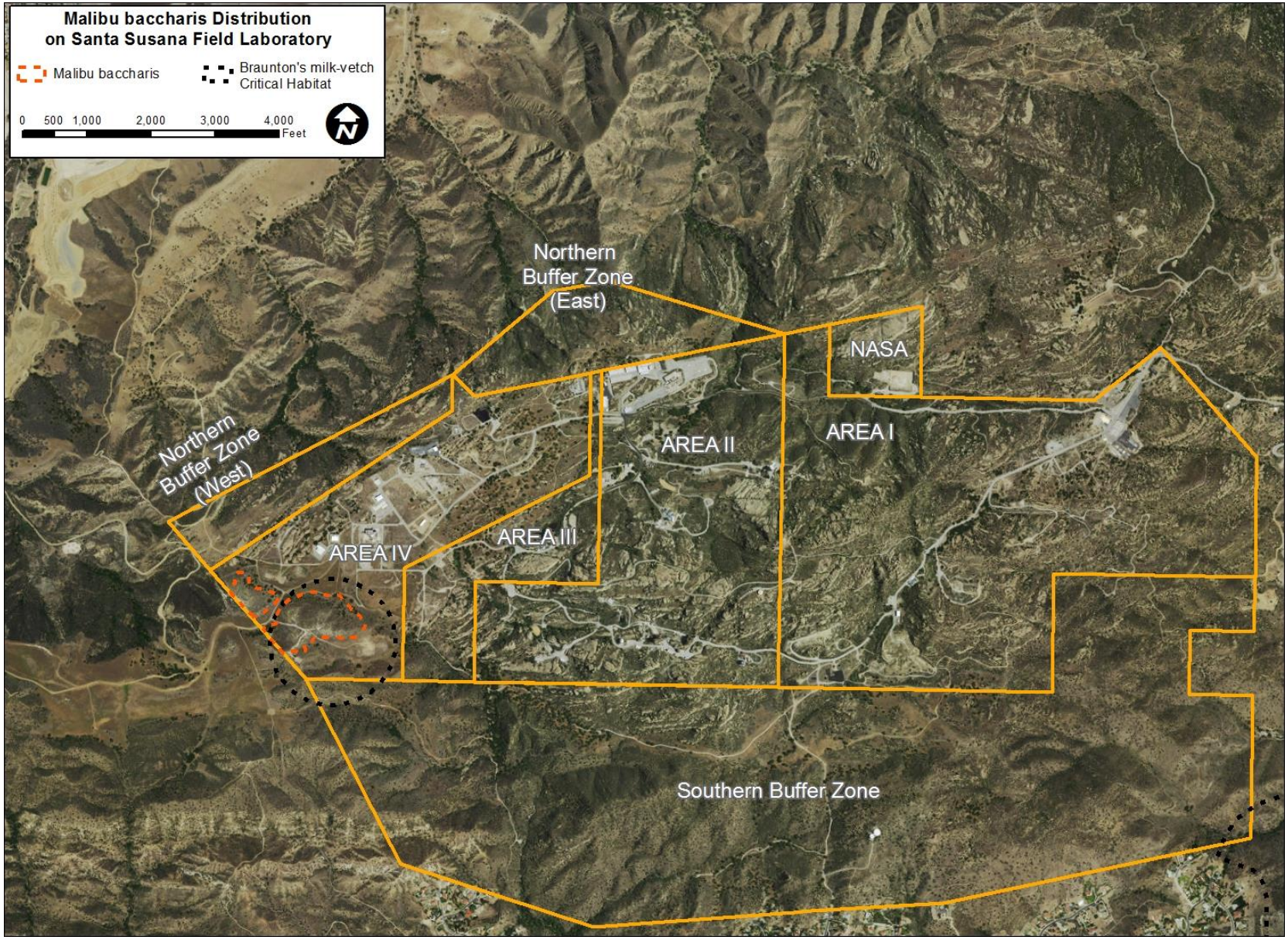
Recovery Plan. Not Applicable.

Period of Greatest Sensitivity within the SSFL. During periods of active growth, flowering, and seed production (March through September).

Potential for Occurrence at SSFL. Present. This species has been documented by the preparers from the western corner of Area IV (**Figure 5–10**) in the same location and habitat as Braunton's milk-vetch. Recent surveys conducted in NASA Areas I and II, Boeing Areas I and III, and portions of the SBZ did not report any occurrences of this species (NASA 2014c; Padre 2014); however, this inconspicuous shrub is easily overlooked. Complete surveys of the SBZ have not been conducted for this species and suitable habitat appears to be present, although suitable soil conditions are limited.



2698 **Figure 5–9. Malibu Baccharis Element Occurrences in the SSFL Vicinity (CDFW 2016b)**
(Note: One additional element occurrence in Orange County is omitted in this map view because of its distance from SSFL).



2699 **Figure 5–10. Known Distribution of Malibu Baccharis on SSFL**

5.2.1.3 Slender Mariposa Lily (*Calochortus clavatus var. gracilis*) CRPR 1B.2, Ventura County Locally Important Species

Description. Slender mariposa lily (*Calochortus clavatus* var. *gracilis*) has a CRPR of 1B.2 (rare, threatened, or endangered in California and elsewhere; fairly endangered in California) and is a species of local concern (CNPS 2016; County of Ventura 2014a). It is a perennial herb in the lily family (Liliaceae) with slender, straight stems and yellow flowers. The identity of this subspecies on SSFL needs confirmation. Boeing has identified clubhair mariposa lily (*C. clavatus* var. *pallidus*) on SSFL.

Habitat. Slender mariposa lily occurs in chaparral, coastal scrub, and valley and foothill grasslands, in shaded foothill canyons often on grassy slopes with sandy soils.

Critical Habitat. Not Applicable.

Distribution and Range. Slender mariposa lily occurs from about 1,050 to 3,280 feet (320 to 1,000 meters) in elevation and is currently known from about 105 occurrences in Los Angeles and Ventura Counties (CNPS 2016).

Primary Constituent Elements. Not Applicable.

Life Cycle. Slender mariposa lily blooms in May and June, grows from an underground corm (bulb-like structure) and dies back each year (CNPS 2016).

Threats. Threats include development, mining, non-native plants, vehicles, and possibly foot traffic (CNPS 2016).

Recovery Plan. Not Applicable.

Period of Greatest Sensitivity within the SSFL. During the period of active growth (from emergence of leaves following seasonal rainfall through seed production). It dies back to an underground bulb-like corm during the dry season.

Potential for Occurrence at SSFL. Present. The identity of this subspecies on SSFL needs confirmation. Undetermined mariposa lily subspecies have been identified by the preparers from several locations in Area IV (Figure 5–11) including near the RMHF and in the western portion of the site including within the Braunton's milk-vetch critical habitat. NASA biologists identified slender mariposa lily from one site in the middle of Area II in the same rock slab as three other unidentified mariposa lilies. (Figure 5–11). Boeing has identified Clubhair mariposa lily on SSFL, which does not have CRPR ranking.

5.2.1.4 Late-flowered Mariposa Lily (*Calochortus fimbriatus*) CRPR 1B.2, Ventura County Locally Important Species

Description. Late-flowered mariposa lily (*Calochortus fimbriatus*) has a CRPR of 1B.2 (rare, threatened, or endangered in California and elsewhere; fairly endangered in California) and is a speceis of local concern (CNPS 2016; County of Ventura 2014a). It is a perennial bulbiferous herb in the lily family (Liliaceae). Stems are slender, generally branched and flower color varies from pale cream to yellow to purple, dark red, or red-brown (Baldwin et al. 2012). It is also known as Weed's mariposa lily and was previously classified as *C. weedii* var. *vestus*. The identity of this plant on SSFL needs confirmation. Plummer's mariposa lily, which is similar in appearance, has been tentatively identified by the preparers in several locations in Area IV and in the SBZ (**Figure 5–11**). Plummer's mariposa is discussed separately below.

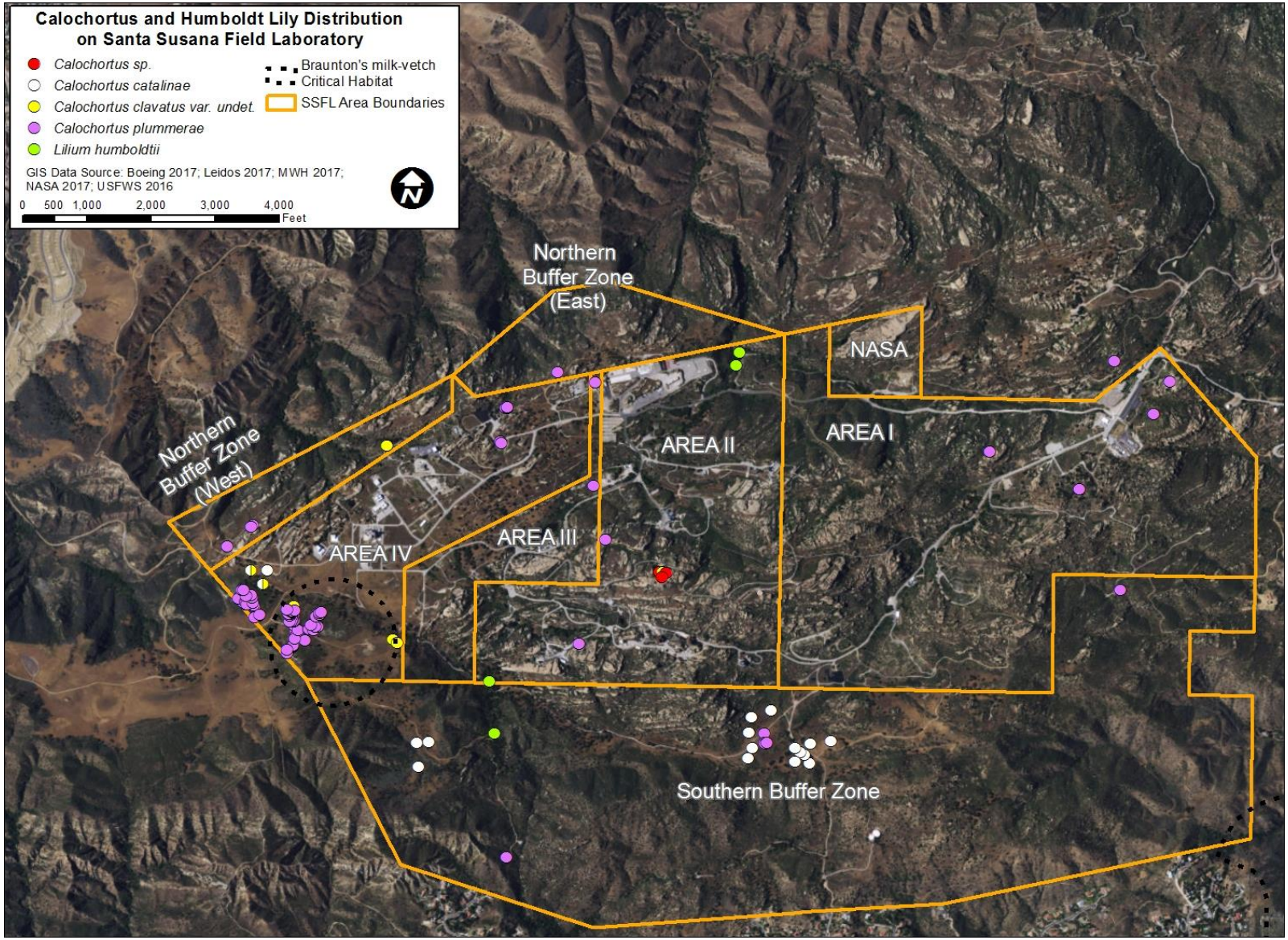


Figure 5–11. Distribution of Mariposa Lilies (*Calochortus* spp.) and Oscellated Humboldt Lily (*Lilium humboldtii* subsp. *oscellatum*) at SSFL

Habitat. Late-flowered mariposa lily occurs in chaparral, cismontane and riparian woodland (including coast live oak dominanted woodlands), often in serpentinite soils, which are not known from SSFL.

Critical Habitat. Not Applicable.

Distribution and Range. Late-flowered mariposa lily occurs from 902 to 6,250 feet (275 to 1,905 meters) in elevation and is currently known from about 89 occurences in Kern, Los Angeles, Monterey, Santa Barbara, San Luis Obispo, and Ventura counties.

Primary Constituent Elements. Not Applicable.

Life Cycle. Late-flowered mariposa lily blooms from June to August (CNPS 2016).

Threats. Threats include grazing, development, road maintenance, and fire suppression (CNPS 2016).

Recovery Plan. Not Applicable.

Period of Greatest Sensitivity within the SSFL. During the period of active growth (from emergence of leaves following seasonal rainfall through seed production). It dies back to an underground bulb-like corm during the dry season.

*Potential for Occurrence at SSFL. I*ts occurrence within the Action Area needs confirmation, but suitable-appearing habitat is present. Plants tentatively identified as this species during a field meeting in the Braunton's milk-vetch critical habitat were photographed but voucher specimens were not taken. Mariposa lilies observed during site visits in 2016 and 2017 at that locality and elsewhere on Area IV have been tentatively identified as Plummer's mariposa lily, which is discussed below in this BA.

5.2.1.5 California Screw Moss (*Tortula californica*) CRPR 1B.2

Description. California screw moss (*Tortula californica*) is in the Pottiaceae family and is endemic from central California to northern Baja California, Mexico. It forms loose tufts of erect, unbranched, hoary stems. The leaves are 1.7 to 2 millimeters long (excluding the awn), obovate to elliptic, with acute, rounded, or emarginated tips (Malcolm et al. 2009).

Habitat. The species occurs in thin soils over rock (Malcolm et al. 2009), and is commonly associated with sandy soils in chenopod scrub and valley and foothill grassland habitats (CNPS 2016).

Critical Habitat. Not Applicable.

Distribution and Range. California screw moss occurs from 33 to 4,790 feet (10 to 1,460 meters) in elevation and is currently known from 15 occurrences in California including Los Angeles, Monterey, Modoc, Riverside, Santa Barbara, San Diego, and Ventura counties as well as Santa Rosa Island, and it may occur elsewhere where conditions are favorable (CNPS 2016).

Primary Constituent Elements. Not Applicable.

*Life Cycle. I*t forms a cylindric, erect, more or less straight, long-exerted capsule ranging from 11 to 14.7 millimeters (urn and serta combined) (Malcolm et al. 2009).

Threats. Unknown, species seems to be rare but maybe infrequently observed because it is so ephemeral (short-lived) (Malcolm et al. 2009).

Recovery Plan. Not Applicable.

Period of Greatest Sensitivity within the SSFL. Since it is an ephemeral species, it will likely be most sensitive during the wet season when it is growing and reproducing.

*Potential for Occurrence at SSFL. I*ts occurrence with in the Action Area needs confirmation, but suitable-appearing habitat is present. The nearest location, documented in 2004, was about 11 miles southwest

of SSFL near Newton Canyon Falls just east of Zuma Canyon in the Santa Monica Mountains in chaparral habitat (CDFW 2016a).

5.2.1.6 Other Sensitive Plant Species that may be Affected by Project Activities

Other special status plant species that are present in the project area or have the potential to be affected by project activities are included in Appendix C, Table C–1. This table includes accounts for CRPR 2B, List 3, and List 4 plant species, such as Plummer's mariposa lily and Humboldt lily (*Lilium humboldtii* subsp. *ocellatum*) that have both been found on the SSFL, as depicted in Figure 5–10.

5.2.2 Wildlife

5.2.2.1 Swainson's Hawk (*Buteo swainsonii*) ST

Description. The Swainson's hawk (*Buteo swainsonii*) is state-listed as threatened under CESA. It is a broad-winged raptor between 19 and 22 inches (48 and 56 centimeters) in length with similar plumage for both sexes and females slightly larger than males. Swainson's hawks are polymorphic with pale, light, and intermediate morph plumages ranging from dark to light or rufous in color. Most Swainson's hawks have a sharp contrast between the wing linings and flight feathers. However, some of the darkest individuals do not have this distinction. The species is distinguishable from other Buteos by their more narrow body and wings (Bechard et al. 2010).

Habitat. The Swainson's hawk breeds in grasslands with scattered trees, juniper-sage flats, riparian areas, savannahs, and agricultural or ranch lands. It requires adjacent suitable foraging areas such as grasslands or alfalfa or grain fields supporting rodent populations. In many areas, the range included agricultural areas with crops that grow lower than most native grasses, making it easier to spot prey (Bechard 1982; Estep 1989; Woodbridge 1991). In California's Central Valley, nests are typically built at the edge of narrow bands of riparian vegetation, in isolated oak woodland, and in lone trees, roadside trees, or farmyard trees, as well as in adjacent urban residential areas (Estep 1989; England et al. 1995).

Critical Habitat. Not Applicable.

Distribution and Range. During the breeding season Swainson's hawks in California can be found mostly in the Central Valley and the Central Coast Ranges. However they can also be located in the Southern Transverse Ranges, Mojave Desert, Northern Coast Range Klamath Mountains, Southern Sierra Nevada White Mountains, Northern Sierra Nevada Cascades Range, and the Great Basin (Bloom 1980). The hawk winters mostly in Argentina, also extending east into Uruguay. The hawk is currently very rare as a spring and fall transient in coastal areas of southern California, having only about 5-6 records in Santa Monica, Corona, Temecula, and San Diego since 1970 (Garrett and Dunn 1981) and a record near Lake Casitas in Ventura County in 1979 (Webster et al. 1980).

Primary Constituent Elements. Not Applicable.

Life Cycle. Egg-laying occurs during March and April, with hatching occurring approximately 34-35 days later. Fledging occurs at around 43 days old which usually ends up being in the beginning or middle of August. Soon after, the young conduct their first few flights and can be gone from the nest within 10 days (Bechard et al. 2010).

Feeding. Young Swainson's hawks are fed rodents, rabbits, and reptiles. When not breeding, however, this hawk is unusual because it is becomes highly insectivorous, feeding on grasshoppers in particular (Bechard et al. 2010). The hawk often hunts from perches such as tree limbs, poles or posts, rocks, and elevated ground.

Threats. Threats include shooting, pesticides and other contaminants and toxins, degradation of habitat, disturbance at nest and roost sites, and collisions with stationary structures or moving objects such as power lines, fences, cars, and trains (Bechard et al. 2010).

Recovery Plan. Not Applicable.

Period of Greatest Sensitivity within the SSFL. During transient migration in the spring or fall.

Potential for Occurrence at SSFL. Very low as a spring or fall transient only (Garret and Dunn 1981; Webster et al. 1980).

5.2.2.2 Bank Swallow (*Riparia riparia*) ST

Description. The bank swallow (*Riparia riparia*) is state-listed as threatened under CESA. It is a small, slender songbird with a small bill, a brown back, and a white underside. It has a dark band extending across the chest and down to the middle of the chest. In addition, the species has long wings that extend 9.8 to 11.4 inches (25 to 29 centimeters). Juveniles look very similar but with a pale edge on the back feathers (Cornell Lab of Ornithology 2016).

Habitat. The bank swallow prefers riparian banks and bluffs of rivers and streams and other lowland habitat west of the desert for nesting habitat. The highly social species nests in large colonies ranging from 10 to almost 2,000 active nests (Garrison 1999). It requires vertical banks and cliffs with fine-textured, erodible, sandy soils near streams, rivers, lakes, or the ocean to dig a nesting hole. In eastern North America, the breeding colonies can be found in sand and gravel quarries.

Critical Habitat. Not Applicable.

Distribution and Range. The bank swallow is one of the most widely distributed swallows in the world. During nesting season it can be found across most of North America, Europe, and Asia. Most of the American population of bank swallows winter in Mexico. The bank swallow has only one definite recent nesting record in the Ventura County area and it was in the Santa Clara River estuary in 1976 (Webster et al. 1980; Garrett and Dunn 1981). In addition, there was one individual spotted in 1977 and three individuals spotted in 1979, with all occurrences in marsh/estuary and agricultural habitats near McGrath Beach and the Santa Clara River estuary (Webster et al. 1980).

Primary Constituent Elements. Not Applicable.

Life Cycle. Male bank swallows begin building the nests by using their bills, feet, and wings to dig burrows that will lead to the nest chamber. The burrows are perpendicular to the ground level and, when finished, are dug about 25 inches into the side of the bank. The male then continues to enlarge the tunnel upward and to both sides to form the nest chamber. The purpose of these burrows is to provide an area where the temperatures are more constant than outside. The female then builds most of the nest itself, constructing a flat mat of straw, grasses, leaves, or rootlets that she has torn from the exposed bank. The nest mat tends to be approximately 1 inch thick and 5 inches in diameter (Cornell Lab of Ornithology 2016).

Feeding. Bank swallows almost exclusively eat flying or jumping insects, such as bees, wasps, ants, butterflies, or moths. The swallows catch insects while flying, usually at a height of 50 feet above water or open ground, and only occasionally taking insects from the ground or from the surface of water. In addition, they can feed alone or in large groups (Cornell Lab of Ornithology 2016).

Threats. Threats include changes to its nesting habitat (vertical sand or mud banks and bluffs), including erosion-control, flood-control, and road building projects that remove these banks or make them less steep. In addition, construction projects that involve high mounds of gravel or dirt often attract nesting bank swallows, creating a high risk if the material is removed before the nesting season ends (Cornell Lab of Ornithology 2016).

Recovery Plan. Not Applicable.

Period of Greatest Sensitivity within the SSFL. During transient migration in the spring or fall.

Potential for Occurrence at SSFL. Extremely low based on lack of suitable habitat and lack of observations in the project region.

5.2.2.3 Other Sensitive Wildlife Species that may be Affected by Project Activities

Other special status animal species that are present in the project area or have the potential to be affected by project activities are included in Appendix C, Table C–2. This table includes species that have been identified by the CDFW as California species of special concern, fully-protected species, or included on the CDFW Special Animals List (CDFW 2016c), and locally important wildlife species identified by County of Ventura (2014a and 2014b).

6.0 Environmental Baseline and Cumulative Effects

6.1 Environmental Baseline

The 2,850-acre SSFL site is a study in contrasts. Highly disturbed formerly developed areas are surrounded by native habitats that have been subjected to relatively little disturbance and retain important values for native wildlife and vegetation. The limited access to the site and need for buffer zones have prevented encroachment of suburban and urban development and related impacts that are characteristic of surrounding areas, which makes the natural habitat values on SSFL of regional importance as habitat for endangered, threatened, and sensitive species and as a wildlife corridor. Of the 2,850 acres, less than 8 percent is currently classified as developed or disturbed; the remainder consists of native or naturalized vegetation and wildlife habitat (Table 4–1). Importantly, 850 acres (26 percent) of the 2,850-acre site is classified as key habitat (habitat supporting populations of endangered, threatened, or sensitive species in addition to regionally important habitats including riparian forest, oak woodland, and wetlands).

The previous history of development and use of SSFL has diminished the quality of the habitat for threatened, endangered, and rare species by removal of vegetation and disturbance of soils causing loss of habitat and enabling invasive species to predominate in some of the previously developed portions of the site. Combined with physical disturbance and paving, chemicals released in the past may affect the capacity of some soils, mostly in previously developed sites, to support native vegetation. Areas of past remediation and restoration attempts have not fully recovered the capacity to support native plant and wildlife species including threatened, endangered, and rare species. Remediation and decommissioning of the SSFL has the potential to rectify some of these impacts by causing the removal of buildings and some paved areas, however, the extent of soil removal to meet AOC LUT values will cause extensive and severe impacts on Area IV and the NBZ. The extent of soil removal on Boeing Areas I and III may also be expected to cause potentially significant impacts to biological resources, and feasible mitigation measures would be considered in DTSC's PEIR and the CMS, possibly including use of different risk- based land use scenarios, e.g., recreator, and other ecological considerations.

6.2 Cumulative Effects

Under the ESA, cumulative effects are the result of future state, tribal, local, or private actions that are reasonably foreseeable in the Action Area. Cleanup activities by others will be proceeding at the same general schedule as the cleanup by DOE, and will require close coordination with DOE in many regards, including keeping truck trips under the required daily maximum. The Boeing activities are directly addressed in this BA at the direction of the resource agencies because of their close spatial and temporal relationship to the DOE cleanup.

Continued suburban development in the SSFL vicinity could have cumulative impacts with the SSFL cleanup if the same resources (e.g., Braunton's milk-vetch, Santa Susana tarplant) that would be affected by the remediation activities would also be impacted by the suburban development. Most of the projects outside SSFL identified in the draft EIS being prepared by DOE for Area IV cleanup are generally sufficiently distant from SSFL to minimize the potential for cumulative biological effects with the remediation projects on SSFL. However, certain proposed projects (such as Sterling Properties in Dayton Canyon, and the Runkle Canyon Residential Project) that would be developed on land that supports endangered or threatened species or sensitive habitats of the same type that would be affected by SSFL remediation activities (e.g., oak woodlands and habitat for Braunton's milk-

vetch and Santa Susana tarplant) could have cumulative adverse impacts on those resources. CEQA review (e.g., Impact Sciences, Inc. 2012) and applicable plans, policies, and regulations would afford some protection to these resources. The degree of cumulative impacts would depend on how the projects are ultimately designed and permitted. The reasonably foreseeable future use of SSFL as open space/parkland with recreational human use (hiking, nature watching) and management as wildlife habitat after cleanup would be a compatible future use.

Beneficial cumulative impacts to biological resources could result from returning land to a more natural state after building removal and removal of radionuclides and other hazardous constituents during soil and groundwater cleanup.

7.0 Effects of the Action

Sections 7.1 to 7.5 will review the major effects of soils cleanup (to AOC LUT values for DOE and cleanup to risk-based values for Boeing), removal of buildings, and groundwater cleanup that apply to more than one species. These include:

- Disturbances associated with removal of vegetation and affected soils and issues associated with restoration after soil removal, including locating and importing suitable backfill, recontouring affected areas and restoring habitat and ecosystem function in affected areas.
- Ecological effects associated with groundwater remediation and building removal.
- Effects of onsite equipment operation, noise, and human activity such as avoidance of human activity by wildlife (temporary habitat loss), effects of dust on biota, nighttime lighting (nighttime lighting is not proposed at this time), incidental mortality to wildlife caused by excavation, hauling, and related onsite activity.
- Possible offsite ecological effects associated with obtaining and transporting material for backfill, hauling impacted soil to landfills, and construction-related traffic.

These factors apply throughout the effects analysis and apply to multiple species. As a result, effects common to many species are discussed in some detail first and provide necessary background to subsequent discussion of species-specific effects. The focus of the assessment is on effects of soil remediation because the potential extent and severity of soil remediation's adverse effects on endangered, threatened, and sensitive species are far greater than and offer less opportunity for impact avoidance, minimization, or rectification under the Proposed Action than do impacts of building removal or groundwater remediation.

This analysis will be followed in Section 7.6 by a discussion of the chemicals and radionuclides that are present in Area IV and the NBZ, their concentrations in the soil, and the relationship of these concentrations to AOC LUT values and to human-health and ecological RBSLs as proposed to be implemented by DOE. DOE's process approach to addressing chemicals and radionuclides in the field with reference to LUT Values and human health and eco RBSLs is described. This process approach is applicable to proposed AOC biological exemption areas in Area IV and the NBZ and offers an alternative to remediation to AOC LUT values by DOE in areas subject to cleanup under the AOC. The process approach uses a systematic, point-by-point, risk-based approach to identify chemicals and radionuclides for removal based on human health and ecological considerations, while minimizing the adverse effects of unnecessary soil removal. Examples of applying this approach in Area IV are provided. Although the Proposed Action is cleanup to AOC LUT values, Section 7.6 concludes with an analysis of impacts on Braunton's milk-vetch and Santa Susana tarplant in specific sample areas proposed as AOC exemption areas, comparing the impacts of cleanup to AOC LUT values with impacts of a risk-based approach in these sample sites using the process approach outlined in Section 7.6.

Sections 7.7 and 7.8 provide a species by species review of potential effects of the Proposed Action for federally listed species (including effects on designated critical habitat) and state-listed species (and other special-status species).

Section 3.6 (above) contains impact avoidance and minimization measures that are briefly referenced in this section including proposed measures for soil stabilization, revegetation, and related activities.

7.1 Removal of Impacted Soils

7.1.1 Adverse Effects Associated with Removal of Impacted Soils

Remediation of chemical and radionuclide constituents in the soils to AOC LUT values would result in the removal of vegetation as well as removal of topsoil and subsoil, the depth of which would depend on the depths of the soil exceeding AOC LUT values. The degree of disturbance caused by removal actions would vary from one area to another depending on the nature and extent of the removal actions required. Soil removal actions could directly impact individuals or habitat of state and federally listed and special status plant species through direct removal of or damage to individuals or habitats that support those species, or by accessing work areas associated with soil removal actions through habitats that support those species, although there may be some flexibility in determining access routes to minimize damage.

Table 7–1 summarizes the impacts of soil removal by Boeing and DOE on vegetation. Approximately 266.9 acres or about 11 percent of the SSFL area would be directly affected by soil remediation by Boeing and DOE. Additional, undetermined acreage would be affected by remediation within proposed AOC exemption areas, and by activities such as development and use of new access or egress routes, staging areas, or stockpiling areas that occur outside existing disturbance footprints. Excluding the 1,143-acre SBZ, which would not be appreciably affected by proposed remediation, approximately 16 percent of the site surface area would be directly impacted by soil removal by Boeing and DOE. [Soil removal conducted as part of NASA's remediation is considered separately in NASA 2013 (BA)]. Not surprisingly the soil removal activities are focused on previously disturbed areas and vegetation types that tend to occupy gentle to moderately sloping land, where most facilities, development, and human activities occurred during the lifetime of the site. Native vegetation types having proportionately high impacts include Venturan coastal sage scrub, coyote brush scrub, coast live oak woodland, southern California walnut woodland, coast live oak riparian woodland, southern willow scrub, mulefat scrub, wetland, and open water. In contrast, chaparral, laurel sumac scrub (mostly in the SBZ), rock outcrop/vegetated, steep dipslope grassland, and rock outcrop would have proportionately low impacts.

Table 7–2 provides the approximate acreage of Key Habitats, including Threatened, Endangered, and Sensitive Species Habitat and Sensitive Habitat, by SSFL sub-area included in soil remediation areas. The overall remediation area as a percentage of total area ranges considerably from sub-area to sub-area, from a low of 1 percent in the SBZ to a high of 48 percent in Area IV including the NBZ (Table 7–2). Similarly, the proportion of key habitats affected varies among subareas, ranging from 0.1 percent in the SBZ to 25 percent in Area IV. Designated critical habitat for Braunton's milk-vetch and CRF would be directly impacted by soil remediation actions under cleanup to AOC LUT values in Area IV, as described below under those species. No other designated critical habitat occurs on SSFL or would be affected by project activities.

Conservation measures, including conducting pre-construction surveys, identifying impact-minimizing access routes, deploying biological monitors during work activities, avoiding nesting season for migratory birds or incorporating adequate setbacks, and implementing soil stabilization and restoration techniques, would help to minimize direct impacts. However, where soil removal would occur in relatively undisturbed native habitats, such as those that support special status plant and wildlife species, it is unlikely that restoration and revegetation would result in habitat functionally equivalent to preexisting native vegetation for the reasons described in Section 7.1.2. Additionally, wildlife use of the habitat would be limited ("temporal habitat loss") during the time replacement habitat is being restored.

Table 7–1. Soil Removal Impacts for Boeing and DOE by Vegetation Type [a]

Vegetation Type (Code)	*Total Acres*	*Total Affected Acres [a]*	*Percent of Onsite Total*	*Outside SSFL Boundary (acres) [c]*
Shrublands				
Chaparral (C)	870.1	58.8	7	4.9
Laurel Sumac Scrub (LSS) [b]	307.8	-	-	-
Venturan Coastal Sage Scrub (VCSS)	87.6	17.5	20	-
Coyote Brush Scrub (CBS)	4.7	0.5	11	-
Rock Outcrop/Vegetated (ROV)	606.3	8.9	2	11.4
Foothill Woodlands (Upland)				
Coast Live Oak Woodland (CLOW)	204.7	42.6	21	2.8
Southern California Walnut Woodland (CWW) [b]	13.3	11.7	88	-
Grasslands				
Grassland (GR)	105.9	40.2	38	-
Steep Dipslope Grassland (SDG) [b]	7.8	-	-	-
Riparian				
Coast Live Oak Riparian Woodland (CLORW)	21.3	0.5	2	-
Southern Willow Scrub (SWS) [b]	1.5	0.1	7	-
Mulefat Scrub (MS)	4.1	0.9	22	-
Aquatic				
Wetland (W)	4.1	1.6	39	-
Open Water (OW)	0.8	0.8	100	-
Other Land Cover				
Rock Outcrop (RO)	0.6	<0.01	<1	0.2
Disturbed (Dis)	57.8	32.7	57	0.8
Developed (Dev)	94.4	37.2	40	0.7
Undifferentiated Exotic Vegetation (ExV)	5.9	0.9	15	0.1
Total	**2,398.7**	**254.9**	**-**	**20.9**

[a] Based on Boeing and DOE proposed soil remediation areas. Total affected areas includes DOE (Area IV and NBZs) and Boeing (Area I, III and SBZ) remediation areas (soil remediation, soil vapor and soil borrow pits) within the SSFL Boundary as depicted on Figure 3-2. Does not account for development/use of new access/egress routes and staging or stockpiling areas, or other factors. This analysis does not include affected acreage on NASA-administered properties (all of Area II and a designated portion of Area I)—See NASA (2013).

[b] Considered a rare or high priority vegetation type (CDFW 2010).

[c] Outside SSFL includes Boeing Remediation Areas (Soil Remediation areas North of Area I and Lead Shot Remediation Areas) and DOE Remediation Areas north of the NBZ, areas are depicted on Figure 3–2.

Loss of habitat due to remediation would reduce wildlife species populations in the affected area and the local vicinity, with the magnitude of the effect depending on the home range of the species. In addition, there would be mortality among less mobile species, which would be reduced by relocating individuals of sensitive species (e.g., coast horned lizard, a California Species of Special Concern) encountered during pre-construction surveys. If vegetation clearing were to occur during nesting season (February through August), bird species protected by the MBTA would experience nest failures within and possibly nearby the remediation area. This could be avoided by clearing vegetation outside of the nesting season, surveying the remediation area and adjacent habitat prior to vegetation clearing by a qualified biologist to verify that no nests are present, or creating suitable buffers around active nests to avoid nest failure.

3029 **Table 7–2. Approximate Acreage of Threatened, Endangered, and Sensitive (T/E/S) Species Habitat and Sensitive Habitat**
3030 **by SSFL Sub-Area Included in Boeing and DOE Soil Remediation Areas[a]**

SSFL Sub-Area	Acres	Remediation Area (acres)	Remediation Area (% of sub-area)	Key Habitats Affected (acres)					Total Key Habitats Affected (acres)	% of Key Habitat Total in SSFL Sub-Area [b]	Affected Vernal Pool/Rock Basin Count [d]	Affected Vernal Pool/Rock Basin (% of total)
				T/E/S Habitat [b]	Sensitive Habitats (acres not overlapping T/E/S Habitat areas) [b]							
					CLOW	CLORW	OR	Wetland [c]				
Area I	670	12.1	2	1.5	0.3	-	0.1 [e]	0.8 [e]	2.7	1.3	3	6
NASA [f]	42	--	--	-	--	--	--	--	--	--	--	--
Area II [f]	409	--	--	--	--	--	--	--	--	--	--	--
Area III	114	5.0	4	0.2	1.3	0.3	0.5	0.6	2.9	5.4	4	17
Area IV including NBZ [b]	472	226.1	48	96	23.4	0.2	0.4	0.1	120.1	50.7	3	38
Southern Buffer [g]	1,143	11.4	1	0.7	0.5	0	0	0	1.2	0.1	0	0

CLORW = Coast live oak riparian woodland; CLOW = Coast live oak woodland; NBZ = Northern Buffer Zone; OR = Other riparian. Acreages include DOE (Area IV and NBZ) and Boeing (Area I, III and SBZ) soil remediation areas (soil remediation, soil vapor and soil borrow pits) within the SSFL Boundary; areas are depicted on Figure 3-2.

[a] Does not include acreage that may be affected by heavy equipment accessing the affected soil areas.

[b] T/E/S Habitat and Sensitive Habitats in this table are proposed as AOC exemption areas in Area IV. To avoid double counting, acreage presented in this table for Sensitive Habitats is limited to that acreage outside the boundaries of T/E/S Habitat areas. Total Key Habitat by SSFL Subarea is given in Table 4-2.

[c] Wetland acreage totals are approximate and do not reflect jurisdictional determinations.

[d] Data for vernal pools reflect uneven survey effort. Survey effort for vernal pools and rock basins (potential listed vernal pool branchiopod habitat) was most concentrated near remediation areas in Areas I and III. It is likely that vernal rock basins are underrepresented in the data set; however they are generally unlikely to be affected by remediation activities because few project activities were conducted in rock outcrops where the basins are found.

[e] Wetland habitat in Area I does not include areas where OR habitat occurs at R-1 and Perimeter Ponds.

[f] This analysis does not include affected acreage on NASA-administered properties (all of Area II and a designated portion of Area I)—see NASA (2013).

[g] Biological surveys of the SBZ have been limited to general reconnaissance and surveys of specific sites. It has not received site-wide surveys.

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Soil removal actions would avoid direct impacts on aquatic and wetland habitats and biota, including vernal pools, where they occur in proposed exemption areas by employing human health and environmental risk-based cleanup methods to the extent feasible. Limited indirect impacts could occur from soil disturbance caused by personnel and equipment access and wind and water erosion, which would be localized, temporary, and reduced or avoided by implementing measures including pre-remediation surveys, identification of access routes, presence of biological monitors, and soil stabilization and restoration techniques. Indirect impacts to aquatic and wetland habitats, including vernal pools and associated biota, could also occur from erosion and movement of sediment or soil or migration of sediment or pollutants during soil remediation. Implementation of BMPs and mitigation measures implemented to protect surface water resources during soil removal and until restoration, or other means of stabilizing soils, would also protect aquatic and wetland habitats and biota from runoff and erosion.

Indirect impacts to existing sensitive plant and wildlife habitats and critical habitat may also occur through the introduction of invasive non-native plant species where ground surfaces are disturbed, providing opportunities for invasive non-native plant species to establish and move into adjacent, undisturbed native habitats. Minimizing the spread of non-native species could reduce impacts to sensitive species and habitats. This would be done through development and implementation of invasive species/weed management activities (see Conservation Measure 6), employing a combination of approaches to minimize entry of invasives onto the site, minimize their spread, and establish self-sustaining native vegetation communities resistant to weed invasion. Specific techniques could include power-washing earthmoving equipment prior to entry into soil removal areas, hand removal of invasives, mowing or trimming to reduce seed set, and control of invasives along roadsides and within imported backfill.

There is the potential for temporary indirect impacts to special-status plant species resulting from dust and debris being scattered and becoming airborne, despite measures to minimize dust generation. The extent of dust disturbance would depend on factors including local soil characteristics, topography, presence of vegetation, and weather conditions. Dust deposits may affect essential plant processes, including photosynthesis, respiration, and transpiration; dust also may cause increased incidence of plant pests and diseases (Farmer 1993). Indirect impacts would likely be localized, and any sensitive plant species located adjacent to or downwind of soil removal areas would likely recover quickly.

In summary, soil remediation would result in removal of vegetation and wildlife habitat causing mortality and disturbance of plants and wildlife, including federally and state-listed and special status species, within and adjacent to the affected area. With implementation of habitat restoration and revegetation measures, as well as measures to reduce or avoid impacts on federally or state-listed plants and wildlife, impacts would be reduced, but would remain substantial depending on the degree of habitat loss, the length of time required to restore vegetation, habitat function, plant and wildlife populations, and the degree to which restoration would be successful given the extensive vegetation removal and profound soil disturbance as well as the possible lack of suitable soil for use as backfill in select areas. Restricting nonessential equipment and personnel access to soil remediation areas using existing disturbed areas where feasible for access roads and laydown areas, restoring disturbed areas, and using BMPs to reduce dust, erosion, and sedimentation could reduce potential indirect impacts to federally or state-listed and special-status species or their habitat.

The following discussion is intended to highlight major issues associated with revegetation given the extensiveness of areas in which vegetation and soil would need to be removed and hauled off as part of remediation under the Proposed Action.

7.1.2 Issues Associated with Restoration of Habitat from which Vegetation and Soils Have Been Removed

The profound soil disturbance caused by remediation will require special measures to accomplish restoration of a self-sustaining native vegetation cover. The uppermost soil layers contain organic matter; seedbank; regenerative structures such as bulbs, corms, and root crowns; and beneficial soil organisms, including mycorrhizae. Where chemicals or radionuclides above AOC LUT values extend from the surface downward, there would be no opportunity to conserve the valuable uppermost soil layers or seedbank for later replacement as part of site restoration and revegetation. In addition, the soil structure would be lost and it will be difficult to obtain backfill material of the same soil type that is removed, especially in areas that support unique or rare plant species or assemblages that are associated with particular soil types. Where soil removal would occur in relatively undisturbed native habitats (such as coast live oak and walnut woodland, chaparral, and coastal scrub vegetation types), it is unlikely without extraordinary measures that restoration and revegetation would result in habitat similar in species composition and functionally equivalent to preexisting native vegetation.

Sources of suitable clean soil for backfill where soil has been removed have not yet been identified. The nature of the backfill (geologic parent material, texture, etc.) will partially determine the type of vegetation the site will support. If backfill is substantially different than the original soil, it may not be able to support vegetation similar to that present before remediation. In addition to having appropriate physical characteristics and meeting required cleanup standards, backfill sources need to be inspected and possibly treated to avoid introduction of invasive non-native species, which, after establishing on the remediation site, may move into adjacent areas, potentially affecting existing sensitive plant and wildlife habitats including critical habitat.

Current plans are to replace soil hauled off the site with a smaller volume of clean backfill. Boeing estimates backfill volume to be approximately 33 percent of the total excavation volume within Areas I and III and in the SBZ; whereas DOE estimates backfill volume to be approximately 75 percent of the total excavation volume within Area IV and the NBZ. The additional backfill percentage for DOE compared to Boeing's areas is to account for deeper excavations required in DOE's areas of responsibility. Special consideration will be required to restore drainage patterns and to avoid ponding of water during recontouring of the site. The shallower resulting soil is likely to affect revegetation in different ways depending on the plant community being restored.

It is essential that seed and propagules used for restoration be collected from the immediate project vicinity in order to maximize the potential for success of restoration efforts and to protect the genetic integrity of the native plant populations present onsite and in the surrounding areas. Given the large amount of materials that may be needed for revegetation, seed or propagule collection and propagation of plants will need to be initiated sufficiently in advance of remediation activities in order to generate adequate seed stock and container stock for use in revegetation, as described below.

Given the need for revegetation over extensive areas, seed and propagule collection would need to be initiated a minimum of three years before plant materials will be needed and nursery propagation and growing will need to start as soon as practicable after seed/propagule collection. The nursery facility and water sources will need to be ready in advance of the propagule collection. The large requirement for seed and for large numbers of container plants required for revegetation coupled with the year-to-year variation in native seed production drive the requirement to start early.

Exceptions would be certain plant species having very short-term seed viability, such as coyote brush and mulefat, which would need to be collected in the appropriate season (late summer or fall, when they ripen) immediately before they are needed in restoration.

Establishment of an onsite nursery and use of onsite sources for growing medium (i.e., clean, weed-free soil), will minimize risk of introducing foreign pathogens, such as water mold (*Phytophthora* spp.), weeds, and unwanted pests, such as Argentine ants (*Linepithema humile*), to the restoration area. Diseases and pests introduced in container stock grown offsite not only have the potential to adversely affect the restoration area and progress of restoration but also may subsequently disperse from restoration areas and have the potential to adversely affect adjacent or nearby undisturbed natural areas.

In areas of native habitat, removal of vegetation and soils from the site as part of remediation will make it very difficult to restore native vegetation similar in species composition, structure, and ecological function to that originally present. Restoration of a self-sustaining native vegetation community under such circumstances requires not only replacement of the soil with suitable backfill (similar to the original in texture and parent material) and establishment of native plants, but also rebuilding of soil structure, organic matter, soil microbial community (including mycorrhizae and beneficial soil microorganisms as well as invertebrates such as earthworms), and replacement of plant regenerative structures including corms, seed, and rhizomes.

Previously developed and contaminated sites on SSFL generally support non-native vegetative cover and removing it as part of soil remediation would have minimal impacts. Restoration of a self-sustaining native vegetation cover on these sites after remediation would still be a challenge however.

Extreme weather conditions during or following remediation could also have substantial effects. For example, exceptionally heavy rainfall events could cause substantial loss of soil (or backfill) in areas where vegetation has been removed and soil has been loosened (or where backfill has been stockpiled or recently placed). The inadvertent redistribution of these materials could affect revegetation and site restoration, both where the soil has been washed away and where it has been redeposited. Similarly, a severe drought following revegetation activities could cause loss of seed and transplant stock and necessitate replanting, which may require additional seed collection and propagation of transplant stock.

Where feasible, implementation of several measures would increase the odds of revegetation success. Boeing has had success in establishing vegetative cover dominated by shrubs typical of coastal sage scrub. Key aspects of their success include that they have been able to use sandy soils obtained on site as backfill and that the remediation sites have been generally very limited in areal extent, facilitating dispersal of native seed and soil organisms from the surrounding native habitat. Boeing has used seed mixes composed of species native to the site. Wherever possible these have been collected within a 20-mile radius of SSFL.

Where vegetative cover is predominantly native, salvaging the uppermost soil and litter layers and reserving them for use in revegetation will help inoculate the backfill with beneficial soil organisms, organic matter, and seedbank. While there may be limitations on this approach on sites where contamination extends downward from the surface, it can certainly be applied to sites were vegetation needs to be cleared to allow access for vehicles or pipelines and where equipment needs to operate (pumps) or wells need to be drilled. The degree to which surface layers of soil and organic matter can be reserved for use in restoration on sites where soil remediation is necessary needs further investigation.

Minimizing soil disturbance to the smallest possible area not only minimizes the area requiring restoration, but also facilitates colonization of the restoration site by native organisms due to greater proximity to adjoining habitat areas.

7.2 Building Removal

Ground-disturbing activities are associated with building removal, which would cause direct impacts on plant and wildlife communities within the disturbed area for each building. However, these impacts would be localized and following removal, the areas would be revegetated. In general, vegetation and wildlife habitats adjacent to buildings consist of cleared or weed-dominated areas, although oak trees and sandstone outcrops that may provide habitat for listed species occur nearby certain buildings. In addition, there have been incidental observations of nesting in buildings by native bird species such as American kestrel (*Falco sparverius*), house finches (*Haemorhous mexicanus*), and sparrows; and use by owls and raptors is likely. Therefore, there could be direct and indirect impacts on federally or state-listed and other special-status species that occur in buildings or their vicinities. Direct impacts include the mortality of individuals or removal of sensitive plant or wildlife species habitat. Critical habitat for the Braunton's milk-vetch or CRF is not located in or near the building removal areas; thus, there would be no impacts on critical habitat for these species. The extent to which buildings are used by federally or state-listed and other special-status species has not been investigated; however, the Santa Susana tarplant has been commonly observed by the BA preparers in the cracks of paved areas near sandstone outcrops in the SRE area and other locations, and thus could occur adjacent to the buildings to be removed. No other sensitive plant species have been observed or would be expected in the already highly disturbed habitat adjacent to the buildings to be removed. However, special status wildlife species such as the Townsend's big eared bat (*Corynorhinus townsendii*) (a candidate for state listing under the CESA) and birds protected under the MBTA may use the structures for shelter or nesting.

Where feasible, impacts to listed species (including the Santa Susana tarplant and Townsend's big eared bat) and habitat (including oak trees and sandstone outcrops) potentially supporting listed species would be avoided, minimized, or compensated through measures including pre-demolition surveys; scheduling building demolition outside the nesting season; restricting nonessential equipment and personnel access to affected areas; use of existing disturbed areas for access roads and laydown areas; and restoration or transplantation of species such as the Santa Susana tarplant. Successful tarplant re-establishment has occurred in other areas of SSFL.

Indirect impacts could occur from noise, dust, and the presence of equipment and personnel associated with building demolition. However, these impacts would likely be localized and temporary, and species would generally avoid such activities if they are mobile. The most likely response from wildlife in the vicinity of a building removal would be temporary movement to another area. Indirect impacts to existing sensitive plant and wildlife habitats and critical habitat could result from disturbed ground surfaces that provide opportunities for invasive non-native plant species to establish and move into adjacent, undisturbed native habitats. Minimizing the spread of non-native species would reduce impacts.

Overall, potential impacts on special-status animal species or their habitats from building removal would be temporary and short-term, could be mitigated or avoided, and would be unlikely to result in take of listed wildlife species. In addition, the removal of the buildings followed by native habitat restoration would have long-term beneficial impacts by removing habitat for nuisance species and replacing it with habitat capable of supporting sensitive wildlife species. Adverse impacts on individuals of the Santa Susana tarplant could occur if they are established next to buildings at the time that demolition occurs.

7.3 Groundwater Monitoring and Remediation

Groundwater may be monitored and allowed to naturally attenuate, or treated through a variety of methods as determined pursuant to the 2007 CO (DTSC 2007) and RCRA requirements. Groundwater monitoring in Area IV would include the installation of five additional monitoring wells, generally in accessible, previously disturbed habitat, resulting in localized and short-term impacts on vegetation and wildlife. Groundwater treatment methods are assumed to generally involve installation and operation of localized pumps and treatment units near existing wellheads. Assuming bedrock is removed to address the strontium-90 source at RMHF, up to 0.25 acres of previously disturbed habitat would be affected during activities such as excavation, stockpiling of excavated material, and operation of equipment. Treatment options involving dewatering would include extraction and treatment of groundwater and disposition in an environmentally safe manner, in compliance with permit conditions. Groundwater treatment units, piping, and pumps would generally be located along roadsides or in previously disturbed areas that are not vegetated or are occupied by weed-dominated herbaceous vegetation and wildlife habitat. Both the installation of groundwater monitoring wells or implementation of groundwater treatment methods would have minor, localized, and short- to medium-term (up to several years) impacts on vegetation and wildlife habitat, including federally and state-listed and special status species and their habitats. Implementing protective measures, including having a qualified biologist assist with siting of units, pumps, and piping, would enable impact avoidance or reduction. Some plumes may be subject to monitored natural attenuation with enhancements such as adding oxidants to encourage the chemical attenuation process. The addition of the enhancements would not adversely impact vegetation and wildlife habitat and impacts on threatened, endangered, or rare species would be avoided by measures such as conducting pre-activity surveys, designating access routes and work areas to avoid impacts on sensitive species, and restricting equipment and personnel to designated work areas.

7.4 Effects of Onsite Equipment Operation and Human Activity

Onsite equipment operation and continued human work activities have the potential to affect sensitive plant and wildlife habitats through direct mortality and habitat disturbance. Vehicles, equipment, and personnel used to excavate, haul, and conduct other related onsite activities could injure or kill individual sensitive plant (especially Braunton's milk-vetch and Santa Susana tarplant) or wildlife species if present. Onsite remediation activities, including operation of heavy equipment, have a potential to ignite fires. Fire ignitions would be most frequent under conditions of low moisture, low relative humidity, and high ambient temperatures, and are especially prevalent under Santa Ana conditions, during which dry air masses move from the interior to the coast, typically accompanied by high winds and hot temperatures. Fire potential would be highest in undeveloped areas with an abundance of natural fine fuels (e.g., dry grasses or finely branched shrubs that extend above the ground surface), dry soil, and low moisture content. Areas disturbed by onsite operations can cause indirect affects to sensitive plant and wildlife habitats by providing suitable conditions for invasive plants. These disturbed areas can act as corridors for the spread of invasive plant species into adjacent wildland areas potentially destroying or permanently altering habitat for sensitive plants or wildlife species. For example, ground disturbance from cleanup activities has the potential to promote expansion of invasive plants already on SSFL, particularly fountain grass (*Pennisetum setaceum*), tamarisk, and purple star thistle (*Centaurea calcitrapa*).

Noise (from the operation of vehicles, equipment, and activities of personnel) during onsite activities would temporarily disturb wildlife in the immediate vicinity of the activity and may cause them to avoid the areas. However, the frequency of noise (how constant or infrequent the noise source is) will affect species differently. For example, constant noise sources such as chronic industrial noise

can reduce nesting bird species richness and lead to a change in the species composition of avian communities towards more tolerant species (Francis et al. 2009). Like industrial noise, chronic traffic noise appears to have the potential to alter avian communities and reduce population densities for several bird species (Reijnen and Foppen 2006). Some species seem to be unaffected by noise while others may not come near roads when traffic volume is high (Bautista et al. 2004). For example, song sparrows (*Melospiza melodia*) living in urban environments in Oregon have been shown to adapt and maintain their populations in urban areas despite the noise (Woods and Yezerinac 2006), whereas horned lark (*Eremophila alpestris*) numbers decreased at distances of up to 1,640 feet (500 meters) from the edge of the road (DOT 2004). Noise associated with remediation activities, as well as an increase in general activity and human presence, could mask bird calls and invoke stress in birds. Nests in the immediate vicinity of activities, if present, would be susceptible to abandonment and depredation if active prior to the activity.

Overall, wildlife in the vicinity of a noise source would likely exhibit increased awareness or response, which would vary depending on animal group and other factors. The species groups most likely to be present in the immediate vicinity of the activity, and thus most likely to be affected by noise associated with continued operations, include small mammals, reptiles, and resident birds. Ungulates and large mammals that use SSFL may avoid accessing resources near construction activity while equipment and people are operating onsite but may possibly return during more inactive conditions (e.g., at night). Animals present would likely avoid the area, take cover, or temporarily suspend activity when the noise and human activity are ongoing. Other wildlife species might avoid the area of activity entirely.

Onsite equipment operation could result in an increase in dust from remediation areas, restoration areas, and traffic on unpaved areas that could affect vegetation (including Braunton's milk-vetch and Santa Susana tarplant) and wildlife habitat over the length of the remediation and subsequent restoration efforts, which could extend for several years. Equipment use would result in dust and debris being scattered and becoming airborne in the immediate vicinity of the cleanup area, although the extent of this dust disturbance would depend on a variety of factors including local soil characteristics, topography, presence of vegetation, and weather conditions. Dust deposits may affect essential plant processes including photosynthesis, respiration, and transpiration; dust also may allow the penetration of phytotoxic gaseous pollutants to nearby vegetation and may cause increased incidence of plant pests and diseases (Farmer 1993). Indirect impacts would be localized to the existing disturbed and/or developed open areas near the activity, to a lesser extent, adjacent vegetation. Additionally, operations associated with soil movement would be a source of sedimentation and could cause erosion that would impact sensitive plant species and wildlife species and critical habitat especially when sediment from long, steep slopes may enter a drainage, vernal pool, or aquatic habitat. Soil BMPs are expected to be sufficient to avoid, minimize, and mitigate impacts from sedimentation in applicable habitat.

Onsite equipment operation and human activity would follow strict protocols outlined in the SRAIPs and CMI Workplans, and measures would be implemented, as appropriate, to minimize or avoid impacts to sensitive plant and wildlife habitats habitat as outlined in Section 3.6. As such, the proposed action could result in the potential loss of sensitive plant and wildlife habitats and critical habitat within the action areas.

7.5 Offsite Effects

The Proposed Action requires the removal, hauling, and disposal of impacted soils to approved off-site locations. Restoration activities would further require the replacement of removed impacted soils with non-impacted backfill sourced and hauled in from off-site locations. Both the removal and

backfill of soils have the potential to result in adverse effects. Borrow sites for backfill have not been identified for DOE but would either be from existing sites operating under permits or new sites that would need separate environmental review and permitting. As a result, the primary off-site potential for adverse effects would be associated with hauling of impacted and non-impacted soils between the project site and their respective off-site locations. Because off-site components of haul routes would be limited to existing major routes, there is no likelihood of adverse effects on sensitive plant communities associated with these activities. However, any increase in traffic can result in an increase in noise disturbance to adjacent habitats, particularly increases at night or during sensitive breeding periods for birds. The magnitude of noise-related effects would be greatest along off-site routes in the immediate vicinity of the project site, such as Woolsey Canyon Road, which are not otherwise heavily used, but would be negligible on major roads due to the small incremental increase in trips that the project would require on heavily traveled thoroughfares. Similarly, the potential for collisions with wildlife increases with additional traffic. Least Bell's vireo and coastal California gnatcatcher both have the potential to occur in off-site locations; however, when considering the time and potential for a project vehicle to be present within the range of a sensitive species, and the likely potential for an individual to avoid the noise and disturbance associated with traffic, the magnitude of any adverse effect is negligible (so low as to be discountable).

7.6 Chemical and Radiological Contamination

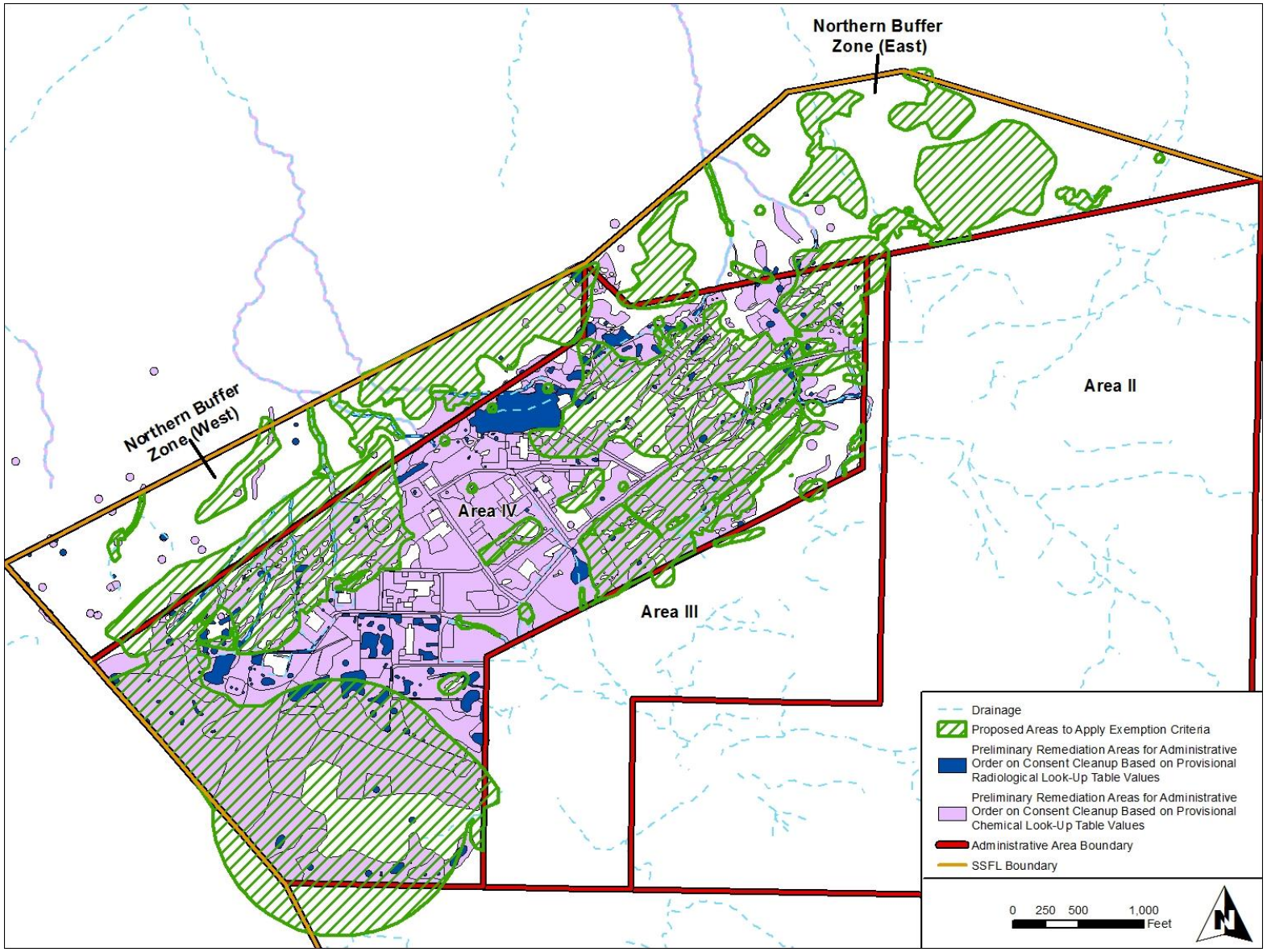
SSFL has been extensively sampled for chemical and radiological materials above background levels. For example, in Area IV alone, more than 8,000 soil samples have been collected and analyzed. Although chemical and radiological contaminants are present, they are not evenly distributed over the site, tend to be focused in previously developed areas, and often occur at relatively low levels compared to LUT values and/or RBSLs.

The proposed action analyzed in this BA is cleanup to AOC LUT values for DOE (Areas IV and NBZ) and to risk-based values for Boeing (Areas I, III, and SBZ). Because the AOC allows exceptions in certain areas (and a similar approach is being followed by Boeing) and because there are alternative approaches and standards that could be applied to the cleanup effort when the decisionmakers weigh the effects of the health risk and the occurrence of sensitive natural and cultural resources against the cleanup goals, this section provides an overview focusing on the following key aspects for Area IV and the NBZ:

- Identification of Proposed AOC exemption Areas
- Review of Chemical and Radionuclide Data and Determination of Exceedance Locations
- Field assessment
- Soil Cleanup Standard
- Ecological Effects if Contaminants Are Left In Place

7.6.1 Identification of Area IV and NBZ Proposed AOC Exemption Areas

Proposed exemption areas were identified for DOE's areas of responsibility in Area IV and NBZ in accordance with the 2010 AOC (DTSC 2010a) and included in the draft EIS prepared by DOE for Area IV remediation (DOE 2017). These originally proposed exemption areas include threatened, endangered, and sensitive species habitat and culturally sensitive areas and are shown in **Figure 7–1**. Figure 7–1 also identifies preliminary remediation areas in which radiological or chemical



3343 **Figure 7–1. Proposed Areas to Apply Exemption Criteria and Extent of Radiological and**
3344 **Chemical Constituents above AOC Look-Up Table Values**

materials exceed AOC LUT values.[11] **Table 7–3** lists sensitive biological resources known to occur in the originally proposed exemption areas within Area IV. See Section 4.2.2 "Key Habitat Areas" for a discussion of the biological resources considered most sensitive on SSFL. Figures 4–2 and 4–3, above, show the SSFL-wide occurrences of Key Habitats, which include Threatened and Endangered Species occurrences and other key habitats that are recommended in this BA to be treated as proposed AOC exemption areas and be subjected to risk-based remediation criteria rather than cleanup to AOC LUT values (DOE and NASA activities), or as areas where further consideration of appropriate risk based cleanup levels (e.g., ecological considerations) in DTSC's PEIR and the CMS may be appropriate (Boeing activities), because of their critical environmental importance. Proposed exemption areas will be formalized as exemption areas upon concurrence from USFWS and CDFW, and acknowledgment by DTSC.

Table 7–3. Sensitive Biological Resources in Proposed Exemption Areas within Area IV and NBZ Illustrated in Figure 7–1

Sensitive Biological Resource	***Status/Protection***
Braunton's milk-vetch (*Astragalus brauntonii)*	ESA – Endangered with designated critical habitat; CRPR 1B.1
Santa Susana tarplant (*Deinandra minthornii*)	CESA – Rare; CRPR 1B.2
Malibu baccharis (*Baccharis malibuensis*)	CRPR 1B.1
Mariposa lily (*Calochortus clavatus* var. undetermined: potentially var. *clavatus* or var. *gracilis*)	CRPR 4.3 (var. *clavatus*); 1B.2 (var. *gracilis*)
Plummer's mariposa lily (*Calochortus plummerae*) Potentially *C. weedii* var. *vestus* (*C. fimbriatus*) or *C. w*. var *intermedius*	CRPR 4.2 (*C. plummerae*); 1B.2 (*C. fimbriatus*); 1B.2 (*C. weedii* var. *intermedius*)
Catalina mariposa lily (*Calochortus catalinae*)	CRPR 4.2
California red-legged frog (*Rana draytonii*)	ESA - Threatened with designated critical habitat
Southern California black walnut (*Juglans californica*)	CRPR 4.2
Golden eagle (*Aquila chrysaetos*) nest sites	Bald and Golden Eagle Protection Act; California fully protected.
Vernal pools and vernal rock pools	Potential habitat for federally listed fairy shrimp

CESA = California Endangered Species Act; CRPR = California Rare Plant Rank; ESA = Endangered Species Act.

DOE would not take action in the proposed exemption areas unless it is demonstrated that levels of chemical or radiological constituents in the soil would pose a risk to human health or the environment in consideration of the future land use as open space habitat as required by the legally binding conservation easement on Boeing-owned property which includes Area IV and the NBZ (see Section 3.1).

Boeing's cleanup for its areas of responsibility (Areas I and III) is to risk-based standards rather than to LUT values. For those areas identified in Figures 4–2 and 4–3, above, as being of critical environmental importance, Boeing's remediation activities may result in potentially significant impacts to biological resources, and if so, DTSC's PEIR and the CMS would evaluate feasible mitigation measures in areas where such impacted biological resources are located.

Remediation of soil in Area IV and the NBZ presents considerable technical challenges and potential environmental impacts, as described in Section 7.1. The Area IV area that would be disturbed equates to 226.1 acres, based on the preliminary remediation areas in which radiological and/or chemical materials exceed LUT values (Table 7–2). These areas are identified in Figure 7–1. In Area IV, 120.1 acres of proposed exemption areas overlap with the 226.1 acres proposed for remediation if cleanup to radiological and chemical AOC LUT values was followed.

[11] The preliminary remediation areas shown in Figure 7–1 are predominantly depicted as being in Area IV and the NBZ. They will be further refined in DOE's SRAIP (to be approved by DTSC) to identify, as required by the AOC, any contiguous radiologic or chemical contamination of soil emanating from Area IV and the NBZ, such as the drainages leading into a pond and the pond itself, e.g., Silvernale Pond.

In recognition that the AOC provides exemptions to cleanup for species and habitats protected under the ESA, DOE has developed an alternative process for addressing impacted soil within proposed AOC exemption areas. In general, the sampling data will be reviewed to determine where soil impacts from contaminants are possible based on exceedance of a LUT value and an Eco and/or HH RBSL. These exceedance locations will be reviewed individually to determine whether the benefits from remediation would offset the habitat destruction associated with the soil removal. If it appears that remediation could be beneficial then a qualified biologist will visit these locations within the proposed exemption areas and assess the habitat condition and occurrence of sensitive plants. If the habitat is in "good condition" (supporting a preponderance of native species, soil profile appears intact) and/or the sensitive plant species is present at the exceedance, then the assumption will be made that the elevated level of the chemical is not adversely affecting the biota and species of concern sufficiently to warrant removal. The details of the field assessment are discussed later in this section.

Review of Chemical Data and Determination of Exceedance Locations

First, exceedance locations are identified for field assessment. Appendix D presents a summary of the analytical results for 186 chemicals in soil samples collected from Area IV, including both the previously developed portions of the site and the proposed exemption areas. For most of the chemicals over 1,000 samples were collected and analyzed.

To identify Chemicals of Concern (COCs) for use in exemption area cleanup decisions from the list of 186 chemicals, a simple screen was conducted. While developing the screen the following technical points were considered:

- The LUT values are local background concentrations or method detection limits. Because the LUT values are not based on toxicological thresholds, exceedance of a LUT value, while in conflict with the 2010 AOC, does not necessarily indicate that the exceedance would be harmful to humans, plants, and wildlife.
- Plants and wildlife can tolerate or adapt to levels elevated above background.
- Eco RBSLs may be below LUT values.

The screen used a conservative, simple, and objective process that eliminated contaminants with no to very low potential to harm ecological receptors. The first step was evaluating whether a chemical was ever detected in a sample. Chemicals not detected were eliminated from further consideration. The next step was comparing detected chemical results with their respective AOC LUT values. Chemicals not exceeding their respective LUT values were eliminated from further consideration. The third step involved comparison of the remaining chemicals with their respective human health and ecological receptor RBSLs. The RBSLs were developed specifically for SSFL soil remediation considerations in *the SSFL Standardized Risk Assessment Methodology* (SRAM, Rev. 2 Addendum (MWH Americas, Inc. 2014). Chemical results at soil sample locations that exceeded the residential human health and/or ecological receptor RBSL then became the COC for assessing soil cleanup in the proposed exemption areas. Those chemical contaminants not detected in any samples (34), those never detected above the LUT value (1), and those never detected above the Eco RBSL (114) were judged unlikely to cause adverse effects to plant and wildlife species. This step left 37 chemicals detected in at least one sample above the LUT value, the Eco RBSL, or both (see **Table 7–4**). In addition, chromium VI was added to Table 7–4 due to human health concerns but is not discussed further in this section.

To identify COCs for use in exemption area cleanup decisions, a multiple step process was followed.

3417 **Table 7–4. Selection of Chemicals of Concern for Area IV SSFL[a]**

Chemical Name	# of Samples Collected	# of Detections	Frequency of Detection	Units	LUT Value	# Samples Above LUT	Percentage Samples Above LUT	ECO RBSL Value	# Samples Above ECO RBSL	Percentage Samples Above ECO RBSL	COC Comments [b]
1,2,4-Trimethylbenzene	1530	8	0.52%	ug/kg			%	4000	1	0.07%	Only detected in 1 sample above Eco RBSL
1,2-Dinitrobenzene	3	3	100%	ug/kg			%	2500	2	66.67%	Only detected in 2 samples above Eco RBSL
1,3,5-Trimethylbenzene	1535	3	0.20%	ug/kg			%	4100	1	0.07%	Only detected in 1 sample above Eco RBSL
4,4'-DDE	1424	521	36.59%	ug/kg	8.6	44	3.09%	280	6	0.42%	Only detected in 6 samples above Eco RBSL
4,4'-DDT	1428	687	48.11%	ug/kg	13	49	3.43%	580	1	0.07%	Only detected in 1 sample above Eco RBSL
Antimony	5706	3135	54.94%	mg/kg	0.86	208	3.65%	2	84	1.47%	LUT exceedance < 1%
Aroclor 1248	5558	175	3.15%	ug/kg	17	75	1.35%	64	48	0.86%	Eco RBSL exceedances < 1%
Aroclor 1254	5567	1449	26.03%	ug/kg	17	520	9.34%	390	42	0.75%	Eco RBSL exceedances > 1%
Aroclor 1260	5567	1348	24.21%	ug/kg	17	335	6.02%	250	29	0.52%	Eco RBSL exceedances > 1%
Aroclor 5460	4872	1006	20.65%	ug/kg	50	132	2.71%	390	21	0.43%	Eco RBSL exceedances > 1%
Arsenic	5901	5807	98.41%	mg/kg	**46**	8	0.14%	**31**	22	0.37%	Only detected in 8 samples above LUT
Barium	5885	5883	99.97%	mg/kg	**371**	12	0.20%	**89**	3808	64.71%	LUT exceedances < 1%
Bis(2-ethylhexyl)phthalate	4451	1955	43.92%	ug/kg	61	300	6.74%	65000	1	0.02%	Only detected in 1 sample above Eco RBSL
Cadmium	5884	5248	89.19%	mg/kg	0.7	299	5.08%	0.81	228	3.87%	LUT & Eco RBSL exceedances <5%
Chromium	5883	5881	99.97%	mg/kg	**94**	12	0.20%	**14**	5228	88.87%	LUT exceedances < 1%
Chromium VI	3423	1754	51.24%	mg/kg	2	54	1.58%	30	0	0%	Above LUT and HH RBSL > 2.5%
Copper	5880	5871	99.85%	mg/kg	**119**	22	0.37%	**24**	326	5.54%	LUT exceedances <1%
Cyanide	1039	27	2.60%	mg/kg	0.6	6	0.58%	1.8	1	0.10%	Only detected in 1 sample above Eco RBSL
Heptachlor Epoxide	1418	79	5.57%	ug/kg	0.24	24	1.69%	6.5	2	0.14%	Only detected in 2 samples above Eco RBSL
Lead	5909	5890	99.68%	mg/kg	**49**	117	1.98%	**39**	168	2.84%	LUT and Eco RBSL exceedances < 5%
Lithium	5570	5561	99.84%	mg/kg	**91**	1	0.02%	**87**	1	0.02%	Only detected in 1 sample above Eco RBSL
Manganese	4804	4804	100%	mg/kg	**1120**	9	0.19%	**920**	15	0.31%	Only detected in 9 samples above LUT
MCPA	1273	302	23.72%	ug/kg	**761**	75	5.89%	**610**	107	8.41%	LUT & Eco RBSL exceedances < 10%
Mercury	6005	3152	52.49%	mg/kg	0.13	304	5.06%	1.7	52	1.65%	LUT and Eco RBSL exceedances < 5%
Molybdenum	5866	4770	81.32%	mg/kg	**3.2**	46	0.78%	**1.3**	247	4.21%	LUT and Eco RBSL exceedances < 5%

Chemical Name	*# of Samples Collected*	*# of Detections*	*Frequency of Detection*	*Units*	*LUT Value*	*# Samples Above LUT*	*Percentage Samples Above LUT*	*ECO RBSL Value*	*# Samples Above ECO RBSL*	*Percentage Samples Above ECO RBSL*	*COC Comments* [b]
Nickel	5881	5865	99.73%	mg/kg	**132**	7	0.12%	**30**	198	3.37%	Only detected in 7 samples above LUT
Perchlorate	3655	131	3.58%	ug/kg	1.63	83	2.27%	7700	7	0.19%	Only detected in 7 samples above Eco RBSL
Phenanthrene	5747	1977	34.40%	ug/kg	3.9	920	16.01%	13000	3	0.05%	Only detected in 3 samples above Eco RBSL
p-Terphenyl	1547	19	1.23%	mg/kg			%	5.4	3	0.19%	Only detected in 3 samples above Eco RBSL
Selenium	5894	3846	65.25%	mg/kg	1	231	3.92%	1.5	54	0.92%	Eco RBSL exceedances < 1%
Silver	5913	4185	70.78%	mg/kg	0.2	405	6.85%	29	16	0.27%	Eco RBSL exceedances < 1%
Tetralin	872	2	0.23%	ug/kg			%	290000	1	0.11%	Only detected in 1 sample above Eco RBSL
Total TEQ_BAP	5708	2992	52.42%	ug/kg	4.47	2992	52.42%	310000	2992	52.42%	Highest percentage of Eco RBSL exceedances
Total TEQ_Dioxin	4687	3979	84.89%	pg/g	0.912	1324	28.25%	5	480	10.24%	2nd highest percentage of Eco RBSL exceedances
Trichloroethene	1607	15	0.93%	ug/kg	5	6	0.37%	797	1	0.06%	Only detected in 1 sample above Eco RBSL
Vanadium	5875	5874	99.98%	mg/kg	**175**	1	0.02%	**16**	5844	99.47%	Only detected in 1 sample above LUT
Zinc	5901	5900	99.98%	mg/kg	215	130	2.20%	320	84	1.42%	LUT & Eco RBSL exceedances < 5%
Zirconium	5576	3967	71.14%	mg/kg	**19**	1	0.02%	**8**	70	1.26%	Only detected in 1 sample above LUT

mg/kg = milligram per kilogram; ug/kg = microgram per kilogram; pg/g = picogram per gram; COC = chemicals of concern; LUT = Look-Up Table; RBSL = risk-based screening level.

[a] In general, all chemicals in this table were detected above the LUT and Eco RBSL in at least one sample. Those chemical contaminants not detected in any samples (34), those never detected above the LUT value (1), and those never detected above the Eco RBSL (114) were screened out from the total list of 186 chemicals.

[b] All chemicals not screened out in footnote (a) were retained as COCs. Chromium VI was added to table because it was detected above the HH RBSL in greater than 2.5 percent of the samples.

Notes:

The locations of exceedances for each COC in the proposed exemption areas will be determined. Field assessment will occur in the proposed AOC exemption areas for any COC with an Eco RBSL exceedance if the Eco RBSL is above the LUT. If the Eco RBSL is below the LUT, then field assessment is only required at locations above the LUT.

Boldface indicates COCs with a LUT value above the Eco RBSL.

These 37 chemicals are identified as COCs. A review of Table 7–4 indicates that a number of the 37 COCs would be expected to cause negligible effects to plants and wildlife. For example, 18 of the COCs were detected in 10 or fewer samples above either the Eco RBSL or LUT. However, these COCs were retained for analysis so that an evaluation of cumulative effects at individual locations could be conducted.

As described in Section 7.4.2.1, Area IV was subdivided into smaller data evaluation units by location. The COC evaluation process described above was repeated for each unit allowing for the identification of contaminant "hot spots".

One chemical not included in Appendix D was total petroleum hydrocarbon (TPH) despite the fact that there are a number of LUT exceedances for TPH. There are three reasons suggesting that the TPH exceedances are not a concern in most locations. First, as noted previously, the LUT values are local background concentrations or method detection limits. Because the LUT values are not based on toxicological thresholds, exceedance of a LUT value, while in conflict with the 2010 AOC, does not necessarily indicate that the exceedance would be harmful to humans, plants, and wildlife. Second, while an Eco RBSL is not available for TPH there are values available for comparison purposes. For example, the State of New Jersey established an ecological screening value of 1,700 mg/kg (milligrams per kilogram) that is applicable to all petroleum hydrocarbon discharges if and only if a sensitive environmental receptor is potentially impacted by petroleum hydrocarbon contamination (NJDEP 2008). NJDEP (2010) further noted that "The 1,700 mg TPH/kg ecological screening level was established following a literature search and a review of the pertinent documents. There are clear adverse effects on soil organisms above this TPH concentration. Below 1,700 mg/kg TPH, adverse effects to ecological receptors are possible but not likely and further ecological evaluation in most cases is not warranted. If data from contaminated site soil are above 1,700 mg/kg and a sensitive ecological receptor is potentially impacted, the soils will be either remediated to 1,700 mg/kg or a site-specific risk-based ecological remediation goal will be determined from more rigorous biological testing." While 1,700 mg TPH/kg soil criterion was not used for screening purposes in the BA, the screening value suggests that the LUT of 5 mg/kg is overly conservative. Third, chemical analysis was conducted to determine the nature of the extractable fuel hydrocarbons (EFH) in the SSFL soil used in the bioremediation microcosm study. The chemical analysis determined that a large portion of what is being reported as EFH is actually natural organic material (Cal Poly San Luis Obispo 2014). As a result, a large portion of the TPH exceedances would be attributed to natural organic matter rather than man-made petroleum hydrocarbons. Based on the information presented above, it is likely that the preliminary remediation area in purple in Figure 7–1 covers a larger area than required because a considerable portion of the purple area is represented by TPH exceedances of the LUT of 5 mg/kg.

Although not listed in Appendix D, TPH was indirectly evaluated. Risks associated with TPH impacts are commonly included in risk assessments based on the petroleum constituent concentrations rather than the TPH results. Calculating RBSLs for mixtures of petroleum is difficult because of the varying or unknown toxicities and chemical properties of many of the individual petroleum hydrocarbon constituents. In addition, when mixtures of petroleum hydrocarbons are present at a site, there are potentially too many individual constituents present for practical evaluation. Lastly, even when the nature of the original TPH source is known, the physical, chemical and toxicological properties of the TPH contamination may be very different from the original material due to weathering. For these reasons, TPH also was indirectly evaluated using RBSLs for the most well-studied and toxicologically important constituents as individual compounds, such as BTEX and polycyclic aromatic hydrocarbons (PAHs) in Appendix D.

Radionuclides

EPA collected and analyzed soil, groundwater, and surface water for a broad range of potential radiological contaminants in Area IV. In all, EPA collected 3,487 soil samples and 55 sediment samples for radiological characterization. Cesium-137 and strontium-90 were the two site-related radionuclides most frequently observed in the samples. Results of the radiological characterization effort are presented in the *Final Radiological Characterization of Soils, Area IV and the Northern Buffer Zone,*

Area IV Radiological Study, Santa Susana Field Laboratory, Ventura County, California (HydroGeoLogic, Inc. 2012).

Soil samples were analyzed for up to 55 radionuclides, depending on the operational history of the area being sampled; not all samples were analyzed for all radionuclides. Of the 55 radionuclides analyzed, 25 were reported as exceeding EPA's Field Action Level (FAL) in one or more samples, and 17 of those radionuclides were naturally occurring radionuclides and most exceedances were attributed to variation in background levels by EPA. The remaining 8 radionuclides reported by EPA could be attributed to site operations. These include americium-241, cesium-137, cobalt-60, curium-243/244, nickel-59 plutonium-238, plutonium-239/240, and strontium-90 (HydroGeoLogic, Inc. 2012).

As shown in **Table 7–5**, most of these 8 radionuclides related to site operations were so infrequently detected above the FAL as to be of no concern to ecological receptors because exposure to elevated concentrations would be extremely limited. DOE (2002) developed a screening approach whereby the concentration of a radionuclide is divided by a biota concentration guide (BCG) for that radionuclide. BCGs are screening values that incorporate default exposure assumptions (DOE 2002). The BCG fractions are then summed because the DOE requirements and recommendations are based on the total weighted absorbed radiation dose rate from all radionuclides. This procedure is termed an initial sum of fractions approach. If the sum of fractions is less than one then the analysis can stop because the dose to a terrestrial receptor does not exceed the recommended dose limits for protection of terrestrial plants and animals.

Regardless of how frequently the 8 remaining radionuclides were detected above the FAL, those with BCGs were subjected to further screening. First, the maximum of the median concentration from all of the 9 soil sub-areas in Area IV was compared to the BCG for those 5 radionuclides with BCGs. The median was used for the site radiological data because the sampling was conducted in a non-random, manner, and the median makes no assumptions about the population distribution. It should be noted that, because of the number of sampling results included in each data set, there was very little difference between the median and arithmetic mean. Only detections exceeding the EPA FAL for radionuclides were used in calculating the medians which resulted in a conservative overestimation of potential impacts. However, applying these results to the impact calculations for potential remediation areas within a subarea was considered to be a fair representation of those areas by DOE and also provided a conservative basis for assessing the impacts from the entirety of each subarea. The maximum median concentration for americium-241, cobalt-60, and plutonium-239/240 were well below the BCGs (Table 7–5).

As noted previously, cesium-137 and strontium-90 were detected more frequently above the FAL than the other 6 radionuclides. However, the maximum of the median concentrations from all sub-areas for both of these radionuclides also were below the BCGs. In addition to reviewing the maximum of the median concentrations, all detections above the FAL were reviewed to determine how many individual locations were above the BCGs. No detections were above the BCGs for americium-241, cobalt-60, and plutonium-239/240. Only one sample location in sub-area 6 was slightly above the BCG for strontium-90 (see Table 7–5). Four samples from three locations in soil sub-area 6 (in the eastern part of Area IV) were above the BCG for cesium-137. While the initial sum of fractions would be above one for these locations, all are proposed for remediation to the LUT values because these locations fall outside the proposed biological exemption areas. In the event that remediation is conducted, no further evaluation is required because there are no concerns for terrestrial plants and animals.

Table 7–5. Summary of Area IV Radionuclide Evaluation for Ecological Receptors

Radionuclide	*Total Samples with a Detect above the FAL*	*Maximum Median Concentration (pCi/g)*	*Biota Concentration Guide (pCi/g)*	*Summary*
Americium-241	3	0.059	4,000	No ecological concern – infrequently detected above FAL; maximum median concentration well below BCG
Cs-137	291	1.2	20	No ecological concern - maximum median concentration below BCG; only 4 detections above FAL also above BCG (196, 74.9, 46.4, and 24.3 versus 20 pCi/g). These locations (6-00290, 6-00293, and 6-00306 [0-0.5 foot and 0.5 -1 foot) in the eastern portion of Area IV are outside the proposed biological exemption areas and scheduled for removal to the LUT value.
Cobalt-60	4	0.048	700	No ecological concern – infrequently detected above FAL; maximum median concentration well below BCG.
Curium-243/244	2	0.065	NA	No ecological concern – infrequently detected above FAL
Ni-59	1	24	NA	No ecological concern – infrequently detected above FAL
Pu-238	2	0.049	NA	No ecological concern – infrequently detected above FAL
Pu-239/240	20	0.079	6,000	No ecological concern – maximum median concentration well below BCG
Sr-90	143	1.0	20	No ecological concern - maximum median concentration below BCG; only 1 of 143 detections above FAL also above BCG (21.3 versus 20 pCi/G). This location (6-00290) in the eastern portion of Area IV is outside the proposed biological exemption areas and scheduled for removal to the LUT value.

pCi/g = picocuries per gram; BCG = biota concentration guide; FAL = Field Action Level.

7.6.1.1 Review of Contaminants in Proposed AOC Exemption Areas

Due to the large number of samples collected, Area IV and the NBZ were divided into grids and the individual exceedances for each COC were reviewed for a few example grids. The purpose of the grid evaluation was to identify specific locations where human health or ecological RBSLs were exceeded by:

a) Eliminating contaminants only detected above the LUT but below an RBSL.

b) Determining the magnitude of each exceedance. If the exceedances are just above the RBSL, then a recommendation for no action is made. For example, those exceedances within 2 times the RBSL are considered too low to warrant soil removal and the associated habitat destruction.

c) Determining how close the location of the exceedance is to other locations with exceedances where soil removal might occur. Is there a cluster of exceedance locations that could be considered a hot spot?

d) Identifying where there are multiple COC exceedances at one location such that combined chemical risk may warrant a removal action.

e) Determining if the chemical is likely to continue to degrade over time (e.g., PAHs, some herbicides).

f) Evaluating whether access to the location of an exceedance could cause more environmental damage than leaving contaminants in place.

g) Evaluating if the contaminant is a candidate for resampling (e.g., MCPA detections can be false positives).

h) Determining if contaminants are in both surface and subsurface soil. If contaminants are just in subsurface samples, removal may not be warranted. However, limited exceedances in the subsurface might warrant removal if the surface removal is also planned.

i) Evaluating if food-chain effects are likely, especially on pollinators, when considering the need to remove impacted soil. If the chemical is absorbed by the plant and is likely to get incorporated into pollen or nectar, the potential effect on pollinators would add weight to removal of the chemical/radionuclide of concern.

This process will be conducted on a grid-by-grid basis to identify other areas "Potential Focused Removal Sites (PFRS)" for soil remediation planning within each grid area. These locations will be mapped using the GIS database to become target locations for soil remediation planning. Results of this process will be presented in the SRAIP for those areas under DOE's authority. This process will also be used for other areas (except for Boeing areas) to determine areas for remediation.

Table 7–6 summarizes the proposed decision criteria for soil cleanup for Area IV and the NBZ proposed AOC exemption areas.

Table 7–6. Summary of Biological Exemption Decision Criteria for Area IV and NBZ

Criterion	*Usage*	*Basis/Rationale*
LUT Values	Comparison against soil results to identify potential locations with contamination	Administrative Order on Consent
Resident Soil RBSL	Use as an initial screening step, per normal RBSL usage, to identify locations potential posing a chemical risk	SSFL Standardized Risk Assessment Methodology (SRAM);
Ecological RBSL (High)	Use as an initial screening step, per normal RBSL usage, to identify locations potentially posing a chemical risk	Eco RBSL High used due to number of values already below background
Soil concentrations above LUT value, but below either RBSL	First step in evaluating potential cleanup; if values are below RBSLs, recommendations for no further action are made	This is the normal practice for identification of cleanup for hazardous waste sites; cleanup of soil not posing a risk is not justifiable
Soil concentrations above either RBSL but RBSL below LUT	Artifact of overly conservative RBSLs and/or those Eco RBSLs derived under conditions different than Area IV	No issue because values below LUT
Soil concentrations above either RBSL, RBSL below LUT, and soil concentration above LUT	Artifact of overly conservative RBSLs and/or those Eco RBSLs derived under conditions different than Area IV	Continue on to other screening criteria below
Locations with only one exceedance	Evaluation of where true contamination exists	The preponderance of data demonstrates that where contamination exists, multiple chemicals with exceedances are present
RBSL exceedance less than twice RBSL	Evaluation of necessity for soil action	RBSLs are conservative and not based on future open space land use; environmental harm from removal likely greater than benefit from small amount of reduction in chemical concentration
Multiple exceedances more than twice RBSL	Identification of locations likely requiring cleanup; recommendation for further evaluation	Locations potentially posing a risk to human health/and or ecological receptors, most likely cleaned up under a normal risk-based scenario; greater potential for cumulative risk

LUT = Look-Up Table; RBSL = risk-based screening level.

7.6.1.2 Field Assessment

The next step will be for a field biologist to visit each PFRS within the proposed AOC exemption areas. The following process is proposed for addressing impacted soil at each PFRS within proposed AOC exemption areas.

1. Review areas proposed for exemption[12] with USFWS and CDFW input. Proposed exemption areas are identified up-front in this BA (see Figure 7–1) and can be subsequently modified, if necessary, based on discussions with USFWS and CDFW and/or new knowledge based on field investigation. Proposed AOC exemption areas are based on presence of endangered or threatened species and designated critical habitat or, in some cases, cultural resources. They also contain state-listed species protected under CESA, other sensitive native plant and wildlife species and essential habitat.
2. Have a qualified biologist visit each PFRS and assess the habitat condition and occurrence of sensitive species.
3. If the habitat condition at the PFRS or on the available ingress/egress route is good (i.e., supporting primarily native species and soil profile appears intact) and/or the sensitive plant is/was[13] growing on the spot with the exceedance at the PFRS then leave impacted soil in place.
4. If the habitat condition at the PFRS is not good (e.g., dominance by non-native species and obvious soil disturbance making it unlikely for sensitive species to grow there) and can be accessed without long-term impacts on species and habitat then conduct focused removal actions to remove the impacted soil using PFRS-specific methods to minimize impacts (small scale excavation, predominantly with hand tools or minimally sized excavation equipment).
    a. Determine the area of impacted soil to be removed at each PFRS based on the availability and proximity of nearby samples.
    b. Ensure that effects of entry/egress to the PFRS are minimized.
    c. Apply appropriate measures to avoid, minimize, and rectify impacts to biological resources and habitat caused by accessing and removing the impacted soils and related activities (such as soil sampling, step-outs).

The following are key underlying assumptions that form the basis for above-described approach:

a) AOC exemption areas allow departure from requirement for cleanup to LUT values, with the intent of protecting important resources.
b) If the habitat is in "good condition" (dominated by native species, soil profile appears intact) and/or the sensitive species is present at the PFRS, then assume that the elevated level of the chemical/radionuclide of concern is not adversely affecting the biota and species of concern sufficiently to warrant removal. Conditions for continued existence of the sensitive species

[12] "Exemption" (used in body of AOC) is used in this document but is considered analogous to "exception" used in the Agreement in Principle.

[13] Sites where short-lived perennials such as Braunton's milk-vetch have been observed in the past need to be protected (as if the aboveground biomass were still there) because the habitat is suitable and the populations are likely present as dormant seed (seed bank). These plants are known to have a substantial degree of dormancy, where they remain present in the soil for years until suitable conditions stimulate germination (Fotheringham and Keeley 1998). Some populations are represented by a polymorphic seed pool in which a portion of the seed bank may germinate following dispersal while other seed persist in a dormant soil seed bank until stimulated to germinate (typically by fire). A similar situation exists where geophytes such as mariposa lilies (*Calochortus* spp.) have been previously observed. They likely still exist as dormant buried corms ("bulbs") that don't emerge every year and can survive for years.

are not expected to degrade over time as a result of contamination, especially given the fact that most of the contamination has been present for decades. Age and/or life span considerations as well as ecological succession over time may cause the species to disappear from the site until the next fire (applies especially to species like Braunton's milk vetch, mariposa lilies, possibly Malibu baccharis). However, the strong expectation is that these species would re-emerge from the soil under the appropriate conditions (such as after a fire or other disturbance that alters the vegetation canopy and stimulates germination or resprouting from dormant underground plant parts).

c) For a habitat in "good condition", if the original soil is removed or the original soil profile is substantially altered, the ability to restore conditions for rare plant species, specifically Braunton's milk-vetch, is questionable. Therefore, from the standpoint of the species and the habitat it is better to leave the impacted soil in place.

d) If the habitat at the PFRS is not in "good condition" and does not support sensitive species, then removing the impacted soil would be unlikely to adversely affect sensitive species. Such remediation also would reduce potential chemical impacts that could migrate to more sensitive areas. Further, it is more practical to restore a previously disturbed site (or ingress/egress pathway) to a beneficial condition than it is to restore a previously undisturbed area in which soil has been removed.

e) Access can have very significant impacts on species and their habitat. If it is necessary to access the PFRS with a vehicle, trimming or driving over vegetation would reduce impacts compared to clearing vegetation and blading an access road. Walking with shovels and wheelbarrow or use of a balloon-tired ATV would be preferred (low impact) methods of access. USFS (1996) provides descriptions of a variety of small-scale mechanized equipment that may be applicable under certain circumstances requiring greater amounts of excavation. Following remediation, the access route within the proposed exemption area would need to be blocked off to exclude further vehicle traffic and monitored for vegetation regrowth and invasive species that may be coming onto the site along the disturbance corridor. Invasive species would need to be removed routinely until the native species have recovered. Implementation of other methods to encourage regrowth of native vegetation such as reseeding or planting may be necessary, depending on the degree of disturbance.

7.6.1.3 Soil Cleanup Standard for Area IV and NBZ

Because the overall intent of this process is to minimize environmental degradation during cleanup in habitat potentially supporting endangered or threatened species while removing impacted soil that may adversely impact human or ecological health in consideration of the future use of the property as open space habitat per Boeing's conservation easement, the soil cleanup standard (SCS) will be the higher of the LUT value or Eco RBSL or HH residential RBSL. For the 37 COCs, the LUT value is above the Eco RBSL for 12 of the 37 COCs (Table 7–4, above). Because remediation below LUT values is impractical and unnecessary, the LUT value is the more relevant comparison in these cases. Eco RBSLs may be below LUT values because the former may have been developed under environmental conditions (e.g., soil type, pH) different than those at the site.

Using the Eco RBSL as the SCS instead of the LUT will have an appreciable effect on some COCs (e.g., bis(2-ethylhexyl)phthalate and total BAP) but a very limited effect on others (e.g., lead). For example, the LUT value for bis(2-ethylhexyl)phthalate is orders of magnitude below the EcoRBSL (61 ug/kg versus 65,000 ug/kg) and only 1 location exceeded the Eco RBSL whereas 300 locations exceeded the LUT value. Remediating 1 location to 65,000 ug/kg would have substantially different

environmental effects compared to remediating 300 locations to 61 ug/kg. For total BAP, the locations above the LUT value and Eco RBSL are the same; however, the LUT value (4.47 ug/kg) is appreciably lower than the Eco RBSL (310,000 ug/kg), again indicating a large difference in the amount of soil requiring removal depending on which value is the SCS. Conversely, because the LUT value (49 mg/kg) and Eco RBSL (39 mg/kg) for lead are so similar, the amount of impacted soil removed using either value as the SCS would be fairly similar in contrast to the case with bis(2-ethylhexyl)phthalate and total BAP.

Because DOE's proposed approach for the identification of remediation areas in the proposed AOC exemption areas is focused on protection of ecological health, and conservatively evaluates exceedances on a point by point basis, an additional, final risk-based evaluation will be employed to ensure that future use of Area IV and the NBZ would also be safe for human receptors as allowed by the conservation easement established for Boeing's property at the SSFL. This risk-based evaluation will be performed by using methodologies in a DTSC-approved SRAM. Results from this risk evaluation will be used to confirm the areas identified for protection of ecological health for the Proposed AOC exemption areas as described above, and if warranted, add remediation locations for protection of human health in consideration of the future use of the property as open space habitat.

7.6.1.4 Ecological Effects If COCs Remain In the Soil

Implementation of the process discussed in the preceding sections will result in some COCs remaining in the soil. While leaving some contamination in place is acceptable because the AOC provides exemptions to cleanup to LUT values for species and habitat protected under the ESA, what effects are possible to the environment from such an action?

One scenario that could lead to increased adverse effects would include migration/mobilization of COCs to more sensitive areas. Such migration could be triggered by landslides, erosion, and/or removal activities. In such cases, movement of COCs into previously undisturbed areas could cause new perturbation. However, in general, no new adverse effects from leaving contamination in place are expected because the contamination has existed for many decades under similar environmental conditions. There are buffering mechanisms in the environment that suggest leaving some contamination in place would not have widespread detrimental effects. To some degree, and this is chemical- and species-specific, plants and wildlife can tolerate or adapt to chemical levels elevated above background. Plants and wildlife unable to tolerate elevated COC levels may already have been replaced by species with reduced sensitivity to COCs. In some cases the COCs might have limited or no bioavailability. Thus, these COCs might be present above LUTs or screening levels but essentially unavailable to plants and wildlife. It should be noted that threatened and endangered species are not necessarily more sensitive to COCs than non-threatened and endangered species. Their status might be due to habitat loss, human encroachment, prey loss, and a host of other factors independent of the presence of COCs. As will be discussed next, even mobilization of the COCs would only be expected to result in negligible effects because the number of elevated COC detections is limited from an areal extent.

More specifically, as noted previously, a review of Table 7–5 indicates that a number of the 37 COCs would be expected to cause negligible effects to plants and wildlife. For example, 18 of the COCs were detected in 10 or fewer samples above either the Eco RBSL or LUT (**Table 7–7**). Other COCs were similarly detected above the LUT or Eco RBSL in very limited samples (Table 7–7). In these cases, plant and wildlife exposures to elevated COCs would be spatially limited suggesting negligible effects to populations of plants and wildlife and the entire ecosystem. Table 7–7 highlights those COCs where exposures to elevated COC concentrations would be

expected to be limited. For example, a COC such as vanadium may appear to be a larger concern than it actually is; while 99 percent of the samples exceeded the Eco RBSL only one sample exceeded the LUT; out of 5875 samples, only one sample was above background.

In general these 29 COCs in Table 7–7 are elevated compared to the LUT value and/or Eco RBSL in very few locations within the proposed exemption areas and these few exceedances would not be expected to cause adverse effects at the population level due to the limited areal extent of the elevated concentrations. In addition, these few locations where the COCs are elevated compared to the LUT value or Eco RBSL are likely to be found in or adjacent to previously developed areas that are unlikely to support endangered or threatened species because of the previous habitat disturbance caused by development.

Table 7–7. Supporting Rationale for COCs Likely to Cause Only Incidental Harm to Terrestrial Plants and Wildlife

COC	*Supporting Rationale*
1,2,4-Trimethylbenzene	Only detected in 8 of 1,530 samples and only 1 detection was above Eco RBSL
1,2-Dinitrobenzene	Limited data set (only three samples) indicates this COC is very localized based on historical activities
1,3,5-Trimethylbenzene	Only detected in 3 of 1,535 samples and only 1 detection was above Eco RBSL
4,4'-DDE	Only detected in 6 samples above Eco RBSL
4,4'-DDT	Only detected in 1 sample above Eco RBSL
Aroclor 1248	0.86% of samples above Eco RBSL
Aroclor 1254	0.75% of samples above Eco RBSL
Aroclor 1260	0.52% of samples above Eco RBSL
Aroclor 5460	0.43% of samples above Eco RBSL
Arsenic	Eco RBSL is below LUT; only 8 of 5,901 samples above LUT
Barium	Eco RBSL is below LUT; only 12 of 5,885 samples above LUT
Bis(2-ethylhexyl)phthalate)	Only detected in 1 sample above Eco RBSL
Chromium	Eco RBSL is below LUT; only 12 of 5,883 samples above LUT
Copper	Eco RBSL is below LUT; 0.37% of samples above LUT
Cyanide	Only 1 detection above Eco RBSL
Heptachlor epoxide	Only 2 detections above Eco RBSL
Lithium	Only 1 detection above both LUT and Eco RBSL
Manganese	Eco RBSL is below LUT; only 9 of 4,804 samples were above LUT
Molybdenum	Eco RBSL is below LUT; 0.78% of samples above LUT
Nickel	Eco RBSL is below LUT; only 7 of 5,881 samples above LUT
Perchlorate	Only 7 detections above Eco RBSL
Phenanthrene	Only 3 detections above Eco RBSL
p-Terphenyl	Only detected in 19 of 1,547 samples and only 3 detections were above Eco RBSL
Selenium	0.27% of samples above Eco RBSL
Silver	0.92% of samples above Eco RBSL
Tetralin	Only detected in 2 of 872 samples and only 1 detection was above Eco RBSL
Trichloroethene	Only detected in 15 of 1,607 samples and only 1 detection was above Eco RBSL
Vanadium	Only 1 detection above Eco RBSL
Zirconium	Eco RBSL is below LUT; only 1 of 5,576 samples above LUT

Excluding the 29 COCs from the original 37, 8 COCs remain: antimony, cadmium, lead, MCPA, mercury, Total TEQ BAP, Total TEQ Dioxin, and zinc. Adverse effects are more likely to be manifested from these COCs than those COCs in Table 7–7. As a result, **Table 7–8** discusses the chemical-specific potential toxic effects from these 7 COCs. Also note that chromium VI, while never

detected above the Eco RBSL, was detected above the HH RBSL and will be evaluated along with the ecological COCs at each sample location. Total TEQ BAP and total TEQ dioxin are detected above both the LUT and EcoRBSL in greater than 10 percent of the samples. From an areal perspective, these are the two COCs most likely to be a concern to native vegetation and wildlife populations. Total TEQ dioxin also has a high potential to bioaccumulate and is less likely to degrade than total TEQ BAP. MCPA is the next most frequently detected COC above both the LUT and Eco RBSL. However, the presence of this herbicide can be associated with false positives and degrades rather quickly; thus, its presence is suspect decades after being used. The metals antimony, cadmium, lead, mercury, and zinc were all detected in 5 percent or less of the samples above the LUT and Eco RBSL. Thus, while adverse effects from these metals are more likely based on areal extent than from the COCs in Table 7–7, they are still relatively limited for most of these metal COCs as well. For example, mercury was only detected above its Eco RBSL in less than 2 percent of the samples. Furthermore, during treatability testing, only about 12 percent of all mercury found in the soil samples was in a chemical form that is soluble (mobile) and thus potentially bioavailable. This is supported by the phytoremediation study (CDM Smith 2015) which saw no increase of mercury in plant tissue samples grown under controlled greenhouse conditions in mercury-affected soils from Area IV. In deeper soils, the majority of mercury exists in an immobile, elemental form that is tightly bound to soil particles (CDM Smith 2015). As a result, most of the mercury at the site (around 88 percent) may not be bioavailable. Removal of impacted soil containing mercury, while beneficial from a source removal perspective, may not have an appreciably beneficial effect on the biology in the proposed exemption areas (especially when considering the damage to the biota associated with removing the affected soil). In addition, phytoremediation studies showed little or no uptake of the chemicals of interest at SSFL (CDM Smith 2015). This suggests limited, if any, effects through the food-chain via plant uptake.

Based on preliminary review, the exceedance locations within most of the proposed exemption areas are much more limited than in the previously developed portions of the site, as would be expected. It is also anticipated that a number of exceedances for chemicals of concern will be co-located in the proposed exemption areas. In addition, some exceedances are at depth and the environmental degradation from removing impacted soil would be greater compared to a surface removal. The biologically active zone is typically in the first foot of soil with biological activity decreasing lower in the depth profile. Removal of impacted soil at depth could do more harm than leaving in place because, depending on the depth, most ecological receptors would not encounter the COC. In addition, more soil disturbance will be needed in order to reach COCs lower in the depth profile.

3721 **Table 7–8. Potential for Greater than Incidental Harm to Terrestrial Plants and Wildlife**

COC	*Supporting Rationale*
Antimony	Low – Antimony is a nonessential metal for plants and is easily absorbed by plants if in the right chemical form (Sample et al. 1997). Plant toxicity data are limited (Sample et al. 1997; USEPA 2005a). Qualitative phytotoxic effects have been noted at concentrations of 5 mg/kg antimony (Sample et al. 1997). Median concentrations above 5 mg/kg were only noted in soil sub-area 7 (at 8.6 mg/kg). Avian toxicity data also are limited (Sample et al. 1997; USEPA 2005a). Ingested antimony is absorbed slowly by the gastrointestinal tract of mammals (Sample et al. 1997; USEPA 2005a). Absorption may be as low as 2-7 percent for some forms (Sample et al. 1997) and 15-39 percent for trivalent antimony (USEPA 2005a). Many antimony compounds are reported to be gastrointestinal irritants (USEPA 2005a). Other toxic effects of antimony in mammals involve cardiovascular changes. Observed changes include degeneration of the myocardium, arterial hypotension, heart dysfunction, arrhythmia, and altered electrocardiogram patterns (USEPA 2005a). Antimony is not listed as a bioaccumulative COC in TCEQ (2014) so food chain effects are unlikely. Antimony was only detected above the Eco RBSL in 1.47 percent of samples. Only soil sub-area 7 had a median concentration above the Eco RBSL (8.6 versus 2 mg/kg). Remaining sub-areas had median concentrations more than one order of magnitude below the Eco RBSL. Note that median concentrations were conservatively estimated using only detected concentrations (i.e., samples in which antimony was not detected were not included in the calculations of median concentration). With the exceptions of terrestrial plants and wildlife with very limited mobility, these median concentrations better represent population exposures in the sub-areas than in individual exceedance locations.
Cadmium	Low – Cadmium is not an essential nutrient for plants or animals (Sample et al. 1997; USEPA 2005b) and is easily absorbed by plants if in the right chemical form (Sample et al. 1997). In comparison with other heavy metals, cadmium is toxic at low levels. Toxic effects include necrosis, wilting, and reduction in growth (Sample et al. 1997). The USEPA Ecological Soil Screening Level (Eco-SSL) for terrestrial plants in soil is 32 mg/kg (USEPA 2005b). Median concentrations in all soil sub-areas were two orders of magnitude below the Eco-SSL. Cadmium-induced effects in mammals associated with oral intake include nephrotoxicity and also possible effects on the liver, reproductive organs, and the hematopoietic, immune, skeletal, and cardiovascular systems (USEPA 2005b). The availability of cadmium to organisms in the environment is dependent on a number of factors including pH, Eh, and chemical speciation. As noted previously, cadmium is taken up by plants from soils and translocated with subsequent transfer through the terrestrial food chain (USEPA 2005b). Cadmium is listed as a bioaccumulative COC in TCEQ (2014) so food chain effects are possible. Cadmium was only detected above the Eco RBSL in 3.9 percent of samples. All soil sub-areas had a median concentration below the Eco RBSL. With the exceptions of terrestrial plants and wildlife with very limited mobility, these median concentrations better represent population exposures in the sub-areas than individual exceedance locations.
Lead	Low – Lead is not an essential nutrient for plants or animals (USEPA 2005c). In plants, lead inhibits growth, reduces photosynthesis (by inhibiting enzymes unique to photosynthesis), interferes with cell division and respiration, reduces water absorption and transpiration, accelerates abscission or defoliation and pigmentation, and reduces chlorophyll and ATP synthesis (USEPA 2005c). The USEPA Eco-SSL for terrestrial plants in soil is 120 mg/kg (USEPA 2005b). Median concentrations in all but one soil sub-area were at least one order of magnitude below the Eco-SSL. The median concentration of lead in soil sub-area 7 was 180 mg/kg versus the plant Eco-SSL of 120 mg/kg. Clinical signs of lead toxicity in domestic animals are manifested differently for different species, but the overall signs are of encephalopathy preceded and accompanied by gastrointestinal malfunction. Other signs of lead poisoning in domestic animals include anxiety, apprehension, hyperexcitability, rapid labored breathing, anorexia, weight loss, decreased milk production, dehydration, emaciation, fetal death with either resorption or abortion of the fetus, general weakness, paraplegia, mortality and impaired postnatal growth, reduced pregnancy rate, and interference with resistance to infectious disease (USEPA 2005c). Lead in soil is relatively immobile and persistent. Once released into soil, lead is normally converted from soluble lead compounds to relatively insoluble sulfate or phosphate derivatives. Mobility of lead also can be limited by forming complexes with organic matter and clay minerals. Lead is most available from acidic sandy soils which contain little material capable of binding lead. Plant uptake can be influenced by cation exchange capacity, soil composition (e.g., organic matter content, calcium content), metal concentrations, precipitation, light, and temperature. Lead uptake by plants is favored at lower pH values and in soils with low organic carbon content (USEPA 2005c). Lead is listed as a bioaccumulative COC in TCEQ (2014) so food chain effects are possible. However, bioaccumulation potential for lead is less than for mercury or cadmium. Lead was detected in above the Eco RBSL 2.8 percent of samples, but above the LUT value in only 2.0 percent of the samples. Only soil sub-area 7 had a median concentration above the Eco RBSL (180 versus 39 mg/kg). With the exceptions of terrestrial plants and wildlife with very limited mobility, these median concentrations better represent population exposures in the sub-areas than individual exceedance locations.

COC	***Supporting Rationale***
MCPA	Low - This broadleaf herbicide works by concentrating in the actively growing regions of the plant (meristematic tissue) where it interferes with protein synthesis, cell division, and ultimately the growth of the plant (Extension Toxicology Network 1996). MCPA is rapidly absorbed and eliminated from mammalian systems. For example, rats eliminated nearly all of a single oral dose within 24 hours, mostly through urine with little or no metabolism. In another rat study, three quarters of the dose was eliminated within 2 days and all was gone after 8 days. As for birds, MCPA is moderately toxic to wildfowl. Lastly, it is nontoxic to bees (Extension Toxicology Network 1996). MCPA was detected above the Eco RBSL in 8.4 percent of samples and above the LUT value in only 5.9 percent of samples. The detection of MCPA in 24 percent of the total Area IV samples is associated with uncertainty because MCPA and its formulations are rapidly degraded by soil microorganisms and have a low persistence, with a reported field half-life of 14 days to 1 month, depending upon soil moisture and soil organic matter (Wauchope et al. 1992). Given the rapid degradation of MCPA, the presence of MPCA in the Area IV soil may be due to analytical method limitations. One inherent problem with the analytical detection of MCPA is false positives. Interferences can be so numerous that a peak is confirmed on the secondary column when the analyte of interest may not be present at all. Given the low persistence of MCPA in the environment, food chain effects are unlikely.
Mercury	Low – Mercury and its compounds have no known biological function (Eisler 1987). The chemical form of a metal is important in determining its toxicity. Mercury exists in both inorganic and organic forms (e.g., methyl mercury). The organic form of mercury is associated with greater toxicity and bioaccumulation (Eisler 1987; TCEQ 2014). Forms of mercury with relatively low toxicity can be transformed into forms of very high toxicity, such as methylmercury, through biological and other processes (Eisler 1987). Potential bioavailability generally increases with increases in acidity, reducing power, salinity, and concentration of organic ligands. Conversely, in the presence of sulfur, a reducing environment will result in the production of insoluble metal sulfides that are as bioavailable. Other specific factors that reduce bioavailability include decreasing sediment size (clay provides more surface area for adsorption and reactions) and presence of hydrous iron and manganese oxides (which adsorb metals). The nutrient regime also can influence bioavailability by affecting the ability of microbes to transform elemental mercury to methylmercury (USACE 2010). Mercury and its compounds taken up by roots are translocated to only a limited extent in plants. Organic forms of mercury may be translocated to a greater degree than inorganic forms in some plants (Efroymson et al. 1997). In the environment, inorganic mercury can be methylated by microorganisms to methylmercury. Methylmercury will accumulate in the tissues of organisms. The animals at the top of the food chain tend to accumulate the most methylmercury in their bodies. Any source of mercury release to the environment may, therefore, lead to increased levels of methylmercury in tissues of large fish and mammals (ATSDR 1999). However, methylation is more common in aquatic environments. As noted previously, the bioavailability of mercury is limited to about 12 percent of the samples in Area IV. In mammals, mercury is a mutagen, teratogen, and carcinogen, and causes embryocidal, cytochemical, and histopathological effects. Signs of mercury poisoning in birds included muscular incoordination, falling, slowness, fluffed feathers, calmness, withdrawal, hyporeactivity, hypoactivity, and eyelid drooping (Eisler 1987). Mercury was only detected above the Eco RBSL in 1.7 percent of samples. All soil sub-area had a median concentration 1 to 2 orders of magnitude below the Eco RBSL. With the exceptions of terrestrial plants and wildlife with very limited mobility, these median concentrations better represent population exposures in the sub-areas than individual exceedance locations.
Total TEQ BaP	Low - PAHs are ubiquitous in the environment at low levels, particularly in soil and sediments, to which they readily bind (USACE 2010). The bioavailability of PAHs in soils is influenced by a number of factors including organic carbon quality and quantity, aging and weathering, microbial action, methylation/hydroxylation, adsorption/desorption hysteresis, and ultra-violent light interaction. Aging reduces the bioavailability of PAHs in soils (USEPA 2007a). Two factors that suggest limited concern with leaving PAHs in place are their ability to degrade over time and their decreased bioavailability over time. Because historical activities on SSFL may have released some PAHs decades ago, lower bioavailability would now be expected. Generally, PAH toxicity involves the disruption of the normal function of enzyme systems or DNA damage by reactive metabolic intermediates (TCEQ 2014). Animal studies have shown that exposure to PAHs can cause harmful effects on the skin, hematopoietic system, small intestine, kidneys, mammary gland, and immune response (USEPA 2007a). PAHs can accumulate to some extent in terrestrial plants. Atmospheric deposition on leaves, however, is likely to be a more significant pathway than uptake from soil by roots (USACE 2010; TCEQ 2014). Uptake of PAHs by plant roots is dependent on numerous factors including concentration, solubility, molecular weight of the PAH, and on the plant species (USACE 2010). Much of the literature indicates minimal bioconcentration of PAHs in terrestrial invertebrates (TCEQ 2014). PAHs show little tendency for bioconcentration or biomagnification, particularly in terrestrial ecosystems, probably because most PAHs are rapidly metabolized by mammals. The ability to metabolize PAHs in nonmammalian species, however, is extremely variable. When PAHs are not metabolized, they have been shown to bioaccumulate and therefore pose a significant dietary route of exposure to predatory species. In species which can metabolize PAHs, one significant mode of toxicity is impairment of reproductive cycles (USACE 2010).

COC	Supporting Rationale
	PAHs were detected in 52 percent of samples above the Eco RBSL, so from an areal extent PAHs are the most likely COC to affect terrestrial plants and wildlife if elevated concentrations remain in place.
Total TEQ Dioxin	Low – Dioxins and furans have a wide range of relative potencies and are usually found in complex mixtures in the environment (TCEQ 2104). Plants take up only very small amounts of dioxins and furans by their roots. Most of the dioxins and furans found on the parts of plants above the ground probably come from air and dust and/or previous use of dioxin/furan containing pesticides or herbicides (ATSDR 1998). The intracellular target of dioxins and furans is the aryl hydrocarbon receptor (AhR), which mediates the transactivation and inhibition of a variety of target genes, with a wide array of deleterious effects. Adverse effects in mammals include cognitive disabilities, wasting syndrome, impaired immune response, decreased reproduction, reduced offspring survival, and mortality (TCEQ 2014). Dioxins and furans bioaccumulate due to their stability and tendency to bind to fat (ATSDR 1998), and are therefore of greatest concern to higher trophic level predators. In mammals, these chemicals are readily absorbed through the gut, respiratory system, and skin, and can be transferred to young mammals either transplacentally or in breast milk (USACE 2010). Dioxins and furans were detected above the Eco RBSL in 10 percent of samples. Given the persistence of and ability to bioaccumulate in the environment, dioxins and furans are the most likely COC to cause food chain effects if left in place.
Zinc	Low - Zinc is an essential trace element for higher plants and animals. Zinc excess in plants commonly produces iron chlorosis. Zinc excess in avian species is associated with decreased body weight, gizzard and pancreatic lesions, and biochemical changes. Mammalian studies have shown vomiting, depressed growth rate, purgation, and ataxia (USEPA 2007b). Zinc is listed as a bioaccumulative COC in TCEQ (2014) so there is potential for food chain effects. However, bioaccumulation is less than for mercury and cadmium. Zinc has low mobility in most soils, and is strongly absorbed into soils with a pH 5 or greater (USEPA 2007b). Only those fractions of zinc in soils that are soluble or may be solubilized are bioavailable. Decreasing pH increases the solubility of zinc. The bioavailability of zinc in soils is also influenced by total zinc content, pH, organic matter, microbial activity, moisture, and interactions with other macro and micronutrients (USEPA 2007b). Zinc was only detected above the Eco RBSL in 1.4 percent of samples. All soil sub-area had a median concentration below the Eco RBSL. With the exception of soil sub-area 7, the median concentrations were an order of magnitude below the Eco RBSL. The sub-area 7 media concentration was 100 mg/kg versus the Eco RBSL of 320 mg/kg. With the exceptions of terrestrial plants and wildlife with very limited mobility, these median concentrations better represent population exposures in the sub-areas than individual exceedance locations.

mg/kg = milligrams per kilogram; RBSL = risk-based screening level; USEPA = U.S. Environmental Protection Agency; COC = chemicals of concern; LUT = Look-Up Table.

7.6.1.5 Examples of Application of the Process Approach in Proposed Exemption Areas

Braunton's Milk-vetch Example

Impacts to the Area IV population and critical habitat should the cleanup to AOC background approach be implemented and comparison with a risk-based cleanup scenario

Within this example, DOE is evaluating two possible soil cleanup scenarios. The first scenario is cleanup to the AOC soil LUT values. The second scenario evaluated in this document is a risk-based scenario, similar to that applied to soil cleanup sites throughout the United States. Human health and ecological receptor RBSLs are used to determine where potential soil cleanup may occur.

The following analysis focuses on Braunton's milk-vetch occupied habitat in Area IV and critical habitat Unit 1d in Area IV. The two soil cleanup scenarios described above differ in the area and volume of soil that would be removed (**Table 7–9**).

Table 7–9. Soil Cleanup Areas in Area IV South within Braunton's Milk-vetch Habitat and within Designated Critical Habitat Unit 1 D in Area IV

Scenario	Cleanup Criteria Basis	Braunton's milk-vetch habitat,[a] affected in Area IV South (acres/percentage of total Braunton's milk-vetch habitat in Area IV) [b]	Critical Habitat affected in Area IV South (acres/percentage of total critical habitat unit area)
1	Soil cleanup to AOC LUT values including TPH	54.7 / 81	44.3 / 79
2	Soil cleanup to human and eco risk-based considerations in proposed AOC exemption areas	0.5 / 0.7	0.5 / 1

AOC = Administrative Order on Consent; LUT = Look-Up Table.

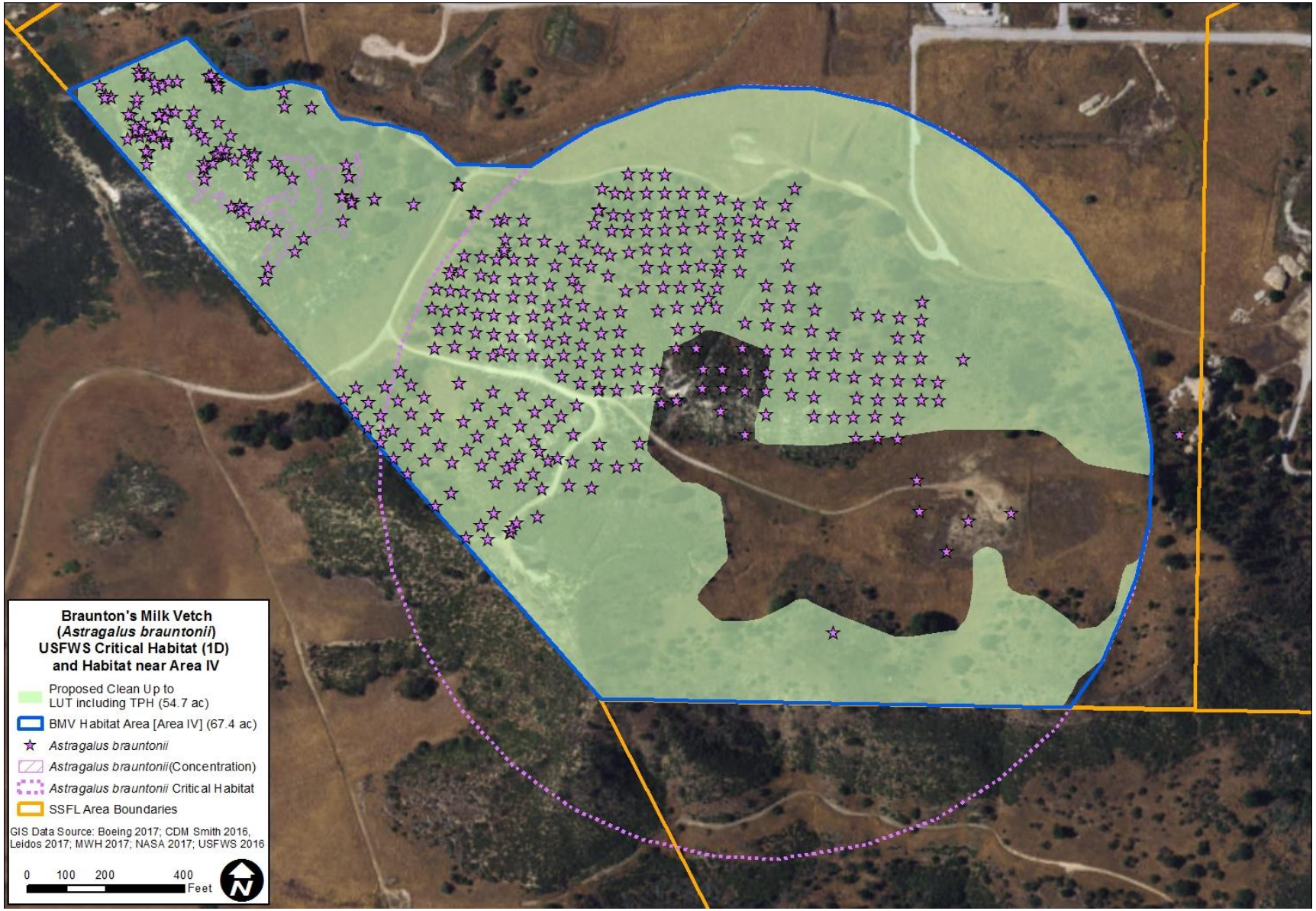
[a] Braunton's milk-vetch habitat total includes occupied habitat in Area IV in addition to the designated critical habitat Unit 1D in Area IV.

[b] Affected acreages in this table account only for acres directly affected by soil removal. Additional acreage would be disturbed to develop routes to enable excavation equipment and haul trucks access to and from the soil removal areas.

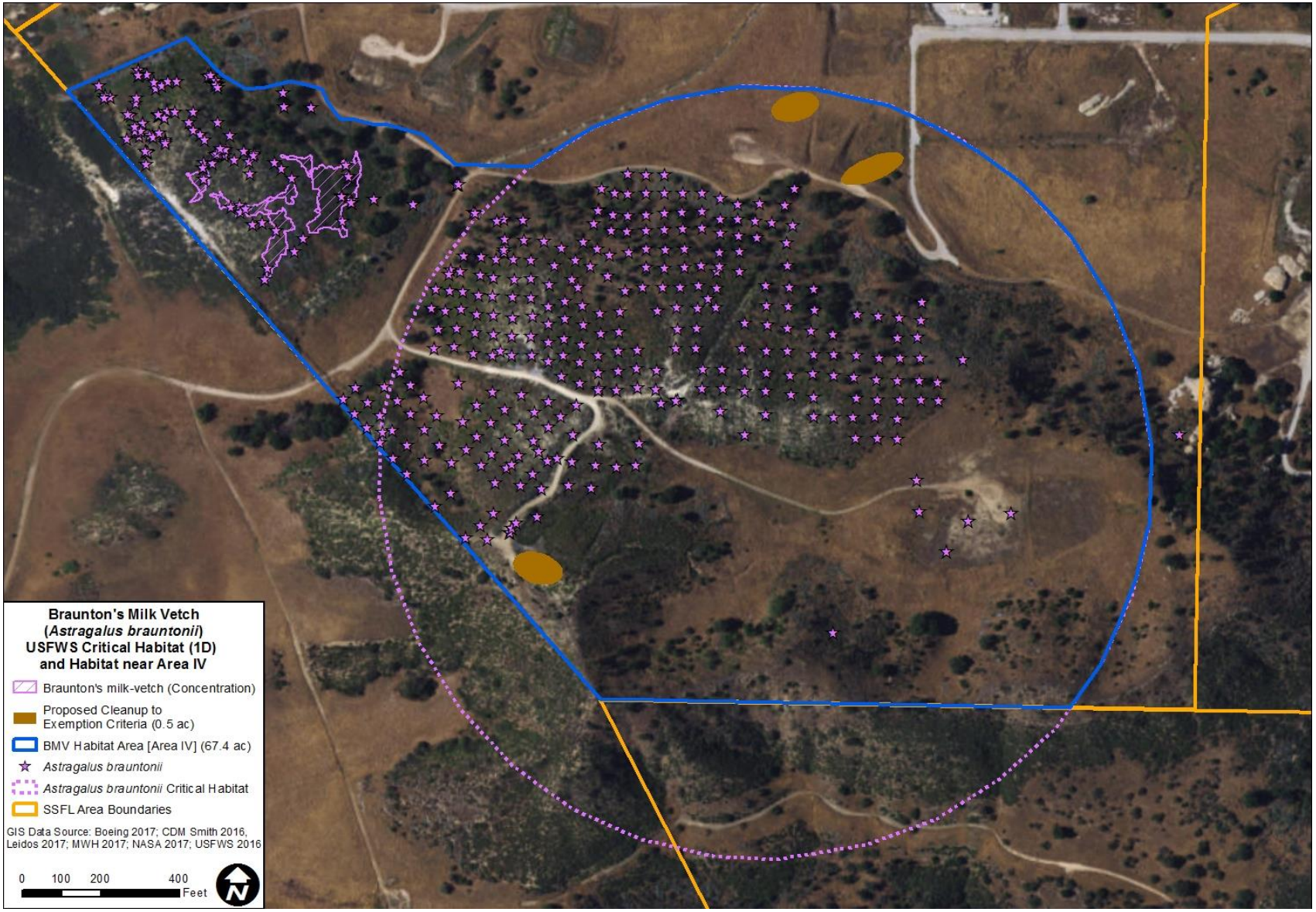
The first scenario, soil cleanup to AOC LUT values, would have far greater impact to Braunton's milk-vetch occupied habitat and critical habitat (Table 7–9; **Figure 7–2**). Under this scenario approximately 54.7 acres of habitat for Braunton's milk-vetch would be directly impacted by soil removal. Of this total, 44.3 acres would be within designated critical habitat, affecting 79 percent of critical habitat Unit 1d in Area IV. The remaining 21 percent of the critical habitat on Area IV where soils do not exceed LUT values (see Figure 7–2) is centered on a former borrow area that was used to provide soil for uses elsewhere on site. Most of this disturbed area supports sparse grasses and weeds and may provide very limited value for Braunton's milk-vetch. The above acreage values do not include impacts associated with access by heavy equipment such as backhoes and haul trucks to soil cleanup sites, which is likely to substantially increase the disturbed area. The second scenario, soil cleanup to human and eco risk-based considerations (i.e., surgical strikes) within proposed AOC exemption areas, would result in impacts to 0.5 acres of Braunton's milk-vetch occupied habitat, including 0.5 acres (1 percent) of the designated critical habitat in Area IV (Table 7–9; **Figure 7–3**).

Based on previous estimates within the designated critical habitat in Area IV, (33,500 plants within 16.6 acres [MWH Global, Inc. 2009] and 18,500 plants in 17.5 acres [SAIC 2009]), the density of plants during the population growth phase following the Topanga Fire ranged between 2,024 individuals per acre and 1,057 per acre (roughly 1,000 to 2,000 individuals per acre in round numbers). These density estimates do not account for dormant seed remaining in the seedbank or the fact that population sizes of short-lived perennials such as Braunton's milk-vetch can vary considerably between germination episodes depending on conditions. Acknowledging these limitations and using round numbers, cleanup to AOC LUT values would result in loss of 55,000 to 110,000 individuals as a result of soil removal alone, whereas cleanup to human health and ecological risk-based cleanup would result in much smaller losses (500 to 1,000 individuals).

Cleanup activities would result in permanent direct impacts to Braunton's milk-vetch through mortality/loss of individuals (if present) and their associated seed bank resulting in a reduction in the genetic diversity provided to the region. The calcium carbonate soils derived from marine sediments, which are essential to their survival, would also be removed. Any seeds present, which can persist in the soil for many years until condition are suitable for germination (e.g., after fire or other disturbance promoting the scarification of the seed coat and lessening of competing vegetation), would be removed further impacting the population (Fotheringham and Keeley 1998).



3766 **Figure 7–2. Proposed Cleanup to AOC LUT Values including TPH**



3767 **Figure 7–3. Proposed Cleanup to Human-health and Ecological Risk-Based Criteria**

Indirect temporary impacts could occur as a result of soil disturbance and/or vegetation removal and subsequent erosion or runoff onto Braunton's milk-vetch populations. Removal of vegetation adjacent to Braunton's milk-vetch populations could decrease resources available for pollinators, which are primarily native megachilid bees and a native bumble bee species (Fotheringham and Keeley 1998). Indirect impacts would also include reduced potential for the plants to persist or spread (due to nearby land disturbance). Ground disturbance from cleanup activities also has the potential to provide suitable habitat for invasive plant species, which would also reduce the potential for Braunton's milk-vetch to occur.

Cleanup activities under cleanup to AOC LUT values would greatly affect the PCEs for this species and the ability for natural recovery on SSFL would be unlikely. Destruction or adverse modification of critical habitat is defined as:

> *Destruction or adverse modification* means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features (USFWS 2016).

The extensive removal of soil and vegetation associated with cleanup to AOC LUT values within critical habitat would adversely affect critical habitat on SSFL by destroying each of the PCE's of the critical habitat listed above within the affected areas. The physical and biological features essential to Braunton's milk-vetch habitat on SSFL would be altered. Alteration of occupied habitat in the vicinity of the critical habitat could further diminish the value of critical habitat for the conservation of a listed species by removing individuals of Braunton's milk- vetch, seed bank and destroying the habitat as well as by affecting pollinator populations.

In contrast, the removal of soil and vegetation associated with soil cleanup to human health and eco-risk based considerations, would have minimal impacts to critical habitat because of the very small area involved, and would not be expected to affect the PCEs except right at the localized remediation sites. Additionally, the likelihood of recovery would be much higher than for cleanup to AOC LUT values because of the small areas subject to disturbance that would be surrounded by intact habitat.

The likelihood of success for on-site mitigation/restoration if the AOC cleanup were to be implemented

Because the profound soil disturbance caused by remediation to AOC LUT values will require sustained effort and special measures to accomplish restoration of a self-sustaining native vegetation cover and because of the considerable uncertainty about a successful outcome, the amount of area subjected to soil removal activities is critically important. Additionally, restoration of small areas affected by soil removal (e.g., by the risk-based approach) is considerably more feasible than restoration of large contiguous areas that would be excavated during remediation to AOC LUT values. The uppermost soil layers contain organic matter; seedbank; regenerative structures such as bulbs, corms, and root crowns; and beneficial soil organisms, including mycorrhizae. Where chemicals or radionuclides above AOC LUT values extend from the surface downward, there would be limited or no opportunity to conserve the ecologically valuable uppermost soil layers or seedbank for later replacement as part of site restoration and revegetation. Lack of this material is a major impediment for restoration. All evidence concerning Braunton's milk-vetch is that the species is limited to specific soil types. One of the three PCEs for Braunton's milk-vetch critical habitat (USFWS 2006a) is "calcium carbonate soils derived from marine sediment." Calcium carbonate soils are of limited occurrence in the project region and it may be difficult or impossible to obtain suitable backfill material

that would meet that specific requirement. Moreover, using such soils for restoration may further impact the species by eliminating potential habitat for the species. In addition, the soil structure would be lost as a result of excavation and backfilling. Where soil removal would occur in the relatively undisturbed native habitats that support Braunton's milk-vetch on SSFL (including coast live oak, walnut woodland, and chamise chaparral), it is unlikely, without extraordinary measures, that restoration and revegetation would result in habitat similar in species composition and functionally equivalent to preexisting native vegetation. Not only are there questions about the ability to restore the habitat and reinitiate the ecological cycles to which Braunton's milk-vetch has adapted, there are also questions about whether and to what extent Braunton's milk-vetch can be re-established and would persist on site into the future. Additional uncertainties about restoration center on restoring conditions suitable to support the pollinators of Braunton's milk-vetch.

Because cleanup to AOC LUT values (Scenario 1) would remove the soil from the majority of the habitat occupied by Braunton's milk-vetch on SSFL, it will be essential to recover the seedbank of this population prior to cleanup. This is necessary to conserve the specific genetic combinations characteristic of Braunton's milk-vetch on this site and, eventually, to propagate plants for use in restoration. Methodology to recover the seedbank from the site needs to be developed, approved, and implemented prior to cleanup. Seed has been collected from 6 of 20 previously known locations and are being stored in a cryogenic seed storage facility at Rancho Santa Ana Botanic Garden, Claremont, California (USFWS 2009a) and Braunton's milk-vetch seeds have been collected from the wild and successfully propagated on several occasions. However, there is a lack of knowledge or experience in reestablishing Braunton's milk-vetch habitat and populations after destruction of the habitat by soil removal.

Conclusion

Cleanup to AOC LUT values (Scenario 1) would remove the soils and vegetation, destroying the PCEs from a large portion (79 percent) of the designated Braunton's milk-vetch critical habitat on site, not including the substantial additional effects caused by accessing the contamination with vehicles and equipment. It would also remove the irreplaceable seedbank of the Braunton's milk-vetch from the affected area. As described above, the feasibility of replacing of the soils and restoring the habitat so that it is capable of supporting Braunton's milk-vetch is highly questionable after the extensive and severe disturbance that would be caused by soil removal. A significant portion of the critical habitat on Area IV that would remain after implementation of cleanup to AOC LUT values centers on a previously disturbed area formerly used as a borrow site and which currently appears to have limited value to the Braunton's milk-vetch population. As noted in Section 5, the Braunton's milk-vetch population in Area IV is the largest documented population of the species and, assuming future protected status of SSFL, it has the potential to be the most secure from future land-use changes, increasing its importance to the survival of the species.

The adverse effects of physically removing the currently thriving critical habitat and species to achieve cleanup to AOC LUT values far outweigh any ecological benefits of the cleanup. Given the specific habitat requirements of Braunton's milk-vetch and associated sensitive species and questionable feasibility of restoration, long-term viability of this species at this location would best be attained by following risk-based cleanup standards. This is because the species or its critical habitat are currently thriving within the proposed exemption area despite the extent of areas where samples indicate that LUT values have been exceeded. With very few exceptions (that would be addressed using a risk-based approach), these exceedances of LUT values are at a very low-level and do not warrant cleanup when human health and ecological receptor RBSLs are used to determine where potential soil cleanup may occur. Additionally, recovering the seedbank and identification of acceptable sources of suitable

soils from calcareous marine sediments are likely to prove difficult and obtaining such soils would have the unintended adverse effect of destroying potential habitat for the species.

As described above, implementation of cleanup to AOC LUT values would clearly result in adverse modification of critical habitat by destroying 79 percent of the critical habitat in Area IV, including the PCEs. Under the cleanup to AOC LUT values scenario the prospects for successful restoration of the habitat are low and likely impractical. Alteration of occupied habitat in the vicinity of the critical habitat could further diminish the value of critical habitat and the conservation of a listed species by removing individuals of Braunton's milk-vetch and its seed bank as well as by destroying its associated habitat including the habitat of pollinator populations.

By removing only soils that pose a risk to human health or ecological receptors, cleanup according to human-health and ecological risk-based criteria, would reduce the amount of habitat affected to 0.5 acres representing one percent of the occupied habitat and 0.7 percent of the critical habitat in Area IV. The small and localized nature of the soil removal areas increases the likelihood that restoration can be successfully accomplished, dramatically diminishing the requirement for replacement soil and minimizing dispersal distances for essential native organisms from adjacent intact habitat.

Santa Susana Tarplant Example

Impacts to the Area IV Population of Santa Susana Tarplant Should the Cleanup to AOC Background Approach be Implemented

The following analysis focuses on Santa Susana tarplant occupied habitat in Area IV. For this analysis, North Central Area IV, an 87.2 acre grid, was chosen as a representative example. Proposed soil removal areas were identified where soils equaled or exceeded AOC LUT values. The overlap of the proposed soil removal areas with Santa Susana tarplant locations and proposed AOC exemption areas were determined in GIS. The Santa Susana tarplant locations were originally identified in the field using GPS as points (for single plants or small groups of plants) and polygons (for areas occupied by numerous plants). Both points and polygons were buffered by 5 meters for the purposes of this GIS analysis. The buffering helps to offset locational uncertainty and potentially overlooked individuals in the original dataset as well as establishment of new individuals in the years since most of the original data was taken.

Results from the North Central Area IV analysis are shown in **Table 7–10** and illustrated in **Figure 7–4**. Cleanup to the AOC LUT values would destroy 0.27 acres of Santa Susana tarplant locations and 4.5 acres of proposed AOC exemption areas by removal of vegetation, soil, and seedbank within the 87.2-acre North Central Area IV analysis area. In comparison, soil cleanup to human and ecological risk-based cleanup levels in the proposed exemption areas would result in significantly lower impacts to tarplant locations and proposed exemption areas (Table 7–10; **Figure 7–5**). The impacted acreage values do not include effects associated with access by heavy equipment such as backhoes and haul trucks to soil cleanup sites, which would increase the disturbed area.

Table 7–10. Effects on Occupied Santa Susana Tarplant Habitat in SSFL North Central Area IV from Soil Cleanup to AOC LUT Values

Cleanup Criteria Basis	Santa Susana Tarplant Locations[a] Affected (acres/percentage of total) [b]	Proposed Exemption Area Affected (acres/percentage of total) [b]
Soil cleanup to AOC LUT values	0.27 / 8.0	4.5 / 18.2
Soil cleanup to human and eco risk-based considerations in proposed AOC exemption areas	0.05 / 1.5	0.8 / 3.2

AOC = Administrative Order on Consent; LUT = Look-Up Table.

[a] Santa Susana tarplant locations total includes locations in SSFL North Central Area IV. Tarplant locations were originally identified in the field using GPS as points (for single plants or small groups of plants) and polygons (for areas occupied by numerous plants). Both points and polygons were buffered by 5 meters for the purposes of the GIS analysis. The buffering helps to offset locational uncertainty and potentially overlooked individuals in the original dataset and establishment of new individuals in the years since most of the original data was taken.

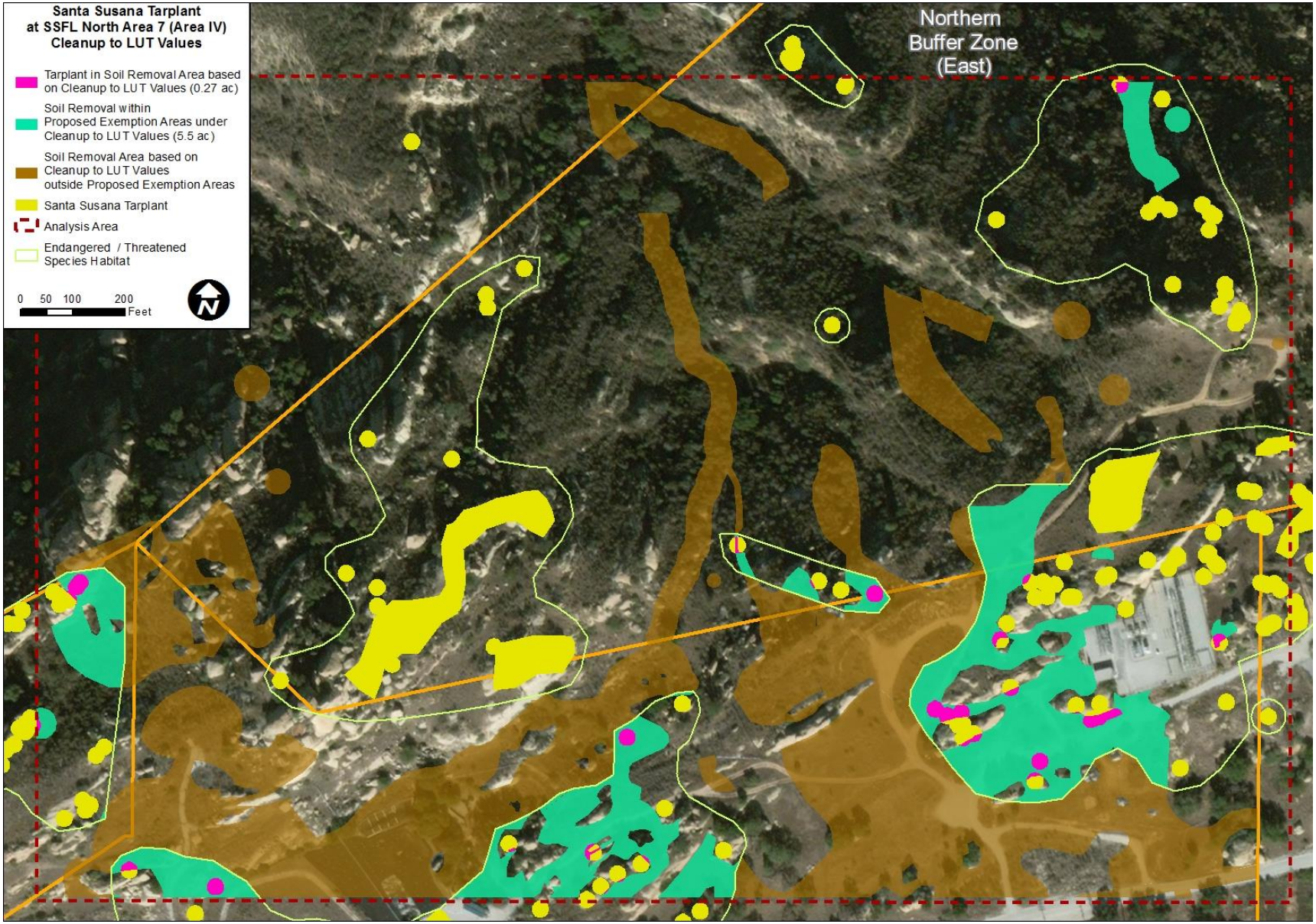
[b] Affected acreages in this table account only for acres directly affected by soil removal. Additional acreage would be disturbed to develop routes to enable excavation equipment and haul trucks access to and from the soil removal areas.

Estimates of number of tarplant individuals per acre of area proposed as exemption areas in Area IV for Santa Susana tarplant in Area IV and NBZ or areas identified in Areas I-III using equivalent methodology) range from about 13 plants in Area IV to 47 in Area III with a mean of 35 plants/acre (Table 5–3). Using the mean value and round numbers, cleanup to AOC LUT values within North Central Area IV would result in loss of 4.5 acres of proposed exemption area (= occupied suitable habitat) for tarplant including an estimated 157 individuals in the analysis area as a result of soil removal alone.

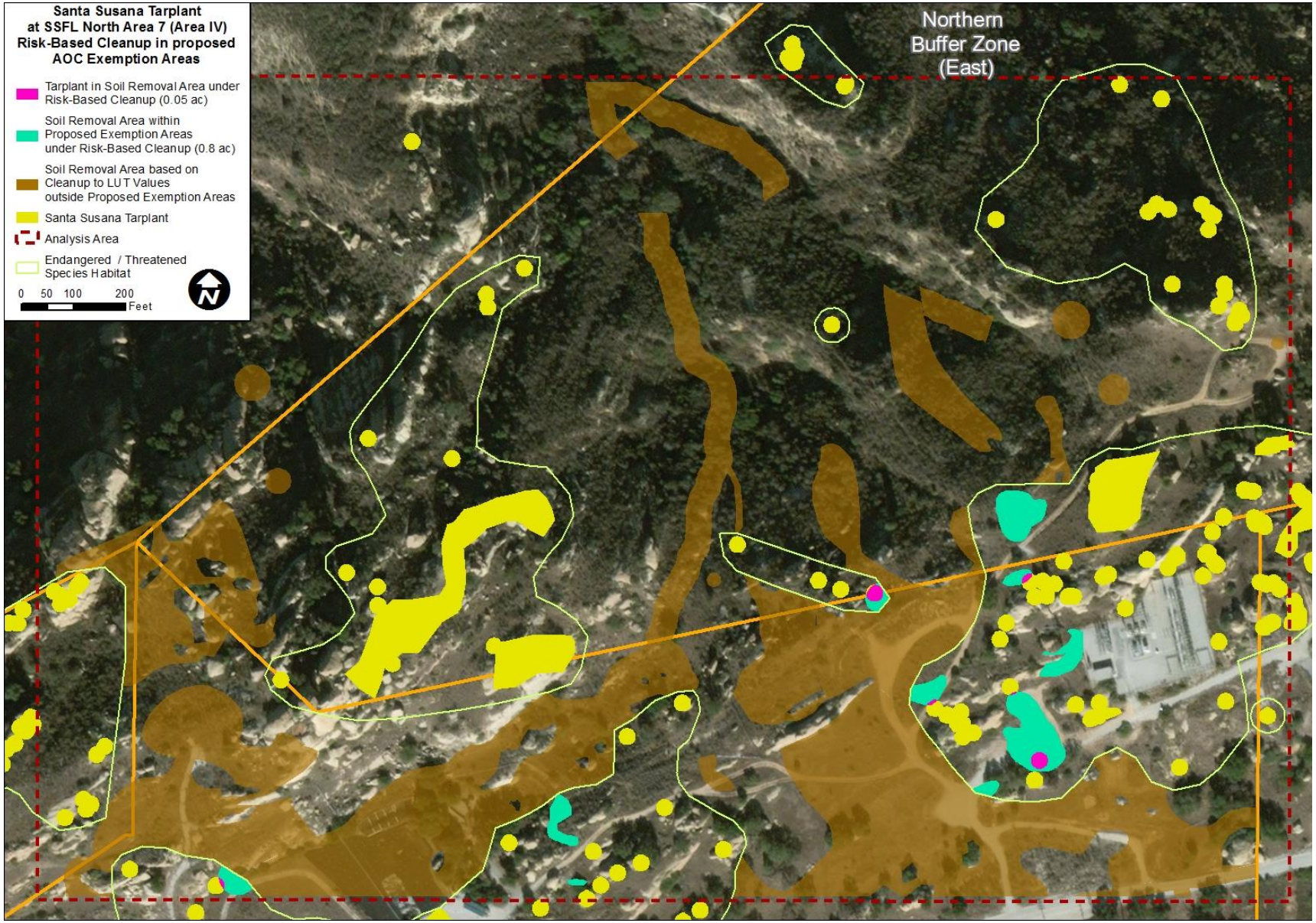
Cleanup activities could result in permanent direct impacts to Santa Susana tarplant through loss of individuals, seedbank, and habitat, with resulting reduction not only in population size but also genetic diversity. The habitat disturbance would also adversely affect pollinator populations through loss of food plants and, possibly, breeding sites (which for many native bees are burrows in the soil). Seeds and beneficial soil organisms persisting in the soil would be lost, further impacting the population. Sandstone outcrops, which form the core habitat for the species, would be adversely affected to an unknown extent.

Indirect temporary impacts could occur from soil disturbance and/or vegetation removal and subsequent erosion or runoff onto Santa Susana tarplant populations. Removal of vegetation and soils adjacent to Santa Susana tarplant populations would decrease resources available for pollinators, which include European honey bees (*Apis mellifera*) and many genera of native bees (Padre 2013). Indirect impacts would also include reduced potential for the plants to persist or spread due to nearby land disturbance. Ground disturbance from cleanup activities also has the potential to provide suitable conditions for expansion of invasive plant species populations, particularly fountain grass, which thrives in sandy soils and crevices in rock outcrops and is well established locally on SSFL along roadsides and disturbed areas where it is poised for further expansion into areas disturbed by remediation.

The extensive removal of soil and vegetation associated with cleanup to AOC LUT values within Santa Susana tarplant habitat would result in altering essential habitat on SSFL by removing individuals of Santa Susana tarplant, its seed bank, and destroying the habitat. Soil removal would affect pollinator populations by destroying their foraging habitat, including food sources, and potentially destroying their nesting habitat, depending on its location.



3927 **Figure 7–4. Proposed Cleanup to AOC LUT Values in North Central Area IV (SSFL Area IV)**



3928 **Figure 7–5. Cleanup to Human Health and Ecological Risk-based Standards in North Central Area IV (SSFL Area IV)**

The Likelihood of Success for On-site Mitigation/Restoration if the AOC Cleanup were to be Implemented

The profound soil disturbance caused by remediation will require sustained effort and special measures to accomplish restoration of a self-sustaining native vegetation cover and there is uncertainty about a successful outcome. The uppermost soil layers that would be removed contain organic matter; seedbank; regenerative structures such as bulbs, corms, and root crowns; and beneficial soil organisms, including mycorrhizae. Where chemicals or radionuclides above AOC LUT values extend from the surface downward, there would be limited or no opportunity to conserve the ecologically valuable uppermost soil layers or seedbank for later replacement as part of site restoration and revegetation. Lack of this material is a major impediment for restoration. Moreover, using such soils for restoration may further impact the species by eliminating potential habitat for the species where the soil is obtained. In addition, the soil structure would be lost as a result of excavation and backfilling. Where soil removal would occur in the relatively undisturbed native habitats that support Santa Susana tarplant on SSFL, it is unlikely, without extraordinary measures, that restoration and revegetation would result in habitat similar in species composition and functionally equivalent to preexisting native vegetation.

Currently sources of suitable soils for backfill have not been identified for DOE but backfill sources have been identified for Boeing. In addition to the requirement that they meet LUT values, they should also be similar in origin (from sandstone). Additionally, current plans prescribe backfilling with less soil than is removed, with replacement ranging from approximately 33 percent to 75 percent of the original volume. It is not clear how the areas to be backfilled will be graded to restore drainage patterns and to avoid ponding. Although ponding could have ecological benefits for some species it would likely have adverse effects on Santa Susana tarplant which occurs only in very well-drained upland soils.

As mentioned above, Boeing has had success at getting Santa Susana tarplant to reestablish at sites where soil has been removed as part of remediation. They have left some individuals in place to act as an *in-situ* seed source as well as hand sowing tarplant seed and have used local sandy soils for backfill. Boeing's typical restoration sites are fairly small in area and adjoin native habitat, minimizing dispersal distance for native plants, animals, and soil organisms in contrast to the extensive disturbance areas required for cleanup to LUT values.

Questions remain about the long-term status of tarplants in restored areas, for example, whether the vegetation will remain sparse enough for the tarplants to continue to grow and reproduce or whether competing vegetation (chaparral or scrub) will become so dense as to preclude reproduction of the tarplants which will gradually diminish in number as they age and die. Additional uncertainties about restoration remain concerning the ability to restore conditions suitable to support the pollinators of Santa Susana tarplant.

Because cleanup to LUT values would remove the soil from a substantial portion of the habitat occupied by Santa Susana tarplant on SSFL, it will be essential to recover and preserve as much seed as possible from an adequate genetic cross-section of the population, prior to cleanup. A portion of the seed collected (at least 5-10 percent) should be deposited at an authorized native seed repository for long-term storage under ideal conditions for preservation. The remainder of the seed would be reserved for propagation of transplant stock and direct seeding as sites are restored. Reserving seed for storage in a seed repository is necessary to conserve the specific genetic combinations characteristic of Santa Susana tarplant on SSFL and, eventually, to enable propagation of plants for use in future restoration if initial attempts fail. There is also some potential for direct transplantation of salvaged

living tarplants to new sites. A plan to recover and store an adequately sized, genetically representative sample for use in restoration as well as back up preservation needs to be developed, approved, and implemented prior to cleanup. Santa Susana tarplant seeds have been collected from the wild and successfully propagated on several occasions and there has been some success in reestablishing Santa Susana tarplant after soil removal using a combination of direct seeding plus preserving plants in situ to provide seed input (Padre 2013) as described above. However the long-term prospects for these sites are unknown. Also unknown is how well these results will translate to sites where deeper and more extensive soil removal is necessary and local soil for backfill is not available.

Conclusion

Cleanup to LUT values would remove the soils and vegetation, destroying tarplant individuals, seedbank, and habitat for Santa Susana tarplant. In the North Central Area IV example, about 18 percent of the proposed AOC exemption area for tarplant would be affected by cleanup to LUT values, not including the substantial additional effects caused by accessing the contamination with equipment to excavate and transport the soil. As described above, questions remain about the feasibility of replacing the soils and restoring the habitat so that it is capable of supporting Santa Susana tarplant after the extensive and severe disturbance that would be caused by widespread soil removal associated with cleanup to LUT values. As noted in Section 5.2.2.1, the population on SSFL is the largest documented population of the species and, assuming future protected status of SSFL, it has the potential to be the most secure from future land-use changes, increasing its importance to the survival of the species.

While the predicted magnitude of impact to Santa Susana tarplant is less extensive and severe than for Braunton's milk-vetch, the adverse effects of physically removing the currently thriving species to achieve cleanup to AOC LUT values far outweigh any foreseeable ecological benefits. Given the specific habitat requirements of Santa Susana tarplant and questionable feasibility of restoring self-sustaining populations, long-term viability of this species at this location would best be attained by following risk-based cleanup standards despite the extent of areas where samples indicate that LUT values have been exceeded. With exceptions, these exceedances of LUT values are at a low level and do not warrant cleanup when human health and ecological receptor RBSLs are used to determine where potential soil cleanup may occur. Additionally, identification of acceptable sources of suitable soils from the project region is likely to prove difficult and obtaining such soils could have the unintended adverse effect of destroying actual or potential habitat for the species.

As described above, implementation of cleanup to LUT values would clearly result in adverse modification of a considerable percentage of the Santa Susana tarplant habitat on SSFL based on this sample analysis. An additional unquantified amount of occupied habitat on SSFL would be destroyed or profoundly altered to enable access to the specific cleanup areas by excavation, soil handling, and hauling equipment. The prospects for successful restoration of the habitat become smaller as the percentage of the habitat affected increases. Destruction or alteration of the habitat adjacent to the occupied habitat caused by accessing the contamination would further diminish habitat value and conservation of Santa Susana tarplant by reducing the overall population size, its seed bank, as well as destroying occupied habitat and pollinator populations.

7.7 Effects on Federally Listed or Proposed Threatened or Endangered Species and Critical Habitat

Table 7–11 provides a summary of the key information about the species and likely effects with a summary effects determination. Where the summary effects determination is "May Affect" there is a

species-specific discussion of the impact following the table. Please refer to Sections 5.1 and 5.2 for complete accounts of species occurrences and their associated habitat requirements. **No effect** applies only to species that don't occur in the Action Area and are judged very unlikely to occur there during project activities. As noted in the table below, these species are not discussed further in this document. Species known or judged to have the potential to occur in the Action Area during project activities are given a **May Affect** determination in this table and are evaluated further in this document.

Table 7–11. Effects of the Action on Species and Critical Habitat within the Project Area

Species Status (Federal ESA/CESA/ CaRPP[a]/VC)	***Conclusion and Determination***
Federally Listed or Proposed Threatened or Endangered Species and Critical Habitat	
Plants	
Astragalus brauntonii Braunton's milk-vetch FE/-/1B.1/- CH	Braunton's milk-vetch is present on SSFL and designated critical habitat is present at two locations on SSFL (USFWS 2006a; Figure 5–3). Unit 1d is situated primarily along the western side of SSFL Area IV along a ridge system located southwest of Burro Flats; Unit 2F is on a ridge system between Dayton and Bell Canyons, and includes the southeastern corner of the SSFL Southern Buffer Zone. The Primary Constituent Elements (PCEs) for Braunton's milk-vetch are (1) calcium carbonate soils derived from marine sediment; (2) low proportion (<10 percent) of shrub cover directly around the plant; and (3) chaparral and coastal sage scrub communities characterized by periodic disturbances that stimulate seed germination (e.g., fire, flooding, erosion) and reduce vegetation cover (USFWS 2009a). **May affect** This species as well as its designated critical habitat occur on SSFL, thus is carried forward for analysis. Impacts of remediation are discussed in Section 7.6.1.5, above, and are also discussed below.
Pentachaeta lyonii Lyon's pentachaeta FE/SE/1B.1/-	Lyon's pentachaeta occurs from 98 to 2,264 feet (30 to 690 meters) in elevation and is currently known from fewer than 20 extant occurrences in the Santa Monica Mountains and western Simi Hills in Los Angeles, and Ventura counties (CNPS 2016). It is commonly associated with rocky and clay soils located in openings of chaparral, coastal scrub, and valley and foothill grassland habitats located on the tops of knolls or at the base in between hills (CNPS 2016). It can be found at the ecotone between grassland and chaparral, on the edge of trails and firebreaks, or anywhere else with bare ground in an area with generally low vegetative cover, due to its low competitive ability against annual grasses and shrubs (Keeley 1995; Fotheringham and Keeley 1998). Volcanic clay soils of the type occupied by known occurrences of Lyon's pentachaeta do not occur on the SSFL site. The nearest documented locations were several occurrences, with the nearest being 1-2 subpopulations with approximately 500 plants 6 miles northwest of SSFL near the Ronald Reagan Presidential Library in shallow volcanic-derived soils in 1994, the next closest being a population of about 400 plants in 1989 but decreased by 20 percent in 1992 about 6 miles northwest of SSFL just above the Wood Ranch Reservoir on a flat area of disturbed coastal scrub in course soils with little vegetation, and the last two being two colonies of about 4,000 plants observed about 7 miles south of SSFL near Cornell Road growing in disturbed grassland and buckwheat scrub in 1992 (CDFW 2015b, 2016a). Designated critical habitat is located in the western Simi Hills and the Santa Monica Mountains in Ventura and Los Angeles counties but absent from the site. The nearest designated critical habitat unit is about 6 miles to the west of SSFL. The PCEs for Lyon's pentachaeta are (1) Clay soils of volcanic origin; (2) exposed soils that exhibit a microbiotic crust which may inhibit invasion by other plant competitors; and (3) a mosaic of bare ground (>10 percent) patches in an area with less than 60 percent cover (USFWS 2006a). **No effect** Due to the absence of the species and its suitable habitat in the action area the species will not be discussed further in this BA.

Species Status (Federal ESA/CESA/ CaRPP[a]/VC)	Conclusion and Determination
Navarretia fossalis Spreading navarretia FT/-/1B.1/-	Spreading navarretia occurs from 98 to 2,149 feet (30 to 655 meters) in elevation and is known from Los Angles, Riverside, San Diego, and San Luis Obispo counties, down to northwestern Baja California, (CNPS 2016). It is an obligate wetland species commonly associated with seasonally flooded alkali vernal plain habitat that includes chenopod scrub, alkali playa, alkali scrub, alkali vernal pool, and alkali annual grassland habitats) (USFWS 2010b; CNPS 2016). It depends on the inundation and drying cycles of its habitat for reproduction and other phases of the life cycle. The surrounding upland area normally consists of coastal sage scrub or grassland habitat. Vegetated vernal pool habitat of the type occupied by known occurrences of spreading navarretia is not known from the SSFL site. The nearest documented locations are two occurrences in northwestern Los Angeles County about 20 miles northeast of SSFL at the Cruzan Mesa vernal pools and 18 miles northeast of the study area above Plum Canyon (USFWS 1998a; USFWS 2010b). Approximately 6,720 acres (2,720 hectares) of vernal pool habitat, seasonally flooded alkali vernal plain habitat, and irrigation ditches and detention basins in Los Angeles, Riverside, and San Diego Counties, has been designated as critical habitat (USFWS 2010b). There is no designated critical habitat present on the SSFL. The nearest designated critical habitat units are in Plum Canyon and Cruzan Mesa areas in northwestern Los Angeles County, 18-20 miles (29–32 kilometers) northeast of SSFL, respectively. The PCEs for spreading navarettia are (1) Ephemeral wetland habitat; (2) intermixed wetland and upland habitats that act as the local watershed; and (3) soils that support ponding during winter and spring (USFWS 2010b). **No effect** Due to the absence of the species and suitable habitat in the action area, the species will not be discussed further in this BA.
Dudleya abramsii subsp. *parva* (=*Dudleya parva*) Conejo dudleya FT/-/1B.2/ LI	Conejo dudleya occurs from 197 to 1,476 feet (60 to 450 meters) in elevation in eastern Ventura County, California (CNPS 2016). It is known from very few occurrences from the western end of the Simi Hills along Mountclef Ridge to the Conejo Grade, where it is associated with outcrops of the Conejo volcanics (USFWS 2015b). Suitable habitat is found in clay or volcanic soils on rocky or gravelly slopes and grassy hillsides in coastal sage scrub and valley and foothill grassland habitats (CNPS 2016). It is most commonly located on north-facing slopes of approximately 10 degrees (Dorsey 2007). In addition, it tends to occur exclusively in thin soils over rocky outcrops derived from the Miocene Conejo volcanics. Volcanic soils of the type occupied by known occurrences of Conejo dudleya do not occur on the SSFL site. The nearest documented locations were three occurrences, with the closest being an unknown number of plants observed about 6 miles northwest of SSFL near Ronald Regan Presidential Library in cracks on north-facing conejo volcanic rocks in 1988, the next closest being about 250 plants observed about 6 miles northwest of SSFL between Lapeyre Road and Esperance Drive in non-native grassland with scattered rock outcrops in 1998, and the last being a population with less than 10,000 plants observed in 1983 and about 58,000 plants observed in 2010 about 8 miles west of SSFL on both sides of Moorpark Road in crevices of volcanic rock outcrops on primarily north- and west-facing slopes in coastal sage scrub and non-native annual grassland slopes (CDFW 2015b, 2016a). There has been no designation of critical habitat for Conejo dudleya. **No effect** Due to the absence of the species and suitable habitat in the action area, the species will not be discussed further in this BA.
Dudleya cymosa subsp. *ovatifolia* (inclusive of *Dudleya cymosa* subsp. *agourensis*) Santa Monica Mountains dudleya FT/-/1B.2/LI	Santa Monica Mountains dudleya occurs from 492 to 5,495 feet (150 to 1,675 meters) in elevation, with Agoura Hills dudleya occurring from 656 to 1,640 feet (200 to 500 meters) in elevation (CNPS 2016). Of the four populations known, two consisting of Santa Monica Mountains dudleya and one consisting of Agoura Hills dudleya are in the Santa Monica Mountains and the fourth, consisting of Santa Monica Mountains dudleya is located in the Santa Ana Mountains (USFWS 2009c). Both subspecies occur in Los Angeles County, while Santa Monica Mountains dudleya occurs also in Orange County and Agoura Hills dudleya occurs also in Ventura County (CNPS 2016). Suitable habitat is located in rocky volcanic or sedimentary soils in chaparral, coastal sage scrub, and cismontane (coast live oak) woodland) habitats (CNPS 2016). In the Santa Ana Mountains, it occurs on shaded sandstone cliffs. In most locations, the topography has prevented deep soil formation, increasing the likelihood of the species being the only flowering plant to occur in an area that is otherwise dominated by mosses, lichens, and ferns (USFWS 1999). In the Santa Monica Mountains, it occurs on rocky volcanic soils and sedimentary and conglomerate rock outcrops near canyon bottoms (Topanga and Malibu creeks— subspecies ovatifolia) and on exposed west- to northwest-facing volcanic rock outcrops south of the Ventura Freeway in Los Angeles County (Nakai 1987; USFWS 1999; Dorsey 2007). Volcanic outcrops and canyon bottom

Species Status (Federal ESA/CESA/ CaRPP[a] /VC)	***Conclusion and Determination***
	outcrops of the type occupied by known occurrences of Santa Monica Mountains dudleya do not occur on the SSFL site. The nearest documented locations were several Agoura Hills Dudleya occurrences, with the closest being about 6 miles south of SSFL along Cornell Road on north-facing volcanic slopes in 2000, and the next being about 7 miles south of SSFL on the west side of Kanan Road in 2000 (CDFW 2015b, 2016a). The closest Santa Monica Mountains Dudleya occurrence was a population of several thousand plants observed in 2006 and about 350-500 observed in 2011 about 10 miles south of SSFL in Malibu Canyon on a steep northeast-facing sandstone rock face with some mosses and lichens (CDFW 2015b). There has been no designation of critical habitat for Santa Monica dudleya. **No effect** Due to the absence of the species and suitable habitat in the action area, the species will not be discussed further in this BA.
Dudleya cymosa subsp. *marcescens* Marcescent dudleya FT/SR/1B.2/LI	Marcescent dudleya occurs from 492 to 1,706 feet (150 to 520 meters) in elevation. It is known from fewer than ten occurrences in the Santa Monica Mountains of Ventura and Los Angeles counties, California (CNPS 2016). Suitable habitat is located in volcanic rocky soils on the lower reaches of sheer volcanic rock outcrops, canyon walls, and boulder surfaces adjacent to perennial streams in chaparral and oak woodlands (CNPS 2016; USFWS 1999). In most locations, the topographic relief has prevented deep soil formation, increasing the likelihood of the species being the only flowering plant to occur in an area that is otherwise dominated by mosses, lichens, and ferns (USFWS 1999). Volcanic soils of the type occupied by known occurrences of Marcescent dudleya do not occur on the SSFL site. The nearest documented locations were four occurrences, with the closest being about 8 miles south of SSFL in Udell Gorge in Malibu Creek State Park on volcanic boulders on a north-facing slope in 1984 (CDFW 2015b). The other three occurrences were in the same general vicinity about 9 miles south of SSFL, all observed in rocky areas with moss, conejo volcanic substrates, or north-facing cliff faces in 1979, 1982, and 1984 (CDFW 2015b). There has been no designation of critical habitat for Marcescent dudleya. **No effect** Due to the absence of the species and suitable habitat in the action area, the species will not be discussed further in this BA.
Chorizanthe parryi var. *fernandina* San Fernando Valley spineflower PT/SE/1B.1/LI	San Fernando Valley spineflower occurs from 492 to 4,003 feet (150 to 1,220 meters) in elevation and was thought to be extinct until it was rediscovered in the late spring of 1999 at Ahmanson Ranch in upper Las Virgenes Canyon Open Space Preserve and on the Newhall Ranch in May of 1999, now ranging from Los Angeles and Ventura counties, California (CNPS 2016). Suitable habitat includes gravel or sandy soils located in washes within coastal sage scrub and valley and foothill grassland habitat (CNPS 2016). The species is commonly found in acidic, fine-sand colluvium, low in nitrogen, and possibly permeated with mycorrhizal mycelia. It tends to be intolerant of shade and competition (Glenn Lukos and Sapphos 2000). Historic localities include areas occasionally inundated or scoured by streams, lakes, or reservoirs. Gravel and sand soils of the type present in washes occupied by known occurrences of San Fernando Valley spineflower do not occur on the SSFL site. The nearest documented occurrences include 14 locations, with the nearest being a population of 5,000-10,000 plants observed (23,000 estimated) in 1999 and 1.8 million plants estimated in 2001 about 3 miles south of SSFL on Ahmanson Ranch on the south side of Laskey Mesa on sandy soil habitat associated with the Modelo Formation in sparsely vegetated areas where soils are thin and compacted, bedrock is exposed, or between coastal sage scrub and nonnative grasslands (CDFW 2015b, 2016a). The next closest location was about 4 miles east of SSFL in Chatsworth Park in 1901, with no ecological information available (CDFW 2015b, 2016a). There has been no designation of critical habitat for San Fernando Valley spineflower. **No effect** Due to the absence of the species and suitable habitat in the action area, the species will not be discussed further in this BA.
Orcuttia californica California Orcutt grass FE/SE/1B.1/LI	California Orcutt grass occurs from 49 to 2,165 feet (15 to 660 meters) in elevation and is currently known from Los Angeles, Orange, Riverside, San Diego, and Ventura counties, down to Baja California (CNPS 2016). This obligate vernal pool species closely associated with deep vernal pools underlain by clay soils and is often associated with other federally listed vernal pool taxa, including species of fairy shrimp (USFWS 2011). Vernal pools of the type do not occur on the SSFL site, and the species has not been reported from the SSFL. The nearest documented occurrences include four locations, with the nearest being a population of over 24 individuals observed in 2003 about 7 miles west of the SSFL in the Tierra Rejada Valley on the southerly lobe of a vernal pool/marsh system fed by an intermittent stream, and the next closest being 8 miles southwest of SSFL in the general vicinity of Thousand Oaks, with no date or

Species Status (Federal ESA/CESA/ CaRPP[a] /VC)	Conclusion and Determination
	ecological information available (CDFW 2015b, 2016a). There has been no designation of critical habitat for California Orcutt grass. **No effect** Due to the absence of the species and suitable habitat in the action area, the species will not be discussed further in this BA.
Birds	
Polioptila californica Coastal California gnatcatcher FT/SC/-	The coastal California gnatcatcher is mainly found in coastal sage scrub, but can also occur in chaparral and riparian areas that are in proximity to sage scrub. California sagebrush, California buckwheat, and mulefat are generally dominant and shrubs generally have a cover of 50 percent or greater for nesting and foraging (Beyers and Wirtz 1995). The coastal California gnatcatcher may be an occasional visitor on the SSFL site. There has been one reported sighting in 2009 but surveys conducted in 2011, 2012 and 2014 have had negative results for species presence. Approximately 151 acres (61 hectares) of potential suitable habitat throughout Area IV and the NBZ and additional suitable breeding habitat occurs in the Bowl in Area I and proposed borrow sites in the SBZ. There have been eight occurrences of Coastal California gnatacters that have been documented nearby SSFL. The nearest is about 3 miles south of SSFL where one individual was heard calling on July 18, 2002, on the west side of the North ends of Las Virgenes Road in a patch of coastal sage scrub habitat. In 2011 and 2012, three occurrences were noted all in the same general area about 6 miles northwest of SSFL near Sinaloa Lake between Madera Road, Tirra Rejada Road and Highway 23/118 just west of Simi Valley (CDFW 2015b, 2016a). These three occurrences were all observed in coastal sage scrub habitat, with some on gentle slopes along a drainage vegetated with chamise, mixed sage scrub, and grassland habitats(CDFW 2015b, 2016a). No critical habitat occurs within the boundaries of SSFL and the nearest designated critical habitat is about 2.5 miles northeast of the SSFL site (USFWS 2010c)—see Figure 5-4. The PCEs for coastal California gnatcatcher are (1) Dynamic and successional sage scrub habitats, including Venturan coastal sage scrub, that provide space for individual and population growth, normal behavior, breeding, reproduction, nesting, dispersal, and foraging; and (2) non-sage scrub habitats, such as chaparral, grassland, and riparian areas, in proximity to sage scrub habitats that provide space for dispersal, foraging, and nesting (USFWS 2007a). Based on current conditions there is a low probability that the Coastal California gnatcatcher would breed anywhere on the SSFL site; however, in future years continued vegetation development subsequent to the 2005 Topanga Fire and the recent unprecedented drought could result in better-developed sage scrub habitat capable of supporting California gnatcatchers. **May affect should it be present during remediation.** This species could potentially occur on site during the project's duration and thus it is carried forward for analysis and is discussed below.
Vireo bellii pusillus Least Bell's vireo FE/SE/-	The least Bell's vireo is a riparian-dependent species, requiring dense, low-growing thickets of willows, cottonwood, mulefat, mugwort, and California wild rose (USFWS 2006b). They often inhabit areas with an overstory consisting of taller willows, cottonwoods, and sycamores. However, nesting and foraging sometimes takes place in adjacent chaparral and coastal sage scrub during a flood season or where laurel sumac and blue elderberry may provide food for birds in marginal habitat (Kus and Miner 1989). During the winter, they are not limited to willow-dominated riparian areas, but occupy a variety of habitats including mesquite scrub within arroyos, palm groves, and hedgerows bordering agricultural and residential areas (Franzreb 1989). The least Bell's vireo is an occasional migrator through the SSFL site based on one reported sighting in 2011 (NASA 2013). In 2012, protocol least Bell's vireo surveys were conducted in approximately 14 acres of potential habitat within Area IV and NBZ but results were negative (Werner 2012). There is minimal if any suitable habitat for breeding on SSFL based on the lack of riverine and floodplain habitat but habitat exists for transient birds. There are eleven nearby documented locations with the closest being one territorial male observed in 1997 about 4 miles northeast of SSFL on Brandeis Ranch; about 2 miles northeast of Chatsworth near some residential development, the next being a nest where eggs were collected in 1889, 1892, 1906, 1913, 1915, 1916, and 1940 about 4 miles northwest of SSFL in the city of Simi Valley in an area that is now developed, and the third closest being one egg set collected on May 24, 1913 and one individual bird heard singing on June 5, 2008 about 6 miles northwest of SSFL along Arroyo Simi in riparian habitat found within the Calleguas Creek Watershed (CDFW 2015b, 2016a). Most occurrences were in southern willow scrub and riparian woodland habitats in the Santa Clara River (CDFW 2015b, 2016a). Approximately 36,000 acres at 10 localities in portions of Santa Barbara, Ventura, Los Angeles, San Bernardino, Riverside, and San Diego counties has been designated as critical habitat (USFWS 1994). The PCEs for least Bell's

Species Status (Federal ESA/CESA/ CaRPP[a] /VC)	***Conclusion and Determination***
	vireo are (1) riverine and floodplain habitats (particularly willow-dominated riparian woodland with dense understory vegetation maintained, in part, in a non-climax stage by periodic floods or other agents) and adjacent coastal sage scrub, chaparral, or other upland plant communities (USFWS 1994). Based on current conditions it is unlikely that the least Bell's vireo would breed anywhere on the SSFL site, but occasional migrating or transient individuals would be possible. **May affect should it be present during remediation** This species could potentially occur on site during the project's duration, thus it is carried forward for analysis and is discussed below.
Gymnogyps californianus California condor FE/SE-FP/-	Suitable nesting habitat for the California condor is found in isolated mountainous or canyon terrain on cliffs and occasionally large trees. Foraging areas are oftentimes separated from nesting habitat and are typically located in open grasslands and oak savannas that support populations of deer, elk, and cattle, or along the coast where they can feed on fish, marine mammals, and marine birds (USFWS 2013b). In addition, foraging locations tends to be seasonal, with areas of preferred activity at different locations throughout the year (USFWS 2013b). This type of backcountry wilderness and isolated mountainous and canyon terrain does not occur on the SSFL site. The nearest documented location was one year-long nesting and roosting occurrence in 1976 about 29 miles to the northwest of SSFL in the Sespe Piru Condor Area (CDFW 2016a). Ongoing recovery efforts and a captive breeding program beginning in 1987 have increased the condor's total wild population to 228 free flying birds as of 2014 with small populations persisting in southern and central California. Area of land, water, and airspace to an elevation of 3,000 feet in Ventura and Los Angeles counties has been designated as critical habitat (USFWS 1977). This area encompasses several back country locations in central and southern California. No critical habitat occurs within or near the boundaries of SSFL. No PCEs for the California condor have been identified. **No effect** Due to the absence of the California condor from the action area or vicinity, the species will not be discussed further in this BA.
Amphibians	
Rana draytonii California red-legged frog FT/SC/- CH	The California red-legged frog is commonly found in aquatic habitat such as ponds, marshes, and creeks with still water for breeding. It needs riparian and upland areas with dense vegetation and open areas for cover, aestivation, food, and basking. Frogs in cooler areas may hibernate in burrows for the winter (USFWS 2010d). The California red-legged frog requires 11-20 weeks of permanent water for larval development and must have access to estivation habitat (CDFW 2016a). While possibly suitable pond habitat was located on site, it is estimated that the ponds' distance and isolation from existing California red-legged frog locations may make future occupation on the SSFL site unlikely. The nearest documented locations were two occurrences in the same general area about 3 miles south of SSFL in the Las Virgenes Creek, the first being one adult observed in 2009 in a plunge pool in the mainstream of Las Virgenes Creek in willow mulefat riparian scrub habitat with uplands that primarily consisted of grassland habitat, and the other being 21 adults and about 200 metamorphs observed in 1999 and 21 adults, 10 juveniles, and 30-60 metamorphs observed in 2000 in riparian habitat surrounded by slopes composed of Venturan coastal sage scrub and non-native grassland habitat (CDFW 2015b, 2016a). In 2010, USFWS updated the revised critical habitat for CRF under the Endangered Species Act. In total, approximately 1,636,609 acres (662,312 hectares) of critical habitat in 27 California counties fall within the boundaries of the final revised critical habitat designation (USFWS 2010d). The Las Virgenes Creek (VEN-3) critical habitat boundary extends slightly onto the southwestern portion of Area IV of SSFL. This represents approximately 0.6 acres of CRF critical habitat on SSFL, all of which overlaps designated CH for Braunton's milk-vetch on Area IV. The PCEs for CRF are (1) Aquatic breeding habitat of standing bodies of fresh water, including natural and manmade stock ponds, slow-moving streams or pools within streams, and other ephemeral or permanent water bodies that typically become inundated during the winter rains and hold water for a minimum of 20 weeks in all but the driest years; (2) non-breeding aquatic habitat of freshwater and wetted riparian habitats that provide shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult California red-legged frogs; (3) upland habitat adjacent to or surrounding breeding and non-breeding aquatic and riparian habitat up to a distance of 1 mile (1.6 kilometers) in most cases (depending on surrounding habitat and dispersal barriers) comprised of various vegetation such as grasslands, woodlands, wetland, or riparian plant species that provides shelter, forage, and predator avoidance; and (4) dispersal habitat including accessible upland or riparian habitat within and between occupied or previously occupied

Species Status (Federal ESA/CESA/ CaRPP[a] /VC)	Conclusion and Determination
	locations within 1 mile (1 kilometer) of each other that support movement between such sites (USFWS 2010d). **May affect should it be present during remediation** A small portion of designated critical habitat occurs within the Action Area and this species could potentially occur on site during the project's duration, thus it is carried forward for analysis and is discussed below.
Invertebrates	
Euphydryas editha quino Quino checkerspot butterfly FE/-/-	The quino checkerspot butterfly is restricted to open grassland and sunny openings within shrubland habitats of the interior foothills of southwestern California and northwestern Baja Mexico. Its distribution is defined primarily by that of its larval host plant, dwarf plantain, although the larvae may also use other plants. The host plants occur in or near meadows, vernal pools, and lake margins, and spread to upland shrub communities of sparse chaparral and coastal sage scrub. The quino checkerspot butterfly is generally only found where high densities of host plants occur (USFWS 1997b). The host plants are very infrequent on site as small colonies in open soils, and it is unlikely that the quino checkerspot butterfly would be able to establish new colonies given the distance from extant populations in Riverside and San Diego counties (Faulkner 2010). The quino checkerspot butterfly was not found during surveys of the SSFL site and two separate habitat assessments concluded its presence is very unlikely. Although there was a potential sighting during the NASA-administered 2010 fall surveys, the species was not confirmed (NASA 2014c). There are no known occurrences in the vicinity of the SSFL site (CDFW 2015b, 2016a). Approximately 62,125 acres (25,141 hectares) of habitat in San Diego and Riverside Counties, California, have been designated as critical habitat for the QCB (USFWS 2009f). This final revised designation constitutes a reduction of approximately 109,479 acres (44,299 hectares) from the 2002 designation of critical habitat. The PCEs for QCB are (1) Open areas within scrublands at least 21.5 square feet (2 square meters) in size that a) contain no woody canopy cover; and b) contain one or more of the host plants dwarf plantain, woolly plantain, white snapdragon, or white collinsia used for QCB growth, reproduction, and feeding; or c) contain one or more of the host plants thread-leaved bird's beak or owl's-clover that are within 328 feet (100 meters) of the host plants listed above; or d) contain flowering plants with a corolla tube less than or equal to 0.43 inches (11 millimeters) used for QCB feeding; (2) open scrubland areas and vegetation within 656 feet (200 meters) of the open canopy areas (PCE 1) used for movement and basking; and (3) hilltops or ridges within scrublands that contain an open, woody-canopy area at least 21.5 square feet (2 square meters) in size used for QCB mating (hilltopping behavior) and are contiguous with (but not otherwise included in) open areas and natural vegetation described in PCEs 1 and 2 above (USFWS 2009e). **No effect** Due to the absence of the species and suitable habitat in the action area, the species will not be discussed further in this BA.
Branchinecta lynchi Vernal pool fairy shrimp FT/-/-	The vernal pool fairy shrimp occupies a variety of different cold water vernal pool habitats from small, clear, sandstone rock pools to large, turbid, alkaline, grassland valley floor pools, but tends to occur primarily in smaller pools less than 0.05 acre (0.02 hectare) in area. Throughout its range, the vernal pool fairy shrimp is only found in some vernal pools. Studies have found that the locations are typically associated with smaller and shallower vernal pools (typically about 6 inches deep) that have relatively short periods of inundation (Helm 1998) and relatively low to moderate total dissolved solids and alkalinity (Eriksen and Belk 1999). However, at the southernmost extremes of the range, the shrimp is present only in large, deep pools (USFWS 2007b). Limited vernal pool habitat was located during surveys of the SSFL site and the vernal pool fairy shrimp was presumed absent at SSFL because no surveys were able to positively confirm the presence of this fairy shrimp. Protocol surveys spanning wet season and dry season are needed to confirm its presence or absence. The nearest documented location was on April 7, 2011 about 8 miles northwest of SSFL in Tierra Rejada Vernal Pool Preserve. It was one population of about 5,000-10,000 individuals estimated to be Riverside and Vernal pool fairy shrimp on March 1, 1998, detections in 2001, no detections from 2002 to 2005, detections in 2006, and about 1,000 individuals estimated to be Riverside and Vernal pool fairy shrimp observed in sagpond and vernal pool habitat within a 2.77 acre pond that was 14" deep (CDFW 2015b, 2016a). Approximately 597,821 acres (241,929 hectares) of habitat in Jackson County, Oregon, and Alameda, Amador, Butte, Contra Costa, Fresno, Kings, Madera, Mariposa, Merced, Monterey, Napa, Placer, Sacramento, San Benito, San Joaquin, San Luis Obispo, Santa Barbara, Shasta, Solano, Stanislaus, Tehama, Tulare, Ventura, and Yuba Counties, California has been designated as critical habitat for the vernal pool fairy shrimp on February 10, 2006 (USFWS

Species Status (Federal ESA/CESA/ CaRPP[a] /VC)	***Conclusion and Determination***
	2006c). The PCEs for vernal pool fairy shrimp are the habitats that provide (1) Topographic features characterized by mounds and swales and depressions within a matrix of surrounding uplands that result in complexes of continuously, or intermittently, flowing surface water in the swales connecting the pools, providing for dispersal and promoting hydroperiods of adequate length in the pools; (2) depressional features including isolated vernal pools with underlying restrictive soil layers that become inundated during winter rains and that continuously hold water for a minimum of 18 days, in all but the driest years; thereby providing adequate water for incubation, maturation, and reproduction. As these features are inundated on a seasonal basis, they do not promote the development of obligate wetland vegetation habitats typical of permanently flooded emergent wetlands; (3) sources of food, expected to be detritus occurring in the pools, contributed by overland flow from the pools' watershed, or the results of biological processes within the pools themselves, such as single-celled bacteria, algae, and dead organic matter, to provide for feeding; and (4) structure within the pools consisting of organic and inorganic materials, such as living and dead plants from plant species adapted to seasonally inundated environments, rocks, and other inorganic debris that may be washed, blown, or otherwise transported into the pools, that provide shelter (USFWS 2006c). **May affect should it be present during remediation** This species has some potential to occur on site thus it is carried forward for analysis and is discussed below.
Streptocephalus woottoni Riverside fairy shrimp FE/-/-	The Riverside fairy shrimp is restricted to deep, cool, lowland vernal pools and other non-vegetated ephemeral pools that retain water through the warmer weather of late spring. The Riverside fairy shrimp is commonly associated with seasonal shallow pools that are filled by winter and spring rains that usually begin in November and continue into April or May. Historically these crustaceans were commonly associated with vernal pool complexes with groups of 5 to 50 pools. However, now most of the complexes containing Riverside fairy shrimp have only 1 to 2 pools (USFWS 2008b). The Riverside fairy shrimp was not found during surveys of the SSFL site. However, limited vernal pool habitat has been located on the SSFL site and vernal pool habitat has not been completely identified. Additional vernal pools or inundated areas may occur that have not yet been mapped. Additionally, protocol surveys spanning wet season and dry season are needed to confirm its presence or absence. During a habitat assessment by a permitted individual only one species was identified, the unlisted versatile fairy shrimp. The nearest documented location was on April 7, 2011 about 8 miles northwest of SSFL in Tierra Rejada Vernal Pool Preserve. It was one population of about 5,000-10,000 individuals estimated to be Riverside and Vernal pool fairy shrimp on March 1, 1998, detections in 2001, no detections from 2002 to 2006, and about 1,000 individuals estimated to be Riverside and Vernal pool fairy shrimp observed in sagpond and vernal pool habitat within a 2.77 acre pond that was 14" deep (CDFW 2015b, 2016a). Occurrences in Los Angeles County include the Cruzan Mesa vernal pools, and occurrences in Ventura County include the Carlsberg vernal pools and two locations within the Los Padres National Forest (USFWS 2007b). Approximately 1,724 acres (698 hectares) of land in Ventura, Orange, and San Diego counties has been designated as critical habitat for the Riverside fairy shrimp (USFWS 2012). The PCEs for Riverside fairy shrimp are (1) Ephemeral wetland habitat consisting of vernal pools and ephemeral habitat that have wet and dry periods appropriate for the incubation, maturation, and reproduction of the Riverside fairy shrimp in all but the driest of years; (2) intermixed wetland and upland habitats that function as the local watershed, including topographic features characterized by mounds, swales, and low-lying depressions within a matrix of upland habitat that result in intermittently flowing surface and subsurface water in swales, drainages, and pools; and (3) soils that support ponding during winter and spring which are found in areas characterized in PCEs 1 and 2 that have a clay component or other property that creates an impermeable surface or subsurface layer (USFWS 2012). **May affect should it be present during remediation** This species has some potential to occur on site, thus it is carried forward for analysis and is discussed below.

Species Status (Federal ESA/CESA/ CaRPP[a] /VC)	Conclusion and Determination
State-listed Species and Species Meeting State Criteria for listing under CESA, including CRPR List 1B species	
Plants	
Deinandra minthornii Santa Susana tarplant -/SR/1B.2/-	Santa Susana tarplant has been sighted in 3,657 locations within the SSFL, with 324 sighted in Area II during the NASA-administered 2010 fall surveys, all of which were on sandstone outcrops (NASA 2014c). Occupied sandstone rock outcrops are generally within coastal scrub and chaparral habitats. It generally roots in rock crevices, and may also grow in sparsely vegetated areas (including cracks in paved areas) in very close proximity to occupied outcrops. **May affect** This species occurs abundantly onsite, thus it is carried forward for analysis and is discussed below.
Baccharis malibuensis Malibu baccharis -/-/1B.1/LI	Malibu baccharis is fairly abundant in the southwestern corner of Area IV where it co-occurs with Braunton's milk-vetch. Although it was found only in Area IV, this inconspicuous shrub may be present elsewhere on the SSFL site, though suitable habitat is probably limited. When originally described, Malibu baccharis was known from sedimentary (Calabasas Formation) and Conejo volcanic substrates in the central Malibu Creek drainage (Beauchamp and Henrickson 1995). **May affect** This species is present on site thus it is carried forward for analysis and is discussed below.
Calochortus clavatus var. *gracilis* Slender mariposa lily -/-/1B.2/LI	Slender mariposa lily occurs in chaparral, coastal scrub, and valley and foothill grasslands, in shaded foothill canyons often on grassy slopes with sandy soils. A form of mariposa lily, which may be slender mariposa lily or a close relative, has been found in several locations on SSFL (see Figure 5–11**)** including Area IV, the NBZ, and Area II and it may occur elsewhere on the SSFL site. **May affect** This species has the potential to occur on site, thus it is carried forward for analysis and is discussed further below.
Calochortus fimbriatus Late-flowered mariposa lily -/-/1B.2/LI	Late-flowered mariposa lily needs confirmation of identity. Plants displaying characteristics of both this species and of Plummer's mariposa lily have been found in several locations of Area IV and may be present elsewhere on the site. Some nearby known locations to the SSFL site (within a 16 mile radius) were 3 occurrences to the north of the study area all along the Palo Sola Fire Truck Trail in 2003 (CDFW 2016a). Late-flowered mariposa lily occurs in chaparral, cismontane (coast live oak) woodland, and riparian woodland, often in serpentinite soils.). Serpentinite soils are lacking within the action area. Late-flowered mariposa lily was tentatively identified during an onsite meeting within the critical habitat of Braunton's milk-vetch, however subsequent field work has not confirmed its presence. Plummer's mariposa, somewhat similar in appearance, has been found in that area during subsequent surveys. **May affect** This species has the potential to occur on site, thus it is carried forward for analysis and is discussed further below.
Tortula californica California screw moss -/-/1B.2/	California screw moss occurs in thin soils over rock in valley and foothill grassland habitats, which are present on the project site. Although known occurrences are sparse, they are fairly widespread in southern California counties, and it has been recorded in Ventura County (CNPS 2016). The plants are small and ephemeral by nature (Malcolm et al. 2009), meaning they can be easily overlooked or missed if surveys are not conducted when the plant is present. Its occurrence with in the Action Area needs confirmation, but suitable habitat is present. The nearest location, documented in 2004, was about 11 miles southwest of SSFL near Newton Canyon Falls just east of Zuma Canyon in the Santa Monica Mountains in chaparral habitat (CDFW 2016a). **May affect** This species has the potential to occur on site, thus it is carried forward for analysis and is discussed further below.
Birds	
Buteo swainsonii Swainson's hawk -/ST/-	The Swainson's hawk breeds in grasslands with scattered trees, juniper-sage flats, riparian areas, savannahs, and agricultural or ranch lands. It requires adjacent suitable foraging areas such as grasslands, or alfalfa or grain fields supporting rodent populations. In many areas, the range included agricultural areas with crops that grow lower than most native grasses, making it easier to spot prey (Bechard 1982; Estep 1989; Woodbridge 1991). In California's Central Valley, nests are typically built at the edge of narrow bands of riparian vegetation, in isolated oak woodland, and in lone trees, roadside trees, or farmyard trees, as well as in adjacent urban residential areas (Estep 1989; England et al. 1995). This arrangement of breeding habitat

Species Status (Federal ESA/CESA/ CaRPP[a] /VC)	***Conclusion and Determination***
	occupied by known occurrences of the Swainson's hawk does not occur on the SSFL site. The last known occurrence near the SSFL site was in Montecito, California in 1974 (Webster et al. 1980). The nearest documented locations were four occurrences, with the closest being one adult hawk observed with three eggs in 1898 about 4 miles east of SSFL in Chatsworth in a nest 18' up a sycamore tree, the next closest being eggs that were collected in 1890, 1896, 1898, and 1899 about 10 miles southeast of SSFL in Encino in nests about 20-50' up oak trees, and the third closest being three eggs collected on May 14, 1898 about 12 miles northeast of SSFL about two miles west of Newhall in a nest 33' up a black oak tree (CDFW 2015b, 2016a). **No effect** Due to the absence of the species and suitable habitat in the action area, the species will not be discussed further in this BA.
Riparia riparia Bank swallow -/ST/-	The bank swallow is commonly found on riparian banks and bluffs of rivers and streams and other lowland habitat west of the desert for nesting habitat. The highly social species nests in large colonies ranging from 10 to almost 2,000 active nests (Garrison 1999). It requires vertical banks and cliffs with fine-textured, erodible, sandy soils near streams, rivers, lakes, and the ocean to dig a nesting hole. In eastern North America, the breeding colonies can be found in sand and gravel quarries. This arrangement of breeding habitat occupied by known occurrences of the bank swallow does not occur on the SSFL site. The last known nesting occurrence near the SSFL site was in the Santa Clara River estuary in 1976 (Webster et al. 1980; Garrett and Dunn 1981). The nearest documented locations were three occurrences, with the closest being six eggs collected on May 15, 1897 about 3 miles northwest of SSFL in Simi Valley in a nest made of sticks and weeds that was in a hole about 2.5 feet deep in a creek bank about 4 feet high from the bottom and about 8 feet high from the top of the bank, the next closest being four eggs collected on a dirt bank on June 2, 1964 about 11 miles southwest of SSFL near Lake Sherwood, and the third closest being a small colony of birds observed nesting in the bluffs during May and June of 1907 about 15 miles southeast of SSFL in the Port of Los Angeles Long Wharf now called Will Rogers State Beach (CDFW 2015b, 2016a). **No effect** Due to the absence of the species and suitable habitat in the action area, the species will not be discussed further in this BA.

[a] Plants only.

Status:

Federal ESA = Endangered Species Act (U.S. Fish and Wildlife Service)
- FE = Federally listed as endangered
- FT = Federally listed as threatened
- PT = Federally proposed for listing as threatened under the ESA

CESA = California Endangered Species Act (California Department of Fish and Wildlife)
- SE = California state listed as endangered
- SR = California state listed as rare

CDFW = California Department of Fish and Wildlife
- SC = California species of special concern
- FP = California fully protected species

CaRPR = California Rare Plant Rank (California Department of Fish and Wildlife/California Native Plant Society)
- 1B = Plants rare, threatened, or endangered in California and elsewhere
- 2B = Plants rare, threatened, or endangered in California but not elsewhere
- 3 = Plants for which more information is needed (a review list)
- 4 = Plants of Limited Distribution – A Watch List
- .1 = Seriously endangered in California.
- .2 = Fairly endangered in California

VC = Ventura County Locally Important Plant List
- LI = Locally Important (1 - 5 occurrences in Ventura County)

CH = Critical Habitat

Sources: Beauchamp and Henrickson 1995; Bechard 1982; Beyers and Wirtz 1995; CDFW 2015b, 2016a, 2016b, 2016c; CNPS 2016; County of Ventura 2014a, 2014b; Dorsey 2007; England et al. 1995; EPA 2010; Eriksen and Belk 1999; Estep 1989; Faulkner 2010; Fotheringham and Keeley 1998; Franzreb 1989; Garrett and Dunn 1981; Garrison 1999; Glenn Lukos and Sapphos 2000; Helm 1998; Keeley 1995; Kus and Miner 1989; Landis 2007; SAIC 2009, 2010; USFWS 1997b, 1998a, 1999, 2006b, 2007b, 2008b, 2009b, 2009c, 2010a, 2010d, 2013b, and 2015b; Webster et al. 1980; Woodbridge 1991.

7.7.1 Plants

The following discussion focuses on plant species identified in Table 7-11 as potentially occurring on site and therefore carried forward for analysis.

7.7.1.1 Braunton's Milk-vetch (*Astragalus brauntonii*), FE, CRPR 1B.1

Impacts on Braunton's milk-vetch and its critical habitat are described in detail in Section 7.6.1.5 and summarized in this section to support the effects determinations below. Cleanup to AOC LUT values would directly remove the soil and seedbank from 54.7 acres of habitat occupied by Braunton's milk-vetch. Of this total, 44.3 acres would be within designated critical habitat, affecting 79 percent of critical habitat Unit 1d (Table 7–9, above). The above acreage values do not include impacts associated with access by heavy equipment such as backhoes and haul trucks to soil cleanup sites, which is likely to increase the disturbed area. Based on density estimates made on this site when the population was growing this removal of habitat could cause loss of 55,000 to 110,000 individuals.

Figure 7–2 (above) shows the area that would be directly affected by soil and seedbank removal, which amounts to 79 percent of the area of designated critical habitat within Area IV. Most of the area where LUT values are not exceeded was formerly used as a borrow area and supported limited numbers of Braunton's milk-vetch when the population was in an active growth mode following the 2005 Topanga fire.

Cleanup activities could result in permanent direct impacts to Braunton's milk-vetch through mortality/loss of individuals (if present) and the associated and irreplaceable seed bank, resulting in a reduction in the genetic diversity provided to the region. Removal of vegetation within and adjacent to Braunton's milk-vetch populations could decrease resources available for pollinators, which are primarily two species of native megachilid (leaf-cutter) bees and a native bumble bee species (Fotheringham and Keeley 1998).

The extensive removal of soil and vegetation associated with cleanup to LUT values within critical habitat *would result in destruction or adverse modification* of critical habitat by destroying each of the PCE's of the critical habitat listed above within the affected areas, which amounts to 79 percent of the designated critical habitat within Area IV. The physical and biological features essential to Braunton's milk-vetch habitat on SSFL would be altered. Alteration of occupied habitat in the vicinity of the critical habitat could further diminish the value of critical habitat for the conservation of a listed species by removing individuals of Braunton's milk-vetch, seed bank and destroying the habitat as well as by affecting pollinator populations.

There is considerable uncertainty as to whether the habitat capable of supporting Braunton's milk-vetch, its pollinators, and associated plant species and soil biota can be restored after removal of the soil and seedbank over such a large portion of their habitat. Additionally, identification of acceptable sources of suitable soils from calcareous marine sediments that would meet LUT values is likely to prove difficult. Obtaining such soils could have the unintended adverse effect of destroying potential habitat for the species. Sources of suitable backfill that would be capable of supporting Braunton's milk-vetch and would meet LUT values are not known. As noted in Section 5, the Braunton's milk-vetch population in Area IV is the largest documented population of the species and, assuming future protected status of SSFL, it has the potential to be the most secure from future land-use changes, increasing its importance to the survival of the species.

The adverse effects of physically removing the currently thriving critical habitat, Braunton's milk-vetch individuals, seedbank and associated species to achieve cleanup to AOC LUT values far outweigh any

ecological benefits of the cleanup. Given the specific habitat requirements Braunton's milk-vetch and associated sensitive species and questionable feasibility of restoration, long-term viability of this species at this location would best be attained by following risk-based cleanup standards. This is because both the species and the habitat are currently thriving within the proposed exemption area despite the extent of areas where samples indicate that LUT values have been exceeded. With very few exceptions (that would be addressed using a risk-based approach), these exceedances of LUT values are at a very low-level and do not warrant cleanup when human health and ecological receptor RBSLs are used to determine where potential soil cleanup may occur.

In conclusion, cleanup to AOC LUT values **may affect and is likely to adversely affect** Braunton's milk-vetch by removing vegetation and soil from nearly all of the area known to be occupied by Braunton's milk-vetch on SSFL (extending beyond the boundaries of the designated critical habitat), destroying the habitat and eliminating the seedbank (see Figure 7–2, above). Additionally, cleanup to AOC LUT values **may affect and is likely to adversely affect designated critical habitat** by destroying each of the PCE's of the Braunton's milk-vetch critical habitat within an estimated 79 percent of the designated critical habitat on SSFL (Figure 7–2).

7.7.1.2 Lyon's Pentachaeta (*Pentachaeta lyonii*) FE, SE, CRPR 1B.1

Not known or expected in the Action Area as described in Table 7–11. **No effect.**

7.7.1.3 Spreading Navarretia (*Navarretia fossalis*) FT, CRPR 1B.1

Not known or expected in the Action Area as described in Table 7–11. **No effect.**

7.7.1.4 Conejo Dudleya (*Dudleya abramsii* subsp. *parva* [=*Dudleya parva*]) FT, CRPR 1B.2, Ventura County Locally Important Species

Not known or expected in the Action Area as described in Table 7–11. **No effect.**

7.7.1.5 Santa Monica Mountains Dudleya (*Dudleya cymosa* subsp. *ovatifolia* [inclusive of *Dudleya cymosa* subsp. *agourensis*]) FT, CRPR 1B.2, Ventura County Locally Important Species

Not known or expected in the Action Area as described in Table 7–11. **No effect.**

7.7.1.6 Marcescent Dudleya (*Dudleya cymosa* subsp. *marcescens*) FT, SE, CRPR 1B.2, Ventura County Locally Important Species

Not known or expected in the Action Area as described in Table 7–11. **No effect.**

7.7.1.7 San Fernando Valley Spineflower (*Chorizanthe parryi* var. *fernandina*) PT, SE, CRPR 1B.1, Ventura County Locally Important Species

Not known or expected in the Action Area as described in Table 7–11. **No effect.**

7.7.1.8 California Orcutt Gass (*Orcuttia californica*) FE, SE, CRPR 1B.1, Ventura County Locally Important Species

Not known or expected in the Action Area as described in Table 7–11. **No effect.**

7.7.2 Birds

The following discussion focuses on bird species identified in Table 7–11 as potentially occurring on site and therefore carried forward for analysis.

7.7.2.1 Coastal California Gnatcatcher (*Polioptila californica californica*) FT, SC

The coastal California gnatcatcher may be an occasional visitor on the SSFL site. There has been one reported sighting in 2009 but since then no individuals have been documented despite protocol surveys on Area IV and the NBZ (Griffith Wildlife Biology 2010, 2011, and 2012) and protocol surveys of portions of Area I, III and the SBZ (Forde 2014; Padre 2016). These breeding season surveys did not reveal any coastal California gnatcatchers. There are approximately 128.6 acres of potential suitable habitat on SSFL (Table 4-1); however, the existing vegetation has not been used for breeding. If the coastal sage scrub onsite continues to develop and mature subsequent to the 2005 Topanga Fire and the recent severe drought, it could provide suitable habitat for the species during the course of remediation activities, which could occur ten to twenty or more years into the future. If coastal California gnatcatcher are present, cleanup activities have the potential to result in direct permanent impacts (mortality/loss and suitable habitat loss) and direct temporary impacts (habitat avoidance due to noise) to coastal California gnatcatcher. Vehicles and equipment driving to cleanup areas could harm or injure individuals and cause disturbance or direct harm to nesting birds. However, the birds would likely escape mortality by fleeing the area. Any removal of coastal sage scrub habitat would degrade vegetation cover and could remove and or reduce suitable habitat for cover and foraging during the nonbreeding season. Direct impacts would be greatest for birds or chicks during the breeding season (late February through July). Ground disturbance and noise could cause temporary effects to non-nesting individuals, which may be present during the non-breeding season. Noise could cause stress responses, flight responses, and changes in foraging behavior. Increased noise levels could affect the ability of individuals to detect approaching predators, mask the alarm calls, or interfere with communication between current or potential mating pairs or between adult birds and their fledglings. Sites with activities that include the removal of sage scrub habitat would be surveyed for coastal California gnatcatchers during the appropriate season prior to implementation to ensure avoidance for the duration of the nesting season of any areas found to be occupied (see proposed Conservation Measure 16). Although these measures would help minimize the potential for impact on coastal California gnatcatcher, they would not eliminate them if the gnatcatcher does happen to be on the site.

Ecological conditions and coastal California gnatcatcher populations could vary considerably during cleanup activities, which are expected to take place over ten to twenty or more years into the future. Over that period of time, there could be environmental conditions that allow expansion and increased suitability of sage scrub habitats on SSFL and that foster increases in nearby coastal California gnatcatcher populations supporting migration of dispersing gnatcatcher individuals to the SSFL where they could be impacted by remediation. Given that uncertainty, we conclude that cleanup to AOC LUT values **may affect and is likely to adversely affect the coastal California gnatcatcher**.

7.7.2.2 Least Bell's Vireo (*Vireo bellii* subsp. *pusillus*) FE, SE

Least Bell's vireo has been observed migrating through SSFL; however, no nesting birds have been documented and suitable breeding habitat is limited on SSFL. If birds and nests are present direct effects from cleanup activities could injure or kill individual least Bell's vireos, resulting in permanent direct impacts to this species. Vehicles and equipment driving to cleanup areas could harm or injure individuals and cause disturbance or direct harm to nesting least Bell's vireos, including mortality of

eggs and young birds if activities take place during the nesting season (March 15 through August 31). However, the birds would likely escape mortality by avoiding the area. Any removal of ripiaran habitat would degrade vegetation cover and could remove and or reduce suitable habitat for cover and foraging during the nonbreeding season (September 1 through March 14). Noise from equipment and vehicle operation could result in temporary direct impacts to least Bell's vireos, such as stress responses, flight responses, and changes in foraging behavior. Increased noise levels could also affect the ability of individuals to detect approaching predators, mask the alarm calls, or interfere with communication between current or potential mating pairs or between adult birds and their fledglings. Disturbance to mating or nesting behavior could result in unsuccessful breeding and nest formation, or abandonment of an active nest by adult birds. The activities would result indirect impacts to least Bell's vireo due to ground disturbance and subsequent sedimentation or runoff into riparian and upland habitats that provide foraging habitat. Conservation Measure 15 provides impact avoidance and minimization measures to avoid or minimize affecting least Bell's vireo should it be present during the breeding season.

Under current conditions, based on lack of breeding season observations of the species on SSFL and only one non-breeding season observation of the species on SSFL, coupled with implementation of proposed Conservation Measures, impacts on the species are so unlikely as to be discountable. However, ecological conditions and least Bell's vireo populations could vary considerably during cleanup activities, which are expected to take place over a period of ten to twenty or more years into the future. Over that period of time, there could be a wet period, for example, that allows the least Bell's vireo populations nearby to expand and suitable habitat to develop or increase on SSFL, thus supporting migrating or nesting individuals at the SSFL where they could be impacted by remediation. Given that uncertainty, we conclude that cleanup to AOC LUT values **may affect and is likely to adversely affect the least Bell's vireo**.

7.7.2.3 California Condor (*Gymnogyps californianus*) FE, SE-FP

Not known or expected in the Action Area as described in Table 7–11. **No effect.**

7.7.3 Amphibians

The following discussion focuses on amphibian species identified in Table 7–11 as potentially occurring on site and therefore carried forward for analysis.

7.7.3.1 California Red-legged Frog (*Rana draytonii*) FT, SC

CRF populations have been documented about 3 miles south of SSFL in the Las Virgenes Creek drainage. The upslope boundary of the Las Virgenes Creek (VEN-3) critical habitat unit extends slightly onto the southwestern portion of Area IV of SSFL (see Figure 5–5 above). There are approximately 0.6 acres of CRF critical habitat on SSFL, all of which overlaps designated CH for Braunton's milk-vetch on Area IV. The total area of the VEN-3 critical habitat area is 5,000 acres (USFWS 2010d).

CRF is not known to occur on SSFL because of limited aquatic habitat on site and relative isolation from existing CRF populations. The documented occurrences of CRF in the Las Virgenes Creek drainage are separated from Area IV by over 1,000 feet in elevation with multiple gains and losses of elevation through steep terrain and semiarid habitat in the approximately three-mile dispersal distance between the occupied habitat and remediation areas on SSFL.

Cleanup to AOC LUT values would adversely affect the 0.6 acres of designated critical habitat on site by removal of all vegetation and soil from the area. Because of its upslope position, the portion of the critical habitat on SSFL could be a source of sediment that could migrate downhill toward the aquatic portion of the habitat. This could be avoided by implementing and maintaining feasible BMPs to stop offsite migration of sediment. The area would need to be restored and revegetated to prevent erosion and sedimentation over the long term.

Cleanup to AOC LUT values would not adversely affect the PCEs for CRF habitat because aquatic habitat is lacking in the portion of the CH that would be affected by cleanup and the affected area exceeds the one mile dispersal radius from aquatic portions of the drainage supporting CRF breeding, which are about 3 miles distant from the remediation area. Figure 7–2, above, shows the remediation area for cleanup to AOC LUT values in the area of the critical habitat.

Under current conditions, given the distance and barriers to migration from existing CRF habitat and relative lack of suitable habitat onsite, it is very unlikely that a red-legged frog would be on site during remediation activities, therefore the likelihood of take in a given year is so low as to be discountable. However, ecological and CRF population conditions could vary considerably during cleanup activities, which are expected to take place over a period of ten to twenty or more years into the future. For example, there could be a wet period that allows the CRF populations nearby to expand and could support migration of dispersing individuals to the SSFL where they could be impacted by remediation. Given that uncertainty, we conclude that cleanup to AOC LUT values **may affect and is likely to adversely affect the CRF**.

Cleanup to AOC LUT values would destroy about 0.6 acre of designated critical habitat but would not affect the PCEs, as described above. Given its peripheral location on the upslope edge of the designated critical habitat and the small fraction (0.6 acres out of the 5,000-acre area of critical habitat unit VEN-3) of the designated critical habitat unit VEN-3 that would be affected, this would not appreciably diminish the size or value of critical habitat for the conservation of the CRF. Therefore the proposed project **may affect but is not likely to adversely affect CRF critical habitat**. Because the red-legged frog's designated critical habitat on SSFL is completely contained within the Braunton's milk-vetch critical habitat on SSFL, cleanup to AOC LUT values in the CRF critical habitat would also affect Braunton's milk-vetch critical habitat as described above.

Cleanup according to human-health and ecological risk-based criteria would reduce or eliminate the amount of critical habitat affected by removing only soils that pose a risk to human health or ecological receptors. As described above in Section 7.6.1.5, the small and localized nature of the soil removal areas under a human health and ecological risk-based cleanup increases the likelihood that restoration can be successfully accomplished and dramatically diminishing the requirement for replacement soil and minimizing dispersal distances for essential native organisms from adjacent intact habitat.

7.7.4 Invertebrates

The following discussion focuses on invertebrate species identified in Table 7–11 as potentially occurring on site and therefore carried forward for analysis.

7.7.4.1 Quino Checkerspot Butterfly (*Euphydryas editha quino*) FE

Not known or expected in the Action Area as described in Table 7–11. **No effect.**

7.7.4.2 Vernal Pool Fairy Shrimp (*Branchinecta lynchi*) FT

The proposed action has the potential to impact vernal pool habitat; however, the occurrence of vernal pool fairy shrimp species on SSFL is not known at this time. If fairy shrimp are present within the cleanup areas, long-term direct impacts to fairy shrimp and/or their cysts could occur and would include mortality/loss of individuals from or being crushed by vehicles and the associated damage or destruction of their habitat. In addition, impacts to the surrounding topography could affect drainage into vernal pools or the hydrologic connectivity amongst vernal pools. The severity of the impacts to federally listed fairy shrimp, if present, would depend on the location, size, intensity, and seasonal timing of the activities. Cleanup activities including movement of soil could result in increased sedimentation and/or loss of ground cover that leads to the loss or damage to individuals of this species. Potential adverse effects on vernal pools would be avoided and minimized to the extent feasible.

Direct effects to vernal pools from mowing, vegetation clearing, and foot trampling within the cleanup areas could result in permanent direct impacts (mortality/loss) to vernal pool fairy shrimp individuals and cysts, if present. However, the potential for mortality/loss or direct damage to any species that occurs in the rock pools is low because soils exceeding LUT values are generally outside of the sandstone rock outcrops most likely to contain vernal pools. Mowing or vegetation clearing to access cleanup areas could change the quantity and pattern of runoff, which could potentially result in an indirect impact to vernal pool fairy shrimp, altering the quantity of water flowing to vernal pools or other suitable habitat. If vernal pool habitats receive insufficient input of surface water from runoff, the species may not be able to carry out its life cycle. Vehicles and/or equipment could serve to transport exotic invasive plant species to the occupied areas from known infested locations elsewhere. Runoff carrying soils disturbed during remediation activities could transport sediments and pollutants to vernal pools, potentially reduce or augment overland flows that contribute to the inundation and transport of detritus and other biomass to vernal pools that could potentially affect vernal pool fairy shrimp.

Systematic and timely implementation of proposed Conservation Measures, which include pre-activity surveys, avoidance of occupied pools, and seasonal restrictions, would minimize impacts to vernal pool fairy shrimp, if present. However, implementation of the approved sampling protocols to determine presence or absence of the species would result in take if the species is present during the surveys. Although it is unknown whether or not vernal pool fairy shrimp occur on the site, ecological conditions and overall vernal pool fairy shrimp populations could vary considerably during cleanup activities, which are expected to take place over a period of ten to twenty or more years into the future. Over that period of time, there could be a wet period, for example, that allows the vernal pool fairy shrimp populations nearby to expand and suitable habitat to develop or increase on SSFL, supporting establishment of the species on SSFL where they could be impacted by remediation. Given that uncertainty, we conclude that cleanup to AOC LUT values **may affect and is likely to adversely affect** the vernal pool fairy shrimp.

7.7.4.3 Riverside Fairy Shrimp (*Streptocephalus woottonii*) FE

The potential for impacts to Riverside fairy shrimp would be as described for the vernal pool fairy shrimp. Systematic and timely implementation of Conservation Measure 13 would enable impacts to the Riverside fairy shrimp, if present, to be minimized.

Systematic and timely implementation of proposed Conservation Measures, which include pre-activity surveys, avoidance of occupied pools, and seasonal restrictions, would minimize impacts to Riverside

fairy shrimp, if present. However, implementation of the approved sampling protocols to determine presence or absence of the species would result in take if the species is present during the surveys. Although it is unknown whether or not Riverside fairy shrimp occur on the site, ecological conditions and overall Riverside fairy shrimp populations could vary considerably during cleanup activities, which are expected to take place over a period of ten to twenty or more years into the future. Over that period of time, there could be a wet period, for example, that allows overall Riverside fairy shrimp populations to expand and suitable habitat to develop or increase on SSFL, supporting establishment of the species on SSFL where they could be impacted by remediation. Given that uncertainty, we conclude that cleanup to AOC LUT values **may affect and is likely to adversely affect** the Riverside fairy shrimp.

7.8 Effects on State-listed Species (not including those that are already federally listed) and Species Meeting State Criteria for Listing as Endangered or Threatened, including CRPR List 1B Species

This section focuses on state-listed plant and wildlife species protected as endangered, threatened or rare under CESA and plant and wildlife species meeting state criteria for listing as endangered or threatened, including CRPR List 1B Species, that are known or judged to have a substantial potential to occur within the SSFL action area.

Appendix C provides summary accounts of "other special-status species", known or potentially occurring in the Action Area. Other special-status plant species discussed in Appendix C include CRPR List 2B, List 3, and List 4, and Species of Local Concern identified by Ventura County. Other special-status animal species include wildlife species that have been identified by the CDFW as California species of special concern or fully-protected species, and species identified by the County of Ventura as locally important wildlife species. Please see Appendix C for discussion of these species.

7.8.1 Plants

7.8.1.1 Santa Susana Tarplant (*Deinandra minthornii*) SR, CRPR 1B.2

Santa Susana tarplant occurs in large portions of Areas I, II, III, and IV and the NBZ, where it is closely associated with conspicuous sandstone outcrops of the Chatsworth Formation that project above much of the landscape of Areas I-IV and the NBZ (Figure 5–8, Table 5–3, above). Impacts on Santa Susana tarplant are described in detail in Section 7.6.3.6 for an example site. SSFL-wide impacts are evaluated in this section to support the effects determinations below. Cleanup to LUT values would result in direct vegetation and soil removal from an estimated 69.0 acres (15.5 percent) of 444.1 acres of key habitat areas dominated by Santa Susana tarplant on SSFL and would result in vegetation and soil removal from 12.2 acres out of 104 acres (11.7 percent) of tarplant points and polygons buffered points and polygons on SSFL). Their close association with the sandstone outcrops means that a majority of the locations are in relatively unbuildable terrain, which is the reason why a larger percentage of the plants and habitat would not be directly affected by soil remediation despite the widespread nature of soil cleanup in Areas I-IV and the NBZ.

Cleanup activities would result in permanent direct impacts to Santa Susana tarplant through loss of individuals, seedbank, and habitat, with resulting reduction not only in population size and habitat but also genetic diversity. The habitat disturbance would also adversely affect pollinator populations through loss of food plants and, possibly, breeding sites (which for many native bees are burrows in the soil). Seeds and beneficial soil organisms persisting in the soil would be lost, further impacting

the population. Sandstone outcrops, which form the core habitat for the species, would be adversely affected to an unknown extent.

Indirect temporary impacts could occur from soil disturbance and/or vegetation removal and subsequent erosion or runoff onto Santa Susana tarplant populations. Removal of vegetation and soils adjacent to Santa Susana tarplant populations would decrease resources available for pollinators, which include European honeybees and many genera of native bees (Padre 2013). Indirect impacts would also include reduced potential for the plants to persist or spread due to nearby land disturbance. Ground disturbance from cleanup activities also has the potential to provide suitable conditions for expansion of invasive plant species populations, particularly fountain grass, which thrives in sandy soils and crevices in rock outcrops and is well established locally on SSFL along roadsides and disturbed areas where it is poised for further expansion into areas disturbed by remediation.

The extensive removal of soil and vegetation associated with cleanup to AOC LUT values within Santa Susana tarplant habitat would result in altering essential habitat on SSFL by removing individuals of Santa Susana tarplant, its seed bank, associated soil biota, including mycorrhizae, and destroying the habitat. Soil removal would affect pollinator populations by destroying their foraging habitat, including food sources, and potentially destroying their nesting habitat, depending on its location. Currently sources of suitable soils for backfill in DOE's area have not been identified. In addition to the requirement that they meet LUT values, they should also be similar in origin (from sandstone). The challenges associated with restoring habitats impacted by cleanup to AOC LUT values are further described above in Sections 7.1 and 7.6.1.5.

As described above, implementation of cleanup to LUT values would clearly result in adverse modification of a considerable percentage of the Santa Susana tarplant habitat on SSFL based on this sample analysis. An additional unquantified amount of occupied habitat on SSFL would be destroyed or profoundly altered to enable access to the specific cleanup areas by excavation, soil handling, and hauling equipment. The prospects for successful restoration of the habitat become smaller as the percentage of the habitat affected increases. Destruction or alteration of the habitat adjacent to the occupied habitat caused by accessing the contamination would further diminish habitat value and conservation of Santa Susana tarplant by reducing the overall population size, its seed bank, as well as destroying occupied habitat and pollinator populations.

Based on the estimated direct destruction of between 10 and 20 percent of Santa Susana tarplant locations and habitat as well as additional unquantified impacts associated with enabling heavy excavation and hauling equipment to access the contamination, cleanup to AOC LUT values would be **regionally significant, direct and indirect long-term impacts that may not be fully mitigable** given the scale of the impact, the uncertainty of restoration, and the importance of the SSFL population to the species.

Implementation of a risk-based cleanup within the proposed AOC exemption area as described above under Braunton's milk-vetch would dramatically reduce this impact and would make restoration more feasible.

7.8.1.2 Malibu Baccharis (*Baccharis malibuensis*) CRPR 1B.1, Ventura County Locally Important Species

Known locations of Malibu baccharis on SSFL are restricted to Area IV, where it co-occurs with Braunton's milk-vetch within the Braunton's milk-vetch designated critical habitat and in the occupied habitat extending to the north of the critical habitat (Figure 5–10). The area occupied by Malibu baccharis is approximately 27.7 acres in extent. Cleanup to LUT values would cause all soil and

vegetation to be removed from about 25.9 acres (approximately 93.5 percent) of the area occupied by Braunton's milk-vetch on SSFL. The above acreages do not include access by heavy equipment such as backhoes and haul trucks to soil cleanup sites, which is likely to increase the disturbed area. The impact of soil removal over this large proportion of its habitat would devastate the SSFL Area IV population, which, with an estimated 200 individuals, may be the largest known for the species. Other occurrences have estimated numbers of individuals less than 25. There is considerable uncertainty as to whether habitat capable of supporting Malibu baccharis, its pollinators, and associated plant species and soil biota can be restored or created after removal of the soil and seedbank over the majority of this species' habitat on site as well as from extensive areas of adjacent habitat. The difficulty and questionable outcome of restoration described above for Braunton's milk-vetch would apply to Malibu baccharis as well, although less is known about its habitat requirements.

This is a **regionally significant, direct, long-term impact that may not be fully mitigable** and could result in the elimination of the SSFL population of this species, which may be the largest of the limited number of occurrences known for the species (see Figure 5–9).

Implementation of a risk-based cleanup within the proposed AOC exemption area as described above under Braunton's milk-vetch would reduce or eliminate this impact.

7.8.1.3 Slender Mariposa Lily (*Calochortus clavatus var. gracilis*) CRPR 1B.2, Ventura County Locally Important Species

As indicated in Section 5.2.1.3, the identity of the subspecies of mariposa lily, on SSFL needs confirmation but is possibly the CRPR 1B.2 slender mariposa lily. The undetermined subspecies is present on several portions of Area IV (Figure 5–11, above). NASA biologists identified slender mariposa lily on a rock slab along with three locations of unidentified mariposa lilies. Boeing identified Clubhair mariposa lily, which does not have a CRPR ranking and no location data is available. The question of identity needs to be resolved, which would happen in preremediation surveys. Cleanup to AOC LUT values would destroy any population of the species that overlaps with soil remediation areas, which includes all of the occurrences of undetermined mariposa lily subspecies in Area IV. The difficulty and questionable outcome of restoration of native habitat after soil removal described above applies to this species as well. These would be **locally significant, direct long-term impacts that may not be mitigable** given the difficulty and uncertainty associated with restoration.

Implementation of a risk-based cleanup within the proposed AOC exemption area as described above under Braunton's milk-vetch would reduce or eliminate impacts to this species because most of the known occurrences of mariposa lilies are within proposed AOC exemption areas in Area IV.

7.8.1.4 Late-flowered Mariposa Lily (*Calochortus fimbriatus*) CRPR 1B.2, Ventura County Locally Important Species

As indicated in Section 5.2.1.4, the identity of late-flowered mariposa lily on SSFL needs confirmation. Plummer's mariposa lily (a CRPR List 4 species discussed in Appendix C) or an undescribed taxon are other possibilities for the identity of this plant. The question of identity needs to be resolved, which would happen in preremediation surveys and consultation with authorities. Assuming this species is on site, cleanup to AOC LUT values would destroy any population of the species that overlaps with soil remediation areas, which includes most or all of the occurrences that could be this species (mapped as Plummer's mariposa lily) in Area IV (see Figure 5–11, above). The difficulty and questionable outcome of restoration of native habitat after soil removal described above applies to this species as

well. These would be **locally significant, direct long-term impacts that may not be mitigable** given the difficulty and uncertainty associated with restoration.

Implementation of a risk-based cleanup within the proposed AOC exemption area as described above under Braunton's milk-vetch would reduce or eliminate impacts to this species because most of the known occurrences of this species or the similar Plummer's mariposa lily are within proposed AOC exemption areas in Area IV.

7.8.1.5 California Screw Moss (*Tortula californica*) CRPR 1B.2

Although the presence of California screw moss has not been confirmed within the Action Area, suitable habitat is present and the species could have easily been overlooked or missed during surveys because of its ephemeral nature. It is associated with thin, sandy soils over rock (Malcolm et al. 2009) and has the potential to occur in steep dipslope grassland, vegetated rock outcrops, or other areas with open canopy where soils support other mosses or bryophytes. If present, this species could be directly affected by removal of suitable habitat and soil disturbance, or indirectly affected by habitat degradation associated with dust or weed invasion. This species may be more widespread than known so the extent of the impact is difficult to determine. Restoration would require the establishment of suitable soil conditions, capable of supporting moss species, which would be difficult. The difficulty and questionable outcome of restoration of native habitat after soil removal described above applies to this species as well. These would be **locally significant, direct long-term impacts that may not be mitigable** given the difficulty and uncertainty associated with restoration.

Implementation of a risk-based cleanup within the proposed AOC exemption areas as described above under Braunton's milk-vetch would reduce or eliminate impacts to this species because most much of the likely suitable habitat for this species also supports other sensitive plant species, such as Santa Susana tarplant and mariposa lilies, within proposed AOC exemption areas. Implementation of a risk-based cleanup within the proposed AOC exemption area as described above under Braunton's milk-vetch would reduce or eliminate this impact.

7.8.2 Birds

7.8.2.1 Swainson's Hawk (*Buteo swainsonii*) ST

Not known or expected in the Action Area as described in Table 7–11. **No effect.**

7.8.2.2 Bank Swallow (*Riparia riparia*) ST

Not known or expected in the Action Area as described in Table 7–11. **No effect.**

8.0 Other Relevant Information

Nothing anticipated here at this time.

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9.0 Conclusions

9.1 Conclusions for Federally Listed or Proposed Threatened or Endangered Species and Critical Habitat

The conclusion for Braunton's milk-vetch is **May Affect and is Likely to Adversely Affect** Braunton's milk-vetch. The conclusion for Braunton's milk-vetch critical habitat is **May Affect and is Likely to Adversely Affect** designated critical habitat through direct loss of habitat**.**

The conclusion for CRF is **May Affect and is Likely to Adversely Affect** the CRF. The conclusion for CRF Critical Habitat is **May Affect but is Not Likely to Adversely Affect** designated critical habitat for CRF.

The conclusion for the four listed species below is **May Affect and is Likely to Adversely Affect**.

Coastal California gnatcatcher
Least Bell's vireo
Vernal pool fairy shrimp
Riverside fairy shrimp

The conclusion for the eight listed and one proposed species below is **No Effect**.

Lyon's pentachaeta
Spreading navarretia
Conejo dudleya
Santa Monica Mountains dudleya
Marcescent dudleya
San Fernando Valley spineflower (proposed species)
California Orcutt grass
California condor
Quino checkerspot butterfly

9.2 Conclusions for State-listed species (not including those that are already federally listed) and species meeting state criteria for listing as endangered or threatened, including CRPR List 1B species.

The conclusions for the five state-listed species below are as follow:

- Santa Susana tarplant – **Regionally significant direct and indirect long-term impacts that are not fully mitigable**.
- Malibu baccharis – **Regionally significant direct long-term impacts that are not fully mitigable**.
- Slender mariposa lily (if present) – **Locally significant direct, long-term impacts that are not fully mitigable**.
- Late-flowered mariposa lily (if present) – **Locally significant direct, long-term impacts that are not fully mitigable**.
- California screw moss (if present) – **Locally significant, direct long-term impacts that may not be fully mitigable**.

The conclusion for the two state-listed species below is **No Effect**.

- Swainson's hawk
- Bank swallow

These conclusions are based on analysis of the status, biology, and baseline conditions for each species, their anticipated response to the Action, and application of associated avoidance and minimization measures provided. Support for the conclusions is discussed in detail above in Section 7 Effects of the Action.

10.0 List of Documents (Environmental Planning Documents that will be submitted with the BA)

Documents to be submitted on behalf of Boeing are indicated with an asterisk (*).

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Seventeen years. GIS support.

Supporting Documentation

1. Letter dated January 31, 2018 from J. Jones, Director, Energy Technology Engineering Center, Simi Valley, California, to Mr. S. Henry, Field Supervisor, Ventura Fish and Wildlife Office Ventura, California, RE: Revised request for the initiation of formal consultation under Section 7, Santa Susana Field Laboratory, Ventura County California.
2. Letter dated March 8, 2018 from Ms. L. Chang, Acting Assistant Field Supervisor, Ventura Fish and Wildlife Office, to J. Jones, PMP, Director, Energy Technology Engineering Center, RE: Acknowledgement of Request to Initiate Formal Consultation for the Cleanup of Area IV of the Santa Susana Field Laboratory, Ventura County, California (2017-F-0632)
3. Letter dated July 20, 2018 from J. Jones, Director, Energy Technology Engineering Center, Simi Valley, California, to Mr. S. Henry, Field Supervisor, Ventura Fish and Wildlife Office, Ventura, California, RE: Clarification of DOE's request for formal consultation based on DOE's Biological Assessment under Section 7, Santa Susana Field Laboratory, Ventura County California).

U. S. Department of Energy
Energy Technology Engineering Center
4100 Guardian Street, Suite 160
Simi Valley, CA 93063

January 31, 2018

Mr. Stephen Henry
FISH AND WILDLIFE SERVICE
Ventura Fish and Wildlife Office
2493 Portola Road, Suite B
Ventura, California 93003

Subject: Revised request for the initiation of formal consultation under Section 7,
Santa Susana Field Laboratory, Ventura County, California

Thank you for the opportunity to clarify with this letter the Department of Energy's (DOE's) intent with the recent submittal of the Biological Assessment (BA). The following describes DOE's intent and determination of effect.

Request for the Initiation of formal consultation under Section 7

With the Biological Assessment (BA) submitted January 31, 2018, the U. S. Department of Energy (DOE) is requesting initiation of formal consultation under Section 7 of the Federal Endangered Species Act (Act) for the Santa Susana Field Laboratory (SSFL) Remediation project for the species and critical habitats listed below under items 1, 2, and 3.
The DOE project analyzed in the accompanying Biological Assessment (BA) is to clean up and/or treat radiologically and chemically impacted soil and groundwater on SSFL, to remove/demolish existing buildings and infrastructure, to dispose of resulting waste, and to restore the affected environment in accordance with requirements prescribed by the Department of Toxic Substances Control (DTSC) in the 2007 Cleanup Order (CO) and the 2010 Administrative Order on Consent (AOC).
Specifically, the proposed action includes soil remediation and off-site disposal by means of cleanup to AOC Look-Up Table (LUT) values.
The BA identifies "proposed AOC exemption areas" which are areas that encompass known distribution of federally listed species and critical habitat as well as state-listed and other sensitive species and habitat recognized as sensitive as discussed in Section 4.2.3. The BA identifies a systematic process approach that would allow cleanup of chemicals and radionuclides to levels protective of human and ecological health within the proposed exemption areas. This process approach, which is described in Sections 7.6.1.1 and 7.6.1.2, avoids or minimizes damage to listed species and their habitat within the proposed exemption areas, and is based on point-by-point analysis of the extensive soil sample data available across the site coupled with field assessment. An example of the application of this process approach for Braunton's milk-vetch is presented in Section 7.6.1.5, where Table 7-9 and Figures 7-2 and 7-3, show effects of the proposed project (Soil cleanup to AOC LUT values including TPH)

compared to effects of cleanup to Human health and ecological risk-based criteria using the process approach described in the BA.

Determination of effects to listed species/critical habitat

DOE has made the following determinations regarding effects of the proposed project on listed, proposed, and candidate species and designated critical habitat.

1. The proposed project "may affect and is likely to adversely affect" the following six species.
   - Braunton's milk-vetch (*Astragalus brauntonii*)
   - Coastal California gnatcatcher (*Polioptila californica)*
   - Least Bell's vireo (*Vireo bellii pusillus)*
   - California red-legged frog (*Rana draytonii*)
   - Vernal pool fairy shrimp (*Branchinecta lynchi)*
   - Riverside fairy shrimp (*Streptocephalus woottoni)*
2. The proposed project "may affect and is likely to adversely affect" critical habitat for the Braunton's milk-vetch through direct loss of habitat.
3. The proposed project "may affect but is not likely to adversely affect" critical habitat for the California red-legged frog.
4. The project will have "no effect" on the eight listed and one proposed threatened species identified below.
   - Lyon's pentachaeta (*Pentachaeta lyonii)*
   - Spreading navarretia (*Navarretia fossalis)*
   - Conejo dudleya (*Dudleya abramsii* subsp. *parva)*
   - Santa Monica Mountains dudleya (*Dudleya cymosa* subsp. *ovatifolia)*
   - Marcescent dudleya (*Dudleya cymosa* subsp. *marcescens)*
   - San Fernando Valley spineflower (proposed threatened) (*Chorizanthe parryi* var. *fernandina)*
   - California Orcutt grass (*Orcuttia californica)*
   - California condor (*Gymnogyps californianus)*
   - Quino checkerspot butterfly (*Euphydryas editha quino)*

Therefore, pursuant to Section 7 of the Endangered Species Act of 1973, as amended, DOE hereby requests initiation of formal consultation for the proposed SSFL Remediation project with regard to the six listed species identified above under #1 and with regard to Braunton's milk-vetch critical habitat. We request your concurrence that the proposed project may affect but is not likely to adversely affect the critical habitat of the California red-legged frog.

The previously submitted BA, dated January 31, 2018, provides the required information identified in 50 CFR Part 402.14(c) and provides thorough analysis supporting the determinations identified above. The main points of the analysis supporting the determinations outlined above are summarized below along with references to the key BA sections containing further information.

1. **Braunton's milk-vetch and critical habitat.** As summarized in Section 7.7.1.2, cleanup to AOC LUT values would directly remove soil and seedbank from 54.7 acres of habitat occupied by Braunton's milk-vetch. This includes 44.3 acres within designated critical habitat, representing approximately 79 percent of the designated critical habitat on SSFL. There is considerable uncertainty as to whether the habitat capable of supporting Braunton's milk-vetch, its pollinators, and associated plant species and soil biota can be restored after removal of the soil and seedbank over such a large portion of their habitat. Sources of suitable backfill that would be capable of supporting Braunton's milk-vetch and would meet LUT values have not been found. The Braunton's milk-vetch population in Area IV is the largest documented population of the species and, assuming future protected status of SSFL, it has the potential to be the most secure from future land-use changes, increasing its importance to the survival of Braunton's milk-vetch. These factors lead to the determinations that the proposed project "may affect and is likely to adversely affect" Braunton's milk-vetch and "may affect and is likely to adversely affect" Braunton's milk-vetch critical habitat.

2. **Coastal California gnatcatcher, Least Bell's vireo, California red-legged frog, vernal pool fairy shrimp, and Riverside fairy shrimp**. As summarized in Table 7-11 and in Sections 7.7.2.1, 7.7.2.2, 7.7.3.1, 7.7.4.2, and 7.7.4.3, these species have not been identified as breeding species in the Action Area although it is possible that they could pass through or occupy it in the future during the course of the proposed remediation activities, which are expected to take place over ten to twenty or more years into the future. Over that period of time there could be environmental conditions (e.g., a series of wet years) that allow population expansion of these species and/or increased suitability of habitats for these species on SSFL facilitating their establishment. Implementation of the proposed impact avoidance and conservation measures for these species described in BA Section 3.6 would reduce but not eliminate the potential for take of these species, if present. Given their potential presence during remediation, we conclude that the project "may affect and is likely to adversely affect" these species.

3. **California red-legged frog critical habitat**. As summarized in Table 7-11 and in Section 7.7.3.1, approximately 0.6 acres at the upslope periphery of the 5,000-acre VEN-3 critical habitat unit for California red-legged frog is within the project boundary and may be affected by the proposed remediation activities. The Primary Constituent Elements (PCEs) of the critical habitat are listed in Table 7-11 and would not be affected by the proposed project and project effects would not appreciably reduce the ability of the critical habitat to support the species given the small size and strictly upland nature of the affected area and its distance (approximately 3 miles) from aquatic portions of the drainage that have been known to support CRF breeding. These factors combined with implementation of proposed conservation measures lead to the determinations that the proposed project "may affect and is unlikely to adversely affect California red-legged frog critical habitat".

4. **Eight listed and one proposed threatened plant species.** Information presented in Section 5.1 and summarized in Table 7-11 indicates that the eight listed and one candidate species identified above under item 4 do not occur in the Action Area and are judged very unlikely to occur there during project activities. These factors lead to a "no effect" determination for each of these species and their critical habitat, where applicable.

We appreciate your timely feedback to our previous BA submittal and hope this response further clarifies DOE's submittal of the SSFL BA. We will be happy to address any further questions to assist you in this consultation. If you have any questions or concerns, please give me a call at (805) 416-0992.

John B Jones, PMP
DOE/ETEC Director

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United States Department of the Interior

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IN REPLY REFER TO:
08EVEN00-2018-TA-0180

March 8, 2018

John Jones, PMP, Director, DOE/ETEC
Energy Technology Engineering Center
U.S. Department of Energy
4100 Guardian Street, Suite 160
Simi Valley, California 93063

Subject: Acknowledgement of Request to Initiate Formal Consultation for the Cleanup of Area IV of the Santa Susana Field Laboratory, Ventura County, California (2017-F-0632)

Dear Mr. Jones:

This letter acknowledges our receipt of the additional requested information and materials, received in our office on January 31, 2018, along with your request for initiation of formal consultation pursuant to section 7 of the Endangered Species Act of 1973, as amended (Act). The U.S. Department of Energy (DOE) is proposing to clean up and/or treat radiologically- and chemically-impacted soil and groundwater on the Santa Susana Field Laboratory (SSFL) on the portion of the site under its jurisdiction (Area IV and the northern buffer zone), to remove existing buildings and infrastructure, to dispose of resulting waste, and to restore the affected environment in accordance with applicable laws, orders, regulations, and agreements with the State of California. The requested consultation concerns the potential effects of the DOE's cleanup of its portion of the SSFL on the federally endangered Braunton's milk-vetch (*Astragalus brauntonii*) and its designated critical habitat, Riverside fairy shrimp (*Streptocephalus woottoni*), and least Bell's vireo (*Vireo bellii pusillus*); and the federally threatened coastal California gnatcatcher (*Polioptila californica californica*), California red-legged frog (*Rana draytonii*), and vernal pool fairy shrimp (*Branchinecta lynchi*). The DOE would implement the proposed project in accordance with the requirements prescribed by the Department of Toxic Substance Control (DTSC) in the 2007 Cleanup Order and the 2010 Administrative Order on Consent.

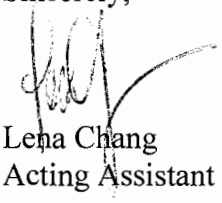
All information required of you to initiate consultation was either included with your request letter, obtained during phone communications, meetings, letters, and electronic mail, or is otherwise accessible for our consideration and reference. The regulations that implement section 7 allow the Service up to 90 days to conclude formal consultation with your agency and an additional 45 days to prepare our biological opinion (unless we mutually agree to an extension). On a March 8, 2018, phone conversation with Mark Elvin of our staff you agreed to a 60-day

extension of the consultation period. Based on that discussion between our staffs, we understand you are supportive of the 60-day extension of the consultation period in accordance with 50 CFR 402.14(e). As a result of this extension, we will strive to issue our biological opinion on the subject project on or before August 14, 2018.

We believe an extension of the consultation period would benefit both our agencies by allowing us more time to ensure that all pertinent information is incorporated into the biological opinion on this complex project.

As a reminder, section 7(d) of the Act requires that, after the initiation of formal consultation, the lead Federal agency may make no irreversible or irretrievable commitment of resources that could preclude the formulation or implementation of any reasonable and prudent alternatives to avoid jeopardizing the continued existence of endangered or threatened species or destroying or adversely modifying critical habitat. If you have any questions regarding this letter or the consultation process, please feel free to contact Jenny Marek of our staff at (805) 677-3313, or by electronic mail at jenny_marek@fws.gov.

Sincerely,



Lena Chang
Acting Assistant Field Supervisor

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July 20, 2018

Mr. Stephen Henry
Fish and Wildlife Service
Ventura Fish and Wildlife Office, 2493 Portola Road, Suite B
Ventura, California 93003

Subject: Clarification of DOE's request for formal consultation based on DOE's Biological Assessment. under Section 7, Santa Susana Field Laboratory, Ventura County, California

Dear Mr. Henry:

Thank you for the opportunity to clarify with this letter the Department of Energy's (DOE's) request for formal consultation on DOE's Biological Assessment (BA) first submitted on August 28, 2017 and revised and re-submitted on January 31, 2018 based on requests by US Fish and Wildlife Service (Service) for additional information. In a letter dated March 8, 2018, US Fish and Wildlife Service, acknowledged that the information requested had been received and that formal consultation began on January 31, 2018 pursuant to section 7 of the Endangered Species Act of 1973, as amended.

The Service and DOE along with the other Responsible Parties (Boeing and NASA), the Department of Toxic Substances Control (DTSC), and the California Department of Fish and Wild life have coordinated efforts with many letters, phone communications, meetings and electronic mail that helped form the basis of the Biological Assessment (BA).

The Service commented on the effects of cleanup activities on listed species and critical habitat identified in the DTSC Draft Environmental Impact Report in a letter dated December 12, 2017. The Service noted in part of the comments that:

> *"Biological resources will be severely impacted in all areas that are subject to excavation of soil, import of backfill, and implementation of restoration. We do not expect that the biological resources that exist before the project can be replaced with the same ecological integrity following the extensive AOC background cleanup."*
>
> *"We concluded that the effects to Braunton's milk-vetch and its critical habitat would be substantial, and recommended a biological exception to limit soil removal in Braunton's milk-vetch habitat to only the soils that contain contamination to levels that pose a risk to human health and the environment."*

Also, prior to the final development of the BA, DOE requested technical assistance from the service on July 26, 2016. The response dated, February 2, 2017 provided DOE with information about the methodology that the Service used to evaluate the effects of cleanup activities on listed species and critical habitat. It also provided DOE with recommendations for minimizing the impact of cleanup on the Braunton's milk-vetch. This technical report concluded with the following paragraph.

"We recommend that DOE and DTSC consider exercising an exemption to the AOC within Braunton's milk-vetch habitat, such that cleanup actions are only conducted in areas where contamination poses a risk to human health or the environment. We understand the intent of cleanup to background as remediating the site to conditions which existed prior to the industrial activities; however, there is the possibility that chemicals may exist in the soil at concentration that are above background but pose no appreciable risk to humans or the environment. In these instances, soil excavation would pose a far greater environmental risk than allowing low levels of oil contamination to persist. We recommend that DOE conduct human health and ecological risk assessment to identify areas where soil contamination exceed risk thresholds, and target soil excavation in those areas only."

The BA identifies "proposed AOC exemption areas" which are areas that encompass known distribution of federally listed species and critical habitat as well as state-listed and other sensitive species and habitat recognized as sensitive as discussed in Section 4.2.3. The BA identifies a systematic process approach that would allow cleanup of chemicals and radionuclides to levels protective of human and ecological health within the proposed exemption areas. This process approach, which is described in Sections 7.6.1.1 and 7.6.1.2, avoids or minimizes damage to listed species and their habitat within the proposed exemption areas, and is based on point-by-point analysis of the extensive soil sample data available across the site coupled with field assessment. An example of the application of this process approach for Braunton's milk-vetch is presented in Section 7.6.1.5, where Table 7-9 and Figures 7-2 and 7-3, show effects of the proposed project (Soil cleanup to AOC LUT values including TPH) compared to effects of cleanup to Human health and ecological risk-based criteria using the process approach described in the BA.

Determination of effects to listed species/critical habitat

DOE has made the following determinations regarding effects of the proposed project on listed, proposed, and candidate species and designated critical habitat.

1. The proposed project "may affect and is likely to adversely affect" the following six species.

- Braunton's milk-vetch (Astragalus brauntonii)
- Coastal California gnatcatcher (Polioptila californica)
- Least Bell's vireo (Vireo bellii pusillus)
- California red-legged frog (Rana draytonii)
- Vernal pool fairy shrimp (Branchinecta lynchi)
- Riverside fairy shrimp (Streptocephalus woottoni)

2. The proposed project "may affect and is likely to adversely affect" critical habitat for the Braunton's milk-vetch through direct loss of habitat.

Therefore, pursuant to Section 7 of the Endangered Species Act of 1973, as amended, DOE hereby requests the Services opinion on the proposed process identified in the BA related to the protection of the six listed species identified above under #1 and with regard to Braunton's milk-vetch critical habitat.

The previously submitted BA, dated January 31, 2018, provides the required information identified in 50 CFR Part 402.14(c) and provides thorough analysis supporting the determinations identified above. The main points of the analysis supporting the determinations outlined above are summarized below along with references to the key BA sections containing further information.

1. Braunton's milk-vetch and critical habitat. As summarized in Section 7.7.1.2, cleanup to AOC LUT values would directly remove soil and seedbank from 54.7 acres of habitat occupied by Braunton's milk-vetch. This includes 44.3 acres within designated critical habitat, representing approximately 79 percent of the designated critical habitat on SSFL. There is considerable uncertainty as to whether the habitat capable of supporting Braunton's milk-vetch, its pollinators, and associated plant species and soil biota can be restored after removal of the soil and seedbank over such a large portion of their habitat. Sources of suitable backfill that would be capable of supporting Braunton's milk-vetch and would meet LUT values have not been found. The Braunton's milk-vetch population in Area IV is the largest documented population of the species and, assuming future protected status of SSFL, it has the potential to be the most secure from future land-use changes, increasing its importance to the survival of Braunton's milk-vetch. These factors lead to the determinations that the proposed project "may affect and is likely to adversely affect" Braunton's milk-vetch and "may affect and is likely to adversely affect" Braunton's milk-vetch critical habitat.

2. Coastal California gnatcatcher, Least Bell's vireo, California red-legged frog, vernal pool fairy shrimp, and Riverside fairy shrimp. As summarized in Table 7-11 and in Sections 7.7.2.1, 7.7.2.2, 7.7.3.1, 7.7.4.2, and 7.7.4.3, these species have not been identified as breeding species in the Action Area although it is possible that they could pass through or occupy it in the future during the course of the proposed remediation activities, which are expected to take place over ten to twenty or more years into the future. Over that period of time there could be environmental conditions (e.g., a series of wet years) that allow population expansion of these species and/or increased suitability of habitats for these species on SSFL facilitating their establishment. Implementation of the proposed impact avoidance and conservation measures for these species described in BA Section 3.6 would reduce but not eliminate the potential for take of these species, if present. Given their potential presence during remediation, we conclude that the project "may affect and is likely to adversely affect" these species.

3. California red-legged frog critical habitat. As summarized in Table 7-11 and in Section 7.7.3.1, approximately 0.6 acres at the upslope periphery of the 5,000-acre VEN-3 critical habitat unit for California red-legged frog is within the project boundary and may be affected by the proposed remediation activities. The Primary Constituent Elements (PCEs) of the critical habitat are listed in Table 7-11 and would not be affected by the proposed project and project effects would not appreciably reduce the ability of the critical habitat to support the species given the small size and strictly upland nature of the affected area and its distance (approximately 3 miles) from aquatic portions of the drainage that have been known to support CRF breeding. These factors combined with implementation of proposed conservation measures lead to the determinations that the proposed project "may affect and is unlikely to adversely affect California red-legged frog critical habitat".

4. Eight listed and one proposed threatened plant species. Information presented in Section 5.1 and summarized in Table 7-11 indicates that the eight listed and one candidate species identified above under item 4 do not occur in the Action Area and are judged very unlikely to occur there during project activities. These factors lead to a "no effect" determination for each of these species and their critical habitat, where applicable.

We appreciate your timely feedback to our previous BA submittal and hope this response further clarifies DOE's submittal of the SSFL BA and our conclusion that it is necessary to have DTSC grant exceptions and implement the process outlined in DOE's BA. In order to protect the Braunton's milk-vetch and its' critical habitat, cleanup in those exempted areas should only happen in those instances where the sampling results resulted in a risk to human health and the environment. DOE believes that the process outlined in the BA provides the necessary protection of the species and asks that the Service render their opinion based on DOE's BA and conclusions. We will be happy to address any further questions to assist you in this consultation. If you have any questions, please give me a call at (805) 416-0992. Best regards.

John B. Jones, PMP
Director of DOE/ETEC

cc: Jenny Marek, US F&W
Mark Elvin, US F&W
Stephie Jennings, DOE
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