National Aeronautics and Space Administration

Draft Supplemental Environmental Impact Statement for Soil Cleanup Activities at Santa Susana Field Laboratory

Ventura County, California

Prepared for

National Aeronautics and Space Administration
Santa Susana Field Laboratory Ventura County, California

October 25, 2019

Draft SEIS

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Cover Sheet

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Abstract: The National Aeronautics and Space Administration (NASA) has prepared this Supplemental Environmental Impact Statement (SEIS) to inform NASA decision makers, regulating agencies, and the public about the environmental impacts of the proposed soil cleanup activities at NASA's Santa Susana Field Laboratory (SSFL) in Ventura County, California. NASA has prepared this SEIS in accordance with the National Environmental Policy Act of 1969 (NEPA), as amended (42 *United States Code* 4321 et seq.); the NEPA-implementing regulations issued by the Council on Environmental Quality (CEQ) (Title 40 *Code of Federal Regulations* [CFR] Parts 1500–1508); and the NASA Procedural Requirements 8580.1 for implementing NEPA (14 CFR Part 1216, Subpart 1216.3).

For NASA's soil cleanup activities at SSFL, significant new information relevant to the scope of the soil cleanup and potential environmental impacts has been identified since the publication of NASA's 2014 Environmental Impact Statement. Specifically, there has been a significant increase in the expected soil remediation area and volume as determined by the follow-on field work and verification by the California Department of Toxic Substances Control in its draft Programmatic Environmental Impact Report.

Section 1, Purpose and Need, describes the site history, reasons for conducting this evaluation, and the scope of the analysis. Section 2, Description of Proposed Action Alternatives, describes the Action Alternatives for implementing the soil remediation and the No Action Alternative for soil cleanup. This section also includes a description of other alternatives and resource areas that were considered but removed from further consideration. Section 3, Affected Environment and Environmental Consequences, provides an overview of the existing physical, biological, social, and cultural conditions and the potential environmental impacts from the Proposed Action Alternatives on the NASA-administered property at SSFL.

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Acronyms and Abbreviations

°F	degrees Fahrenheit
µg/kg	microgram(s) per kilogram
µg/m³	microgram(s) per cubic meter
AADT	average annual daily traffic
ACHP	Advisory Council on Historic Preservation
ADT	average daily traffic
AOC	Administrative Order on Consent
APE	area of potential effects
ARB	California Air Resources Board
ARPA	Archaeological Resources Protection Act of 1979
ATSDR	Agency for Toxic Substances and Disease Registry
BBC	Brandeis-Bardin Campus
bgs	below ground surface
BMP	best management practice
Boeing	The Boeing Company
CAA	Clean Air Act
Cal EPA	California Environmental Protection Agency
Cal OSHA	California Occupational Safety and Health Administration
CalEEMod	California Emissions Estimator Model
Caltrans	California Department of Transportation
CAMU	corrective action management unit
CDFA	California Department of Food and Agriculture
CDFW	California Department of Fish and Wildlife
CDHS	California Department of Health Services
CDL	commercial driver's license
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFGW	Chatsworth Formation Groundwater
CFOU	Chatsworth Formation Operable Unit
CFR	*Code of Federal Regulations*
CHRIS	California Historical Resources Information System
CNL	community noise equivalent level
CNPS	California Native Plant Society
CO	carbon monoxide
COC	chemical of concern
CRWQCB	California Regional Water Quality Control Board
CTCP	construction traffic control plan
CWA	Clean Water Act
dB	sound pressure level decibel
dBA	sound pressure level in decibels (A-weighted)
DNL	day-night noise level
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DSR	data summary report
DTSC	Department of Toxic Substances Control
EcoRBSL	ecological risk-based screening level

EIS	environmental impact statement
Environ	Environ International Corporation
EO	executive order
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESAAP	Environmentally Sensitive Areas Action Plan
ETEC	Energy Technology Engineering Center
FEIS	final environmental impact statement
FEMA	U.S. Federal Emergency Management Agency
FHWA	Federal Highway Administration
ft	foot (feet)
GAC	granular activated carbon
GETS	groundwater extraction and treatment system
GSA	General Services Administration
H&S	health and safety
HAER	Historic American Engineering Record
HCM	Highway Capacity Manual
I	interstate
ICRMP	Integrated Cultural Resources Management Plan
ISRA	interim source removal action
lb/day	pound(s) per day
L_{eq}	equivalent noise level
LLRW	low-level radioactive waste
LOS	level of service
LOX	liquid oxygen
LUT	Look-Up Table
mg/kg	milligram(s) per kilogram
MNA	monitored natural attenuation
mph	mile(s) per hour
MRL	method reporting limit
msl	mean sea level
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves and Repatriation Act
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act of 1969
NHPA	National Historic Preservation Act of 1966
NO_2	nitrogen dioxide
NOA	notice of availability
NOI	notice of intent
NOx	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	National Resources Conservation Service
NRHM	non-radioactive hazardous materials
NRHP	National Register of Historic Places
NSGW	near-surface groundwater
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PEIR	Program Environmental Impact Report
PERP	Portable Equipment Registration Program

pg/g	picogram(s) per gram
PM_{10}	particulate matter having an aerodynamic equivalent diameter of 10 microns or less
$PM_{2.5}$	particulate matter having an aerodynamic equivalent diameter of 2.5 microns or less
ppm	part(s) per million
PSD	prevention of significant deterioration
RAG	Risk Assessment Guidance
RCNM	Roadway Construction Noise Model
RCRA	Resource Conservation and Recovery Act of 1976
ROD	record of decision
ROI	region of influence
RWQCB	Regional Water Quality Control Board
SCAB	South Coast Air Basin
SCAQMD	South Coast Air Quality Management District
SCCAB	South-Central Coast Air Basin
SDSU	San Diego State University
SEIS	supplemental environmental impact statement
SHPO	State Historic Preservation Officer
SJVAB	San Joaquin Valley Air Basin
SJVAPCD	San Joaquin Valley Air Pollution Control District
SMAQMD	Sacramento Metropolitan Air Quality Management District
SO_2	sulfur dioxide
SR	state route
SRAM	Standardized Risk Assessment Methodology
SSC	species of special concern
SSFL	Santa Susana Field Laboratory
SVE	soil vapor extraction
SVOC	semivolatile organic compound
SWPPP	stormwater pollution prevention plan
TCDD	tetrachloro-dibenzo-p-dioxin
TCP	Traditional Cultural Property
TPH	total petroleum hydrocarbons
tpy	ton(s) per year
TRB	Transportation Research Board
U.S.	United States
U.S.C.	United States Code
UCLA	University of California, Los Angeles
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geologic Survey
V/C	volume to capacity
VCAPCD	Ventura County Air Pollution Control District
VOC	volatile organic compound
yd^3	cubic yard(s)

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Executive Summary

The National Aeronautics and Space Administration (NASA) has prepared this supplemental environmental impact statement (SEIS) to inform NASA decision makers, regulating agencies, and the public about the environmental impacts of the proposed soil cleanup activities at NASA's Santa Susana Field Laboratory (SSFL) in Ventura County, California. This SEIS will aid in the decision-making process to select the preferred soil cleanup approach. NASA has prepared this SEIS in accordance with the National Environmental Policy Act of 1969 (NEPA), as amended (42 *United States Code* [U.S.C.] 4321 et seq.); the NEPA-implementing regulations issued by the Council on Environmental Quality (CEQ) (Title 40 *Code of Federal Regulations* [CFR] Parts 1500–1508); and the NASA Procedural Requirements 8580.1 (NASA, 2001, 2008, 2017a) for implementing NEPA (14 CFR Part 1216, Subpart 1216.3).

Introduction

In March 2014, NASA prepared the *Final Environmental Impact Statement* [FEIS] *for the Proposed Demolition and Environmental Cleanup Activities at SSFL* (NASA, 2014a). After the required 30-day wait period, NASA issued a record of decision (ROD) to move forward with demolishing facilities at SSFL (NASA, 2014b). When the 2014 FEIS was published, a decision was made to defer issuing RODs for the cleanup of soil and groundwater until further investigations, analysis, and planning could be completed. Subsequently, NASA completed groundwater investigations and reviewed a broad range of applicable remediation technologies that could achieve the cleanup goals for groundwater at SSFL. The groundwater technologies were developed further in a draft groundwater corrective measures study for SSFL (NASA, 2018a). A ROD allowing groundwater cleanup at SSFL was signed on October 4, 2018 (NASA, 2018b).

A ROD allowing soil cleanup at SSFL was deferred so that NASA could complete soil investigations, perform feasibility studies, and conduct additional surveys of natural and cultural resources. These efforts revealed significant new circumstances and information relevant to the environmental impacts that need to be considered. For example, there has been a significant increase in estimated soil removal volumes since the 2014 FEIS was published and an identified lack of suitable replacement soil. Consequently, per NEPA, an SEIS is required. This SEIS is written per the requirements outlined in the Administrative Order on Consent (AOC) for Remedial Action, which NASA entered into with the State of California Department of Toxic Substances Control (DTSC) in 2010 (State of California DTSC Docket No. HSA-CO 10/11-038, 2010).

Given the significance of the new information and the necessary scale of analysis, this SEIS is written as a standalone document that presents the full analysis of potential effects of soil cleanup, instead of only the changes from the 2014 FEIS (NASA, 2014a). This executive summary briefly describes the information contained within the SEIS and its appendixes.

Site History

SSFL is located on 2,850 acres of open, rocky terrain above California's Simi Valley in southeastern Ventura County, approximately 30 miles northwest of Los Angeles. Beginning in 1948, site activities at SSFL included researching, developing, and testing liquid-fueled rocket engines and components. These activities ceased in 2006, and testing is now conducted at other NASA facilities. In September 2009, NASA determined the property was no longer needed to support its mission. NASA approached the General Services Administration (GSA) about transferring the property and GSA has conditionally accepted the property.

SSFL is divided into four Administrative Areas (Areas I through IV) and two undeveloped areas. Area II and a small portion of Area I (the Former Liquid Oxygen [LOX] Plant Area) are owned by the U.S. Government and administered by NASA. The remainder of the property is owned by The Boeing Company (Boeing). In Area IV, the U.S. Department of Energy (DOE) is responsible for building demolition and the cleanup of soil and groundwater.

In August 2007, NASA, Boeing, DOE, and DTSC signed a Consent Order for Corrective Action that addressed the cleanup of soil and groundwater at SSFL (State of California DTSC Docket No. P3-07/08-003); DTSC, 2007). In 2010, NASA and DTSC executed an AOC that stipulated specific remedial requirements, including the characterization and cleanup of soil contamination in the NASA-administered areas of SSFL to Look-Up Table (LUT) values, which are the chemical-specific values used to assess whether SSFL cleanup objectives are achieved (State of California DTSC Docket No. HSA-CO 10/11-038; DTSC, 2010). Three years after the signing, DTSC developed LUT values based on a DTSC chemical background study and the method reporting limits (MRLs) of laboratory equipment (DTSC, 2013).

Purpose and Need for Action

The purpose of the Proposed Action is to use the best available science and technology to achieve soil cleanup swiftly and in a manner that reduces impacts to the community and protects public health, the environment, and cultural resources.

Alternatives Evaluated

In this SEIS, the impacts of soil remediation activities at the NASA-administered Area I Former LOX Plant Area and Area II (approximately 450 acres) are evaluated. The alternatives considered for cleaning up the soil are as follows:

- Alternative A: AOC Cleanup
- Alternative B: Revised LUT Levels Cleanup
- Alternative C: Suburban Residential Cleanup
- Alternative D: Recreational Cleanup
- No Action Alternative

These alternatives are described in detail in the *Alternatives* section. The following specifics apply to the cleanup alternatives considered in this SEIS:

- All risk-based alternatives are protective of public health and the environment and follow nationwide U.S. Environmental Protection Agency (EPA) guidelines and the DTSC-approved standardized risk-based methodology specific to SSFL.
- The implementation of the AOC cleanup alternative would have the most significant impacts to the surrounding community and the protected cultural, natural, and biological resources.
- The beneficial impacts for biology, water resources, and health and safety are the same for all of the cleanup alternatives.

Issues with Implementing the AOC Cleanup

NASA has identified the following issues regarding implementation of the 2010 AOC and the DTSC's proposed LUT cleanup requirements.

- **Limited Treatment Technologies:** NASA has evaluated multiple onsite treatment options for use at SSFL. Although some treatment options are viable under the site conditions at SSFL, the LUT values are so much lower than conventional cleanup levels that most treatments are largely unproven to meet the remedial goals for SSFL and are not expected to meet AOC LUT cleanup criteria. As a result, significantly more soil would have to be excavated and transported offsite under the AOC Cleanup alternative, as excavation and disposal is the only proven method, in many cases, for reaching the LUT standard.
- **Availability of Suitable Replacement Soil:** NASA will require approximately 448,000 yd^3 of backfill and topsoil to meet the 2010 AOC LUT values and support native revegetation and habitat restoration. This

volume equates to excavating approximately 10 feet deep across 21 football fields. NASA tested soil from multiple potential offsite backfill locations. However, the only backfill materials that complied with the AOC contained predominately sand and gravel mixtures, which lack the soil structure or nutrients needed to revegetate the excavated areas. California State University studies have shown that amending backfill materials to produce soil that is capable of supporting the SSFL ecosystem would result in soil with chemical nutrient levels that exceed the AOC LUT values. DOE observed that even store-purchased topsoil fails to meet the AOC LUT values (DOE, 2018). The implications of being unable to obtain suitable backfill materials in the necessary volumes are significant. Native plant establishment would be greatly hindered, resulting in potentially devastating effects to the natural environment at SSFL, as the site would remain barren in areas where gravel was used, and non-native plants could become established where native species are currently dominant.

- **Laboratory Screening Limitations:** AOC LUT values are significantly below conventional laboratory capabilities; for example, levels of polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPHs), and dioxins are so low that laboratories cannot distinguish potential “contamination” releases from natural “background” concentrations of these types of constituents. Furthermore, during the sampling efforts detailed in the NASA Soil Data Summary Report (DSR) (NASA, 2017b), soil concentrations of these three parameters were discovered to be above AOC LUT values, even in areas with no known source of contamination.
- **Significant Environmental Effects:** The quantity of excavated soil material necessary to achieve the AOC LUT cleanup levels has increased significantly since the 2014 FEIS was published, from 500,000 cubic yards (yd^3) in 2014 to 870,000 yd^3 (current estimate). This substantial increase means that the AOC LUT cleanup standard would result in severe environmental damage, which would not be realized under other EPA- and DTSC-recognized cleanup scenarios. The significant impacts associated with the AOC LUT cleanup levels were identified in the DTSC Draft Program Environmental Impact Report (DTSC, 2017), DOE FEIS (DOE, 2018), 2014 FEIS (NASA, 2014a), and this SEIS. NASA is committed to making the necessary effort to mitigate impacts associated with the cleanup; however, many impacts are not avoidable under the AOC cleanup requirements. Consequently, it is appropriate to consider alternatives to the AOC LUT cleanup standard.
- **Differing Cleanup Standards:** In the same way NASA is working with DTSC to achieve soil cleanup at SSFL, Boeing and DOE are involved in similar soil cleanup activities. Boeing is not subject to the AOC and has a different cleanup requirement for soil on the portion of the property for which it is responsible (approximately 1,930 acres). Boeing has announced that it will clean up soil to a recreational risk-based standard, which Boeing has determined to be the future land use type (Boeing, 2017a). Different cleanup standards across responsible parties pose several seemingly unresolvable issues. For example, even if NASA were able to successfully complete an AOC-based cleanup, soil that does not meet the AOC LUT cleanup standard could shift onto NASA-administered property from Boeing’s adjacent property, requiring NASA to remediate soil considered clean by recreational standards.
- **Health Basis of AOC LUT Values:** The AOC background cleanup requirement provides an unproven increase in protection to public health compared to EPA-recognized risk-based cleanup alternatives. The EPA and DTSC have established health-based exposure limits for chemicals of concern (COCs) that are dependent on the intended land use and associated exposure pathways. The AOC LUT values were not developed based on the EPA or California Environmental Protection Agency (Cal EPA)-developed exposure values; instead, they were developed based on sampling performed at an offsite location (background values) and laboratory equipment capabilities.

Soil Treatment Technologies

The soil cleanup methods considered in this SEIS represent a broad array of possible methods to achieve the soil cleanup values as a part of the Proposed Action Alternatives. The actual combination and location of the technologies will be developed as part of the soil design planning document, which will be finished after the

NEPA process is completed. To allow for the appropriate flexibility in cleanup implementation, it was assumed that NASA would choose one technology or a combination of these technologies when implementing the Action Alternatives. To be chosen, a technology must be able to remediate the soil to the degree specified for the chosen alternative.

The following technologies have been identified as viable options for the NASA-administered areas of SSFL and could be applied to the Action Alternatives.

- **Excavation and Offsite Disposal:** Surface and subsurface contaminated soil would be excavated, transported, and disposed of. This technology could be used to remove soil with multiple types of contaminants or to address contaminants not treatable by other technologies. Excavation may be used as a backup approach to another technology, if that technology does not achieve soil cleanup levels. As such, excavation is considered in each of the Action Alternatives. Soil would be transported in bulk using dump trucks or similar vehicles and backfill material would be acquired from an onsite or offsite source, when available.
- **Ex Situ Soil Treatments**: Ex situ methodologies involve excavating soil from its original location and moving it to another location onsite where it would be treated. Ex situ treatment differs from excavation and offsite disposal in that the soil would be treated at the SSFL site and then used as backfill, to the degree possible. The ex situ treatments being considered at the NASA-administered areas of SSFL include soil washing, land farming, chemical oxidation, and thermal desorption.
- **In Situ Soil Treatments**: In situ methodologies involve treating soil at its original location. The in situ treatments being considered at the NASA-administered areas of SSFL include soil vapor extraction, chemical oxidation, and anaerobic or aerobic biological treatment. In situ treatments generally present the least environmental impacts of the soil technologies.
- **Monitored Natural Attenuation (MNA)**: MNA relies on natural processes to destroy contamination. It is typically used in coordination with another remedial technology. For example, MNA could be used after a remedial technology is no longer effective in reducing the chemical concentrations of organic compounds. MNA would be used only if active treatment had reduced concentrations below risk-based cleanup values or initial concentrations were already below risk-based cleanup values and additional reductions were required to meet AOC LUT requirements.

Alternatives

NASA has identified four cleanup alternatives that are fully protective of the public and the environment. These alternatives along with the No Action Alternative are explained in detail below.

Alternative A: AOC Cleanup – Under this alternative, NASA would remediate the soil on NASA-administered property at SSFL to the DTSC's proposed LUT values. After NASA signed the AOC, DTSC developed LUT values based on a chemical background study of the combined Chatsworth Formation and Santa Susana geological formations, as well as those chemicals most frequently identified as contaminants at SSFL or that are of interest to DTSC. The LUT values are based on either assessed naturally occurring threshold values derived from DTSC's background study or the MRL for chemicals without a background threshold value. The MRL is the minimum level that an analytical instrument can report and provide a reliable result. These values are developed based on the capabilities of laboratory equipment; they are not based on known risks to human health and the environment or designed to ensure contaminant levels associated with risks are protective. Alternative A would require that the majority would be transported for offsite disposal, because it is the only proven remediation method to clean up to the AOC standard. Consequently, Alternative A results in the greatest impacts to environmental and cultural resources. If other treatments were shown to be effective, NASA would implement them as approved.

Alternative B: Revised LUT Levels Cleanup – Under this alternative, NASA would remediate based on a revised set of AOC LUT values for seven specific COCs, as shown in Table ES-1. These values were developed using the Cal EPA Office of Environmental Health Hazard Assessment, Los Angeles County screening levels for contaminants and EPA screening levels. The revised AOC LUT values are based on the seven specific COCs with values significantly different from environmental agency screening levels. This alternative would reduce or eliminate many of the AOC implementation concerns, such as the availability of backfill and reduce impacts to natural and cultural resources and the surrounding community.

TABLE ES-1
Proposed Look-Up Table Revisions
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Analyte (soil)	AOC LUT Value	Revised LUT Value	Los Angeles County Regional Water Board Soil Screening Level	EPA Regional Screening Level for Residential Soil	California Human Health Screening Level for Residential Soil
PAHs[a]	4.47 µg/kg	**110 µg/kg**	not applicable	**110**[c] µg/kg	not applicable
TPH	5 mg/kg	**1,000 mg/kg**	**1,000 mg/kg**	Varies[e]	not applicable
Dioxin/Furans[b]	0.912 pg/g	**4.6 pg/g**	not applicable	4.8[d]pg/g	**4.6[d] pg/g**
Antimony	0.86 mg/kg	**30 mg/kg**	not applicable	31mg/kg	**30 mg/kg**
Silver	0.2 mg/kg	**380 mg/kg**	not applicable	390 mg/kg	**380 mg/kg**
Cadmium	0.7 mg/kg	**1.7 mg/kg**	not applicable	71 mg/kg	**1.7 mg/kg**
Acetone	20 µg/kg	**61,000,000 µg/kg**	not applicable	**61,000,000 µg/kg**	not applicable

Notes:
Bold text indicates a revised AOC LUT value.
[a] Calculated as benzo(a)pyrene toxic equivalency (PAHTEQ)
[b] Calculated as 2,3,7,8-tetrachloro-dibenzo-p-dioxin (TCDD) toxic equivalency (DIOXTEQ)
[c] Based on benzo(a)pyrene
[d] Based on 2,3,7,8-TCDD
[e] Varies based on six TPH fractions, depending on level of aliphatic or aromatic levels
µg/kg = microgram(s) per kilogram
AOC = Administrative Order on Consent
EPA = U.S. Environmental Protection Agency
LUT = Look-up Table
mg/kg = milligram(s) per kilogram
pg/g = picogram(s) per gram
PAH = polycyclic aromatic hydrocarbon
TPH = total petroleum hydrocarbon

Alternative C: Suburban Residential Cleanup – This alternative would entail the cleanup of soil to meet established Suburban Residential risk-based cleanup goals. This alternative would use site-specific risk-based cleanup levels for contaminants in soil at SSFL that have been developed based on standard risk assessment procedures and equations provided in the DTSC-approved Standardized Risk Assessment Methodology (SRAM), EPA risk assessment guidance (RAG), and Cal EPA RAG. Alterative C would allow for more onsite soil treatment and would eliminate all significant environmental impacts.

Alternative D: Recreational Cleanup – This alternative would entail the cleanup of soil to meet Recreational risk-based soil cleanup goals and reflects the cleanup standard to be implemented in the adjacent land areas administered by Boeing. Alternative D uses site-specific cleanup levels for contaminants in soil at SSFL that are based on standard risk assessment procedures and equations provided in the DTSC-approved SRAM, EPA RAG, and Cal EPA RAG. Alterative D is the least impactful of the four Action Alternatives and matches the most likely future land use (recreational open space) for the site.

No Action Alternative – This alternative is included in the analysis per NEPA requirements. The No Action Alternative considers a continuation of current activities where NASA would not conduct soil remediation beyond what has already been directed under separate regulatory direction. Contaminants not captured by this program would remain in place or attenuate naturally over time. No monitoring of natural attenuation would occur.

Table ES-2 summarizes the associated level of effects with each alternative.

TABLE ES-2
Alternative Comparison
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Description	Alternative A AOC Cleanup	Alternative B Revised LUT Levels Cleanup	Alternative C Suburban Residential Cleanup	Alternative D Recreational Cleanup	No Action Alternative No soil Cleanup
Soil Excavation Volume (yd^3)[a]	870,000	384,000	247,000	176,500	0
Excavation Footprint (acres)	220	78	36	26	0
Off Haul Truckloads[b]	65,414	28,872	18,571	13,271	0
Backfill Volume (yd^3)[c]	448,000	253,000	189,000	141,000	0
Backfill Import Truckloads[b]	33,684	19,023	14,211	10,602	0
Total Truckloads [b]	**99,098**	**47,895**	**32,782**	**23,873**	**0**
Total Duration (years) [d]	**25+**	**12**	**8**	**6**	**0**

Notes:

[a] These numbers are provided as a best available estimate to facilitate the assessment of environmental impacts and represent the upper levels of expected excavated soil quantities and footprint. They are calculated based on the most current data as presented in the NASA Soil DSR (NASA, 2017b). Refinements may be made during the development of soil design planning document. If there is a significant deviation discovered during the development of the soil design planning document or if sensitive resources, which were previously avoidable become unavoidable, NASA will determine whether supplemental NEPA documentation is required and coordinate with the appropriate resource agencies as warranted.
[b] The truckload capacity is assumed to be 19 yd^3; however, due to the expansion factor for excavated soil, 13.3 yd^3 of excavated soil is equivalent to 1 truckload.
[c] Backfill calculations assume that soil excavations between a 0- and 2-foot depth require 1/3 of the excavation volume for backfill, and excavations greater than a 2-foot depth require 100 percent of the excavation volume as backfill (NASA, 2018c).
[d] Duration calculation assumptions: NASA is limited to 16 round-trip truckloads (32 trucks total) per day, 250 days per year (NASA, Boeing, and DOE, 2015).
yd^3 = cubic yard(s)

Selection of Preferred Alternative

CEQ regulations at 40 CFR Section 1502.14(e) require an agency to identify its preferred alternative, if one exists, in the draft SEIS. At this time, NASA does not have a preferred alternative. However, NASA will identify the preferred alternative in the final SEIS.

How the SEIS was Conducted

NASA identified specific activities involved in implementing the Action Alternatives and then evaluated how much of an impact the activities would have on the environment. For the SEIS, impacts were analyzed by the environmental resource areas that make up the natural and human environment and include physical, social, and cultural issues that could affect, or be affected by, the Action Alternatives. NASA identified nine major environmental resource areas:

- Cultural resources
- Biological resources
- Air quality
- Water resources
- Geology
- Hazardous and nonhazardous materials and waste
- Health and safety
- Traffic and transportation
- Noise

For each of the nine environmental resource areas, a region of influence (ROI) was identified that included the entire vicinity surrounding the resource area that could be affected. The intensity of the potential impacts (negligible, minor, moderate, or significant) in each resource area in the appropriate ROI was then evaluated for the Action Alternatives and the No Action Alternative. Whether an impact would have a beneficial or adverse effect and whether it would be temporary, occurring only during the remediation period, or permanent, lasting after the remediation period is complete, were considered as part of the evaluation. The definition for each term varies by resource area and is described in detail in this SEIS.

Cumulative activities were identified that might occur in the same area or timeframe as the Action Alternatives. These activities were evaluated to identify potential environmental impacts that, when added to the Action Alternative's impacts, would result in a cumulative effect as a result of past, ongoing, and reasonably foreseeable future activities. For the purpose of the analysis, the Action Alternative impacts were based on the overall impact estimates of all activities. It was also assumed that the mitigation measures described in each resource section would be implemented.

Summary of Findings by Action Alternative

A summary of the impacts by Action Alternative is provided in Table ES-3. Alternative A and Alternative B have more significant impacts than the other Action Alternatives, resulting, in large part, from the extended duration of soil cleanup activities and the larger quantities of soil requiring remediation.

TABLE ES-3
Impact Summary Table
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Alternative	Significant Beneficial	Moderate Beneficial	Minor Beneficial	Significant Negative	Moderate Negative	Minor Negative	Negligible Negative
AOC Cleanup	2	1	1	10	10	11	4
Revised LUT Levels Cleanup	2	1	1	7	10	12	6
Suburban Residential Cleanup	2	1	1	0	11	18	6
Recreational Cleanup	2	1	1	0	11	18	6

The severity of the impacts discussed in this section takes into account the implementation of the environmental protection measures and standard best management practices, which are summarized at the end of each resource section in the SEIS. Significant impacts are summarized under each of the following alternatives.

Alternative A: AOC Cleanup

It is anticipated that the following significant, negative environmental impacts could occur as a result of soil cleanup at SSFL under Alternative A:

- **Cultural Resources** – The excavation and removal of soil would affect the physical integrity of the Native American sacred sites and Traditional Cultural Property (TCP) by altering the landscape through plant and soil removal. There would be physical changes to the significant characteristics of the Native American sacred site and access to the site could be impeded. There also would be temporary visual impacts to the Native American sacred site and the TCP during the equipment and excavation activities. The excavation and offsite removal of soil from the Burro Flats Site (5.7 acres), the archeological district (6 acres), and 13 individual archeological sites outside the archeological district (approximately 7 total acres) would constitute an adverse effect under Section 106 of the National Historic Preservation Act (NHPA), because archeological artifacts lose their significance when removed from their location and context.
- **Biological Resources** – Excavation of surface soil would result in the potential removal of existing soil on approximately 170 acres of native habitat, permanently altering the biodiversity of the site. Remediation activities could also increase the spread of invasive and noxious weed species, which could out-compete native species in areas where soil was exposed, resulting in weed species becoming dominant in areas previously suitable only for locally adapted plants.
- **Water Resources** – Excavation of soil would alter site drainage conditions and potentially create new drainage and ponded areas. The soil function would be greatly affected by the removal of this quantity of soil. The filtering function offered by plants and soil chemistry would be altered at the site. While this function may return to some degree after soil development and the reestablishment of vegetation, it is highly unlikely the existing conditions would ever be the same.
- **Geology** – The existing soil profiles and corresponding functions would likely be substantially changed following excavation of up to 870,000 yd^3 of soil. Proposed soil cleanup activities could increase erosion through the removal of ground cover; the loosening of soil; the temporary stockpiling of soil; increased slopes; the grading of stockpiling and staging locations; the use of unpaved temporary access roads; onsite excavation and placement of backfill material; and differential compaction from the construction and use of access roads.

In addition, the following significant, beneficial impact could occur as a result of soil cleanup at SSFL under Alternative A:

- **Health and Safety** – Removal of existing soil contamination to meet AOC LUT requirements would permanently improve future onsite health and safety conditions, including those for children who may use the site in the future.

Alternative B: Revised LUT Levels Cleanup

It is anticipated that the following significant, negative environmental impacts could occur as a result of soil cleanup at SSFL under Alternative B:

- **Cultural Resources** – The excavation and removal of soil would affect the physical integrity of the Native American sacred sites and TCP by altering the landscape through plant and soil removal, resulting in an adverse effect finding under Section 106 of the NHPA. There would be physical changes to the significant characteristics of the Native American sacred sites and access to the site could be impeded. There also would be temporary visual impacts to the Indian Sacred Site and the TCP during the equipment and excavation activities. The excavation and offsite removal of soil from the Burro Flats Site (1.3 acres), the archeological district (1.25 acres), and six individual archeological sites outside the archeological district (approximately 1 acre) would constitute an adverse effect under Section 106 of the NHPA because archeological artifacts lose their significance when removed from their location and context.
- **Geology** – The existing soil profiles and corresponding functions would likely be substantially changed following the excavation of up to 384,000 yd^3 of soil. Soil erosion would be impacted in a manner similar

to that described under Alternative A; however, as the excavation area is decreased, the potential for erosion would also decrease.

In addition, the following significant beneficial impact could occur as a result of soil cleanup at SSFL under Alternative B:

- **Health and Safety** – Removal of existing soil contamination to revised LUT values would permanently improve future onsite health and safety conditions, including those for children who may use the site in the future.

Alternative C: Suburban Residential Cleanup

There are no significant, negative environmental impacts expected to occur as a result of soil cleanup at SSFL under Alternative C. However, the following significant, beneficial impact is expected to occur:

- **Health and Safety** – Removal of existing soil contamination to a standard protective of future residential land use would permanently improve future onsite health and safety conditions, including those for children who may use the site in the future.

Alternative D: Recreational Cleanup

There are no significant, negative environmental impacts expected to occur as a result of soil cleanup at SSFL under Alternative D. However, the following significant, beneficial impact is expected to occur:

- **Health and Safety** – Removal of existing soil contamination to a standard protective of future recreational land use would permanently improve future onsite health and safety conditions, including those for children who may use the site in the future.

Public Engagement

Public and agency involvement included informational materials, public meetings, agency meetings, and notification and circulation of the 2014 FEIS and this SEIS. NASA has posted meeting notices, materials, and public documents on its website at https://ssfl.msfc.nasa.gov.

- On April 5, 2019, a Notice of Intent (NOI) for this SEIS was published in the *Federal Register*. The purpose of the NOI was to apprise interested agencies, organizations, tribal governments, and individuals of NASA's intent to prepare this SEIS.
- On October 25, 2019, a Notice of Availability (NOA) was published for the draft SEIS, which initiated a 45-day public comment period.
- On November 20 and 21, 2019, NASA hosted public meetings to allow the public to express comments on the draft SEIS.

Outside Agency Consultation

National Historic Preservation Act Section 106 Consultation

The NHPA requires NASA to consult with federal, state, and local agencies, Native American tribes, other organizations, and members of the public having a potential interest in the Proposed Action. In 2014 NASA entered into a Programmatic Agreement, per Section 106 of the NHPA, with the California State Historic Preservation Officer (SHPO), Advisory Council on Historic Preservation (ACHP), and Santa Ynez Band of Chumash Indians (Appendix 3.1A).

Endangered Species Act Section 7 Consultation

The Endangered Species Act requires NASA to consult with the U.S. Fish and Wildlife Service regarding potential impacts to threatened and endangered species resulting from the implementation of the Proposed Action. In 2013, the USFWS issued a letter of concurrence, agreeing with NASA's determination that the project may affect, but is not likely to adversely affect, federally threatened and endangered species (Appendix 3.2A). In meetings with NASA, DOE, Boeing, and DTSC in May 2018, USFWS confirmed that the 2013 Biological Assessment and the associated species characterizations were still acceptable (Appendix 3.2A).

SECTION 1
Purpose and Need

1.1 Introduction

The National Aeronautics and Space Administration (NASA) prepared a *Final Environmental Impact Statement* [FEIS] *for the Demolition and Cleanup Activities at Santa Susana Field Laboratory* (SSFL) in March 2014 (NASA, 2014a). After a required 30-day wait period, NASA issued a record of decision (ROD) to move forward with demolishing facilities at SSFL (NASA, 2014b). A decision was made at the time the FEIS was published to defer issuing RODs for the cleanup of soil and groundwater until further investigations, analysis, and planning could be completed. NASA has reviewed a broad range of applicable remediation technologies that could achieve the cleanup goals for SSFL soil and groundwater. The groundwater technologies were developed further in a draft corrective measures study for SSFL (NASA, 2018a). A ROD allowing groundwater cleanup at SSFL was subsequently signed on October 4, 2018 (NASA, 2018b). For soil cleanup, significant new circumstances and information relevant to the environmental impacts need to be considered; for example, the estimated quantity of excavated soil has increased substantially from 500,000 cubic yards (yd^3) in the 2014 FEIS to 870,000 yd^3 based on current estimates. Consequently, per 40 *Code of Federal Regulations* (CFR) Section 1502.9(c)(1)(ii), a supplemental environmental impact statement (SEIS) is required. This SEIS provides an evaluation of potential environmental impacts from the proposed soil cleanup activities. A conservative approach is taken to ensure that decision makers are considering the greatest potential effect of the proposed remediation strategies.

> **40 CFR Section 1502.9(c)(1)(ii)**
>
> Agencies:
> (1) Shall prepare supplements to either draft or final environmental impact statements if:
> (i) The agency makes substantial changes in the proposed action that are relevant to environmental concerns; or
> (ii) There are significant new circumstances
> or information relevant to environmental concerns and bearing on the proposed action or its impacts.
> (2) May also prepare supplements when the agency determines that the purposes of the Act will be furthered by doing so.

This SEIS is written per the requirements outlined in the Administrative Order on Consent (AOC) for Remedial Action, which NASA entered into with the State of California Department of Toxic Substances Control (DTSC) in 2010 (State of California DTSC Docket No. HSA-CO 10/11-038, 2010). Given the significance of the new information, which is described in Section 2.2, *Action Alternatives*, and the necessary scale of analysis, this SEIS has been written as a standalone document that presents the full analysis of potential effects, instead of only the changes from the 2014 FEIS.

NASA is the lead federal agency for this SEIS. The purpose of this SEIS is to provide NASA decision makers, regulating agencies, and the public with a conservative assessment of the potential impacts of soil cleanup activities in the NASA-administered areas of SSFL, which include a portion of Area I (the former Liquid Oxygen [LOX] Plant) and all of Area II (Figure 1.1-1). Section 2, *Description of Proposed Action Alternatives*, provides descriptions and the locations of the soil cleanup activities.

NASA has prepared this SEIS in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended; the implementing regulations issued by the Council on Environmental Quality (CEQ) (40 CFR Parts 1500–1508); and the NASA Procedural Requirements 8580.1 (NASA, 2001, 2008, 2017a) for implementing NEPA (14 CFR Sections 1216.1 and 1216.3).

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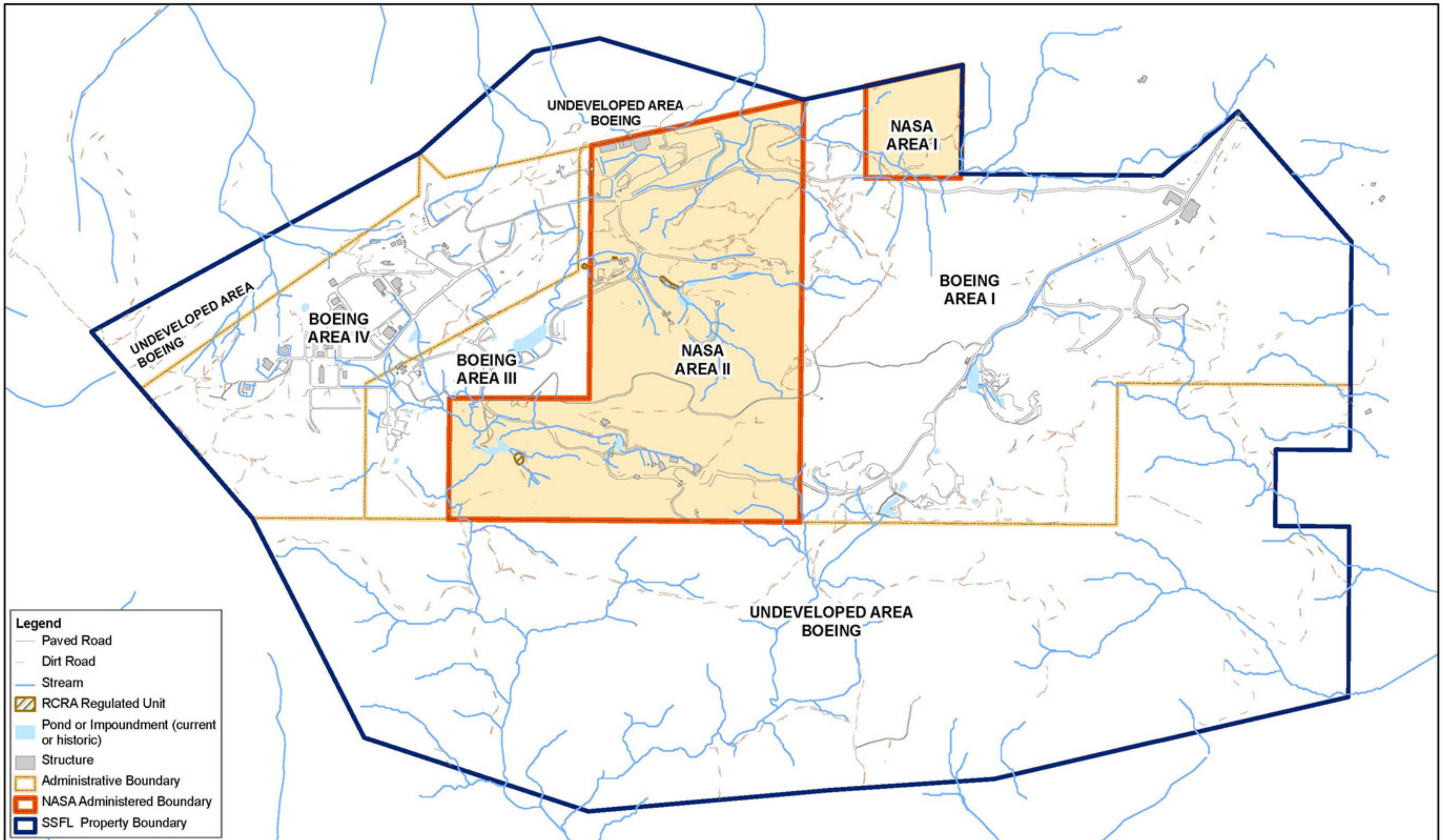

0 500 1,000 2,000 Feet
0 150 300 600 Meters

17-Aug-2018
Drawn By:
A. Cooley

Figure 1.1-1
NASA-Administered Areas
Supplemental Environmental Impact Statement for NASA Soil Cleanup Activities at Santa Susana Field Laboratory
Ventura County, California

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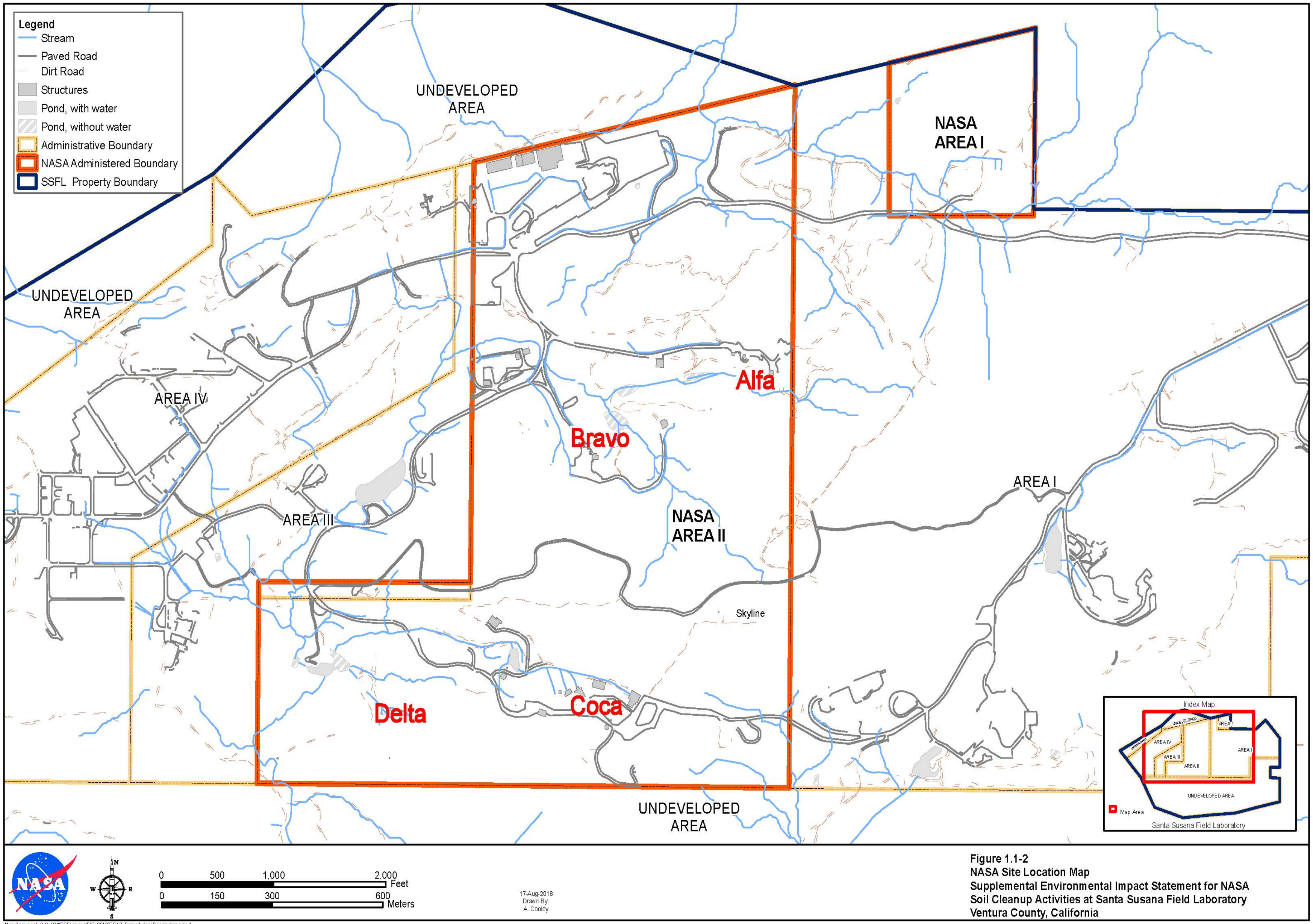

Figure 1.1-2
NASA Site Location Map
Supplemental Environmental Impact Statement for NASA Soil Cleanup Activities at Santa Susana Field Laboratory
Ventura County, California

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1.2 Site History and Description

SSFL is located approximately 30 miles northwest of downtown Los Angeles, California, in the southeastern corner of Ventura County. SSFL occupies approximately 2,850 acres of hilly terrain and is owned in part by The Boeing Company (Boeing) and by the United States (U.S.) Government. The land management is designated by administrative areas. NASA administers part of Area I and all of Area II (approximately 450 acres). Boeing owns the remainder of the SSFL property (Figure 1.1-1).

Prior to development, the land at SSFL was used for ranching. In 1948, North American Aviation leased and began using what is now known as the northeastern portion, or Area I, of SSFL. The majority of SSFL was acquired with the purchase of the Silvernale property in 1954, and development of the western portion of SSFL began soon after. Beginning in 1948, research, development, and testing of liquid-fueled rocket engines and associated components, such as pumps and valves, were the primary site activities at SSFL (Science Applications International Corporation [SAIC], 1994). The majority of rocket engine testing and ancillary support operations occurred from the 1950s through the early 1970s (Photograph 1.1-1). Rocketdyne, which was established as a separate division of North American Aviation in 1955, and other predecessors to Boeing conducted these operations in Areas I and III in support of various government space programs and in Area II on behalf of the U.S. Air Force (USAF). In December 1958, Rocketdyne deeded some of the property to the U.S. Government. In the 1970s, the General Services Administration (GSA) transferred custody and accountability from the U.S. Government to NASA, and NASA currently administers both Area II and the former LOX Plant portion of Area I (Figure 1.1-1).

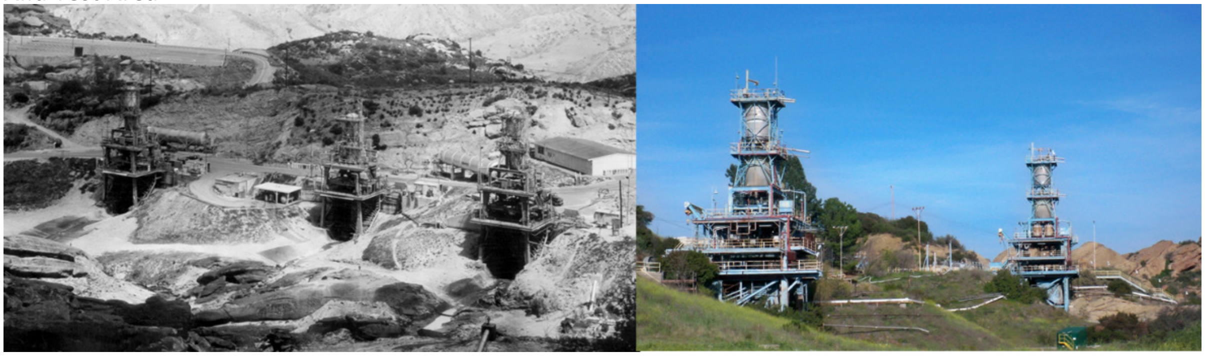
PHOTOGRAPH 1.1-1
Engine Testing at SSFL

In Area II, rocket engine testing occurred at four test stand areas constructed between 1954 and 1957 and known as Alfa, Bravo, Coca, and Delta. Figure 1.1-2 shows the four test stand areas, which contain additional buildings for support activities and infrastructure. Photographs 1.1-2 through 1.1-5 show historical images of the test stands compared to how they appeared in 2018.

Beginning in the 1980s, NASA gradually discontinued rocket test activities and conducted its final tests in 2006. In September 2009, NASA submitted a "report of excess" to GSA regarding the property administered by NASA at SSFL (NASA, 2009). GSA conditionally accepted the report pending NASA's completion of cleanup activities. The only activities ongoing at the site are demolition and environmental cleanup in preparation for disposal of the property.

On November 8, 2018, the Woolsey Canyon Fire burned portions of SSFL. On November 9, 2018, DTSC requested assistance from the Response Team, including federal, state, and local agencies, and coordinated with the Response Team to assess the impacts of the fire on SSFL. On November 21, 2018, the fire was 100 percent contained after burning 96,946 acres in Ventura and Los Angeles Counties. In December 2018, DTSC published an Interim Summary Report, summarizing the work completed in November 2018 to address concerns about the impacts from the fire (DTSC, 2018a).

PHOTOGRAPH 1.1-2
Alfa Test Area



PHOTOGRAPH 1.1-3
Bravo Test Area

PHOTOGRAPH 1.1-4
Coca Test Area

PHOTOGRAPH 1.1-5
Delta Test Area

1.3 Site Characterization and Remediation

Initial engine testing at SSFL required the use of solvents, petroleum-based fuels, and oxidizers. The constituents of some of these products are recognized as hazardous materials and existing contamination has been identified in the NASA-administered areas. For more than 25 years, NASA has conducted environmental sampling to characterize site conditions on its portion of SSFL. The results of these studies indicate that volatile organic compounds (VOCs), including trichloroethene, semivolatile organic compounds (SVOCs), metals, dioxins, and polychlorinated biphenyls (PCBs) are present in the soil and upper groundwater, known as the Surficial Media Operable Unit. VOCs, metals, and SVOCs also are present in the deeper groundwater, known as the Chatsworth Formation Operable Unit (CFOU).

Interim source removal action (ISRA) activities were conducted at SSFL between 2009 and 2013 following National Pollutant Discharge Elimination System (NPDES) permit exceedances for stormwater on the facility. The sources of the NPDES exceedances on the NASA-administered portions of SSFL included areas near the Area II Landfill, Ash Pile/Sewage Treatment Plant, Expendable Launch Vehicle, and the former LOX Plant. Details of the various ISRA activities, including the boring and trenching logs, are in the phased implementation reports for the remediation efforts (MWH, 2010, 2011, 2014a).

In response to the Woolsey Canyon Fire, DTSC and a Response Team consisting of federal, state, and local agencies evaluated the impacts from the fire on chemical and radiological conditions at the SSFL site and communities around the site. Directly after the fire, these entities performed field inspections and computer simulations, took measurements and field samples, conducted monitoring, and reviewed available data from existing monitoring stations on the SSFL site and in nearby communities. Field sample results showed chemicals that are associated with contamination at SSFL, including metals, PCBs, polycyclic aromatic hydrocarbons (PAHs), VOCs, and dioxin. Although dioxin concentrations in two samples collected onsite were above U.S. Environmental Protection Agency (EPA) risk screening levels, these increased dioxin levels suggest that compounds containing chlorine were burned during the wildfire and are not associated with previous or current SSFL activities. The interim investigation concluded that no hazardous materials from SSFL were released from the fire into offsite and adjacent communities, and there are no offsite impacts other than the those normally posed by wildfires and wildfire smoke (DTSC, 2018a).

1.4 SSFL Administration and Commitments

After consideration and review of its current and future needs, NASA concluded it had no further need of the property it administers at SSFL. In accordance with statutory requirements, NASA notified Congress in April 2009 of its intent to declare the land “excess.” In September 14, 2009, NASA submitted a “report of excess” to the GSA regarding the property. GSA conditionally accepted NASA’s report pending NASA’s certification that remedial action necessary to protect human health and the environment with respect to hazardous substances on the property has been completed, or that the Governor concurs with the suitability of the property for transfer in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Section 120(h)(3)(C).

In August 2007, NASA, Boeing, the U.S. Department of Energy (DOE), and DTSC signed a Consent Order for Corrective Action (State of California DTSC Docket No. P3-07/08-003, 2007) that addressed the cleanup of soil and groundwater at SSFL (DTSC, 2007). Subsequently on December 6, 2010, NASA and DTSC executed an AOC (State of California DTSC Docket No. HSA-CO 10/11-038, 2010) stipulating the specific remedial requirements, including the characterization and cleanup of soil contamination in the NASA-administered areas of SSFL to Look-Up Table (LUT) values (DTSC, 2010). After the signing, DTSC developed LUT values based on a DTSC chemical background study and method reporting limits (MRLs) of laboratory equipment (DTSC, 2013). The 2010 AOC also requires NASA to complete a federal environmental review pursuant to NEPA regarding the impacts of implementing soil and groundwater remedial activities.

DTSC’s 2017 Draft Programmatic Environmental Impact Report (PEIR) and surveys completed after the 2014 NASA FEIS indicate that the amount of soil that must be removed to attain the AOC cleanup levels established by DTSC is far greater than originally expected and will result in severe damage to SSFL's natural, cultural, and biological resources, as well as have significant impacts on the local community. The soil confirmation sampling methodology described in the 2010 AOC states that residual concentrations should not exceed local background concentrations. Because LUT levels are so low, final cleanup levels may never be reached for parameters such as PAHs, total petroleum hydrocarbons (TPH), and dioxins, because laboratories are unable to distinguish potential "contamination" releases from natural "background" concentrations for these types of constituents. The results of the sampling efforts described in the NASA Soil Data Summary Report (DSR) for SSFL (NASA, 2017b) show the soil concentrations for these three parameters leveling off from known areas of releases to above LUT values, which means soil concentrations for these three parameters are above LUT values in areas with no known source of contamination. The implications of being unable to fully delineate existing soil contamination are significant, because cleanup activities could continue indefinitely. In light of this outcome, other cleanup approaches must be considered. NASA has identified alternatives in Section 2.2, *Action Alternatives,* that greatly reduce the potential damage to SSFL's habitat and cultural resources and the local community.

1.5 Purpose and Need for Action

The purpose of the Proposed Action is to use the best available science and technology to achieve soil cleanup swiftly and in a manner that reduces impacts to the community and protects public health and the environment.

1.6 Scope of the Analysis

NASA has prepared this SEIS in accordance with NEPA, the CEQ-implementing regulations (40 CFR Parts 1500–1508), and the NASA Procedural Requirements for Implementing NEPA, and as a requirement of the 2010 AOC. The scope of this SEIS includes the potential environmental impacts of soil cleanup at the NASA-administered portions of SSFL. The purpose of the SEIS is to inform NASA decision makers of the potential impacts of the Proposed Action through a complete and objective analysis of Action Alternatives that meet the project purpose and need, a No Action Alternative, and a range of soil remedial technologies that could meet soil cleanup goals at the site. This project scope provides the decision makers with a comparative analysis by which to make a fully informed decision.

GSA will conduct a separate environmental review under NEPA for the action of transferring the land out of NASA's stewardship. The options are undecided but could include reuse or redevelopment of the property under separate local, state, or private ownerships. NASA anticipates the future land use of the NASA-administered portion of SSFL to be designated open space.

DTSC prepared a draft PEIR under the California Environmental Quality Act (CEQA) (DTSC, 2017). This state-led environmental review analyzed the potential environmental effects of environmental cleanup activities occurring SSFL-wide by NASA, Boeing, and DOE. The PEIR was generated in accordance with DTSC's requirements under CEQA and was a separate effort from this SEIS, which was generated in accordance with NASA's requirements under NEPA.

1.7 Decision to be Made

This SEIS informs NASA decision makers, regulating agencies, and the public of the potential environmental consequences of the Proposed Action Alternatives and No Action Alternative. NASA will use the SEIS analysis to consider the potential environmental, economic, and social impacts from the Proposed Action. On the basis of the SEIS findings, NASA will issue a ROD documenting the findings and NASA's decisions.

SECTION 2

Description of Proposed Action Alternatives

This section describes the Action Alternatives for implementing the soil remediation and the No Action Alternative for soil cleanup. This section also includes a description of other alternatives and resource areas that were considered but removed from further consideration.

2.1 Proposed Action

The Proposed Action evaluated in this SEIS is the remediation of soil contamination on the NASA-administered Area I former LOX Plant and Area II (approximately 450 acres) at SSFL.

2.1.1 Soil Treatment Technologies

The soil cleanup methods considered in this SEIS represent a broad array of possible methods to achieve the soil cleanup values as a part of the Proposed Action Alternatives. This section describes each of the cleanup technologies, including the contaminant analyses group each technology addresses, the approach and application of technology implementation, and the general operational timeline. The actual combination and location of the technologies will be developed as part of the soil design planning document, which will be completed after the NEPA process. To allow for the appropriate flexibility in cleanup implementation, it was assumed that NASA could choose one technology or a combination of these technologies when implementing the Action Alternatives described in Section 2.2, *Action Alternatives*. To be chosen, a technology must be able to remediate the soil to the degree specified for the chosen alternative.

Viable soil cleanup technologies were evaluated based on their effectiveness in cleaning up site-specific contaminants under the environmental conditions present at SSFL. Technologies were eliminated if they were unlikely to be effective given the geologic setting or contaminant profile. Additionally, remedial processes were eliminated if the implementation of a technology might have an undesirable effect on an important environmental resource. Remedial processes that passed these criteria were further evaluated to identify the following:

- **Direct applicability to contaminants detected at SSFL, including VOCs, SVOCs, PAHs, TPHs, metals, PCBs, pesticides, and dioxins** – The best technology for application to specific chemicals of concern (COCs) was evaluated. Process options were considered if the technology could degrade or destroy a target COC to below the cleanup values, or if the technology would have the potential to successfully concentrate or segregate the COCs that are untreatable onsite.
- **Short- and long-term effectiveness** – A technology is considered effective if the process can degrade or destroy COCs successfully to levels that do not pose risks to human or ecological health without impairing the surroundings during implementation of the remediation or the future use of the site.
- **Implementability** – This factor encompasses the technical feasibility, difficulties, and uncertainties associated with the construction and implementation of the remedial technology and availability of the services, materials, and equipment required to implement it to completion.

The following technologies have been identified as viable options for NASA-administered areas and could be applied to the Action Alternatives, as described in Section 2.2, *Action Alternatives*.

2.1.1.1 Excavation and Offsite Disposal

This method would include the excavation, transport, and disposal of surface and subsurface contaminated soil. The types of construction equipment that would be used include backhoes, bulldozers, front-end loaders, and dump trucks to reduce the levels of contamination to soil cleanup level values. In areas of SSFL where protected species, habitat, or sensitive resources occur, NASA would work with the appropriate regulatory agency to develop an acceptable soil removal process to mitigate impacts to sensitive resources or habitat. This technology could be used to remove soil with multiple types of contaminants or to address contaminants not treatable by other technologies. Excavation may be used as a backup approach to another technology, if that technology does not achieve the soil cleanup level values. As such, this SEIS considers excavation in each of the Action Alternatives.

Soil would be excavated to the bedrock in areas where the top of the bedrock is shallow, but the bedrock would not be excavated. Rock outcrops generally would be retained. After completing excavation, no other monitoring would be required. The excavated soil would be stockpiled in multiple designated areas at SSFL and then loaded into dump trucks. Each stockpile would be limited to an area of 0.14 acre, with a height limit of 8 feet (ft), per Ventura County Air Pollution Control District (VCAPCD) Rule 74.29 and South Coast Air Quality Management District (SCAQMD) Rule 1157.

Material and equipment staging would occur in the immediate vicinity of ongoing environmental cleanup activities. Figures 2.2-1 to 2.2-4 show the possible locations for staging and stockpiling for each alternative. These designated areas would consist mainly of parking lots or other relatively flat, paved areas adjacent to the proposed remediation areas.

Soil would be transported in bulk using dump trucks or similar vehicles, each with a capacity of approximately 19 yd^3. As soil is excavated, the volume expands; therefore, 13.3 yd^3 of excavated soil would expand to fill the 19 yd^3 truck capacity. Hazardous materials would be placed in labeled U.S. Department of Transportation (DOT)-approved 20-yd^3 transport bins or other DOT-approved containers. A detailed analysis of capacity and accepted waste types is provided in Section 3.6, *Hazardous and Nonhazardous Materials and Waste*.

Backfill material would be acquired from an onsite or offsite source, when available. A backfill material investigation was completed in June 2014 at five local sand and gravel pits in Ventura County, California, and surrounding areas (NASA, 2015a). The preferred source from this investigation is the Vulcan Materials Pit (Boulevard Pit) in Los Angeles, California; however, it is uncertain whether the chemical characteristics of the fill material would be consistent with the 2014 sampling results because the pit operates as a fill recycling center, accepting and blending soil from a variety of sources prior to redistributing it. Consequently, it is reasonably expected that the physical and chemical characteristics of soil supplied by Vulcan would change over time. The alternative preferred source is Grimes Rock, Inc. in Fillmore, California. The Grimes Rock pit has adequate supply and met the chemical requirements for general backfill at SSFL. However, Grimes Rock material differs from the onsite native soil physically, and it is unknown whether the fill material is adequate to support vegetative restoration. Initial analyses indicated relatively low levels of natural nutrients. Several studies have been conducted to further evaluate the suitability of the backfill for long-term sustained plant growth, given that traditional soil amendments may exceed LUT values.

2.1.1.2 Ex Situ Soil Treatments

Ex situ methodologies involve excavating soil from its original location and moving it to another location onsite where it would be treated. Ex situ treatment differs from excavation and offsite disposal in that the soil would be treated at the SSFL site and then used as backfill, to the degree possible. The following ex situ treatments are being considered at the NASA-administered areas of SSFL.

2.1.1.2.1 Ex Situ Treatment Using Soil Washing

Soil washing could be implemented to remediate soil contaminated with organic and inorganic COCs. Most of the contaminants in soil typically are concentrated in the finer-grained soil (silt and clay), with progressively lower contaminant levels in the coarse-grained soil (sand and gravel). A physical separation of the fine- and coarse-grained particles could be performed to minimize the amount of contaminated material. The separation is made by adding water, and potentially surfactants (detergent), to the soil to make a slurry, which detaches the particles from each other. The washing process also can remove soluble contaminants, which then can be treated more readily in the liquid. If the soil contaminants are soluble, the waste stream generated from the washing would have to be treated to meet water quality standards for discharge. The numbers and types of components used in a soil washing treatment plant depend on the types of soil being treated, the nature and concentrations of the contaminants, and the target levels of residual contaminant concentrations.

A location would be selected at each site and a series of sieves would be set up to separate the fine- and coarse-grained soil. A tank with water and possibly a surfactant addition (detergent) would be available to wash the soil through the sieves. The water could be treated by filtration and reused to reduce the amount required for this technology. The solids captured by the filtration system could be disposed of along with the fine-grained soil.

The time required to meet remediation goals using soil washing varies greatly. A bench-scale test was conducted to provide information regarding the quantity of fine-grained soil that contains contamination and whether the coarse-grained soil meets the LUT values for the residual contamination present. The bench-scale test also provided information regarding the types of contaminants that could be present within each of the fine- and coarse-grained soil. Monitoring the soil and waste stream would continue for the duration of the treatment period until the cleanup values were met. The cleaned coarse soil could be repurposed and used as backfill material, and the fine-grained fraction with contaminated soil would be disposed of offsite.

2.1.1.2.2 Ex Situ Treatment Using Land Farming

This method of onsite treatment could be used to biologically degrade organic contamination, such as petroleum product constituents (SVOCs and VOCs) in treatable volumes of soil typically deeper than 2 ft below ground surface (bgs). Land farming would entail excavating and hauling the soil to a designated onsite area using ordinary construction equipment, such as front-end loaders, backhoes, and dump trucks. No bedrock or rock outcrops would be removed. The treatment areas typically would be flat, with an asphalt or concrete base that could be lined with polyethylene plastic sheeting. The flat areas available at SSFL for implementing this technology may be a limiting factor for the volume of soil that could be treated at any given time. The typical thickness of the soil would be between 12 and 18 inches. Soil containing SVOCs and VOCs would be placed in the treatment area, where nutrients and moisture would be added to stimulate the biodegradation of the organic constituents. Water trucks and tractors with disc attachments would be used to add the nutrients and moisture and then blend in the additives. Once the levels of contamination met criteria, the soil would be hauled back to the site and placed in the excavation area as backfill. Soil monitoring would be required to assess the rate and amount of contamination reduction using this technology.

Monitoring would continue for the duration of the ex situ treatment period until cleanup values were met. The frequency of monitoring would be established based on the rate of contaminant reduction in the soil, essentially more frequent in the beginning and less frequent as the soil becomes clean. Once the cleanup values were met, the soil would be returned to the excavation area and monitoring would be complete. However, if the cleanup values were not met, chemical oxidants (for example, hydrogen peroxide, permanganate, or persulfate) could be mixed into the soil in batches using mixers and containment tanks to further reduce concentrations of the remaining VOCs and SVOCs (see Section 2.1.1.1.3, Ex Situ Chemical Oxidation). The flat areas available at SSFL for land farming are limited to about 3 acres, and a single batch can treat approximately 2,300 yd^3. The time needed to treat a single batch varies according to the cleanup level.

2.1.1.2.3 Ex Situ Chemical Oxidation

This method of onsite treatment could be used to destroy organic contamination, such as petroleum product constituents (SVOCs and VOCs) typically found deeper than 2 ft bgs. Ex situ oxidation would entail excavating and hauling soil to a designated onsite area using ordinary construction equipment, such as front-end loaders, backhoes, and dump trucks. No bedrock or rock outcrops would be removed.
The treatment areas typically would be flat, with an asphalt or concrete base that could be lined with

polyethylene plastic sheeting. Soil containing SVOCs and VOCs would be placed in the treatment area and oxidants such as hydrogen peroxide, permanganate, or persulfate would be added, using mixers to blend in the additives, to destroy the organic constituents.

The treatment time would vary depending on the cleanup level. Soil monitoring would be required to assess the rate and amount of contaminant reduction using this technology. The frequency of monitoring would be established based on the rate of contaminant reduction in the soil, essentially more frequent in the beginning and less frequent as the soil becomes clean. Monitoring would continue for the duration of the ex situ treatment period until cleanup values were met. Once the cleanup values were met, soil would be returned to the excavation area and monitoring would be complete.

2.1.1.2.4 Ex Situ Treatment Using Thermal Desorption

This method could be used to treat soil contaminated with organic constituents, primarily petroleum products (VOCs and SVOCs) typically found more than 2 ft bgs. Soil would be excavated and treated using an onsite heat source. Typical equipment would include a rotary dryer, natural gas tanks, soil excavation and transportation trucks, blower, heat exchanger, and gas treatment system (usually a granular activated carbon [GAC]). NASA would heat the soil in a rotary dryer or similar technology to target temperatures between 200 to 600 degrees Fahrenheit (°F) using natural gas or other heating media to volatilize organic contaminants. A carrier gas or vacuum system would transport the volatilized organic compounds to a gas treatment system. NASA would establish an area at the site to thermally treat the soil. The area would have to be flat and the excavated soil would be stockpiled in one area and moved to the dryer for treatment. Typical treatment volumes would be between 15 and 20 tons per hour for sandy soil. A second stockpile of treated soil would be maintained and allowed to cool. The size of the treatment area would depend on the quantity of soil requiring treatment. Monitoring of the treated soil would continue for the duration of the ex situ treatment period until cleanup values were met. The frequency of monitoring would be established based on the rate of contaminant reduction in the soil. Once cleanup values were met, monitoring would be discontinued, and the soil would be left in a stockpile to cool. The soil would then be returned to the excavation area, probably within a month. The treated soil would be placed in the excavation areas and used as backfill.

2.1.1.3 In Situ Soil Treatments

In situ methodologies involve treating soil at its original location. The following in situ treatments are being considered at the NASA-administered areas of SSFL.

2.1.1.3.1 Soil Vapor Extraction

Soil vapor extraction (SVE) is used to remediate VOCs typically found in cleaning solvents and light petroleum fuels such as gasoline. If SVE is selected, NASA would install a series of vapor recovery wells using mechanical drilling techniques and apply a vacuum to the wells using a blower, associated piping, and manifolds. The vapor in the pore spaces of the soil would then be removed into the air. If required, the airstream from the vapor wells would be transported via pipelines for treatment with GAC or to another treatment system, such as a flare, to absorb the organic vapor before the air is released to the atmosphere. The wells most likely would be spaced at 10- to 20-ft intervals and interconnected with pipes throughout the area selected for treatment. The spacing would be evaluated during the design phase of the project and would be subject to change. If the area selected for treatment is vegetated, pathways would be cleared for the well and pipeline installations. The system would be operated for a few years and then removed from the site.

To increase the pore space in the soil, including weathered bedrock, and the radius of influence, the soil matrix could be pneumatically enhanced before installation of the SVE wells. The increase in the effective porosity of the matrix would increase the airflow and allow more vapor to be recovered. NASA would monitor the contamination removed in the airstream as part of the operation and maintenance efforts.

In addition, a power source would be required to operate the system. The VCAPCD would specify the monitoring and reporting requirements.

2.1.1.3.2 In Situ Chemical Oxidation

This technology could be used to treat organic contamination such as VOCs and SVOCs in the treatable volume of soil at depths over 5 to 10 ft bgs. A network of injection wells or boreholes would be drilled using mechanical drilling techniques, and fluids such as oxidants (for example, hydrogen peroxide, permanganate, persulfate, or ozone) would be distributed into the subsurface to treat the contamination. The soil could be pneumatically enhanced, as described for SVE, before the fluid injection. In addition, nitrogen could be used as a carrier gas to distribute oxidants into the subsurface more effectively. Typical equipment for this process would include drilling rigs, tanks to hold the fluids, pumps, hoses, valves, and a nitrogen source. The wells or boreholes most likely would be spaced at 10- to 20-ft intervals; spacing would be evaluated during the design phase of the project and could be subject to change. If the area selected for treatment is vegetated, pathways would be cleared for the well or borehole installations.

2.1.1.3.3 In Situ Anaerobic or Aerobic Biological Treatment

This method would treat organic contamination (VOCs and SVOCs) in the treatable soil volume, typically greater than 2 ft bgs, using microorganisms. NASA would drill a network of injection wells or boreholes using mechanical methods and would inject fluids into the subsurface to stimulate microbial growth. Fluids could be injected into boreholes as described for in situ chemical oxidation. The fluids could be augmented with oxygen-releasing compounds and nutrients to increase the microorganism populations and accelerate the treatment process. The wells most likely would be spaced at 10- to 20-ft intervals; spacing would be evaluated during the design phase of the project and could be subject to change. If the area selected for treatment is vegetated, pathways would be cleared for the well or borehole installations.

For aerobic bioremediation, fluids containing inducer and electron acceptors (oxygen) or oxygen to enhance aerobic biodegradation would be injected into the subsurface. In the presence of sufficient oxygen and other nutrients, such as nitrogen and phosphorus, microorganisms would convert many organic contaminants to carbon dioxide and water. For anaerobic bioremediation, electron donors would be injected into the subsurface to stimulate the reduction of chlorinated organic compounds. In the absence of oxygen, the organic contaminants ultimately would metabolize to methane, carbon dioxide, and hydrogen gas. Common electron donors are sugars such as lactate, corn syrup, and vegetable oils. Typical equipment would include a drilling rig, tanks to hold the fluids, and pumps.

2.1.1.4 Monitored Natural Attenuation

Monitored natural attenuation (MNA) relies on natural processes to destroy contamination and is typically applied in coordination with another remedial technology. For example, MNA could be used after a remedial technology is no longer effective in reducing chemical concentrations of organic compounds. MNA could require 50 to 85 years, or possibly longer, to meet the AOC cleanup levels. MNA would involve the use of monitoring equipment so that the natural elimination of contamination is observed. If it is found that contamination is not being destroyed, a more active treatment would be employed. MNA would be used only if active treatment had reduced concentrations below risk-based cleanup values or initial concentrations were already below risk-based cleanup values and additional reductions were required to meet AOC LUT requirements.

2.1.1.5 Summary of Potential Soil Treatment Technologies

Table 2.1-1 provides a summary of the soil cleanup technologies that have potential applicability at SSFL.

TABLE 2.1-1
Comparison of Soil Remediation Technologies
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Technology	Constituent Treatment	Excavation	Soil Replacement	Onsite Trucks	Stockpiling	Offsite Trucks	Construction	Energy Needs	Soil Monitoring
Excavation and offsite disposal	All	Yes	Commercial backfill	Yes	Yes	Yes	Staging Area	No	No
Ex situ using soil washing	Organic and Inorganic	Yes	Replacement of treated soil	Yes	Yes	Yes	Staging Area and Treatment Area	No	Yes
Ex situ using land farming	VOCs and SVOCs	Yes	Replacement of treated soil	Yes	Yes	No	Staging and Treatment Area	No	Yes
Ex situ chemical oxidation	VOCs and SVOCs	Yes	Replacement of treated soil	Yes	No	No	Temporary Mixing Structure	Yes	Yes
Ex situ using thermal desorption	VOCs and SVOCs	Yes	Replacement of treated soil	Yes	Yes	No	Temporary Thermal Desorption Chamber	Yes	Yes
Soil vapor extraction (SVE)	VOCs	No	Soil left on site	Yes	No	No	SVE Wells	Yes	Yes
In situ chemical oxidation	VOCs and SVOCs	No	Soil left on site	Yes	No	No	Injection Wells or Boreholes	No	Yes
In situ anaerobic or aerobic biological treatment	VOCs and SVOCs	No	Soil left on site	Yes	No	No	Injection Wells or Boreholes	No	Yes
MNA	VOCs	No	Soil left on site	No	No	No	Installation of Monitoring Equipment	Yes	Yes

2.2 Action Alternatives

NASA has identified four Action Alternatives that meet CERCLA cleanup requirements and follow EPA and California EPA (Cal EPA) recognized methods for identifying appropriate site cleanup levels for the COCs at SSFL. These alternatives require the implementation of the soil treatment technologies described in the preceding section. Three of the Action Alternatives are new since the 2014 FEIS and would not meet the proposed AOC LUT cleanup values; however, CEQ implementing regulations for NEPA require that the agency evaluates all reasonable alternatives (40 CFR Section 1502.14). These three additional alternatives were identified by NASA as providing for a risk based clean up standard given the reasonably foreseeable future uses of the SSFL property that would be protective of human health and the environment. NASA has identified the following issues regarding implementation of the 2010 AOC and the DTSC's proposed LUT cleanup requirements.

- **Limited Treatment Technologies:** NASA has evaluated multiple onsite treatment options for use at SSFL. Although some treatment options are viable under the site conditions, the LUT values are so much lower than conventional cleanup levels that most treatments are largely unproven to meet the remedial goals and are not expected to meet AOC LUT cleanup criteria. As a result, significantly more soil would have to be excavated and transported offsite for the AOC Cleanup Alternatives as it is the only proven method, in many cases, for reaching the LUT standard.
- **Availability of Suitable Replacement Soil:** NASA will require approximately 448,000 yd^3 of backfill and topsoil to meet the 2010 AOC LUT values and support native revegetation and habitat restoration. NASA tested soil from multiple potential offsite backfill locations. However, the only backfill materials that complied with the AOC contained predominately sand and gravel mixtures, which lack the soil structure or nutrients needed to revegetate the excavated areas. California State University studies have shown that amending backfill materials to produce soil that is capable of supporting the SSFL ecosystem would result in soil with chemical nutrient levels that exceed the AOC LUT values. DOE observed that even store-purchased topsoil fails to meet the AOC LUT values (DOE, 2018). The implications of being unable to obtain suitable backfill materials in the necessary volumes are significant. Native plant establishment would be greatly hindered, resulting in potentially devastating effects to the natural environment at SSFL, as the site will remain barren in areas where gravel is used, and non-native plants may establish where native species are currently dominant.
- **Laboratory Screening Limitations:** AOC LUT values are significantly below conventual laboratory capabilities; for example, levels for polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPHs), and dioxins are so low that laboratories are unable to distinguish potential “contamination” releases from natural “background” concentrations of these types of constituents. Furthermore, during the sampling efforts detailed in the NASA Soil Data Summary Report (DSR) (NASA, 2017b), soil concentrations for these three parameters were discovered to be above LUT values, even in areas with no known source of contamination.
- **Significant Environmental Effects:** The quantity of excavated soil material necessary to achieve the AOC LUT cleanup levels has increased significantly since the 2014 FEIS, from 500,000 cubic yards (yd^3) in 2014 to 870,000 yd^3 (current estimate). This substantial increase meant that the AOC LUT cleanup standard would result in severe environmental damage, which would not be realized under other EPA and DTSC recognized cleanup scenarios. The significant impacts associated with the AOC LUT cleanup were identified in the DTSC Draft Program Environmental Impact Report (DTSC, 2017), DOE FEIS (DOE, 2018), 2014 FEIS (NASA, 2014a) and this SEIS. NASA is committed to making the necessary effort to mitigate impacts associated with the cleanup; however, many impacts are not avoidable under AOC cleanup requirements. Consequently, it is appropriate to consider alternatives to the AOC LUT cleanup standard.
- **Differing Cleanup Standards:** In the same way NASA is working with DTSC to achieve soil cleanup at SSFL, Boeing and DOE are involved in similar soil cleanup activities. Boeing is not subject to the AOC and

has a different cleanup requirement for soil on the portion of the property for which it is responsible (approximately 1,930 acres). Boeing has announced that it will clean up soil to a recreational risk-based standard, which Boeing has determined to be the future land use type (Boeing, 2017a). Different cleanup standards across responsible parties pose several seemingly unresolvable issues. For example, even if NASA was able to successfully complete an AOC-based cleanup, soil that does not meet the AOC LUT cleanup standard could shift onto NASA-administered property from Boeing's adjacent property, requiring NASA to remediate soil considered clean by recreational standards.

- **Health Basis of AOC LUT Values:** The AOC background cleanup requirement provides an unproven increase in protection to public health compared to EPA-recognized risk-based cleanup alternatives. The EPA and DTSC have established health-based exposure limits for chemicals of concern (COCs) that are dependent on the intended land use and associated exposure pathways. The AOC LUT values were not developed based on the EPA or California Environmental Protection Agency (Cal EPA)-developed exposure values; instead, they were developed based on sampling performed at an offsite location (background values) and laboratory equipment capabilities.

As a result of these concerns, alternate levels of soil cleanup have been included in this SEIS. The alternatives identified are widely accepted as protective of human health and the environment and would result in substantially fewer environmental impacts than the AOC LUT cleanup requirements.

2.2.1 Alternative A: AOC Cleanup

Under Alternative A, NASA would remediate the soil on the NASA-administered property at SSFL to DTSC proposed LUT values (DTSC, 2013). The AOC LUT values are found in Appendix 2A. After NASA signed the AOC, DTSC developed LUT values based on a chemical background study of the combined Chatsworth Formation and Santa Susana geological formations, as well as those chemicals most frequently identified as contaminants at SSFL or that are of interest to DTSC. Background concentrations are substances that are not influenced by the releases from the site and are usually described as naturally occurring (EPA, 2002). The LUT values are based on either assessed naturally occurring threshold values derived from DTSC's background study or a method reporting limit (MRL) for chemicals without a background threshold value. The MRL is the minimum level that an analytical instrument can report and provide a reliable result. These values are developed based on the capabilities of laboratory equipment; they are not based on known risks to human health and the environment or designed to ensure contaminant levels associated with risks are protective [1]. Figure 2.2-1 shows the general footprints of the proposed soil remediation areas for Alternative A. The soil remediation areas were developed in a DSR for SSFL and shared with DTSC (NASA, 2017b). Alternative A assumes that all soil remediation would be conducted using primarily the excavate and offsite disposal technology, as it is the only proven remediation technology to cleanup to this standard. If other treatments were shown to be effective, NASA would implement them as approved.

Where cleanup areas are separated from existing roadways, NASA would develop temporary access roads on SSFL. Figure 2.2-1 shows where staging and stockpile areas might be located to minimize impacts to the surrounding environment. It is assumed that soil would be excavated to bedrock or up to 20 ft bgs. The total excavation area is estimated to be 220 acres and the total excavation volume would be approximately 870,000 yd^3. These numbers are provided as a best available estimate to facilitate the assessment of environmental impacts and represent the expected levels of excavated soil quantities and footprint, given that most ex situ and in situ treatments are unproven for the AOC LUT cleanup level. They are based on the most current surveys as presented in the NASA Soil DSR (NASA, 2017b). Refinements may be made during the development of soil design planning documents. If there is a significant deviation discovered during the soil design planning document development stage or if sensitive resources that were previously avoidable

[1] "Protective" is defined here and throughout this SEIS as representing a 1×10^{-6} (or 1 in 1,000,000) likelihood of a seriously adverse health effect (such as cancer) under defined exposure scenarios. (40 CFR Section 300.430)

become unavoidable, NASA would determine whether supplemental NEPA documentation is required and coordinate with the appropriate resource agencies as warranted.

Soil would be sampled and characterized before transport to confirm soil content and to identify the appropriate handling and disposal facility.

2.2.2 Alternative B: Revised LUT Levels Cleanup

Alternative B is based on a set of revised AOC LUT values for soil cleanup, shown in Table 2.2-1. These values were developed using the Cal EPA Office of Environmental Health Hazard Assessment (Cal EPA, 2005a), Los Angeles County screening levels for contaminants (Los Angeles, 1996) and EPA screening levels (EPA, 2018a). These values are based on levels used by the above-referenced agencies to screen concerns, instead of the potential risks to human health. Screening values are typically used to help identify areas, contaminants, and conditions that require further attention at a site. Generally, at sites where contaminant concentrations fall below screening levels, no further study is warranted. Chemical concentrations above screening levels would not automatically designate a site as “dirty” or trigger a response action (EPA, 2018b). The values provided in Table 2.2-1 are considered by these organizations to be protective for humans, including sensitive groups, over a lifetime in a residential scenario. Table 2.2-1 illustrates the differences in AOC LUT values and the revised LUT values.

The revised AOC LUT values are based on the seven contaminants that result in the greatest disproportionate level of cleanup between the AOC and environmental agency screening levels; they also have the benefit of eliminating the other AOC implementation concerns such as availability of backfill, reducing impacts to natural and cultural resources, and reducing unnecessary impacts to the community from transportation and air pollution emissions. The cleanup levels for the remaining contaminants would reflect the original AOC LUT values outlined in Appendix 2B. The revised screening levels represent concentrations of chemicals in soil that are below thresholds of concern for risks to human health (Cal EPA, 2005b).

TABLE 2.2-1
Proposed Look-Up Table Revisions
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Analyte (soil)	AOC LUT Value	Revised LUT Value	Los Angeles County Regional Water Board Soil Screening Level	EPA Regional Screening Level for Residential Soil	California Human Health Screening Level for Residential Soil
PAHs[a]	4.47 µg/kg	**110 µg/kg**	not applicable	**110**[c] µg/kg	not applicable
TPH	5 mg/kg	**1,000 mg/kg**	**1,000 mg/kg**	Varies[e]	not applicable
Dioxin/Furans[b]	0.912 pg/g	**4.6 pg/g**	not applicable	4.8[d]pg/g	**4.6[d] pg/g**
Antimony	0.86 mg/kg	**30 mg/kg**	not applicable	31mg/kg	**30 mg/kg**
Silver	0.2 mg/kg	**380 mg/kg**	not applicable	390 mg/kg	**380 mg/kg**
Cadmium	0.7 mg/kg	**1.7 mg/kg**	not applicable	71 mg/kg	**1.7 mg/kg**
Acetone	20 µg/kg	**61,000,000 µg/kg**	not applicable	**61,000,000 µg/kg**	not applicable

Notes:
Bold text indicates revised AOC LUT value.
[a] Calculated as benzo(a)pyrene toxic equivalency (PAHTEQ)
[b] Calculated as 2,3,7,8-tetrachloro-dibenzo-p-dioxin (TCDD) toxic equivalency (DIOXTEQ)
[c] Based on benzo(a)pyrene
[d] Based on 2,3,7,8-TCDD
[e] Varies based on six TPH fractions, depending on level of aliphatic or aromatic levels
µg/kg = microgram(s) per kilogram
mg/kg = milligram(s) per kilogram
pg/g = picogram(s) per gram

PAH = polycyclic aromatic hydrocarbon
TPH = total petroleum hydrocarbon

Figure 2.2-2 shows the general footprints of the proposed soil remediation areas for the Revised LUT Levels Cleanup Alternative as well as the staging and stockpile areas. The cleanup area and volume are estimated to be approximately 78 acres and 384,000 yd^3, respectively. It is assumed that soil would be excavated to bedrock or up to 20 ft bgs. These parameters are used as an estimate to aid in the environmental impact analysis and are expected to represent the upper limits of potential excavation quantities and footprint, as ex situ and in situ treatments would be implemented when viable. The estimates will be refined during the soil design planning document process, which will be performed on the chosen alternative and coordinated with DTSC.

Soil would be sampled and characterized before transport to confirm soil content and identify the appropriate handling and disposal facility.

2.2.3 Alternative C: Suburban Residential Cleanup

Alternative C would entail the cleanup of soil to meet Suburban Residential risk-based cleanup goals, as provided in Appendix 2C. Site-specific risk-based cleanup levels for contaminants in soil at SSFL have been developed based on standard risk assessment procedures and equations provided in the DTSC-approved Standardized Risk Assessment Methodology (SRAM, Revision 2 Addendum) (MWH, 2014b), EPA risk assessment guidance (RAG; EPA, 1989, 1991, 2003, 2004, 2009, 2014), and Cal EPA RAG (Cal EPA, 2017a, 2017b). These cleanup levels are derived from equations that incorporate site-specific exposure assumptions for a hypothetical suburban residential land use scenario with toxicity factors published by EPA and Cal EPA. The EPA uses the target of 1×10^{-6} (or 1 in a 1,000,000) as the guide for managing health concerns related to cancer under a risk-based cleanup (EPA, 1991). In other words, there would be an approximately 1 in a 1,000,000 possibility for an exposed individual to experience health concerns, such as cancer, under the Suburban Residential risk-based cleanup scenario. Exposure areas that have excess lifetime cancer risk estimates of less than 1 in a 1,000,000 (1×10^{-6}) are characterized as not posing a threat to human health for the evaluated exposed populations, per established EPA guidelines (EPA, 2018b).

The exposure scenario for Suburban Residential cleanup assumes that both adults and children would be exposed to contaminants in soil and groundwater at a home located on the current site. The exposure duration is assumed to be 24 hours per day, 350 days per year, for a total of 26 years. The exposure to onsite residents is assumed to include surface soil (0 to 2 ft) and subsurface soil to a depth of 10 ft (assuming that a basement was excavated during construction of the home). The exposure route for soil would include incidental soil ingestion, inhalation of soil particles, inhalation of vapors emanating from surficial soil, and dermal contact with soil. It is assumed that the onsite residents would be exposed to contaminant vapors off-gassing from soil or groundwater and migrating beneath the home, a process known as vapor intrusion. The indirect exposure pathway from an onsite residential garden is not included in the analysis of this scenario. A Suburban Residential cleanup is considered to be protective for humans living onsite, including sensitive groups, over a lifetime (EPA, 2018b). Suburban Residential cleanup would also be protective for communities offsite as there are limited pathways for contamination to travel offsite and natural dilution processes would significantly reduce contaminant levels. Alternative C cleanup is protective of future suburban residential land use and is considered protective for humans that might live onsite or in the neighboring communities.

An ecological risk assessment was conducted in accordance with the ecological risk assessment guidance developed for the DTSC-approved SRAM, Revision 2 Addendum (MWH, 2014b). Media-specific ecological risk-based screening levels (EcoRBSLs) were derived for comparison with site-related concentrations. The EcoRBSLs used in this assessment were derived for terrestrial (plants, invertebrates, birds, and mammals) and aquatic (aquatic invertebrates and aquatic birds) receptors and are presented in detail in the SRAM for SSFL (MWH 2014b, 2017). The EcoRBSLs are protective of survival, growth, and reproduction for the respective receptor. Under this scenario, it is assumed that the ecological receptors use the site 100 percent of the time. To identify ecological risk-based remediation areas, contaminant concentrations were compared to the EcoRBSLs. It has been confirmed that the ecological remediation areas are within the residential cleanup areas identified for Alternative C and that Alternative C is protective of ecological receptors such as plants, invertebrates, birds, and mammals that may live or forage on this site.

Figure 2.2-3 shows the general footprints of the proposed soil remediation areas for the Suburban Residential Cleanup Alternative, as well as staging and stockpile areas. The cleanup area and volume are approximately 36 acres and 247,000 yd^3, respectively. It is assumed that soil would be excavated to bedrock or up to 20 ft bgs. These parameters are used as an estimate to aid in the environmental impact analysis and are expected to represent the upper limits of potential excavation quantities and footprint as less impactful treatments would be used when feasible. The estimates will be refined during the soil design planning document process, which will be performed on the chosen alternative and coordinated with DTSC.

Soil would be sampled and characterized before transport to confirm soil content and to identify the appropriate handling and disposal facility.

2.2.4 Alternative D: Recreational Cleanup

Alternative D would entail the cleanup of soil to meet Recreational risk-based soil cleanup goals provided in Appendix 2D. The site-specific cleanup levels for contaminants in soil at SSFL are based on standard risk assessment procedures and equations provided in the DTSC-approved SRAM, Revision 2 Addendum (MWH, 2014b), EPA RAG (EPA, 1989, 1991, 2003, 2004, 2009, 2014), and Cal EPA RAG (Cal EPA, 2017a, 2017b). These cleanup levels are derived from equations that incorporate site-specific exposure assumptions for a hypothetical recreational land use scenario with toxicity factors published by EPA and Cal EPA. Exposure areas that have excess lifetime health risk estimates of less than 1 in a 1,000,000 (1×10^{-6}) are characterized as not posing a threat to human health for the evaluated exposed populations (EPA, 2018b).

The exposure scenario for Recreational cleanup assumes that both adults and children are exposed to soil and groundwater while performing recreational activities on the current site. The exposure duration is assumed to be several hours per day, 50 days per year, for a total of 26 years. The media to which the recreationists would be exposed includes surface soil (0 to 2 ft). The exposure routes for soil would include accidental ingestion, inhalation of soil particles, and dermal contact. The analysis assumes that onsite recreationists would be exposed to vapors in the soil gas from the subsurface soil via the vapor intrusion pathway. The cleanup levels are considered to be protective for humans, including sensitive groups, recreating on the site over a lifetime (EPA, 2018a). A cleanup protective of future onsite recreational land use would be safe for people who use SSFL for recreational purposes and for the neighboring communities. Neighboring communities would be protected more than those recreating at the site, because of the natural dilution process and limited exposure pathways.

The ecological risk exposure scenario presented in Alternative C was compared to the recreational cleanup area identified for Alternative D. It has been confirmed that the soil cleanup under Recreational Scenario (Alternative D) is also protective of ecological receptors.

Figure 2.2-4 shows the general footprints of the proposed soil remediation areas for the Recreational Cleanup Alternative, as well as staging and stockpile areas. The cleanup area and volume are estimated to be approximately 26 acres and 176,500 yd^3, respectively. It is assumed that soil would be excavated to bedrock or up to 20 ft bgs. These parameters are used as an estimate to aid in the environmental impact analysis, and they are expected to represent the upper limits of potential excavation quantities and footprint as less impactful treatments would be used when feasible. The estimates will be refined during the soil design planning document process, which will be performed on the chosen alternative and coordinated with DTSC.

Soil would be sampled and characterized before transport to confirm soil content and identify the appropriate handling and disposal facility.

2.2.4.1 No Action Alternative

The CEQ regulations (40 CFR Section 1502.14(d)) require that an EIS includes consideration of a No Action Alternative. For the purpose of this analysis, the No Action Alternative considers a continuation of current activities. Under this alternative, NASA would not conduct soil remediation beyond what has already been directed under separate regulatory direction (the 2013 ISRA NPDES action). Contaminants not captured by this program would remain in place or attenuate naturally over time. No monitoring of the natural attenuation would occur.

The No Action Alternative would not meet NASA's Purpose and Need (Section 1.5). The No Action Alternative is used as a baseline with which to assess the environmental impacts of the Proposed Action and other Action Alternatives.

2.2.5 Alternative Comparison

Table 2.2-2 summarizes the associated activities with each alternative.

TABLE 2.2-2
Alternative Comparison
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Description	Alternative A AOC Cleanup	Alternative B Revised LUT Levels Cleanup	Alternative C Suburban Residential Cleanup	Alternative D Recreational Cleanup	No Action Alternative No Soil Cleanup
Soil Excavation Volume (yd^3)[a]	870,000	384,000	247,000	176,500	0
Excavation Footprint (acres)	220	78	36	26	0
Off Haul Truckloads[b]	65,414	28,872	18,571	13,271	0
Backfill Volume (yd^3)[c]	448,000	253,000	189,000	141,000	0
Backfill Import Truckloads[b]	33,684	19,023	14,211	10,602	0
Total Truckloads [b]	**99,098**	**47,895**	**32,782**	**23,873**	**0**
Total Duration (years) [d]	**25+**	**12**	**8**	**6**	**0**

Notes:
[a] These numbers are provided as a best available estimate to facilitate the assessment of environmental impacts and represent the upper levels of expected excavated soil quantities and footprint. They are calculated based on the most current data as presented in the NASA Soil DSR (NASA, 2017b). Refinements may be made during the development of soil design planning document. If there is a significant deviation discovered during the development of the soil design planning document or if sensitive resources, which were previously avoidable become unavoidable, NASA will determine whether supplemental NEPA documentation is required and coordinate with the appropriate resource agencies as warranted.
[b] The truckload capacity is assumed to be 19 yd^3; however, due to the expansion factor for excavated soil, 13.3 yd^3 of excavated soil is equivalent to 1 truckload.
[c] Backfill calculations assume that soil excavations between a 0- and 2-ft depth require 1/3 of the excavation volume for backfill, and excavations greater than a 2-ft depth require 100 percent of the excavation volume as backfill (NASA, 2018c).
[d] Duration calculation assumptions: NASA is limited to 16 round-trip truckloads (32 trucks total) per day, 250 days per year (DTSC, 2017).
yd^3 = cubic yard(s)

All excavated soil is conservatively assumed to be transported to a landfill, though some excavated soil could be treated using the in situ soil remediation methods described in Section 2.1.1, *Soil Treatment Technologies*. A soil design planning document will be developed following the selection of a cleanup level to determine the precise volume of excavated soil that may be treated onsite. The backfill quantities are based on conservative estimates of what will be needed to return the site to a reasonably safe topography after soil removal.

A transportation and road agreement signed in 2015 limits the maximum number of daily truck trips associated with the project to 48 round trips per day. It is assumed that this quantity will be equally shared among the three responsible parties for the site, namely, Boeing, NASA, and DOE (NASA, Boeing, and DOE, 2015).

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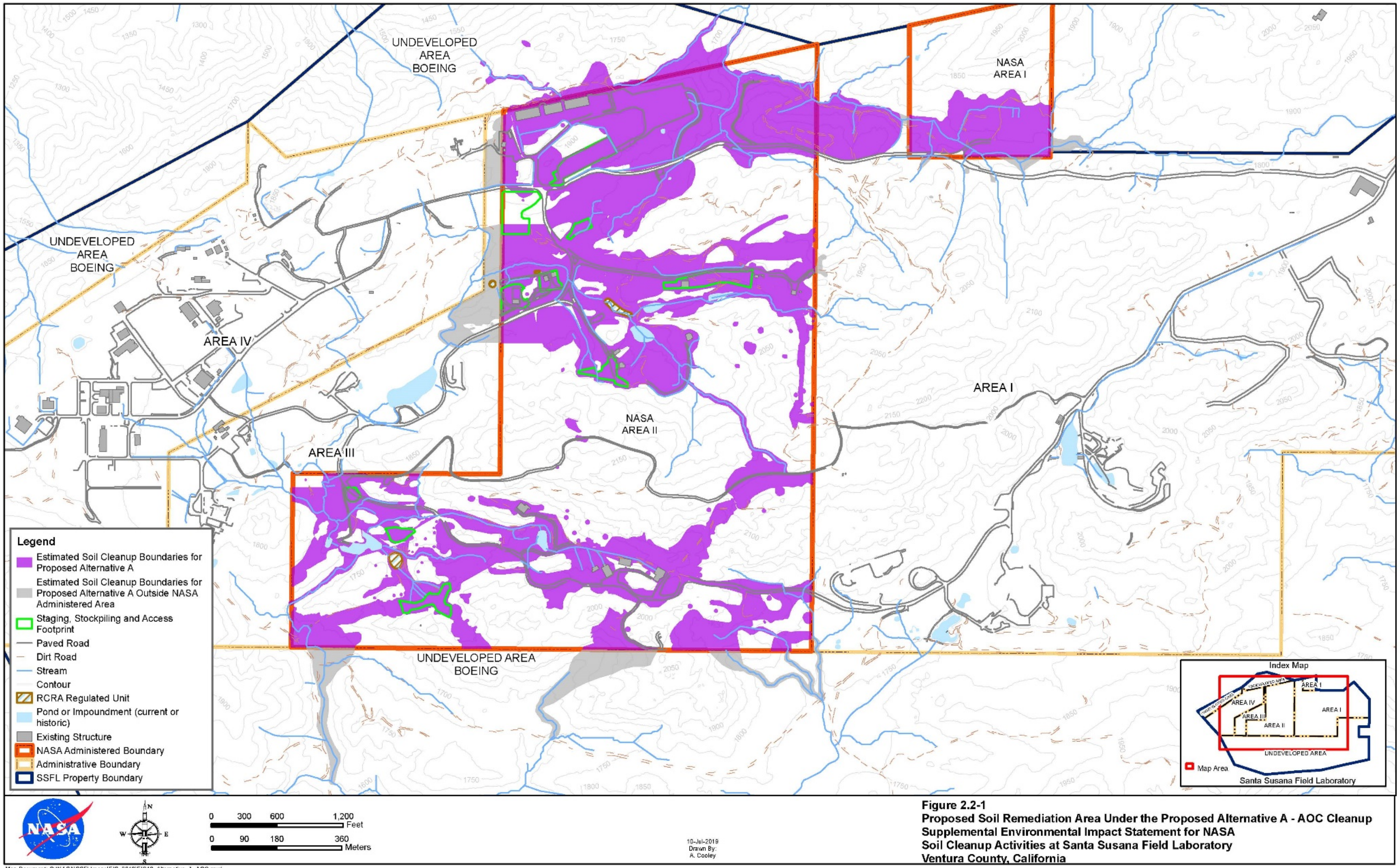

Figure 2.2-1
Proposed Soil Remediation Area Under the Proposed Alternative A - AOC Cleanup
Supplemental Environmental Impact Statement for NASA
Soil Cleanup Activities at Santa Susana Field Laboratory
Ventura County, California

Map Document: O:\NASA\SSFL\maps\EIS_2018\EIS18_Alternative_A_AOC.mxd

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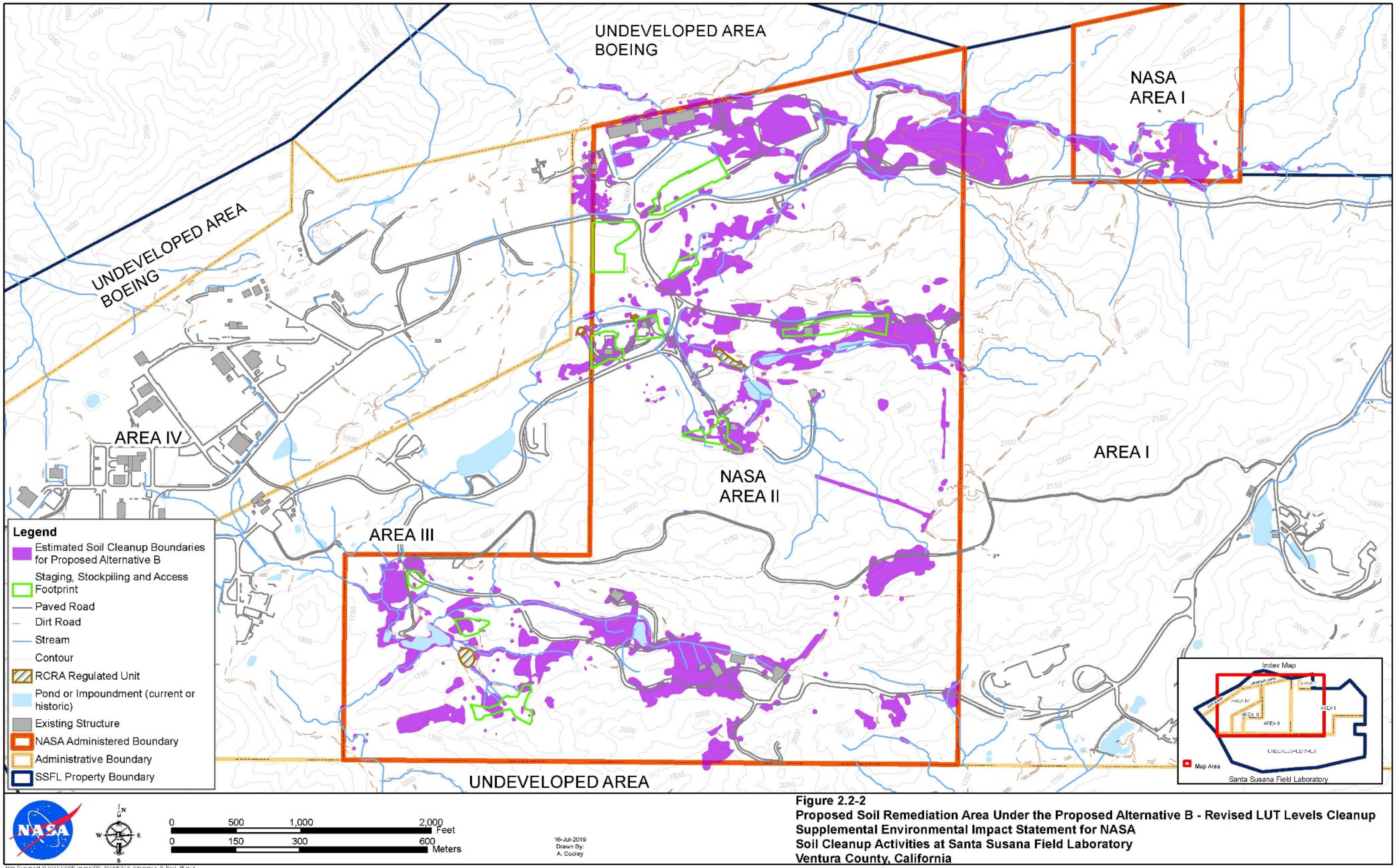

Figure 2.2-2
Proposed Soil Remediation Area Under the Proposed Alternative B - Revised LUT Levels Cleanup
Supplemental Environmental Impact Statement for NASA
Soil Cleanup Activities at Santa Susana Field Laboratory
Ventura County, California

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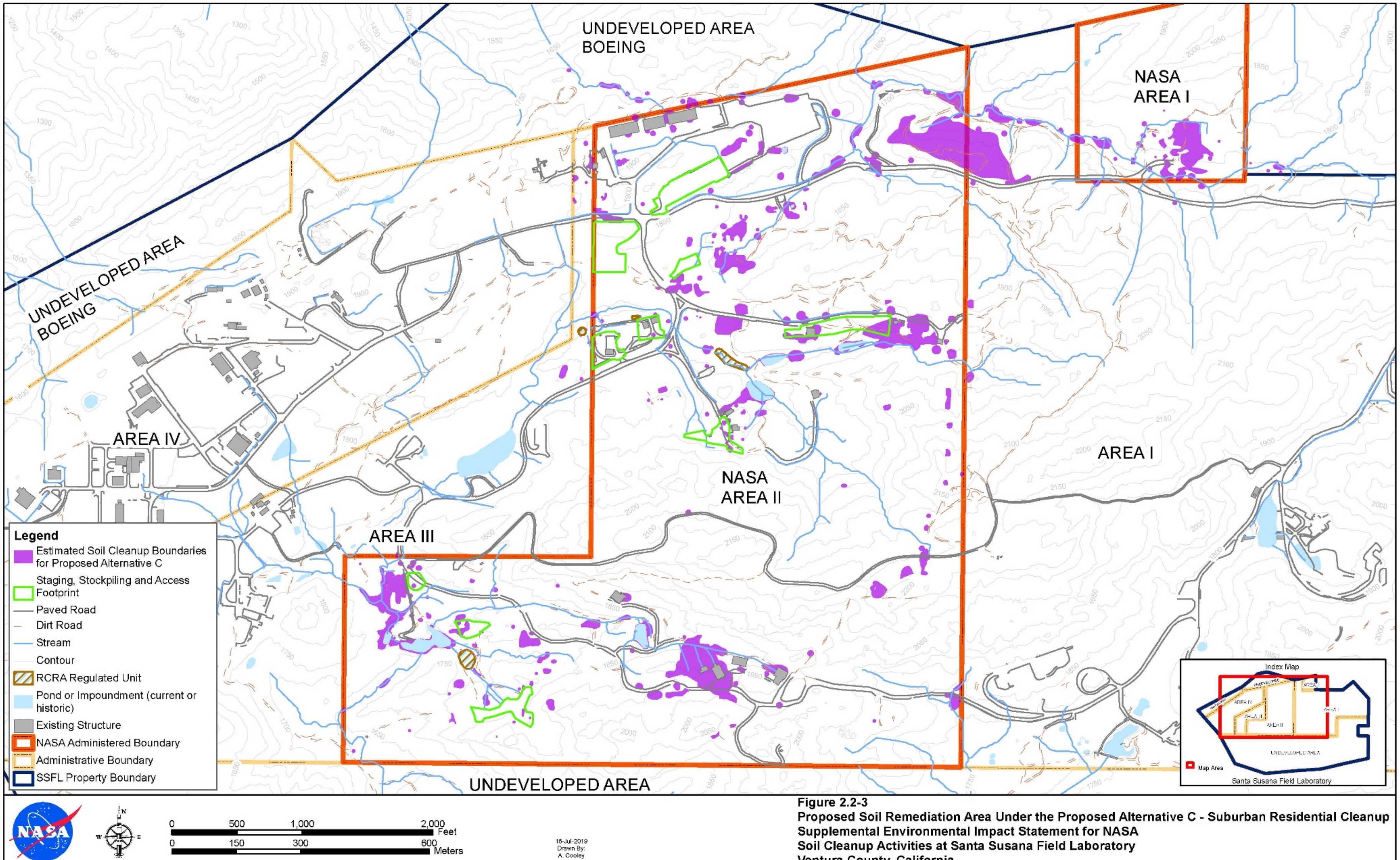

Figure 2.2-3
Proposed Soil Remediation Area Under the Proposed Alternative C - Suburban Residential Cleanup
Supplemental Environmental Impact Statement for NASA
Soil Cleanup Activities at Santa Susana Field Laboratory
Ventura County, California

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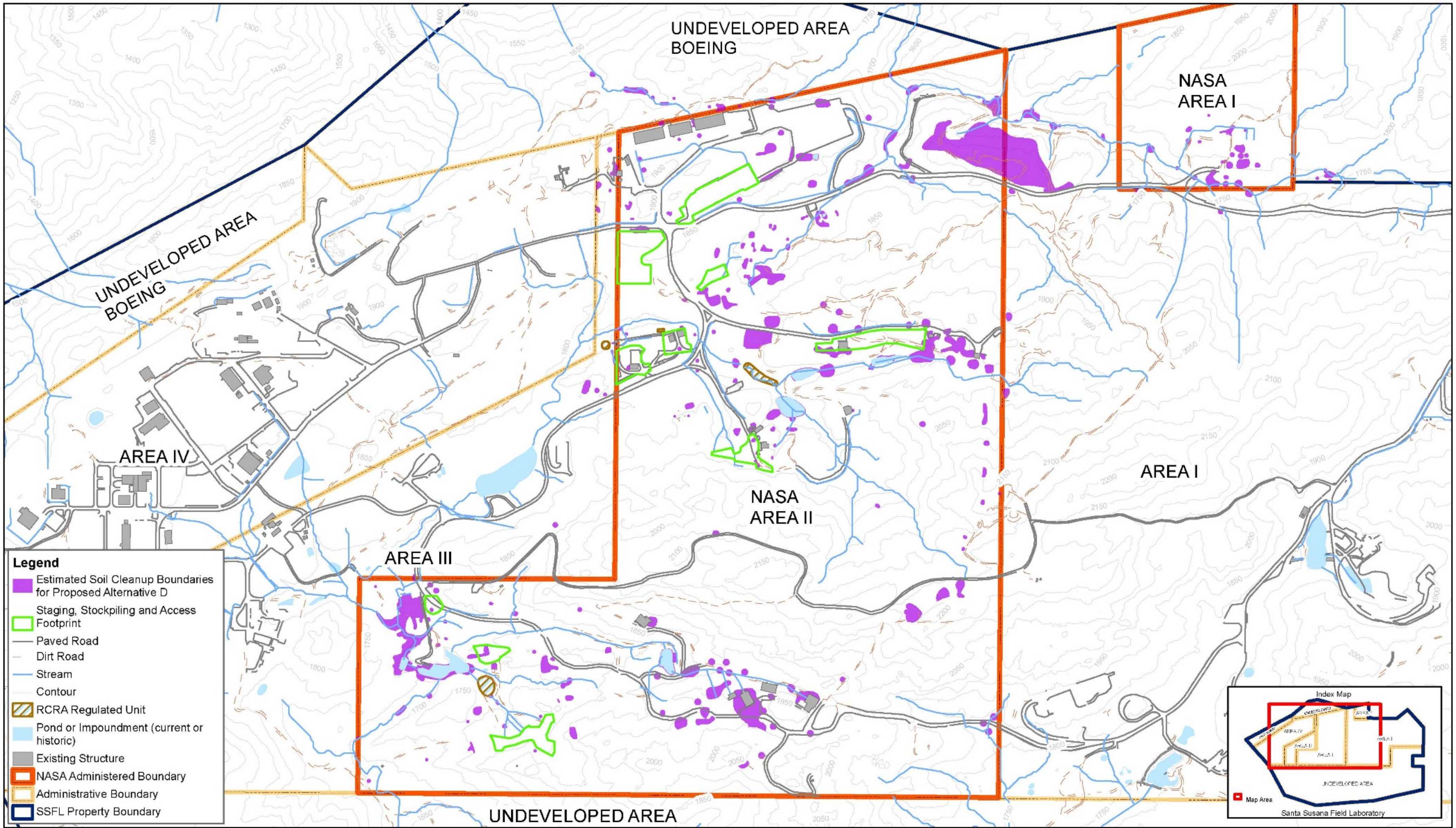

Figure 2.2-4
Proposed Soil Remediation Area Under the Proposed Alternative D - Recreational Cleanup
Supplemental Environmental Impact Statement for NASA
Soil Cleanup Activities at Santa Susana Field Laboratory
Ventura County, California

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2.3 Alternatives and Options Eliminated

During the evaluation of soil cleanup activities, a few alternatives and options were considered but eliminated. These alternatives were broken into the following three categories and are described in the following sections:

- Additional risk-based cleanup standards
- Additional cleanup technology options
- Additional soil transport options

2.3.1 Additional Risk-based Cleanup Alternatives

Other risk-based cleanup scenarios that are standard across California and the United States could be applied at SSFL. For example, Commercial/Industrial cleanup levels are between the suburban residential and recreational levels. However, additional risk-based cleanup levels were eliminated because the Suburban Residential Cleanup (Alternative C) and Recreational Cleanup (Alternative D) represent the most likely range of future land use scenarios. Suburban Residential Cleanup was chosen because it represented the most conservative potential land use scenario, while Recreational Cleanup was chosen because it represented the most likely future land use.

2.3.2 Additional Cleanup Technology Options

2.3.2.1 Corrective Action Management Unit and Encapsulation

This technology would involve excavation, as described previously. However, instead of staging and transporting soil to an approved offsite landfill facility, this remedial technology would involve siting, permitting, constructing, and encapsulating a corrective action management unit (CAMU) on SSFL. A CAMU is a waste management unit specifically intended for storage, treatment, or disposal of waste generated from onsite remediation activities and cannot be used for disposal of offsite waste or waste from onsite industrial processes.

Because this approach does not remove or destroy contamination within the soil at SSFL, it would not meet the obligations set forth in the purpose and need statement.

2.3.2.2 Institutional Controls

Access to contaminated areas of SSFL could be restricted primarily through fencing, with signage and security being present at the site. By erecting fences with visible, hanging signage to warn trespassers to keep out of the area and restricting access to SSFL through security measures, potential exposure to humans would be limited or eliminated. The fencing and signage would require inspections at a frequency that would allow NASA to make repairs as needed.

Because this approach does not remove or destroy contamination within the soil at SSFL, it would not meet the cleanup goals.

2.3.2.3 In Situ Physical Treatment Using Soil Mixing

This technology would entail using large-diameter augers or Lang-tool mixers to disturb the soil physically with a series of borehole locations. Hot air, steam, hydrogen peroxide, zero-valent iron, or other fluids would be mixed into the soil to treat the contamination in place. Typical equipment would include large drilling rigs, tanks, piping, and valves. If a heat source is required, equipment would be needed to heat either air or water. This technology primarily is used to treat organic compounds (VOCs and SVOCs).

This technology was eliminated because the ex situ methods for treating soil are likely to be more effective in reducing contamination than treating the soil in place because ex situ methods offer better contact between the treatment fluids and the soil once the soil has been removed from the subsurface.

2.3.2.4 Phytoremediation

This method is primarily used in wetland areas or where the depth to groundwater is from 3 to 5 ft bgs. Phytoremediation has been known to treat VOCs, some metals, and PCBs. Trees such as cottonwoods or poplars can uptake moisture that contains contaminants and metabolize the contaminants. An irrigation system using treated groundwater and fertilizers would be required to enhance plant growth. However, because of the dry climate and deep groundwater depths at SSFL (greater than 3 to 5 ft bgs and up to hundreds of ft bgs), as well as the slow uptake rates of moisture containing contamination, the likelihood of success is low for phytoremediation. Approximately 3 acres of wetlands are within the NASA-administered portion of SSFL (2 acres within remediation areas) and 1.9 of the 3 acres are streams that intermittently flow. Therefore, the streams may not be able to adequately support the non-native plant life required for this technology, and the uptake rates of the plants are slow. Therefore, NASA eliminated this technology from further evaluation.

2.3.3 Additional Soil Transport Options

2.3.3.1 Overland Conveyor and Rail Transport of Soil

This technology involves the construction and operation of an overland conveyor system that would route soil removed from SSFL to an offsite rail staging area. From that location, the stockpiled soil would be loaded on rail cars for transport to disposal facilities. The conveyor-rail system could also transport clean soil to SSFL as backfill. Upon completion of the soil removal and backfill process, the conveyor system and offsite rail staging area would be removed, and installation sites restored.

Potential conveyor routes were identified based on several considerations, including topography, location of existing rail system facilities, access road availability, offsite property ownership, cultural and biological resources, and other environmental factors. Ultimately, two potential routes were identified for construction of an elevated, enclosed conveyor system that would transport excavated soil from the northern side of SSFL toward the Simi Valley area. Four general locations were identified as terminal points for the conveyor for construction of rail staging areas adjacent to the existing railroad network. In addition, licensed solid waste facilities (intrastate and interstate) that likely could accept the soil for disposal and were located at, or close to, the rail networks were identified.

Although this soil transport alternative is considered technically feasible, several key factors would affect NASA's ability to implement this alternate approach at SSFL:

- Regional, state, and federal permitting, agreements, consultations, and property acquisition negotiations would have to occur under this alternative. These processes would add unnecessary years to the timeline before soil cleanup activities could commence.
- It is possible eminent domain (or forced relocation) would be necessary to obtain the required properties. The federal government is prohibited from using eminent domain if any other alternative is possible.
- Construction of a new conveyor would introduce new environmental and social impacts, such as increased landslide risks from the removal of vegetation, additional impacts to wildlife habitat and corridors, and impacts to previously unidentified archeological sites. These impacts would be avoided by using the existing access road.

Additionally, in its PEIR, DTSC determined that a conveyor alternative would not meet the objective of recognizing the unique biological and cultural significance of the project site through the protection of resources and would not be consistent with applicable laws and regulations for such resources, because construction of the conveyor system would increase the area of disturbance and result in additional impacts to biological and cultural resources. This alternative also would not meet the objective to remediate the site in an expedient and cost-effective manner, given this alternative would cost an additional $80 million to develop and $464 million to operate (DTSC, 2017). For these reasons, the transport of soil by overland conveyor and rail was eliminated from further consideration.

2.3.3.2 New Road Construction

NASA considered building a new road for use by heavy vehicles accessing and leaving SSFL. Woolsey Canyon Road is the only road accessing the site that can carry heavy construction vehicles. Although NASA considered constructing a new access road to SSFL, alternative access was dismissed from further consideration for the same reasons as those described above for the conveyor system.

2.4 Resources Eliminated from Further Consideration

This SEIS focuses on key issues identified through the scoping and public involvement process conducted under the NASA SSFL FEIS (NASA, 2014a). CEQ guidelines state that a NEPA analysis should be proportional to the potential for effect. Table 2.4-1 lists the resources evaluated but eliminated from further consideration because the Proposed Action would have no to limited effect on these resources.

TABLE 2.4-1
Resources Eliminated from Further Consideration
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Resources Eliminated	Justification for Elimination
Utilities and Infrastructure	Impacts to utilities and infrastructure at SSFL were disclosed in the 2014 FEIS (NASA, 2014a) and addressed in the corresponding demolition ROD. NASA could find active utility infrastructure, such as gas or electricity, that was not removed during demolition activities, while planning soil cleanup activities. NASA would communicate such infrastructure with local utilities and reroute, as necessary, before site work. Utility services that could be retained without rerouting would be turned off for the duration of the cleanup activities in coordination with the utility provider. Some cleanup technologies would require energy usage; however, the usage would be within currently available capabilities. The soil cleanup activities would result in no new utility requirements and would be expected to result in limited disruption to service recipients. However, because of the arid environment and concerns over recent droughts, water usage is discussed in the Water Resources section.
Land Use	The proposed soil cleanup activities would not result in a change in land use on the NASA-administered property; implementation of the Action Alternatives would not require a change in zoning, and no easements or land encroachments would be necessary. No land use acquisitions or transfers would be required. Existing and proposed land uses do not conflict with federal or state land use plans, policies, regulations, or laws. Future land use designation after cleanup changes will be analyzed under a separate NEPA action as the future land use is currently unknown for the NASA-administered areas. Therefore, impacts to land use are not considered in this SEIS.
Flooding	According to the Federal Emergency Management Agency (FEMA) flood insurance rate maps 06111C1005E and 06111C1010E (FEMA, 2010), the SSFL area is within Zone X (outside the 0.2 percent annual chance floodplain); therefore, it is unlikely that the project would affect, or be affected by, flooding.
Green House Gas Emissions	Cleanup-related greenhouse gas emissions would be very small compared to regional greenhouse gas emissions. Furthermore, CEQ guidance on analyzing climate change in NEPA documents has been rescinded (CEQ, 2017); therefore, there are no established thresholds with which to compare project emissions. Greenhouse emissions are not analyzed further in this SEIS for these reasons.
Climate Change	The Proposed Action does not include the construction of infrastructure, which could be affected by climate change; therefore, climate change is not considered further in this SEIS.

Resources Eliminated	Justification for Elimination
Socioeconomics	The Action Alternatives would not induce, directly or indirectly, population growth or cause the displacement of existing residents or housing. Therefore, there would be no increase in school enrollment, demand for public transportation, or other population-related impacts. The construction workforce within Ventura and Los Angeles Counties is sufficient to meet the demand for the proposed soil cleanup activities, and no appreciable migration of construction workers from outside this area would be expected. The small onsite construction workforce could result in a negligible increase in demand for public safety services, such as police protection provided by the Ventura County Sheriff's Department or fire and emergency medical services provided by the Ventura County Fire Department, which would be well within existing capacities. Therefore, the Action Alternatives would have negligible adverse impacts on socioeconomic conditions.
Environmental Justice	EO 12898, Federal Actions to Address Environmental Justice in Minority and Low-income Populations, requires federal agencies to consider disproportionate risks to minority and low-income communities. Using the EPA's Environmental Justice Screening and Mapping Tool, the 5-mile buffer area surrounding SSFL boundaries did not contain a disproportionate percentage of minority or low-income populations. Therefore, there would be no disproportionate impacts to minority or low-income communities. See Appendix 2E for the Environmental Justice Mapping and Screen report. Although there could be minority and low-income populations around the identified landfills and truck routes, the Proposed Action is within the realm of normal activities for the roadways and landfills; consequently, there is no likelihood for a disproportionately high and adverse effect to minority or low-income populations resulting from the Proposed Action.
Effects around Designated Landfills and Disposal Facilities	Air emissions associated with truck hauling between SSFL and the disposal facilities is analyzed and discussed in Section 3.3, *Air Quality*. However, the siting and licensing of these facilities included consideration of the potential effects of bringing designated and permitted waste to the site; the potential impacts of traffic safety, roadway conditions, and noise; and environmental justice. Therefore, these considerations were not analyzed in detail in this SEIS. Furthermore, roadways near landfill locations were not considered in the detailed analysis, because project-related traffic volume, once outside the vicinity of SSFL, would dissipate in route to various disposal facilities. Before hauling material to a facility, NASA would confirm acceptance of specific waste.
Bicycle and Pedestrian Operations	Within the primary region of influence (ROI), pedestrian facilities are provided along Topanga Canyon Boulevard, Roscoe Boulevard, Plummer Street, and portions of Valley Circle Boulevard. The addition of trucks from the remediation activities to these roadways is within the acceptable loss of service operation criteria. In addition, these roadways have designated sidewalks, crosswalks, and bicycle pathways (Roscoe Boulevard) for pedestrian use. Currently, there is no pedestrian access to the main project site entrance. Proposed and alternative activities would not affect these operations.
Railroads and Airports	This project would not affect railroads or airports.

SECTION 3

Affected Environment and Environmental Consequences

This section provides an overview of the existing physical, biological, social, and cultural conditions and the potential environmental impacts from the Proposed Action Alternatives on the NASA-administered property at SSFL, as implemented through the following:

- Alternative A: AOC Cleanup
- Alternative B: Revised LUT Levels Cleanup
- Alternative C: Suburban Residential Cleanup
- Alternative D: Recreational Cleanup
- No Action Alternative

Sections 3.1 through 3.9 provide resource-focused analyses of the affected environment and the potential environmental impacts. Pursuant to NEPA regulations (40 CFR Parts 1500–1508), the effects of the Proposed Action were evaluated based on context and intensity. Context refers to the affected environment in which a proposed project occurs, which is described in the "Affected Environment" sections for each resource in Section 3. The intensity of the impact is based on type (negligible, minor, moderate, or significant), quality (negative or beneficial), and duration (temporary or permanent). The definition for each term is provided in a table in the "Environmental Consequences" section for each resource. An intensity designation was assigned for every impact identified in Section 3 and the impacts were numbered to allow comparisons across all the Alternatives. For example, Biology-1 corresponds to direct vegetation impacts across all the Alternatives.

The analysis also identifies any environmental protection measures, including best management practices (BMPs) and mitigation measures. These environmental protection measures offset negative impacts from the Proposed Action. BMPs and mitigation measures are defined as follows:

- **BMPs:** These measures are standard practices.
- **Mitigation Measures:** These measures are based on a legal or regulatory requirement.

BMPs and mitigation measures for each resource impact also were numbered to allow comparisons across the Alternatives. An impact summary table is provided at the end of each site discussion and resource section.

Section 3.10, *Cumulative Impacts*, describes the cumulative impacts for each resource area, followed by an overall summary table. Section 3.11, *Other Required Analysis*, summarizes the analyses required by NEPA regarding the relationships among local, short-term uses of the environment and long-term productivity and irreversible or irretrievable commitment of resources.

The potential project footprint and cubic yards of soil removal for the Excavation and Offsite Disposal technology represent the technology with the greatest potential impact for most resources. However, a few of the technologies described in Section 2.1 have unique environmental concerns. Table 3.0-1 depicts the unique environmental concerns by technology type. Each resource section begins with an explanation of the technologies and how they would affect that resource. The technology with the greatest potential effect is then used to assess the potential impact for each Alternative.

TABLE 3.0-1
Technology Components
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Soil Remediation Technology	Excavation	Noise	Air Emissions of Concern	Stockpiling	Offsite Haul Trucks	Generate Solid Waste	Energy Needs	Water Needs	Unique Chemicals
Excavation and Offsite Disposal	Removal of contaminated soil	Excavation equipment	Dust and/or VOCs from excavation and vehicle emissions	Material stockpiled prior to hauling	Transport of material to offsite disposal site	Disposal of all soil to landfill	Fuel	Water for dust suppression	Nutrient amendments
Ex Situ Using Soil Washing	Removal of contaminated soil	Excavation equipment and screening	Dust from excavation and screeninig and vehicle emissions	Material moved to new location for treatment	Tranposprt of some material to offsite disposal site	Washing wastestream and contaminated fine soil	Fuel	Water for creating slurry	Detergents
Ex Situ Using Land Farming	Removal of contaminated soil	Excavation and soil mix equipment	Dust and/or VOCs from excavation and vehicle emissions	Material moved to new location for treatment	None	Polyethylene plastic sheeting, concrete or asphalt, and wood for treatment cells	Fuel	Water for biological reaction	Nutrient amendments
Ex Situ Chemical Oxidation	Removal of contaminated soil	Excavation and soil mix equipment	Dust and/or VOCs from excavation and/or mixing and vehicle emissions	Material moved to new location for treatment	None	Polyethylene plastic sheeting, concrete or asphalt, and wood for treatment cells	Fuel	Water to blend with oxidants	Oxidants, stabilizers, and acids/bases for pH control
Ex Situ Using Thermal Desorption	Removal of contaminated soil	Excavation and rotary dryer equipment	Dust from excavation and treated soil, vehicle emissions, VOCs and SVOCs	Material moved to new location for treatment	None	Off-gas treatment media (e.g., spent carbon)	Natural gas for dryers and gas treatment equipment, and fuel	None	Biological Amendments

Soil Remediation Technology	Excavation	Noise	Air Emissions of Concern	Stockpiling	Offsite Haul Trucks	Generate Solid Waste	Energy Needs	Water Needs	Unique Chemicals
In Situ SVE	None	Soil sampling auger, blower, and drilling	VOCs	None	Transport of spent activated carbon	Soil sampling waste, spent activated carbon, and condensate	Grid power or solar power with battery backup for blowers and pneumatic tools	None	Activated carbon
In Situ Chemical Oxidation	None	Soil sampling auger, pumps, pneumatic tools, and drilling	None	None	Transport of drill cuttings and purge water	Soil sampling waste	Fuel for pumps and pneumatic tools	Water to blend with oxidants	Oxidants, stabilizers, acids/bases for pH control
In Situ Biological Treatment	None	Soil sampling auger, pumps, and drilling	None	None	Transport of drill cuttings and purge water	Soil sampling waste	Fuel for pumps	Water for biological reaction	Fermentable carbon substrates and nutrients to facilitate anaerobic reduction
Monitored Natural Attenuation	None	Soil sampling auger	None	None	None	Soil sampling waste	None	None	None

3.1 Cultural Resources

Federal agencies are required to protect and preserve cultural resources in cooperation with state and local governments under numerous federal statutes, including NEPA, the Archaeological Resources Protection Act of 1979 (ARPA), and the National Historic Preservation Act of 1966 (NHPA), as amended (Public Law 89-665; 54 U.S.C. 300101). The term “cultural resources” includes prehistoric and historic archeological sites, districts, and objects; historic structures, buildings, districts, and objects; locations associated with important historic events; and sites of traditional or cultural importance to various groups, including Indian Sacred Sites. “Historic property” is defined in 36 CFR Part 800 as any prehistoric or historic district, site, building, structure, or object listed in, or eligible for listing in, the National Register of Historic Places (NRHP). The term includes properties of traditional religious and cultural importance to an Native American tribe or Native Hawaiian organization and that meet the NRHP criteria. In this context, the term historic property is used to indicate the properties are significant cultural resources. Significant cultural resources are identified as historic properties as defined by the NHPA; cultural items as defined by the Native American Graves and Repatriation Act (NAGPRA); archeological resources as defined by ARPA; sacred sites as defined in Executive Order (EO) 13007, to which access is afforded under the American Indian Religious Freedom Act; and collections and associated records as defined in 36 CFR Part 79.

The ROI for cultural resources encompasses the NASA-administered portion of SSFL and areas extending outside the NASA boundary that are projected to have ground disturbance from the project cleanup alternatives, as shown on Figures 2.2-1 through 2.2-4. The ROI, also referred to as the area of potential effects (APE) for the purposes of Section 106 compliance under NHPA, is shown on Figure 3.1-1. The APE is defined as the area in which the direct and indirect effects of a project might cause alterations to the character of historic properties. The APE was determined through Section 106 consultation and is included as Attachment 3 in the 2014 Programmatic Agreement (Appendix 3.1A). The APE includes the approximately 450 acres of NASA-administered property plus 39 acres of Boeing property that could require soil remediation.

The criteria used under NHPA to evaluate properties for NRHP eligibility are provided in 36 CFR Part 60, NRHP. A resource must meet one or more of the following criteria to be considered for eligibility:

- Be associated with events that have made a significant contribution to the broad patterns of history (Criterion A).
- Be associated with the lives of persons significant to our past (Criterion B).
- Embody the distinctive characteristics of a type, period, or method of construction, or represent the work of a master, possess high artistic values, or represent a significant and distinguishable entity whose components might lack individual distinction (Criterion C).
- Have yielded, or have the potential to yield, information important to prehistory or history (Criterion D).

In addition to meeting one or more of the evaluation criteria, a resource must retain integrity to be considered eligible for listing on the NRHP. Integrity is the authenticity of the physical identity, as evidenced by the survival of characteristics that existed during the resource’s period of significance. Historic properties must retain enough of their historic character or appearance to be recognizable and convey the reasons for their significance. The seven aspects of integrity, as presented in 36 CFR Part 60, are location, design, setting, materials, workmanship, feeling, and association. Appendix C of the NASA SSFL FEIS (NASA, 2014a), *Cultural Resources Study for Environmental Cleanup and Demolition at Santa Susana Field Laboratory, NASA Areas I and II, Ventura County, California*, contains detailed information regarding the cultural resources, the ROI (APE), the identified historic properties within the ROI, and the consultation process required under NEPA and Section 106 of NHPA.

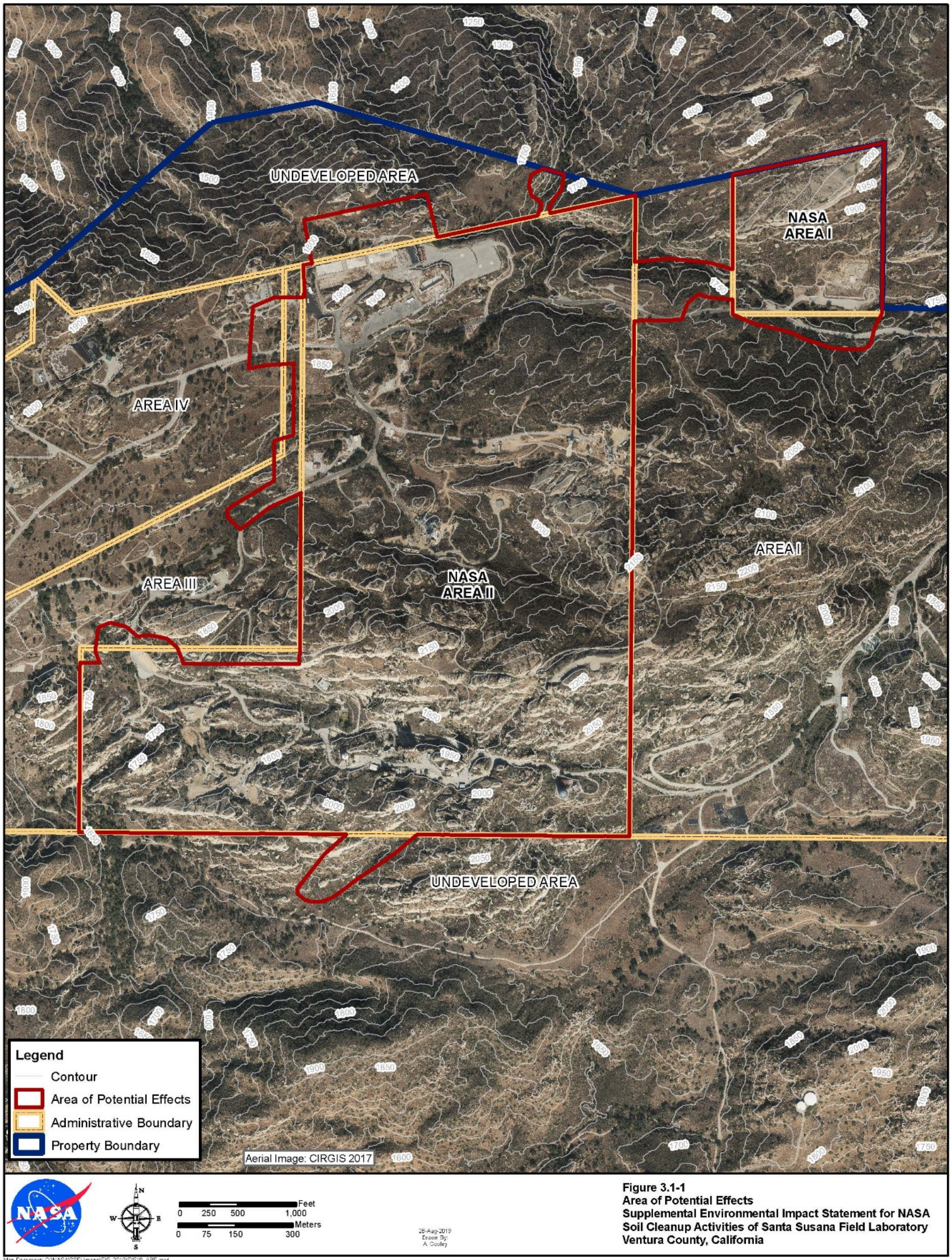

Figure 3.1-1
Area of Potential Effects
Supplemental Environmental Impact Statement for NASA Soil Cleanup Activities of Santa Susana Field Laboratory
Ventura County, California

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3.1.1 Affected Environment

Multiple significant cultural resources are located within the project APE; many of these were identified as part of the NEPA evaluation and Section 106 consultation for the 2014 FEIS (NASA, 2014a). However, since that time, additional cultural resources have been identified and studies have been conducted to clarify or adjust historic property boundaries.

3.1.1.1 Indian Sacred Site

In December 2012, NASA received notice from the Santa Ynez Band of Chumash Indians of the tribe's designation of land, including NASA-administered areas of SSFL, as an Indian Sacred Site (Armenta, pers. comm., 2012) in accordance with EO 13007 (1996). This EO states that, for lands designated as sacred sites, agencies managing federal lands shall:

(1) Accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and

(2) Avoid adversely affecting the physical integrity of such sacred sites. Where appropriate, agencies shall maintain the confidentiality of sacred sites.

NASA is limited by EO 13007 from disclosing the sacred site boundaries. For the purposes of this SEIS, the boundary for the sacred site encompasses all of NASA's portion of SSFL.

3.1.1.2 Traditional Cultural Property

In accordance with the 2014 Programmatic Agreement (Appendix 3.1A) and based on the *Ethnographic Overview of the Native American Communities in the Simi Hills and Vicinity* (Lawson et al., 2017), NASA completed an NRHP nomination of the Burro Flats Cultural District, which is eligible for listing in the NRHP as a traditional cultural property (TCP) in 2018 and sent it to the California State Historic Preservation Officer (SHPO) for review and comment. The boundaries of the TCP are confidential. For the purposes of this analysis, the TCP is defined as the entirety of SSFL. As of August 2019, the TCP nomination was under review with the California SHPO.

The local Native American communities have indicated that the area included in the Burro Flats Cultural District TCP was important to their communities historically, as described through their oral histories, and is significant to the beliefs, customs, and practices of today's communities. This area has fresh water and plentiful flora, including plants traditionally used for celebrations and ceremonies (Lawson et al., 2017).

The Burro Flats Cultural District TCP is eligible for listing on the NRHP for its association with events important to the history of local Native American communities: the creation of the world, a time when people were animals, the great flood, and the celebration of the winter and summer solstices. The local Native American communities consider the area significant and believe the area retains all aspects of integrity. Its primary significance is derived from archeology, ethnic heritage, art, and religion. It is significant in the areas of Ethnic Heritage: Native American and Religion for its association with ceremonial solstice events. Contributing features to the TCP include landforms, outcrops, overhangs, hills, rock shelters, creeks, springs, the viewshed, the flora, the fauna, open spaces, and the sky above SSFL (Lawson et al., 2017).

3.1.1.3 Archeological Resources

Fifty-four NRHP-eligible or listed archeological sites have been identified within the APE, including the Burro Flats Site (CA-VEN-1072), which is listed on the NRHP. Forty-one sites are located within the archeological district and 13 sites are located within the APE but outside the district. NASA conducted an Extended Phase I investigation in the footprint of the cleanup and remediation areas (NASA, 2016), as identified at that time. Non-intrusive field testing was undertaken in 2015 to delineate the outer boundaries of the Burro Flats Site in accordance with the testing plan (NASA, 2015b). Although the results of the non-intrusive testing were inconclusive, observations made during the removal of the vegetation in preparation for testing made it possible not only to delineate the outer surface boundaries of the Burro Flats Site, but also to refine the boundaries of loci within the site (NASA, 2016).

Archeological survey methodologies were consistent with professional standards and conducted in accordance with common practice for such studies in the State of California.

3.1.1.3.1 Burro Flats Site (CA-VEN-1072)

The Burro Flats Site (CA-VEN-1072) is 11.74 acres, the majority of which are located on NASA-administered property in Area II; the remainder is located on Boeing-owned property. Notable features of the Burro Flats Site include pictographs, petroglyphs, mortars, stone tool production sites, and habitation sites. Although the Burro Flats Site has been subject to some disturbance, its overall integrity is good because SSFL operated as a secure research facility, closed to the public, which protected the Burro Flats Site from vandalism and the effects of commercial development.

The first archeological investigations at the Burro Flats Site was an archeological testing program done by the Archaeological Survey Association of Southern California in 1953 and 1954. The Burro Flats Site was first systematically recorded in 1959 (Rozaire, 1959) and was resurveyed in 1972 by Franklin Fenenga (Fenenga, 1972). The boundary of the site was enlarged to 25.02 acres by the Ventura County Heritage Board in 1975 and was accepted by the National Park Service (NPS) and listed on the NRHP in May 1976. Researchers have since suggested that the 1976 boundary of the site does not adequately reflect the number, density, and distribution of loci associated with the site (Corbett et al., 2016a). An updated nomination includes four additional loci and reduces the overall site footprint from 25.02 acres to 11.74 acres, resulting from data gathered during pedestrian surveys (Corbett et al., 2013, 2016b) and the testing of loci boundaries in some locations (Corbett et al., 2016b). The updated nomination is currently under review with the California SHPO.

CA-VEN-1072 is significant under Criterion A in the areas of Ethnic Heritage: Native American and Religion for its association with ceremonial solstice events. The Burro Flats Site is the only one of its kind in the region, where it has been determined that both winter and summer solstice observations were made and are still made. The site is significant under Criterion C in the area of Art for its remarkable examples of prehistoric Native American rock art that possess high artistic value and are important representatives of the aesthetic and possibly religious values of the Native American groups who created them. The site also continues to be significant under Criterion D in the area of Archeology: Prehistoric for its potential to contribute information to important regional research themes, including regional and local prehistoric settlement patterns, prehistoric subsistence, prehistoric lithic technology, and prehistoric rock art. The period of significance is from approximately 5,000 BC, based on artifact types excavated from the site, to 1947, when the area was closed to public access because of the establishment of SSFL.

3.1.1.3.2 Archeological District

Based on the analysis of GIS data and the data derived from the California Historical Resources Information System (CHRIS) literature search, SSFL contains a significant concentration of sites that are related geographically, as well as by site type, indicating there is an NRHP-eligible archeological district at SSFL. Because of the sensitivity of the archeological sites, the boundaries of the archeological district are confidential.

NASA has identified a discontinuous archeological district extending across SSFL Administrative Areas II, III, and IV that is eligible for listing in the NRHP. The Burro Flats Archeological District is significant under NRHP Criterion D for its potential to provide information and answers to identified research questions. The district could corroborate and expand current information regarding the uses and tribes associated with this area. SSFL contains a significant concentration of sites, which are united geographically and thematically (habitation and resource exploitation). Within the district boundary, 41 sites contribute to the significance of the district and are dated to the period of significance. Eight of the sites have signs of habitation and 23 sites are associated with rock shelters. Six sites have been recorded as open-air lithic scatters that, although not individually eligible for listing on the NRHP, have data potential when analyzed together with geographically related sites. The SHPO has not concurred with the eligibility and boundaries of this archeological district.

In addition, the Santa Ynez Band of Chumash Indians has submitted an NRHP nomination to the California SHPO for an archeological district that is larger than the one NASA has determined eligible and includes NASA-administered areas. The California SHPO has not concurred with the archeological district submitted by the Santa Ynez Band of Chumash Indians-submitted.

3.1.1.4 Architectural Resources

Three historic districts—the Alfa, Bravo, and Coca Test Area Historic Districts—were documented in 2007 and are eligible for listing on the NRHP. In addition, nine structures within the districts are individually eligible for listing on the NRHP.

3.1.1.4.1 Historic Districts

In 2007, NASA conducted an assessment of the built environment within NASA-administered Area 1 former LOX Plant and Area II of SSFL. This survey assessed 139 federally owned buildings, structures, and sites (NASA, 2014a). The survey results indicated that 60 of the structures within Area II were temporary, including small storage sheds, roadways, pipelines, and objects such as light fixture poles that are generic in use.

The investigation identified three NRHP-eligible historic districts: Alfa Test Stand Area, Bravo Test Stand Area, and Coca Test Stand Area. The archival research and field survey found that six test stands (Buildings 727, 729, 730, 731, 733, and 787) in the Alfa, Bravo, and Coca Test Area Historic Districts, and three associated control houses (Buildings 208, 213, and 218), also within the district boundaries, are individually eligible for listing on the NRHP (ACI and WR, 2009).

The three historic districts (Alfa, Bravo, and Coca Test Stand Areas) meet NRHP eligibility Criterion A for their associations with engine testing and Criterion C for their distinctive design and engineering (NASA, 2008). SHPO concurred with these findings in 2008. The relevant historic contexts include Cold War defense and missile programs (Military) and Space Exploration from the mid-1950s to 1991, from Project Gemini to the Space Shuttle Program.

3.1.1.4.2 Individually Eligible Structures

Within the three historic districts, the Alfa, Bravo, and Coca Test Stands (Buildings 727, 729, 730, 731, 733, and 787) and three associated control houses (Buildings 208, 213, and 218) were recommended as individually meeting the NRHP criteria for eligibility in the context of the Cold War (Military) and Space Exploration from circa mid-1950s to 1991. They are eligible under Criterion A for their exceptionally important role in the development and testing of various rocket engines and under Criterion C for their specialized engineering and design. Table 3.1-1 lists the identified historic properties within the ROI.

TABLE 3.1-1
Impacted Significant Cultural Resources
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Site Name	Site Type	NRHP Status
Indian Sacred Site	Sacred Site	Not Applicable
Burro Flats Site	Archeological Site	Listed
Burro Flats Cultural District	Traditional Cultural Property	Eligible
Burro Flats Archeological District (includes 41 archeological sites)	Historic District	Eligible
Individual Archeological Sites (13 sites)	Archeological Site	Eligible
Alfa Test Area Historic District	Historic District	Eligible
Bravo Test Area Historic District	Historic District	Eligible
Coca Test Area Historic District	Historic District	Eligible
Alfa Control House	Structure	Individually Eligible
Alfa Test Stand 1	Structure	Individually Eligible
Alfa Test Stand 3	Structure	Individually Eligible
Bravo Control House	Structure	Individually Eligible
Bravo Test Stand 1	Structure	Individually Eligible
Bravo Test Stand 2	Structure	Individually Eligible
Coca Control House	Structure	Individually Eligible
Coca Test Stand 1	Structure	Individually Eligible
Coca Test Stand 4	Structure	Individually Eligible

3.1.2 Environmental Consequences

Pursuant to Section 106 of the NHPA, NASA must consider the effects of a proposed undertaking on historic properties. If the agency finds that historic properties might be affected by the Proposed Action Alternatives, the agency must examine those effects to evaluate whether the project could have an adverse effect on historic properties. Under Section 106, findings of effect include “no historic properties affected” when an agency finds that no historic properties are present or that the undertaking would not impact a historic property. A finding of “no adverse effect” indicates that an undertaking would impact a historic property but would not alter the defining characteristics of the historic property, or an undertaking is modified, or conditions are imposed to avoid an adverse effect. “Adverse effect” indicates an undertaking may alter directly or indirectly a historic property’s defining characteristics in a manner that would diminish the integrity of the property’s location, design, setting, materials, workmanship, feeling, or association (36 CFR Section 800.5(a)(1)). Adverse effects include reasonably foreseeable effects caused by the undertaking that could occur later in time, be farther removed in distance, or be cumulative. The following are examples of adverse effects:

- Physical destruction or damage
- Alteration inconsistent with the Secretary of the Interior's Standards for the Treatment of Historic Properties

- Relocation of the property
- Change in the character of the property's use or setting
- Introduction of incompatible visual, atmospheric, or audible elements
- Neglect and deterioration
- Transfer, lease, or sale out of federal control without adequate preservation restrictions

According to NEPA regulations, in considering whether an action might "significantly affect the quality of the human environment," the agency must consider the following:

- Unique characteristics of the geographic area such as proximity to historic or cultural resources (40 CFR Section 1508.27(b)(3))
- The degree to which the action might adversely affect districts, sites, highways, structures, or objects listed on, or eligible for listing on, the NRHP (40 CFR Section 1508.27(b)(8))

The 2010 AOC allows for consideration of exceptions subject to DTSC's oversight and approval that aim to achieve a cleanup as close to background as practicable. An exception was provided in the 2010 AOC for "Native American Artifacts that are formally recognized as Cultural Resources" (DTSC, 2010). NASA will work with DTSC to identify whether impacts to the Burro Flats Site, Burro Flats Cultural District, archeological district, or Indian Sacred Site can be minimized under this exception. Stipulations in the 2014 Programmatic Agreement (Appendix 3.1A) describe the process for requesting the exception (Stipulation III.D), overriding the exception (Stipulation III.E), and deciding the appropriate cleanup methodology (Stipulation III.E) in sensitive areas (Stipulation III.F).

This subsection provides an analysis of impacts to cultural resources from the proposed soil remediation technologies. Potential impacts to cultural resources from the Action Alternatives would include, but not be limited to, the following: demolition of historic structures; alterations to historic districts; changes to the viewshed from the removal of structures and vegetation; alterations to the setting, feeling, and association of a property; removal of, or damage to, prehistoric and historic archeological sites; physical changes to significant characteristics of, and impeded access to, a sacred site; and physical changes to significant characteristics of a cultural site.

The stockpiling and staging areas would be located in areas previously affected by ground-disturbing activity, such as existing roads or parking lots, to avoid or minimize impacts to historic archeological resources. There would be no additional impacts from staging or stockpiling activities.

NASA considered the unique impacts from the soil treatment technologies described in detail in Section 2.1.1. In general, using ex situ technologies would have a greater impact on cultural resources than using in situ technologies because the cultural materials in the soil would be removed from their location, altering the setting, feeling, and association of the artifacts and other cultural materials and removing them from their historic context, which is crucial for the significance of archeological sites and TCPs. Using ex situ technologies would impact the flora and fauna by removing large quantities of soil; the flora and fauna are contributing elements to the TCP, so if they are reduced or removed, the TCP is negatively impacted. The in situ technologies would have less impact than the ex situ technologies, but anywhere the technology requires ground-disturbing activities, there would be the possibility of impacting archeological sites.

The following list is a brief comparison of the soil technologies and their potential impacts on cultural resources.

- **Excavation and Offsite Disposal:** The excavation and offsite disposal soil treatment technology is the method with the most intense impacts on cultural resources. The excavation and removal of soil would affect the physical integrity of the Indian Sacred Site, TCP, and archeological sites and districts by altering the landscape through plant and soil removal and removing any cultural materials in the soil from their context and rendering them almost meaningless in archeological terms. Excavation and offsite disposal may affect historic structures if they are in remediation areas where their removal is necessary to reach the contaminated soil. There also would be temporary visual impacts to the Indian Sacred Site and the TCP during the excavation activities from the machinery required to carry out the work. Permanent visual impacts are possible if the plant and animal communities do not rebound after the remediation is complete.

- **Ex Situ Treatment Using Soil Washing:** This treatment technology would have the same impact footprint as excavation and offsite disposal. The difference is in the removal of the soil; as the treated soil would be returned to the excavated areas. However, if artifacts or cultural materials were in the soil, they would likely be damaged and not returned to the exact location from which they were originally taken, thus losing their scientific or historic significance.
- **Ex Situ Treatment Using Land Farming:** This treatment technology would have the same impacts as the other ex situ treatments. Please see soil washing description.
- **Ex Situ Chemical Oxidation*:*** This treatment technology would have the same impacts as the other ex situ treatments. Please see soil washing description.
- **Ex Situ Treatment Using Thermal Desorption:** This treatment technology would have the same impacts as the other ex situ treatments. Please see soil washing description.
- **SVE:** This treatment technology would reduce the excavation footprint, as the soil would be treated in situ through the installation of vapor recovery wells spaced at 10- to 20-ft intervals. The impact to cultural resources would be less than from excavation and offsite disposal and the ex situ treatments because less ground surface would be disturbed. There could be impacts to known and previously unidentified archeological resources from the installation and removal of wells and other ground-disturbing activities associated with this method. There could be some temporary visual impacts to the TCP from wells, piping, and holding tanks.
- **In Situ Chemical Oxidation:** This treatment technology would treat the soil in situ through the installation of injection wells spaced at 10- to 20-ft intervals. There could be impacts to known and previously unidentified archeological resources from the installation and removal of wells and other ground-disturbing activities associated with this method. There could be some temporary visual impacts to the TCP from the wells, piping, and holding tanks.
- **In Situ Anaerobic or Aerobic Biological Treatment:** This treatment technology would also treat the soil in situ through the installation of injection wells spaced at 10- to 20-ft intervals. There could be impacts to known and previously unidentified archeological resources from the installation and removal of wells and other ground-disturbing activities associated with this method.
- **MNA:** This technology relies on natural processes to destroy contamination. On its own, MNA would have minimal impact to cultural resources, but it is frequently used with other technologies. Impacts to archeological resources could be from the installation of monitoring equipment needed to observe and record the changes over time. If the equipment requires ground-disturbing activities for installation and use, then it could impact archeological resources. There could also be visual impacts from the monitoring equipment. This would be the least impactful technology.

To obtain an understanding of the greatest potential impact by alternative and to provide decision makers with a comparative analysis by which to make a fully informed decision, it was assumed that excavation and offsite disposal would be the technology applied to the majority of the site. Consequently, the soil excavation quantities and truck traffic explained in Table 2.2-2 were used to analyze the greatest potential impact as a conservative assumption.

The threshold for measuring the intensity of impacts on cultural resources is based on 36 CFR Section 800.5, as described previously, EO 13007, and NEPA. Per EO 13007, agencies managing federal lands shall "avoid adversely affecting the physical integrity of such sacred sites." The impacts analysis considers the impacts of Alternatives A through D and the No Action Alternative on the physical integrity of the identified cultural resources. Per NEPA, impacts are analyzed based on quality, proximity, and duration. Table 3.1-2 identifies and defines the impact thresholds for cultural resources.

TABLE 3.1-2
Impact Thresholds for Cultural Resources
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Impact	Description
No Impact	No impacts to cultural resources would be expected. This would be analogous to a determination of **no historic properties affected** under Section 106 of the NHPA.
Negligible	Impacts to cultural resources would not be detectable and would not alter cultural resources conditions, such as site preservation, or the relationship between the resource and the affiliated group's body of practice or beliefs. This is analogous to a determination of **no historic properties affected** under Section 106 of the NHPA.
Minor	Impacts on cultural resources would result in little, if any, loss of integrity and would be slight but noticeable. Impacts would not appreciably alter resource conditions or the relationship between the resource and the affiliated group's body of practices or beliefs. This is analogous to a determination of **no adverse effect** under Section 106 of the NHPA.
Moderate	Impacts on cultural resources would result in disturbance to a site, loss of integrity, and/or alteration of resource conditions. Impact would appreciably alter resource conditions and/or the relationship between the resource and the affiliated group's body of practices or beliefs. This is analogous to a determination of **adverse effect** under Section 106 of the NHPA. Measures to minimize or mitigate adverse effects would be decided through consultation to reduce the intensity of impacts to a level less than significant.
Significant	Impacts on cultural resources would result in disturbance to a site, loss of integrity, and/or alteration of resource conditions. Impacts would appreciably alter resource conditions and/or the relationship between the resource and the affiliated group's body of practices or beliefs. This is analogous to a determination of **adverse effect** under Section 106 of the NHPA. Measures to mitigate adverse effects would be decided through consultation, but mitigation would not be sufficient to reduce the intensity of impacts to a level less than significant under NEPA.
Quality:	Beneficial–would have a positive effect Negative–would have an adverse effect
Duration:	Temporary–would occur only during the remediation period, even if remediation took years. Permanent–would continue beyond the remediation period.

3.1.2.1 Alternative A: AOC Cleanup

This subsection discusses the potential impacts of the Alternative A soil cleanup activities on cultural resources.

3.1.2.1.1 Indian Sacred Site and Traditional Cultural Property

The TCP and the Indian Sacred Site are assumed to encompass the entirety of SSFL, so the impacts to each would be similar. They are discussed together in this subsection.

The excavation and removal of up to 870,000 yd^3 of soil would affect the integrity of the Indian Sacred Site and the TCP by altering the landscape through plant and soil removal. The setting and feeling of the place would be irrevocably altered. The plants, animals, rocks, views, sky, and human creations are all significant elements of the TCP. Generations of plants and animals would be removed, and this would drastically change the feeling of the site for decades to come. There would be physical changes to the significant characteristics of the sacred site and access to the sacred site could be impeded for more than 25 years as the remediation efforts progress.

There also would be temporary visual impacts to the Indian Sacred Site and the TCP during the equipment and excavation activities.

The impact on the Indian Sacred Site and the TCP from the excavation and removal of up to 870,000 yd^3 of soil would be **significant, negative, and permanent** and would constitute an **adverse effect** under Section 106 because it would alter the sense of place and the landscape, including plants and habitat, and reduce the integrity of setting, feeling, and association **(Cultural Impact-1).**

3.1.2.1.2 Archeological Resources

Burro Flats Site

The location of the Burro Flats Site is confidential and is not disclosed in this document. Roughly 5.7 acres of the Burro Flats Site would be impacted by soil excavation and offsite disposal as part of the cleanup activities under Alternative A if an AOC exemption is not issued. The disturbance from the excavation and removal of soil to another location would impact the Burro Flats Site because of the loss of the cultural materials within that volume of soil. Archeological resources, loci, and features of the Burro Flats Site would be damaged or removed from the site because of soil excavation and offsite removal. Archeological artifacts lose their significance when removed from their location and context.

The impacts to the Burro Flats Site from the excavation and removal of soil under Alternative A would be **significant, negative, and permanent** and would constitute an **adverse effect** under Section 106 **(Cultural Impact-2).**

Archeological District

The location of the archeological district is confidential and is not disclosed in this document. Roughly 6 acres of the archeological district would be impacted by soil excavation and offsite disposal as part of the cleanup activities under Alternative A. Within the district, seven contributing archeological sites would be damaged or removed from the site because of soil excavation and offsite removal. Archeological artifacts lose their significance when removed from their location and context. The removal of significant artifacts and the damage to archeological sites would reduce the significance of the district as a whole and could render the district ineligible for the NRHP or reduce its size.

The impacts to the archeological district site from the excavation and removal of soil under Alternative A would be **significant, negative,** and **permanent** and would constitute an **adverse effect** under Section 106 (**Cultural Impact-3**)**.**

Individual Archeological Sites

Thirteen archaeological sites outside the archeological district would be impacted under Alternative A, totaling approximately 7 acres of impact. Impacts from soil cleanup activities on identified archeological sites outside the archeological district would be **significant, negative, and permanent**, resulting in a finding of **adverse effect** under Section 106 **(Cultural Impact-4)** under Alternative A.

During soil excavation and disposal activities, previously undiscovered archeological sites could be affected because the soil could contain previously unidentified archeological resources that would be impacted by the excavation and removal of soil to another location. Impacts from excavation activities on previously undiscovered archeological sites found to be NRHP-eligible could be **significant, negative, and permanent**, resulting in a finding of **adverse effect** under Section 106 **(Cultural Impact-4)**. Stipulation VII of the 2014 Programmatic Agreement addresses unanticipated discoveries.

3.1.2.1.3 Architectural Resources

Historic Districts

Because remediation areas in some cases are located under existing structures, this technology could require historic structures in remediation areas to be removed to reach contaminated soil. The Alfa, Bravo, and Coca Test Area Historic Districts have remediation areas that correspond to the locations of individually eligible structures. The removal of contributing or individually eligible structures within historic districts to excavate and remove soil would result in **significant, negative, and permanent** impacts on cultural resources under NEPA and a finding of **adverse effect** under Section 106 (**Cultural Impact-5**). There would be no impacts to the significant architectural resources in the district from soil remediation activities outside the boundaries of the historic districts.

Individually Eligible Structures

Because remediation areas could be located under existing structures, this technology could require historic structures in remediation areas to be removed to reach contaminated soil. The Alfa, Bravo, and Coca Test Area Historic Districts have remediation areas that correspond to the locations of individually eligible structures. The removal of individually eligible structures to excavate and remove soil would result in **significant, negative, and permanent** impacts on cultural resources under NEPA and a finding of **adverse effect** under Section 106 **(Cultural Impact-6)**.

The 2014 Programmatic Agreement includes mitigation measures to address the impacts and adverse effects from demolition and soil and groundwater cleanup at NASA-administered areas of SSFL. No additional mitigation measures beyond those identified in the Programmatic Agreement would be required to address the identified effects of Alternative A.

3.1.2.2 Alternative B: Revised LUT Levels Cleanup

This subsection discusses the potential effects of the Alternative B soil cleanup activities on cultural resources.

3.1.2.2.1 Indian Sacred Site and Traditional Cultural Property

Up to 384,000 yd^3 of excavated soil from within the APE would be transported offsite for Alternative B (Figure 2.2-2). The setting and feeling of the place would be irrevocably altered. The plants, animals, rocks, views, sky, and human creations are all significant elements of the TCP. Generations of plants and animals would be removed, and this would drastically change the feeling of the site for decades to come. There would be physical changes to the significant characteristics of the sacred site and access to the sacred site could be impeded. There also would be temporary visual impacts to the Indian Sacred Site and the TCP during the equipment and excavation activities.

The impact on the Indian Sacred Site and TCP from soil excavation and removal under Alternative B would be **significant, negative, and permanent** and would constitute an **adverse effect** under Section 106, because it would alter the sense of place and the landscape, including plants and habitat **(Cultural Impact-1).**

3.1.2.2.2 Archeological Resources

Burro Flats Site

Roughly 1.3 acres of the Burro Flats Site in five distinct areas would be impacted by soil excavation and offsite disposal as part of the cleanup activities under Alternative B. The disturbance from the excavation and removal of soil to another location would impact the Burro Flats Site because of the loss of cultural materials within that volume of soil. Archeological resources, loci, and features of the Burro Flats Site would be damaged or removed from the site because of soil excavation and offsite removal. Archeological artifacts lose their significance when removed from their location and context.

The impacts to the Burro Flats site from the excavation and removal of soil under Alternative B would be **significant, negative, and permanent** and would constitute an **adverse effect** under Section 106 **(Cultural Impact-2).**

Archeological District

Roughly 1 acre in 10 distinct areas of the archeological district would be impacted by soil excavation and offsite disposal as part of the cleanup activities under Alternative B. Within the district, three contributing archeological sites would be damaged or removed from the site because of soil excavation and offsite removal. Archeological artifacts lose their significance when removed from their location and context. The removal of significant artifacts and the damage to archeological sites would reduce the significance of the district as a whole and could render the district ineligible for the NRHP or reduce its size.

The impacts to the archeological district site from the excavation and removal of soil under Alternative B would be **significant, negative, and permanent** and would constitute an **adverse effect** under Section 106 **(Cultural Impact-3).**

Individual Archeological Sites

Six archeological sites outside the archeological district would be impacted under Alternative B, totaling approximately 1.25 acres of impact. The number of individual sites impacted would be reduced compared to Alternative A (13 sites would be impacted under Alternative A). Impacts from soil cleanup activities on identified archeological sites outside the archeological district would be **significant, negative, and permanent**, resulting in a finding of **adverse effect** under Section 106 **(Cultural Impact-4)** under Alternative B.

During soil excavation and disposal, previously undiscovered archeological sites could be affected because the soil could contain previously unidentified archeological resources that would be impacted by the excavation and removal of soil to another location. Impacts from excavation activities on previously undiscovered archeological sites found to be NRHP-eligible could be **significant, negative, and permanent**, resulting in a finding of **adverse effect** under Section 106 **(Cultural Impact-4)**. The 2014 Programmatic Agreement contains a stipulation that addresses unanticipated discoveries.

3.1.2.2.3 Architectural Resources

Historic Districts

Because remediation areas in some cases are located under existing structures, this technology could require historic structures in remediation areas to be removed to reach contaminated soils. The Alfa, Bravo, and Coca Test Area Historic Districts have remediation areas that correspond to the locations of individually eligible structures. The removal of contributing or individually eligible structures within historic districts to excavate and remove soil would result in **significant, negative, and permanent** impacts on cultural resources under NEPA and a finding of **adverse effect** under Section 106 (**Cultural Impact-5**). There would be no impacts to the significant architectural resources from soil remediation activities outside the boundaries of the historic districts.

Individually Eligible Structures

Because remediation areas in some cases are located under existing structures, this technology could require historic structures in remediation areas to be removed to reach contaminated soil. The removal of individually eligible structures within historic districts to excavate and remove soil would result in **significant, negative, and permanent** impacts on cultural resources under NEPA and a finding of **adverse effect** under Section 106 **(Cultural Impact-6)**.

The 2014 Programmatic Agreement includes mitigation measures to address the impacts and adverse effects from demolition and soil and groundwater cleanup at NASA-administered areas of SSFL. No additional mitigation measures beyond those identified in the Programmatic Agreement would be required to address the identified effects of Alternative B.

3.1.2.3 Alternative C: Suburban Residential Cleanup

This subsection discusses the potential effects of the Alternative C soil cleanup activities on cultural resources.

3.1.2.3.1 Indian Sacred Site and Traditional Cultural Property

Up to 247,000 yd^3 of excavated soil from within the APE would be transported offsite for Alternative C (Figure 2.2-3). The impact to the Indian Sacred Site and the TCP from Alternative C would be less than the impacts under Alternatives A or B. The excavation footprint would be smaller, lessening the overall impact. Contributing elements of the TCP would be removed or altered, but the impacts would be less concentrated and would cover a smaller percentage of the whole. There would be physical changes to the significant characteristics of the sacred site and access to the sacred site could be impeded. There also would be temporary visual impacts to the Indian Sacred Site and the TCP during the equipment and excavation activities.

The impact on the Indian Sacred Site and TCP from excavation and soil removal under Alternative C would be **moderate, negative, and permanent** and could constitute an **adverse effect** under Section 106, because it would alter the sense of place and the landscape, including plants and habitat **(Cultural Impact-1).**

3.1.2.3.2 Archeological Resources

Burro Flats Site

Roughly 0.09 acre of the Burro Flats site in four distinct areas would be impacted by soil excavation and offsite disposal as part of the cleanup activities under Alternative C. The overall area disturbed by soil excavation and removal would be less than a tenth of an acre of the Burro Flats Site and would be smaller than the disturbed area under Alternatives A and B. Any time there is ground disturbance within the boundaries of the Burro Flats Site, there is the possibility of encountering cultural materials. The removal of those materials would reduce the integrity of the site.

The impacts to the Burro Flats Site from the excavation and removal of soil under Alternative C would be **moderate, negative, and permanent** and could constitute an **adverse effect** under Section 106 **(Cultural Impact-2).**

Archeological District

Roughly 0.09 acre in eight distinct areas of the archeological district would be impacted by soil excavation and offsite disposal as part of the cleanup activities under Alternative C. Within the district, three contributing archeological sites would be damaged or removed from the site because of soil excavation and offsite removal. Archeological artifacts lose their significance when removed from their location and context.

The overall area disturbed by soil excavation and removal would be less than a tenth of an acre within the district and would be smaller than under Alternatives A and B; however, there would still be eight impact areas. Archeological resources, loci, and features of the district could be damaged or removed from the site because of soil excavation and removal.

The impacts to the archeological district site from the excavation and removal of soil under Alternative C would be **moderate, negative, and permanent** and could constitute an **adverse effect** under Section 106 **(Cultural Impact-3).**

Individual Archeological Sites

Four archaeological sites outside the archeological district would be impacted under Alternative C, totaling approximately 0.09 acre of impact. The number of individual sites impacted would be reduced compared to Alternatives A and B. Impacts on identified archeological sites outside the archeological district from soil cleanup activities would be **moderate, negative, and permanent**, resulting in a finding of **adverse effect** under Section 106 **(Cultural Impact-4)** under Alternative C.

During soil excavation and disposal, previously undiscovered archeological sites could be affected because the soil could contain previously unidentified archeological resources that would be impacted by the excavation and removal of soil to another location. Impacts from excavation activities on previously undiscovered archeological sites found to be NRHP-eligible could be **moderate, negative, and permanent**, resulting in a finding of **adverse effect** under Section 106. The 2014 Programmatic Agreement contains a stipulation that addresses unanticipated discoveries **(Cultural Impact-4)**.

3.1.2.3.3 Architectural Resources

Historic Districts

The likelihood of removing contributing or individually eligible structures within historic districts to excavate and remove soil under Alternative C would be less than under Alternatives A and B. The reduced impact would result in **minor, negative, and permanent** impacts on cultural resources under NEPA and a finding of **no adverse effect** under Section 106 **(Cultural Impact-5)**.

Individually Eligible Structures

The likelihood of removing individually eligible structures within historic districts to excavate and remove soil under Alternative C would be less than under Alternatives A and B. The reduced impact would result in **minor, negative, and permanent** impacts on cultural resources under NEPA and a finding of **no adverse effect** under Section 106 **(Cultural Impact-6)**.

The 2014 Programmatic Agreement includes mitigation measures to address the impacts and adverse effects from demolition and soil and groundwater cleanup at NASA-administered areas of SSFL. No additional mitigation measures beyond those identified in the Programmatic Agreement would be required to address the identified effects of Alternative C.

3.1.2.4 Alternative D: Recreational Cleanup

This subsection discusses the potential effects of the Alternative D soil cleanup activities on cultural resources.

3.1.2.4.1 Indian Sacred Site and Traditional Cultural Property

Up to 176,500 yd^3 of excavated soil from within the APE would be transported offsite under Alternative D. There would be physical changes to the significant characteristics of the sacred site and access to the sacred site could be impeded. There also would be temporary visual impacts to the Indian Sacred Site and the TCP during the equipment and excavation activities. The impact on the Indian Sacred Site and the TCP from excavation and soil removal under Alternative D would be **moderate, negative, and permanent** and could constitute an **adverse effect** under Section 106, because it would alter the sense of place and the landscape, including plants and habitat **(Cultural Impact-1).**

3.1.2.4.2 Archeological Resources

Burro Flats Site

Roughly 0.07 acre of the Burro Flats Site in four distinct areas would be impacted by soil excavation and offsite disposal as part of the cleanup activities under Alternative D. The overall area disturbed by soil excavation and removal would be less than a tenth of an acre of the Burro Flats Site and would be smaller than under Alternatives A, B, or C. Any time there is ground disturbance within the boundaries of the Burro Flats Site, there is the possibility of encountering cultural materials. The removal of those materials would reduce the integrity of the site.

The impacts to the Burro Flats Site from the excavation and removal of soil under Alternative D would be **moderate, negative, and permanent** and could constitute an **adverse effect** under Section 106 **(Cultural Impact-2).**

Archeological District

Roughly 0.08 acre in eight distinct areas of the archeological district would be impacted by soil excavation and offsite disposal as part of the cleanup activities under Alternative D. Within the district, three contributing archeological sites would be impacted from soil excavation and offsite removal. Archeological artifacts lose their significance when removed from their location and context.

The overall area disturbed by soil excavation and removal would be less than a tenth of an acre within the district and would be smaller than under Alternatives A and B and similar to Alternative C; however, there would still be eight impact areas. Archeological resources, loci, and features of the district could be damaged or removed from the site because of soil excavation and removal.

The impacts to the archeological district site from the excavation and removal of soil under Alternative D would be **moderate, negative,** and **permanent** and could constitute an **adverse effect** under Section 106 **(Cultural Impact-3).**

Individual Archeological Sites

Four archaeological sites outside the archeological district would be impacted under Alternative D, totaling approximately 0.08 acre of impact. The number of individual sites impacted would be reduced compared to Alternatives A and B and would be similar to Alternative C. Impacts from soil cleanup activities on identified archeological sites outside the archeological district would be **moderate, negative, and permanent**, resulting in a finding of **adverse effect** under Section 106 **(Cultural Impact-4)** under Alternative D.

During soil excavation and disposal, previously undiscovered archeological sites could be affected because the soil could contain previously unidentified archeological resources that would be impacted by the excavation and removal of soil to another location. Impacts from excavation activities on previously undiscovered archeological sites found to be NRHP-eligible could be **moderate, negative, and permanent**, resulting in a finding of **adverse effect** under Section 106 **(Cultural Impact-4)**. The 2014 Programmatic Agreement contains a stipulation that addresses unanticipated discoveries.

3.1.2.4.3 Architectural Resources

Historic Districts

The likelihood of removing contributing or individually eligible structures within historic districts during soil excavation and removal under Alternative D would be less than under Alternatives A, B, or C. The reduced impact would result in **minor, negative, and permanent** impacts on cultural resources under NEPA and a finding of **no adverse effect** under Section 106 **(Cultural Impact-5)**.

Individually Eligible Structures

The likelihood of removing individually eligible structures within historic districts to excavate and remove soil under Alternative D would be less than under Alternatives A, B, or C. The reduced impact would result in **minor, negative, and permanent** impacts on cultural resources under NEPA and a finding of **no adverse effect** under Section 106 **(Cultural Impact-6)**.

The 2014 Programmatic Agreement includes mitigation measures to address the impacts and adverse effects from demolition and soil and groundwater cleanup at NASA-administered areas of SSFL. No additional mitigation measures beyond those identified in the Programmatic Agreement would be required to address the identified effects of Alternative D.

3.1.2.5 No Action Alternative

Under the No Action Alternative, NASA would not conduct soil remediation on NASA-administered areas of SSFL but would continue with demolition and groundwater cleanup activities and implementing the 2014 Programmatic Agreement (Appendix 3.1A). The No Action Alternative would result in **no impacts** to historic properties under NEPA and **no historic properties affected** under Section 106 from soil cleanup **(Cultural Impact-1, Impact-2, Impact-3, Impact-4, Impact-5, and Impact-6)**. However, previously identified impacts from demolition and groundwater cleanup would remain.

The 2014 Programmatic Agreement includes mitigation measures to address the impacts and adverse effects from demolition and soil and groundwater cleanup at NASA-administered areas of SSFL. The Programmatic Agreement would continue to be implemented under the No Action Alternative.

3.1.3 Mitigation Measures

The 2014 Programmatic Agreement (Appendix 3.1A) stipulates the specific mitigation measures to be carried out by NASA to address the adverse effects from demolition and soil and groundwater cleanup at NASA-administered areas of SSFL. This subsection provides a brief summary of the mitigation measures detailed in the 2014 Programmatic Agreement.

- **Cultural Mitigation Measure-1** (All Action Alternatives): Historic American Buildings documentation – NASA will engage the NPS to complete Historic American Engineering Record (HAER) Level I documentation of all test stands in Alfa, Bravo, and Coca Test Area Historic Districts and will complete HAER Level II documentation for control houses within each district, and HAER Level III for all remaining structures to the Alfa, Bravo, and Coca Test Area Historic Districts and submit the documentation to the Library of Congress for archiving. This mitigation measure is completed.
- **Cultural Mitigation Measure-2** (All Action Alternatives): Creation of a Native American Advisory Board – NASA will establish a Native American Advisory Board comprising volunteer representatives from federally recognized Indian tribes and state-listed tribes with an interest in the protection of Native American sites on NASA SSFL to advise NASA on matters relating to historic properties of interest to Native Americans on NASA SSFL. This mitigation measure is completed.
- **Cultural Mitigation Measure-3** (All Action Alternatives): Creation of an Environmentally Sensitive Areas Action Plan (ESAAP) – NASA will develop an ESAAP that will be submitted for review to SHPO and Santa Ynez Band of Chumash Indians and will be used by NASA and its contractors for sensitive cultural areas such as archeological sites to provide active protection during the undertaking to prevent inadvertent damage. This mitigation measure is completed.
- **Cultural Mitigation Measure-4** (All Action Alternatives): Native American monitoring – NASA will use archeological and Native American monitors to oversee field sampling, vegetation clearing, and ground-disturbing activities within Burro Flats Site and the buffer area defined by NASA in 2008 for management purposes, as well as within any other known archeological sites, and will coordinate, where feasible, any sampling within Burro Flats Site Boundary with the boundary determination work. This mitigation measure is ongoing.
- **Cultural Mitigation Measure-5** (All Action Alternatives): Oral histories – NASA will conduct 12 oral history interviews of personnel who formerly worked at NASA SSFL and will include the transcripts on NASA’s oral history website https://www.jsc.nasa.gov/history/nasa_history.htm with links to other NASA websites, including SSFL. This mitigation measure is completed.
- **Cultural Mitigation Measure-6** (All Action Alternatives): Video documentation – NASA will produce a video documenting the history of the construction and use of NASA's SSFL test stands; the video will be posted on NASA's website and available on CD by request. This mitigation measure is completed.
- **Cultural Mitigation Measure-7** (All Action Alternatives): Completion of an ethnographic study – NASA will conduct an ethnographic history, adding to and synthesizing the analyses from the TCP survey and previous related ethnographic studies. This mitigation measure is completed.
- **Cultural Mitigation Measure-8** (All Action Alternatives): Updating the Burro Flats Site NRHP nomination – NASA will consult with SHPO to identify a testing plan to conduct further archeological investigations within NASA's boundary to confirm the extent of the boundary ("Burro Flats Site Boundary") on NASA-administered land, and in consultation with the Santa Ynez Band of Chumash Indians and Boeing (or its consultants), develop an updated National Register nomination form to be submitted to the SHPO and NRHP. This mitigation measure is completed.
- **Cultural Mitigation Measure-9** (All Action Alternatives): Submitting an NRHP nomination for a TCP – In consultation with SHPO, Boeing, DOE, Native American Advisory Board, Santa Ynez Band of Chumash Indians, and NPS, NASA will produce and submit a NRHP nomination of the TCP to the California State

Historic Resources Commission and the NRHP for the TCP. The TCP nomination has been submitted to California SHPO.

- **Cultural Mitigation Measure-10** (All Action Alternatives): Updates to the Integrated Cultural Resources Management Plan (ICRMP) for NASA-administered areas of SSFL – NASA will update its ICRMP to include the National Register-eligible site(s), should they exist, and to include in the ICRMP protection measures during demolition and cleanup. This mitigation measure is completed.
- **Cultural Mitigation Measure-11** (All Action Alternatives): Additional archeological investigations – NASA will conduct Extended Phase I archeological investigations in those footprints of the cleanup areas where NASA plans to excavate soil to achieve cleanup goals. This mitigation measure is completed.

3.1.4 Summary of Impacts

Table 3.1-3 provides a summary of the impacts on cultural resources from soil cleanup and remediation, as described in this section.

TABLE 3.1-3
Summary of Cultural Resources Impacts
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Impacts	Alternative A AOC Cleanup	Alternative B Revised LUT Levels Cleanup	Alternative C Suburban Residential Cleanup	Alternative D Recreational Cleanup	No Action Alternative
Cultural Impact-1: Indian Sacred Site and TCP	Significant, negative, and permanent (adverse effect under Section 106)	Significant, negative, and permanent (adverse effect under Section 106)	Moderate, negative, and permanent (adverse effect under Section 106)	Moderate, negative, and permanent (adverse effect under Section 106)	No Impact
Cultural Impact-2: Burro Flats Site	Significant, negative, and permanent (adverse effect under Section 106)	Significant, negative, and permanent (adverse effect under Section 106)	Moderate, negative, and permanent (adverse effect under Section 106)	Moderate, negative, and permanent (adverse effect under Section 106)	No Impact
Cultural Impact-3: Archeological District	Significant, negative, and permanent (adverse effect under Section 106)	Significant, negative, and permanent (adverse effect under Section 106)	Moderate, negative, and permanent (adverse effect under Section 106)	Moderate, negative, and permanent (adverse effect under Section 106)	No Impact
Cultural Impact-4: Individual Archeological Sites	Significant, negative, and permanent (adverse effect under Section 106)	Significant, negative, and permanent (adverse effect under Section 106)	Moderate, negative, and permanent (adverse effect under Section 106)	Moderate, negative, and permanent (adverse effect under Section 106)	No Impact
Cultural Impact-5: Historic Districts	Significant, negative, and permanent (adverse effect under Section 106)	Significant, negative, and permanent (adverse effect under Section 106)	Minor, negative, and permanent (no adverse effect under Section 106)	Minor, negative, and permanent (no adverse effect under Section 106)	No Impact
Cultural Impact-6: Individually Eligible Structures	Significant, negative, and permanent (adverse effect under Section 106)	Significant, negative, and permanent (adverse effect under Section 106)	Minor, negative, and permanent (no adverse effect under Section 106)	Minor, negative, and permanent (no adverse effect under Section 106)	No Impact

3.2 Biological Resources

This subsection describes the biological resources at the NASA-administered areas of SSFL and the associated environmental consequences from the Action Alternatives and the No Action Alternative. For the context of this SEIS, biological resources were broken into the following subcategories: vegetation and land cover types, wildlife, sensitive species, weed species, and wetlands. The ROI for biological resources is generally the NASA-administered property at SSFL (Area 1 former LOX Plant and Area II); however, when necessary, a broader overview of the ecoregion or watershed is considered.

3.2.1 Affected Environment

The existing biological conditions within the ROI are described in the following subsections.

3.2.1.1 Vegetation and Land Cover Types

The local distribution and density of plant communities vary substantially at SSFL because of the differences in habitat quality and historical disturbances, such as development and wildfires. Approximately 230 acres of the 450 acres (51 percent) of the NASA-administered property at SSFL consist of rock outcrops. Prior to the Woolsey Canyon Fire in November 2018, the predominant natural plant communities within the ROI included California sagebrush, chaparral scrublands, and Coast Live Oak. Because these plant communities have adapted to a wildfire environment, these communities would be expected to return in a similar fashion after the fire. While pre-fire habitat conditions are potentially indicative of future habitat conditions, the amount of time needed for specific habitats to recover may vary widely. Table 3.2-1 lists the habitat types identified during the fall 2010 habitat mapping event (NASA, 2011a) and Figure 3.2-1 shows the vegetative cover across the ROI and surrounding areas. Descriptions of these habitat types are provided in Appendix 3.2A.

TABLE 3.2-1
Habitat Types Identified on NASA-administered Property during Fall 2010 Surveys
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Natural Habitats	Acreage
Baccharis Scrub	3 acres
Chaparral	173 acres
Coast Live Oak Riparian Forest	9 acres
Coast Live Oak Woodland	13 acres
Freshwater Marsh	0.2 acre
Mulefat Scrub	2 acres
Non-native Grassland	19 acres
Venturan coastal sage scrub	64 acres
Southern willow scrub	1 acre
Non-Natural Habitats	**Acreage**
Developed	58 acres
Open Water	0.4 acre
Ruderal	16 acres

Source: NASA, 2011a
Notes:
Estimated acreages are based on the dominant habitat type.

3.2.1.2 Wildlife and Migration Linkages

Wildlife species within the NASA-administered areas of SSFL have been identified during surveys via sightings, calls, and other evidence of occurrence (NASA, 2011a, 2011b). The surveys indicate a strong diversity of wildlife on the site, where numerous species thrive while surrounded by a dense urban corridor. The common vertebrate wildlife species include mule deer (*Odocoileus hemionus californicus*), coyote (*Canis latrans*), turkey vulture (*Cathartes aura),* common raven (*Corvus corax*), wild pig (*Sus Scrofa*) and western rattlesnake (*Crotalus oreganus helleri*). Numerous common invertebrate species were observed, including butterflies and dragonflies. Appendix 3.2A provides detailed descriptions of the observed wildlife.

SSFL habitat and species diversity, physical attributes, and geographic location make the area a potentially important route for species migrations. Open space at SSFL plays a role for habitat linkage among the Santa Susana Mountains, the Simi Hills, and possibly the Santa Monica Mountains (NASA, 2011a). Species observed using the migration linkage through SSFL include mountain lion (*Puma concolor*), badger (*Taxidea taxus),* and mule deer, though potential habitat exists for many other species as well (South Coast Wildlands, 2008). While the NASA-administered portions of SSFL are outside the identified habitat linkages in the region (Figure 3.2-2), wildlife species may still use the NASA-administered areas as a habitat linkage and during migrations.

3.2.1.3 Sensitive Species

For the purpose of this SEIS, "sensitive species" refer to plants and animals that either are listed by the U.S. Fish and Wildlife Service (USFWS) or by the California Department of Fish and Wildlife (CDFW) as threatened or endangered or could be listed in the foreseeable future. An "endangered" species is one in danger of extinction throughout all, or a significant portion, of its range, while a "threatened" species is one that is likely to become endangered within the foreseeable future. If a species does not meet the qualifications to be a state or federally listed species, it still could be considered a "sensitive species" if it meets the USFWS's requirements for "candidate" or the CDFW's "rare" or "Species of Special Concern (SSC)" classifications.

The following subsections describe the sensitive plant and wildlife species found within the ROI. These descriptions are based on surveys conducted for the 2014 FEIS and associated Endangered Species Act (ESA) Section 7 Biological Assessment (Appendix 3.2B). In meetings with USFWS, NASA, DOE, Boeing, and DTSC (May 3, 2018), USFWS confirmed that the 2014 Biological Assessment and the associated species characterizations were still acceptable (DTSC, 2018b).

3.2.1.3.1 Sensitive Plant Species

The USFWS has identified 10 threatened or endangered listed plant species that potentially are located within the SSFL ROI (USFWS, 2019a). Table 3.2-2 lists these species. General and species-specific surveys were conducted within the ROI during 2010 and 2011; however, no federally listed plant species were found (NASA, 2011a, 2011b). Braunton's milk-vetch (*Astragulus brauntonii*) and its critical habitat do occur within Area IV and the undeveloped areas of SSFL administered by the DOE. For this reason, Braunton's milk-vetch was specifically sought during the 2010 and 2011 surveys on the NASA-administered properties of SSFL. While no Braunton's milk-vetch has been observed within the ROI, soil conditions indicate that suitable habitat may exist in the northeastern portion of Area II and the southern portion of Area I. The Woolsey Canyon Fire in 2018 also may have created favorable habitat conditions for the Braunton's milk-vetch.

A single state-listed special-status plant species was documented within the NASA-administrated properties (NASA, 2011a, 2011b). The Santa Susana tarplant (*Deinandra minthornii*) is state-listed as rare. However, this plant is locally abundant and was observed in numerous locations throughout the NASA-administered areas of SSFL, where the plant was generally associated with the sandstone outcrops. Approximately 90 percent of the identified plants found at SSFL were observed within Area II (NASA, 2011a). Santa Susana tarplant populations are distributed throughout Ventura and Los Angeles Counties and numerous populations of Santa Susana tarplant have been found outside the SSFL site (Baldwin et al., eds., 2012).

TABLE 3.2-2
Sensitive Plant Species Potentially Located within SSFL
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Species Name	Agency	Designation	Identified in ROI?
Braunton's milk-vetch (*Astragalus brauntonii*)	USFWS	Endangered	No
Lyon's pentachaeta (*Pentachaeta lyonii*)	USFWS	Endangered	No
Spreading navarretia (*Navarretia fossalis*)	USFWS	Threatened	No
California orcutt grass (*Orcuttia californica*)	USFWS	Endangered	No
Conejo dudleya (*Dudleya parva*)	USFWS	Threatened	No
Agoura Hills dudleya (*Dudleya cymosa* spp. *agourensis*)	USFWS	Threatened	No
Santa Monica live-forever (*Dudleya cymosa* spp. *ovatifolia*)	USFWS	Threatened	No
Marcescent dudleya (*Dudleya cymosa* spp. *marcescens*)	USFWS	Threatened	No
Gambel’s Watercress (*Rorippa gamebelli*)	USFWS	Endangered	No
Marsh Sandwort (*Arenaria paludícola*)	USFWS	Endangered	No
Santa Susana tarplant (*Deinandra minthornii*)	CDFW	Rare	Yes
Conejo buckwheat (*Erigonum crocatum*)	CDFW	Rare	No
San Fernando spine flower (*Chorizanthe parryi* var. *fernandina)*	CDFW	Endangered	No

Sources: USFWS, 2019a; NASA, 2011a, 2011b

3.2.1.3.2 Sensitive Wildlife Species

The USFWS has identified nine threatened or endangered listed wildlife species that are potentially located on the NASA-administered portion of SSFL (USFWS, 2019b). One state-listed species, one fully protected species, and eight SSC species have been identified within the vicinity of SSFL (NASA, 2011a, 2011b). Table 3.2-3 lists these species.

TABLE 3.2-3
Sensitive Wildlife Species Potentially Located within SSFL
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Species Name	Animal Class	Agency	Designation	Identified in ROI?
Least Bell's vireo (*Vireo bellii pusillus*)	Bird	USFWS/CDFW	Endangered	Yes
Arroyo toad (*Bufo californicu = Anaxyrus californicus*)	Amphibian	USFWS	Endangered	No
California red-legged frog (*Rana draytonii*)	Amphibian	USFWS	Threatened	No
Coastal California gnatcatcher (*Polioptila californica californica*)	Bird	USFWS	Threatened	No
California Condor (*Gymnogyps californianus*)	Bird	USFWS	Endangered	No
Southwestern Willow Flycatcher (*Empidonax trailli extimus*)	Bird	USFWS	Endangered	No
Quino checkerspot butterfly (*Euphydryas editha quino*)	Insect	USFWS	Endangered	No

Species Name	Animal Class	Agency	Designation	Identified in ROI?
Riverside fairy shrimp (*Streptocephalus woottoni*)	Crustaceans	USFWS	Endangered	Potentially
Vernal pool fairy shrimp (*Branchinecta lynchi*)	Crustaceans	USFWS	Threatened	Potentially
Arroyo toad (*Anaxyrus californicus*)	Amphibian	CDFW	SSC	No
Coast horned lizard (*Phrynosoma coronatum* [*blainvillii* population])	Reptile	CDFW	SSC	Yes
Loggerhead shrike (*Lanius ludovicianus*)	Bird	CDFW	SSC	Yes
Ring-tailed cat (*Bassariscus astutus)*	Mammal	CDFW	Fully Protected	No
San Diego desert woodrat (*Neotoma lepida intermedia*)	Mammal	CDFW	SSC	No
Silvery Legless Lizard (*Anniella pulchra*)	Reptile	CDFW	SSC	No
Tricolored blackbird (*Agelaius tricolor*)	Bird	CDFW	Threatened	No
Two-striped garter snake (*Thamnophis hammondii*)	Reptile	CDFW	SSC	Yes
Western mastiff bat (*Eumops perotis californicus*)	Mammal	CDFW	SSC	No
Western spadefoot toad (*Spea hammondii*)	Amphibian	CDFW	SSC	No

Sources: USFWS, 2019a; NASA, 2011a, 2011b

Of the federally listed species, only the Least Bell's vireo (*Vireo bellii pusillus*) has been observed on SSFL. A single Least Bell's vireo was sighted outside the typical breeding period and was considered a transient moving through the area. Mulefat, a favored plant of the Least Bell's vireo, exists on the site; however, the coverage of scrub habitat is relatively limited and fragmented. No Least Bell's vireos were observed or heard during surveys conducted during their breeding period and the closest reported nesting location occurs approximately 9 miles northwest of the site (NASA, 2011b).

The Quino checkerspot butterfly (*Euphydryas editha quino*), which is federally listed as endangered, possibly was observed within the NASA-administered property and the butterfly's host plant, *Plantago erecta*, was observed in the ROI during the 2011 survey (NASA, 2011a). However, a subsequent survey by a qualified entomologist indicated that the potential habitat was marginal at best, and no butterfly specimens were observed (ECS, 2012; survey included in Appendix 3.2B).

The California red-legged frog (*Rana draytonii*) is federally listed as threatened and known to occur south of NASA-administered portions of SSFL in Las Virgenes Canyon and upper Las Virgenes Creek. A habitat assessment was conducted in NASA-administered areas of SSFL in accordance with USFWS guidance, and opportunistic surveys also were conducted. No evidence of California red-legged frog occurrence was found during any of these surveys. There is limited potential suitable habitat for this frog species in the NASA-administered areas, primarily around the R-2 Ponds and the Coca Skim Pond; however, there are considerable barriers to frog movement into these potentially useable habitats.

Listed fairy shrimp species known to occur in pools on rock outcrops in southern California include the federally endangered Riverside fairy shrimp (*Streptocephalus woottoni*) and the federally threatened vernal pool fairy shrimp (*Branchinecta lynchi*). Basins and depressions on rock outcrops that are inundated during the wet season could support listed fairy shrimp species. Although the species were not observed during surveys, these species have the potential to occur within the ROI, but the quality and quantity of suitable habitat appear to be very limited onsite.

Two SSC reptile species have been observed within the NASA-administered property: the coast horned lizard (*Phrynosoma coronatum* [*blainvillii* population]) and the two-striped garter snake (*Thamnophis hammondii*).

Three juvenile coast horned lizards were sighted during the 2010 and 2011 surveys. A two-striped garter snake was observed in the seasonal pond northwest of the former LOX Plant during the 2011 survey.

The SSC bird species sighted within the NASA-administered property at SSFL was the loggerhead shrike (*Lanis ludovicianus*). An individual loggerhead shrike was seen in Area II during the fall 2010 survey and one was sighted foraging at the Alfa Test Stand site (within Area II) during the August 2011 survey.

An individual ring-tailed cat (*Bassariscus astutus*), a CDFW fully protected mammal species, was sighted at SSFL on a rock outcrop near a riparian drainage adjacent to NASA-administered Area II, but outside the ROI.

3.2.1.3.3 High-priority Conservation Habitats

Two high-priority conservation natural habitats (southern willow scrub and Venturan coastal sage scrub), as defined by the CDFW, were identified and mapped in the NASA-administered areas of SSFL (NASA, 2011a). These habitats have been assigned a state ranking of either S2 or S3. A ranking of S2 means the community is considered imperiled because of a restricted range, steep declines, or other factors making it vulnerable to extirpation (local extinction) from the state. A ranking of S3 means the habitat is considered vulnerable, with a moderate risk of extirpation because of a restricted range, recent declines, or other factors. Details about these habitats are as follows:

- **Southern willow scrub (S2).** Southern willow scrub occurs along major rivers of coastal Southern California but has been reduced by urban expansion, flood control, and channel improvements (Holland, 1986). Southern willow scrub is relatively limited within the ROI (1 combined acre) and is associated with seasonal drainages, as well as with more permanent water sources. Small areas of this habitat type were identified in Area II, along the drainages north of the Area II landfill and the Coca Test Stand site, and around the R-2 Ponds and the Coca Area detention pond. The largest area of southern willow scrub in NASA-administered areas occurs along the drainage on the southern side of the Alfa Test Stand site within Area II.
- **Venturan coastal sage scrub (S3).** Venturan coastal sage scrub is one of three floristic provinces of coastal sage scrub, which occurs from Baja California to San Francisco. Venturan coastal sage scrub specifically occupies northern coastal areas to Point Conception and the Channel Islands (Davis, 1994). Venturan coastal sage scrub is widespread throughout SSFL (64.44 combined acres). The largest areas of this habitat occur in the southwestern part of Area II. This habitat generally is intermixed with chaparral and rock outcrops.

No federally designated critical habitat exists within the NASA-administrated areas of SSFL (USFWS, 2019a).

3.2.1.3.4 Biological Species of Native American Concern

A number of plant and wildlife species found on SSFL have been identified as species of concern to Native American tribes. The list of species, the reason for their significance, and their distribution are provided in Table 3.2-4.

TABLE 3.2-4
Biological Species of Native American Concern
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Scientific Name	Common Name	Concern	Distribution
Plant Species			
Asclepias eriocarpa	Broad leaved milkweed	Culturally recognized for material culture use and ceremonial use	California
Asclepias fascicularis	Narrow leaved milkweed	Culturally recognized for material culture use and ceremonial use	Western U.S.

Scientific Name	Common Name	Concern	Distribution
Amsinckia menziesii	Common fiddleneck	Culturally recognized as a food source and for ceremonial use	U.S.
Marah macrocarpus	Wild cucumber	Culturally recognized for material culture use, ceremonial use, medicinal purposes, and as food	Southern California
Quercus agrifolia	Coast live oak	Culturally recognized as a staple food source and for ceremonial use	Coastal California
Salvia columbariae	Chia sage	Culturally recognized as a food source and for ceremonial use	Western U.S.
Animal Species			
Phrynosoma blainvillii	Coast horned lizard	Culturally recognized in oral tradition and ceremonially recognized	Coastal California
Melanerpes formicivorus	Acorn woodpecker	Culturally recognized in oral tradition and ceremonially recognized	Western U.S.
Corvus brachyrhynchos	American crow	Culturally recognized in oral tradition, song, and ceremony	U.S.
Corvus corax	Common raven	Culturally recognized in oral tradition and ceremonially recognized	U.S.
Geococcyzus californianus	Greater roadrunner	Culturally recognized in oral tradition and ceremony	Western U.S.

Sources: Cohen, pers. comm., 2011; USDA, 2019; NatureServe, 2019

A search of the U.S. Department of Agriculture (USDA) Plants Database (USDA, 2019) and the California Native Plant Society's (CNPS's) Inventory of Rare, Threatened and Endangered Plants of California (CNPS, 2019) was performed to determine the distribution and sensitivity of each of these plant species. None of these species is listed as rare, threatened, or endangered by the CNPS, CDFW, or USFWS. Furthermore, the distribution of each of these species extends beyond the boundaries of SSFL.

A search of the USFWS Endangered Species Database (USFWS, 2019b) and Nature Serve Explorer (NatureServe, 2019) was performed to determine the distribution and sensitivity of these animal species. None of these species is listed by CDFW or USFWS as rare, threatened, or endangered, with exception of the coast horned lizard, which is listed by the CDFW as an SSC. Furthermore, the distribution of each of these species extends beyond the boundaries of SSFL.

3.2.1.4 Noxious and Invasive Weeds

A noxious weed is a plant that is considered to be harmful to the environment or agriculture and is the subject of regulations governing attempts to control it by the U.S. Department of Agriculture or the California Department of Food and Agriculture (CDFA). Invasive weeds include species that may present an economic or ecological threat but are not subject to legal regulations.

Numerous noxious and invasive weed species have been identified within the ROI. Five of these species are classified by CDFA as noxious weeds (NASA, 2011b). Table 3.2-5 lists the noxious and invasive weeds identified during the 2011 surveys; however, other noxious and invasive weeds could be present, as well.

TABLE 3.2-5
Noxious and Invasive Weeds Identified on the NASA-administered Property at SSFL
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Scientific Name	Common Name	Type	Threat
Ailanthus altissima	Tree of heaven	Noxious	Moderate
Brassica nigra	Black mustard	Invasive	Moderate
Bromus diandrus	Ripgut brome	Invasive	Moderate
Bromus madritensis ssp. *rubens*	Red brome	Invasive	High
Carduus pycnocephalus	Italian plumeless thistle	Noxious	Moderate
Centaurea melitensis	Maltese star-thistle	Noxious	Moderate
Cirsium vulgare	Bull thistle	Noxious	Moderate
Cynodon dactylon	Bermudagrass	Invasive	Moderate
Foeniculum vulgare	Sweet fennel	Invasive	High
Gazania linearis	Treasureflower	Invasive	Moderate
Mesembryanthemum crystallinum	Common iceplant	Invasive	Moderate
Pennisetum setaceum	Crimson fountaingrass	Invasive	Moderate
Salsola tragus	Prickly Russian thistle	Noxious	Limited
Vulpia myuros ssp. *myuros*	Rat-tail fescue	Invasive	Moderate

Sources: CDFA, 2019; Cal-IPC, 2019

3.2.1.5 Wetlands

Wetlands are unique ecological habitats and are defined as areas that are “inundated by surface water or groundwater with a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas” (40 CFR Section 230.3 and 33 CFR Part 238). Wetlands are protected by the CWA, which requires a Section 404 permit whenever dredge or fill material may enter a “water of the U.S.,” including wetlands. The term “water of the U.S.” generally refers to waters that are navigable to a major water body or are connected to a navigable waterway. The process of determining whether a wetland or other water body is a water of the U.S. is called a jurisdictional determination and it is conducted by the U.S. Army Corps of Engineers (USACE).

In 2013, NASA obtained a jurisdictional determination from the USACE that the jurisdictional waters within the ROI include natural drainages and the R-2A, R-2B, and Coca Area ponds, which were created along the natural drainage channels and, therefore, are considered either impoundments of waters of the U.S. or adjacent to waters of the U.S. (NASA, 2012; Allen, pers. comm., 2013). Figure 3.2-3 shows the locations of these wetlands. NASA will work with USACE to update this jurisdictional determination prior to remediation activities. The original wetland delineation and jurisdictional determination are included in Appendixes 3.2C and 3.2D, respectively.

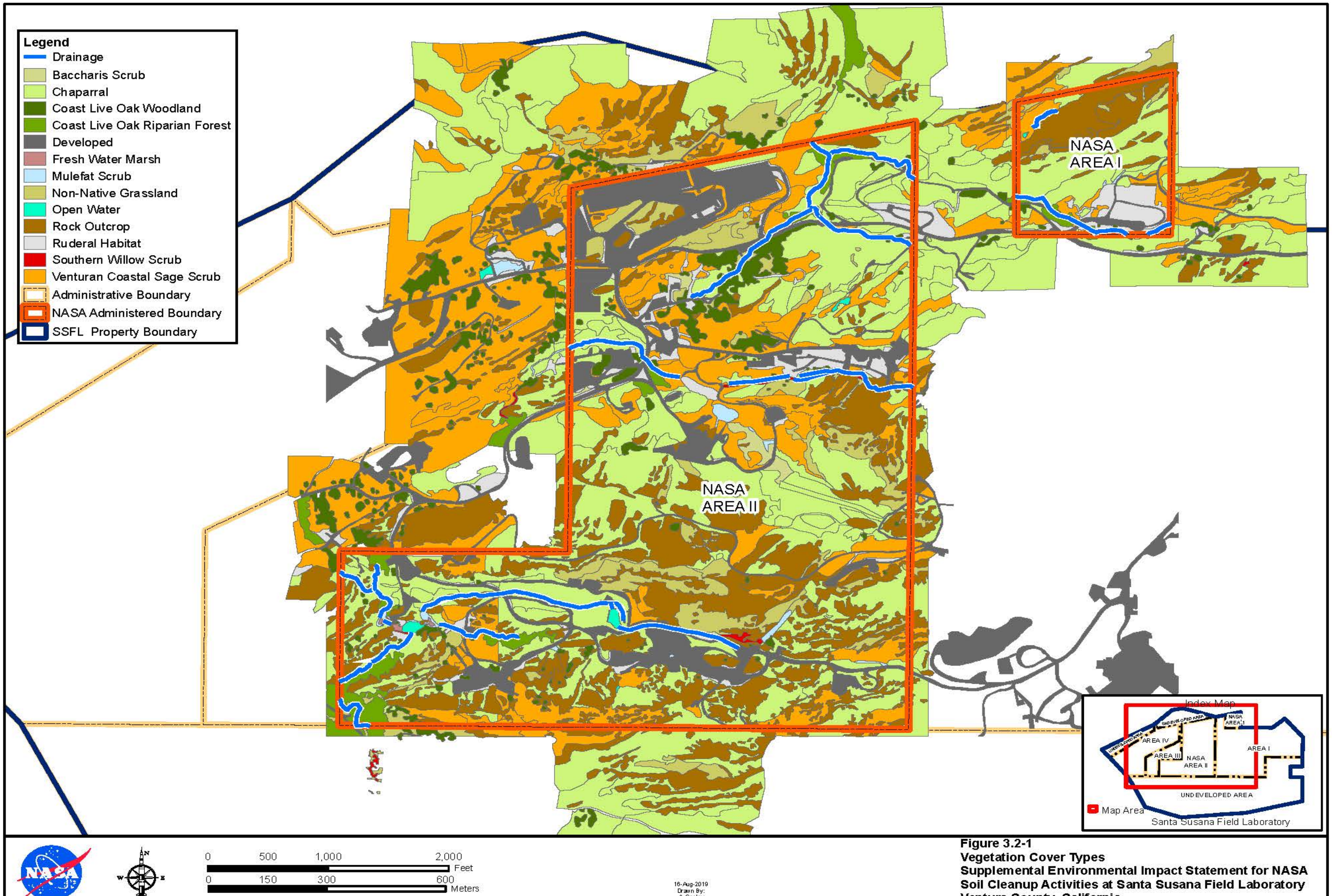

Figure 3.2-1
Vegetation Cover Types
Supplemental Environmental Impact Statement for NASA Soil Cleanup Activities at Santa Susana Field Laboratory
Ventura County, California

Map Document: O:\NASA\SSFL\maps\EIS_2018\EIS18_Vegetation.mxd

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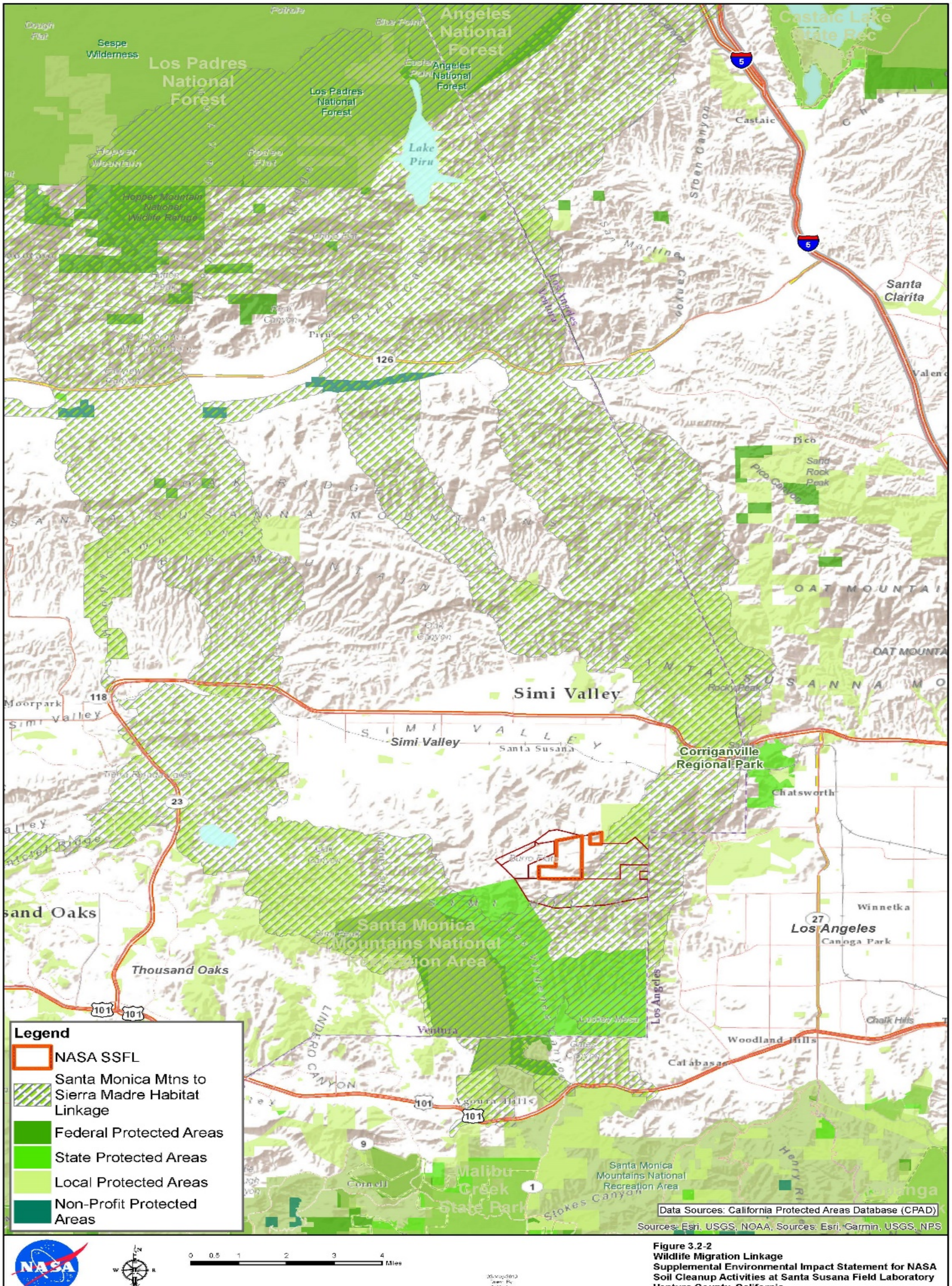

Figure 3.2-2
Wildlife Migration Linkage
Supplemental Environmental Impact Statement for NASA Soil Cleanup Activities at Santa Susana Field Laboratory
Ventura County, California

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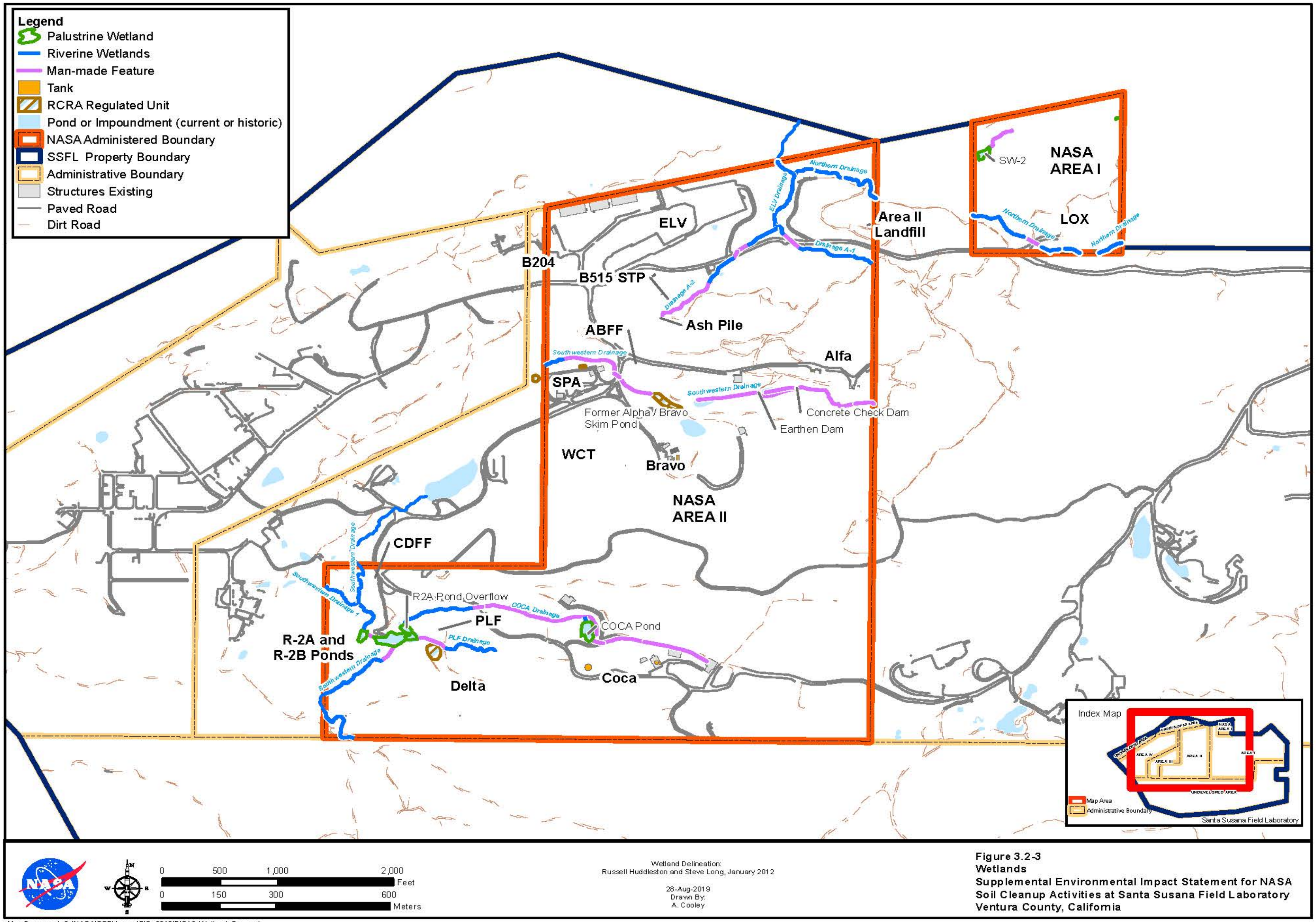

Figure 3.2-3
Wetlands
Supplemental Environmental Impact Statement for NASA Soil Cleanup Activities at Santa Susana Field Laboratory Ventura County, California

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3.2.2 Environmental Consequences

This subsection describes the potential impacts to biological resources within the ROI from the No Action Alternative or the implementation of the Action Alternatives. The evaluation criteria for biological resources include disturbance, displacement, and mortality of plant and wildlife species and destruction of sensitive habitat. These measures are the basis for the evaluation criteria used to assess the potential impacts of the Proposed Action Alternatives and the No Action Alternative.

The soil remediation technology implemented under each Action Alternative is dependent on the specific cleanup requirements, site conditions, and available resources. Therefore, NASA may implement a variety of the soil technologies throughout the project area. A brief explanation of the relevant components of the technologies and how they may affect biology is provided as follows:

- **Excavation and Offsite Disposal:** This technology would result in the removal of large areas of natural habitat. Imported soil would be used as backfill to replace the excavated soils; however, the backfilled soil would not fully mimic existing conditions. Wildlife species would be disturbed by the permanent loss of habitat and the increased presence of heavy equipment onsite.
- **Ex Situ Treatment Using Soil Washing:** While large quantities of soil would be removed under this technology, the soil would be treated offsite and returned post-remediation. Consequently, the post-remediation soil conditions would be closer to original conditions, and native vegetation reestablishment would be more likely, though it is assumed the original seed bank and the physical structure of the soil will be lost during remediation. Wildlife species would be disturbed by the temporary loss of habitat and the increased presence of heavy equipment onsite.
- **Ex Situ Treatment Using Land Farming:** The biological conditions would be similar to those described for ex situ treatment using soil washing.
- **Ex Situ Chemical Oxidation*:*** The biological conditions would be similar to those described for ex situ treatment using soil washing. However, the chemicals used could affect the microbial composition of the treated soil.
- **Ex Situ Treatment Using Thermal Desorption:** The biological conditions would be similar to those described for ex situ treatment using soil washing. However, the high temperatures may also kill the microbial species found in the treated soil.
- **SVE:** This technology would require the construction of a system of wells, piping, and manifolds. It would result in a lower area of disturbance than the ex situ remediation technologies and soil would be treated in place, resulting in lower levels of impact to the soil conditions found onsite. The potential exists for the preserved existing seed bank to naturally establish native species. Wildlife species would be disturbed by the temporary loss of habitat and the increased presence of heavy equipment onsite; they would also be subjected to the constant noise from operation of the remediation equipment.
- **In Situ Chemical Oxidation:** The biological conditions would be similar to those described for SVE.
- **In Situ Anaerobic or Aerobic Biological Treatment:** The biological conditions would be similar to those described for SVE.
- **MNA:** This technology would result in minimal impact to biological resources. Monitoring equipment would be installed, but the area of impact would be small in comparison with the other technologies. There would be a human presence during periodic monitoring, but this would be similar to the conditions currently found at the site.

To obtain an understanding of the greatest potential impact by alternative and to provide decision makers with a comparative analysis by which to make a fully informed decision, it was assumed that excavation and offsite disposal would be the technology applied to the majority of the site. Consequently, the soil excavation quantities and truck traffic shown in Table 2.2-2 were used to analyze the greatest potential impact as a conservative assumption.

Table 3.2-6 identifies the impact thresholds for biological resources.

TABLE 3.2-6
Impact Thresholds for Biological Resources
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Impact	Description
No Impact	No impacts to biological resources would be expected.
Negligible	Impacts to biological resources would not be detectable and would not alter resource conditions.
Minor	Impacts to biological resources would be detectable but they would result in little loss of resource integrity. Impacts would not appreciably alter resource conditions, or long-term or permanent changes of population use of habitats.
Moderate	Impacts to biological resources would result in disturbance to a site, loss of integrity, and/or alteration of resource conditions. Impacts would appreciably alter biological resource conditions; however, the scale of the impacts would not be expected to affect resource stability in the region.
Significant	Impacts to biological resources would result in severe disturbance to a site, loss of integrity, and/or alteration of resource conditions. Impact would appreciably alter resource conditions and could be severe and long lasting.
Quality:	Beneficial–would have a positive effect Negative–would have an adverse effect
Duration:	Temporary–would occur only during the remediation period, even if remediation took years. Permanent–would continue beyond the remediation period.

3.2.2.1 Alternative A: AOC Cleanup

This subsection discusses the potential effects of the Alternative A soil cleanup activities on biological resources.

3.2.2.1.1 Native Vegetation Communities

The proposed soil remediation areas analyzed under Alternative A (Figure 2.2-1) total approximately 220 acres. Of this area, 50 acres are composed of developed and non-natural habitats. The highest proportion of disturbance to natural habitats would occur to chaparral habitat.

Excavation of surface soil (up to 870,000 yd^3) would result in the potential removal of existing soil on approximately 170 acres of native habitat within the ROI. In soil remediation areas, excavated material would be replaced with clean backfill and attempts would be made to revegetate the excavated areas with native plant species. Remediated areas would be reseeded using drill, broadcast, or hydroseeding techniques, depending on the slope or remoteness of the disturbed area. The site would be reseeded using an approved native seed mix developed for Boeing's property that is commercially available. NASA would also plant shrubs and trees depending on the final contours and soil cover **(Biology BMP-1)**.

However, revegetation of native species is viable only when soil presents the structure, nutrients, and microbial environment to which the native plants are adapted. The predominant soil types under chaparral vegetation are Sedimentary Rock Land and Gaviota Rocky Sandy Loam. The best source of backfill evaluated to date is owned by Grimes Rock. Although not exactly similar, the studied backfill material appears to provide chemical and physical conditions suitable for the reestablishment of native vegetation (CH2M HILL, 2017). A series of studies were conducted to determine the suitability of the identified backfill material for the long-term restoration of the excavated soil areas (SDSU, 2019). The first study focused on the taxonomic diversity of microbial communities found in the native and backfill soils. The second study compared the germination and initial plant growth of various native plant species using the backfill and native soils in a greenhouse environment.

The first study found that the microbial community of the backfill material differed greatly from those found on the site, even after inoculation attempts were made. The second study indicated that the currently available replacement soil may be inadequate for the long-term growth and development of native plant species. Initial germination rates for many species were quite high using the backfill material; however, as the trials progressed, many of the plants growing in the backfill soil began to die off after about a month, and by the end of the 11-week trial, very few seedlings remained alive in the backfill soil, while greenhouse soil supported a much higher percentage of live seedlings (SDSU, 2019). The addition of organic material may improve the viability of revegetation efforts.

NASA would make the appropriate effort to improve revegetation success, including adding organic material to backfill to help mimic natural soil conditions and using backfill sources that most closely resemble existing soil conditions. However, unless more sources become available, there is an insufficient quantity of appropriate backfill to meet restoration needs, especially when combined with the Boeing and DOE requirements at the site. Therefore, it is assumed that a portion of the backfill for Alternative A would comprise gravel, which would differ substantially from the existing soil environment. The gravel would be used as a base layer, with the backfill material spread over the gravel layer. While this could help plant establishment, soil conditions would not resemble current conditions at the site.

It can take many years for native species to become reestablished in disturbed areas and the species composition would be different from the original composition, despite reseeding with the approved native seed mix. The restoration goal would be 50 percent plant cover within 3 years of restoration for grass and herbaceous species, though it may take much longer for shrub and tree species. If gravel must be used to augment backfill materials discussed previously, the applied native vegetation may never fully reestablish, particularly for deep-rooted species. The biodiversity of the site would be permanently altered under Alternative A; consequently, the overall impacts after implementation of **Biology BMP-1** would be **significant, negative, and permanent** (**Biology Impact-1**).

CDFW high-priority conservation habitats, including southern willow scrub and Venturan coastal sage scrub, make up approximately 38 acres of the Alternative A remediation area. These communities would be destroyed during soil excavation operations, unless they are provided an exemption protection from DTSC. If an exemption is not issued, and if the cleanup can be completed in a manner compliant with the 2010 AOC, the least detrimental soil remediation technology would be implemented in these areas (**Biology BMP-2**); however, it is not certain the less detrimental technologies could meet the AOC LUT requirements. Because the communities within the ROI represent a small percentage of the regional populations, impacts would remain at the local level, and impacts to high-priority conservation habitats would be **moderate, negative, and permanent (Biology Impact-2)**. No excavation material would be placed in sensitive habitats **(Biology BMP-3)**.

Remediation activities could increase the spread of invasive and noxious weed species. Weed species could out-compete native species in areas where soil is exposed and weed species could become dominant in areas previously suitable only for locally adapted plants. In addition, introduced weed species could out-compete native plants in areas. Removal of native vegetation during excavation and aerobic biological treatments could induce the spread of noxious weeds. NASA would implement a weed management plan to eradicate noxious and invasive plant species as they appear onsite, using federally approved methods **(Biology BMP-4)**. Use of the low nutrient backfill material discussed previously would help limit the spread of noxious weeds. However, even with proper weed management, the current vegetation composition would likely never return, and the likeliest outcome is that the area would become dominated with non-native annual grasses resulting from changes in soil structure. These factors could lead to a **significant, negative, and permanent impact** on native vegetation and wildlife from weeds **(Biology Impact 3)**.

3.2.2.1.2 Wildlife

Large-scale excavation of cleanup areas would eliminate vegetation, create physical barriers, and drive away wildlife because of noise, human presence, and loss of habitat. Most wildlife would vacate the operation areas and return upon reestablishment of vegetation. Direct impacts from mortality to smaller, less mobile species could occur during operations if those species were present, though this mortality would be individualized and would not measurably affect population stability. Also, while birds usually can escape harm during demolition and cleanup activities by flying away, during the nesting season (February 1 through August 15), eggs and chicks would be at risk. Impacts to wildlife populations, including birds, would be **moderate, negative, and temporary (25+ years) (Biology Impact-4)**. The NASA-administered portions of SSFL are adjacent to a potential migration corridor for numerous wildlife species (South Coast Wildlands, 2008). If migrating species are present during cleanup activities, the impacts would be similar to **Biology Impact-4.**

Wildlife species might acquire toxic substances from the environment, along with nutrients and water. Some contaminants are metabolized or excreted, but others accumulate in specific tissues. Bioaccumulated toxins become more concentrated in successive levels in the food web (large amounts of contaminated biomass are consumed by herbivores, which then would be consumed by carnivores). Thus, top-level carnivores, such as snakes or coyotes, are most severely affected by contaminants. Bioaccumulation of chemicals, such as mercury and PCBs, could result in species mortality, reproductive impairment, and developmental effects (Freshman and Menzie, 1996). However, the vegetation composition and wildlife abundance on the site is similar to surrounding natural areas and exceeds the developed areas around the site, indicating that the existing contamination has had limited effect on the biological resources on the site. The remediation of soil would have a **minor, beneficial, and permanent** effect on wildlife species by reducing the potential for contaminant exposure or bioaccumulation **(Biology Impact-5)**.

3.2.2.1.3 Sensitive Species

The following discussion includes species that are listed by USFWS as a threatened, endangered, or candidate species or by CDFW as a rare, SSC, or fully protected species and that were observed in the ROI during past surveys of the site (NASA, 2011a, 2011b). Sensitive species have been divided into plant and wildlife categories. Impacts to sensitive species were assessed at the population level, except in the case of federally listed threatened or endangered species, in which case an impact to an individual organism would be considered significant.

Listed Plant Species

Santa Susana tarplant. The only listed plant species observed in the ROI is the Santa Susana tarplant, which is state-listed rare. The Santa Susana tarplant is an aggressive colonizer that is locally abundant and present throughout the ROI and in other areas of Ventura and Los Angeles Counties (Baldwin et al., eds., 2012). Within the ROI, the Santa Susana tarplant has been observed growing in recently disturbed areas, even on surfaces that have been sprayed with gunnite (e.g., Coca and Delta Areas). The Proposed Action could have a negative effect on the Santa Susana tarplant through disturbance and mortality of individuals during soil remediation, demolition, and mitigation efforts. However, because a large Santa Susana tarplant population exists adjacent to the remediation areas, potential impacts would not adversely affect the survival, reproduction, or productivity of the regional population. Also, NASA would avoid the Santa Susana tarplants to the extent possible to preserve the local seed sources. Individuals working on cleanup and demolition activities would be trained to identify the Santa Susana tarplant and avoid it where possible **(Biology BMP-5)**. The effects on the local population of the Santa Susana tarplant would be **moderate, negative, and temporary (25+ years) (Biology Impact-6)**.

Braunton's milk-vetch. Although Braunton's milk-vetch, a federally listed endangered species, has not been observed in the NASA-administered areas (NASA, 2011a, 2011b), soil conditions indicate that habitat could be supported in the northeastern portion of NASA-administered Area II and in the southern portion of the former LOX Plant in Area I. An abundance of Braunton's milk-vetch has been observed in the DOE-administered areas. Also, the 2018 Woolsey Canyon Fire may have created favorable conditions for the establishment of the plant in new areas. Nonetheless, because the species was not identified during the surveys and no critical habitat exists within the ROI, there are **no expected impacts (Biology Impact-7)** to Braunton's milk-vetch. NASA will perform pre-remediation surveys for Braunton's milk-vetch to confirm the species has not migrated onto the site.

Listed Wildlife Species

Least Bell's vireo. A single Least Bell's vireo, a federally and state-listed endangered species, was observed during the site surveys, though it appeared to be transient and no nests were found (NASA, 2011b). However, there are **no expected impacts (Biology Impact-7)** to the Least Bell's vireo, because suitable habitat for the Least Bell's vireo within the ROI is of limited quality and quantity and nesting has not been documented within the Proposed Action area (Phillips, pers. comm., 2013). NASA will perform pre-remediation surveys for Least Bell's vireo to confirm the species has not migrated onto the site.

Quino checkerspot butterfly. A qualified entomologist surveyed the ROI for the Quino checkerspot butterfly, a federally listed endangered species, and observed no individuals. Furthermore, the entomologist found that potential butterfly habitat within the ROI was marginal (ECS, 2012). Because there is a minimal likelihood of encountering a Quino checkerspot butterfly during remediation and demolition, there would be **no expected impacts (Biology Impact-7)** to this species.

California red-legged frog. No signs of the California red-legged frog, a federally threatened species, were observed during surveys (NASA, 2011a, 2011b), and the quantity of potentially suitable habitat for the frog is limited (Phillips, pers. comm., 2013). The ponds within the ROI that are potentially suitable to support this species include the R-2 Ponds and the detention basin north of the Coca Test Stand site, but there are existing downstream barriers that would make frog migration into these habitats problematic. Therefore, there would be **no expected impacts (Biology Impact-7)** to the California red-legged frog. NASA will perform pre-remediation surveys for the California red-legged frog to confirm the species has not migrated onto the site.

Fairy shrimp. Two species of federally listed fairy shrimp have the potential to exist within the ROI. The Riverside fairy shrimp is federally listed as endangered and the vernal pool fairy shrimp is federally listed as threatened. These species could exist in the seasonal wetlands and small pools on rock outcrops at SSFL, but none have been identified within the remediation area. Rock outcrops, which might support these habitats, would be avoided during cleanup activities. Consequently, there would be **no expected impacts (Biology Impact-7)** to listed fairy shrimp populations.

Coast horned lizard. The coast horned lizard, a CDFW SSC reptile species and a species of Native American concern, was observed in NASA-administered Area I and Area II. During the fall 2010 survey, it was sighted within the proposed remediation boundary near the Area II landfill (NASA, 2011a). Because only one specimen was observed in the remediation area (NASA, 2011a), indicating that the population size is small, the impacts to population stability would be **minor, negative, and temporary (25+ years) (Biology Impact-8)**.

Two-striped garter snake. The two-striped garter snake, a CDFW SSC reptile species, was observed near the former LOX Plant site in NASA-administered Area I and another snake was photographed at the R-2 Pond. The observations were outside the remediation area; however, there is still the potential for the species to be present within the remediation area. Furthermore, snake species often bask on roadways; consequently, the increased truck traffic could result in individual mortality. The impacts to the snake population would be **minor, negative, and temporary (25+ years) (Biology Impact-8)**.

Loggerhead shrike. The loggerhead shrike, a CDFW SSC bird species, was sighted during the fall 2010 survey flying near the Storable Propellant Area site of Area II (NASA, 2011a) and foraging on a hill above the viewing stand at the Bravo Test Stand site during the August 2011 survey (NASA, 2011b). These observations were within the proposed remediation area and the loggerhead shrike may be a resident nesting species in the region. However, because only two specimens were observed, indicating that the population in the region is small, the impacts to the loggerhead shrike populations would be **minor, negative, and temporary (25+ years) (Biology Impact-8)**.

Ring-tailed cat. A ring-tailed cat, a CDFW fully protected species, was observed outside, but near, NASA-administered Area II. Because no specimens were identified within the ROI and the species likely would avoid human activity, there would be **no expected impacts** to the ring-tailed cat.

NASA consulted with USFWS for the Proposed Action because of the potential presence of a federally listed species within the ROI. On December 13, 2013, USFWS concurred with NASA's determination that the Proposed Action may affect, but is not likely to adversely affect, the Braunton's milk-vetch, Least Bell's vireo, California red-legged frog, Riverside fairy shrimp, and vernal pool fairy shrimp (Phillips, pers. comm., 2013), which is consistent with the impact findings detailed previously. The following mitigation measures were identified by USFWS to lessen the potential impacts to federally threatened or endangered listed species (Phillips, pers. comm., 2013) (Appendix 3.2B) and NASA has committed to performing these measures as detailed below **(Biology Mitigation-1)**. NASA met with USFWS, DTSC, CDFW, Boeing and DOE in 2018 to discuss the status of the ESA consultations. During that meeting, USFWS confirmed that the 2013 Effect Determination is still applicable to NASA's activities at SSFL (DTSC, 2018b).

- Prior to any remediation activities, NASA will conduct protocol-level surveys in all suitable habitats for Braunton's milk-vetch, California red-legged frog, Least Bell's vireo, Riverside fairy shrimp, and vernal pool fairy shrimp.
- Individuals working on cleanup and demolition activities would be trained to identify federally and state-listed species. If a listed species were observed during operations, operations would halt in the vicinity of the sighting and a qualified wildlife biologist would be called to the site.
- If a federally listed species is identified either through pre-remediation or worker identification, activities will halt in the vicinity of the sighting and NASA will initiate ESA consultation with USFWS, during which time additional mitigation measures will be developed.
- Additional dialogue will occur with USFWS if rock basins are impacted by the Proposed Action. Where rock basins occur near construction areas, exclusion fencing will be set up.

3.2.2.1.4 Species with Native American Cultural Uses

A search was conducted to evaluate the distribution and status of plants and animals identified as species used by Native Americans. Only one of the species listed in Table 3.2-4 has been identified by USFWS, CDFW, or CNPS as a species of concern, and the distribution of this species extends beyond the SSFL boundaries (USDA, 2019; Baldwin et al., eds., 2012; NatureServe, 2019). The coast horned lizard is a CDFW reptile species but impacts to the species are expected to be minor and temporary. Consequently, it is assumed that the species population is stable and that cleanup activities would have little effect on the stability of the species population. Nonetheless, excavation would result in the removal of all plants and seeds in the area of the soil removal. Efforts will be made to use less invasive excavation methods around the coast live oaks, such as removal of soil by vacuum truck when the AOC cleanup standards can be met **(Biology BMP-6)**. However, all plant species would be removed from the areas of soil cleanup, and reestablishment of existing vegetation is unlikely given the lack of available soil. Impacts to species of Native American cultural uses are expected to be **moderate, negative, and permanent (Biology Impact-9).** Cultural impacts are discussed further in Section 3.1.

3.2.2.1.5 Wetlands

Excavation of soil for cleanup purposes could affect approximately 3 acres of wetlands identified within the ROI (NASA, 2012). USACE determined these areas to be waters of the U.S. and subject to CWA Section 404 permitting (Allen, pers. comm., 2013). Expected impacts to wetlands would be **moderate, negative, and permanent (Biology Impact-10)**. However, NASA would obtain a CWA Section 404 permit from USACE and a

CWA Section 401 certification from the Regional Water Quality Control Board (RWQCB) for the discharge or dredge of material into jurisdictional waters of the U.S**.** The Section 404 permits would include necessary measures to avoid, minimize, or otherwise mitigate impacts to wetlands and other waters of the U.S. (**Biology Mitigation-2**)

3.2.2.2 Alternative B: Revised LUT Levels Cleanup

This subsection discusses the potential effects of the Alternative B soil cleanup activities on biological resources.

3.2.2.2.1 Native Vegetation Communities

The proposed soil remediation areas analyzed under Alternative B (Figure 2.2-2) total approximately 78 acres. Of this area, 26 acres are composed of developed and non-natural habitats. The highest proportion of disturbance to natural habitats would occur to chaparral habitat.

Excavation of surface soil (up to 384,000 yd^3) would result in the potential removal of existing soil on approximately 52 acres of native habitat within the ROI. **Biology BMP-1**, revegetation of disturbed areas, would be applied to Alternative B. However, remediation technologies such as in situ treatment and ex situ treatment with the return of backfill offer less soil disturbance and would be viable technologies to meet the revised LUT values, where they might not be able to meet the 2010 AOC LUT values. The use of soil technologies that leave or replace the existing soil would be beneficial for plant reestablishment by more closely reflecting the natural conditions, maintaining the existing seed bank, and allowing native soil microbes to inoculate any backfilled material. Also, a reduction in the amount of backfill needed would greatly reduce the need for gravel backfill. This would result in a much higher probability of success for the reestablishment of native vegetation. The impacts to vegetation communities would be **moderate, negative, and temporary (12 years) (Biology Impact-1).**

CDFW high-priority conservation habitats make up approximately 10 acres of the Alternative B remediation area. The least detrimental soil remediation technology would be implemented in these areas (**Biology BMP-2**). Because the communities within the ROI represent a small percent of the regional populations, and because less impactful soil technologies could be employed, impacts would be **minor, negative, and permanent (Biology Impact-2)**. No excavation material would be placed in sensitive habitats **(Biology BMP-3)**.

Excavation could increase the spread of invasive and noxious weed species for Alternative B in the manner described for Alternative A. NASA would implement a weed management plan **(Biology BMP-4)**; however, with the application of appropriate soil, native plants would be more likely to reestablish. A **moderate, negative, and temporary impact (12 years)** on native vegetation and wildlife from weeds would be expected for Alternative B **(Biology Impact-3)**.

3.2.2.2.2 Wildlife

Wildlife would be disturbed by activities under Alternative B in a manner similar to Alternative A and result in **moderate, negative, and temporary (12 years) impacts** to non-sensitive wildlife populations, including birds **(Biology Impact-4)**. The NASA-administered portions of SSFL are adjacent to a potential migration corridor for numerous wildlife species (South Coast Wildlands, 2008). If migrating species are present during cleanup activities, the impacts would be similar to **Biology Impact-4.**

Wildlife species might acquire toxic substances from the environment, along with nutrients and water. The remediation of soil would also have a **minor, beneficial, and permanent** effect on wildlife species by reducing the potential for contaminant exposure or bioaccumulation **(Biology Impact-5)**.

3.2.2.2.3 Sensitive Species

The impacts to sensitive species under Alternative B are expected to be similar to those described for Alternative A; there would be **no impacts** to federally listed species (**Biology Impact-7**) and **minor, negative, and temporary (12 years)** to state-listed species **(Biology Impact-8)**. However, considering the lessened area of impact under Alternative B and the increased potential for vegetation reestablishment, the impacts to Santa Susana tarplant are expected to be **minor, negative, and temporary (12 years) (Biology Impact-6).** NASA would implement **Biology BMP-5,** avoidance of Santa Susana tarplant, and **Biology Mitigation-1,** agreed-upon mitigation with USFWS, under Alternative B.

3.2.2.2.4 Species with Native American Cultural Uses

Impacts to species with Native American cultural uses under Alternative B would be similar to those described for Alternative A; however, the probability of the reestablishment of native vegetation is more likely under Alternative B, given the availability of soil backfill and the ability to use less intrusive soil technologies in coast live oak habitat **(Biology BMP-6)**. Impacts to species of Native American cultural uses are expected to be **minor, negative, and temporary (12 years) (Biology Impact-9)**.

3.2.2.2.5 Wetlands

Excavation of soil for cleanup purposes could affect wetlands identified within the ROI (NASA, 2012). USACE has determined these areas to be waters of the U.S. and subject to CWA Section 404 and Section 401 permitting (Allen, pers. comm., 2013). Expected impacts to wetlands would be **moderate, negative, and permanent (Biology Impact-10)**. NASA would implement **Biology Mitigation-2** (CWA permitting) under Alternative B.

3.2.2.3 Alternative C: Suburban Residential Cleanup

This subsection discusses the potential effects of the Alternative C soil cleanup activities on biological resources.

3.2.2.3.1 Native Vegetation Communities

The proposed soil remediation areas analyzed under Alternative C (Figure 2.2-3) total approximately 36 acres. Of this area, 9 acres are composed of developed and non-natural habitats. The highest proportion of disturbance to natural habitats would occur to chaparral habitat.

Excavation of surface soil (up to 247,000 yd^3) would result in the potential removal of existing soil on approximately 27 acres of native habitat within the ROI. **Biology BMP-1**, revegetation of disturbed areas, would be applied to Alternative C. However, given the lower cleanup extents for Alternative C, the probability of the backfill material discussed in Alternative A being sufficient to replace the excavated soil is much higher. Also, a larger area of land would be available for in situ treatments, which could maintain the existing native seed bank and would result in a much higher probability of success for the reestablishment of native vegetation. The amount of natural habitat disturbed is also greatly reduced in Alternative C. Consequently, the impacts to vegetation communities would be **minor, negative, and temporary (8 years) (Biology Impact-1).**

CDFW high-priority conservation habitats make up approximately 3 acres of the remediation area. The least detrimental soil remediation technology would be implemented in these areas (**Biology BMP-2**). Because the communities within the ROI represent a small percent of the regional populations and the least impactful soil remediation technology would be implanted, impacts would be **minor, negative, and permanent (Biology Impact-2)**. No excavation material would be placed in sensitive habitats **(Biology BMP-3)**.

Excavation could increase the spread of invasive and noxious weed species under Alternative C in the manner described for Alternative A. NASA would implement a weed management plan **(Biology BMP-4)**; however, with the application of appropriate soil, native plants would be expected to reestablish. Also, the lower acreage of disturbance under Alternative C would reduce the likelihood of large-scale weed establishment. A **minor, negative, and temporary impact (8 years)** on native vegetation and wildlife from weeds would be expected under Alternative C **(Biology Impact 3)**.

3.2.2.3.2 Wildlife

Wildlife, including birds, would be disturbed by activities under Alternative C in a manner similar to Alternative A; however, given the reduced timeframe and area of disturbance, impacts to wildlife and birds are expected to be **minor, negative, and temporary (8 years) (Biology Impact-4)**. The NASA-administered portions of SSFL are adjacent to a potential migration corridor for numerous wildlife species (South Coast Wildlands, 2008). If migrating species are present during cleanup activities, the impacts would be similar to **Biology Impact-4.**

Wildlife species might acquire toxic substances from the environment, along with nutrients and water. The remediation of soil would also have a **minor, beneficial, and permanent** effect on wildlife species by reducing the potential for contaminant exposure or bioaccumulation under Alternative C **(Biology Impact-5)**.

3.2.2.3.3 Sensitive Species

The impacts to sensitive species under Alternative C would be the same as those described for Alternative B; there would be **minor, negative, and temporary (8 years) impacts (Biology Impact-6)** to the Santa Susana tarplant, **no impacts** to federally listed species (**Biology Impact-7**), and **minor, negative, and temporary (8 years) impacts** to state-listed species **(Biology Impact-8)**. NASA would implement **Biology BMP-5,** avoidance of Santa Susana tarplant, and **Biology Mitigation-1,** agreed-upon mitigation with USFWS, under Alternative C.

3.2.2.3.4 Species with Native American Cultural Uses

Impacts to species with Native American cultural uses under Alternative C would be the same as those described for Alternative B. There would be **minor, negative, and temporary (8 years) impacts (Biology Impact-9)**. The use of less intrusive methodologies around coast live oaks under **Biology BMP-6** would be applied under Alternative C.

3.2.2.3.5 Wetlands

Excavation of soil for cleanup purposes could affect wetlands identified within the ROI (NASA, 2012). USACE has determined these areas to be waters of the U.S. and subject to CWA Section 404 and Section 401 permitting (Allen, pers. comm., 2013). Expected impacts to wetlands would be **moderate, negative, and permanent (Biology Impact-10)**. NASA would implement **Biology Mitigation-2** (CWA permitting) under Alternative C.

3.2.2.4 Alternative D: Recreational Cleanup

This subsection discusses the potential effects of the Alternative D soil cleanup activities on biological resources.

3.2.2.4.1 Native Vegetation Communities

The proposed soil remediation areas analyzed under Alternative D (Figure 2.2-4) total approximately 26 acres. Of this area, 6 acres are composed of developed and non-natural habitats. The highest proportion of disturbance to natural habitats would occur to chaparral habitat.

Excavation of surface soil (up to 176,500 yd^3) would result in the potential removal of existing soil on approximately 20 acres of native habitat within the ROI for the footprint identified in Figure 2.2-4. **Biology BMP-1**, revegetation of disturbed areas, would be applied to Alternative D. The resulting impacts would be similar to those described for Alternative C and would be **minor, negative, and temporary (6 years) (Biology Impact-1).**

CDFW high-priority conservation habitats have been identified in the Alternative D remediation area. The least detrimental soil remediation technology would be implemented in these areas (**Biology BMP-2**). Because the communities within the ROI represent a small percent of the regional populations, and because the least impactful soil technology could be employed, impacts would be **minor, negative, and permanent (Biology Impact-2)**. No excavation material would be placed in sensitive habitats **(Biology BMP-3)**.

Excavation could increase the spread of invasive and noxious weed species under Alternative D in the manner described for Alternative C. A **minor, negative, and temporary impact (6 years)** on native vegetation and wildlife from weeds would be expected for Alternative D **(Biology Impact-3)**. NASA would implement a weed management plan **(Biology BMP-4)**.

3.2.2.4.2 Wildlife

Wildlife would be disturbed by activities under Alternative D in a manner similar to that described in Alternative C and result in **minor, negative, and temporary (6 years) impacts (Biology Impact-4)**. The NASA-administered portions of SSFL are adjacent to a potential migration corridor for numerous wildlife species (South Coast Wildlands, 2008). If migrating species are present during cleanup activities, the impacts would be similar to **Biology Impact-4.**

Wildlife species might acquire toxic substances from the environment, along with nutrients and water. The remediation of soils would also have a **minor, beneficial, and permanent** effect on wildlife species by reducing the potential for contaminant exposure or bioaccumulation under Alternative D **(Biology Impact-5)**.

3.2.2.4.3 Sensitive Species

The impacts to sensitive species under Alternative D would be the same as those described for Alternative B; there would be **minor, negative, and temporary (6 years) impacts** to the Santa Susana tarplant, **no impacts** to federally listed species (**Biology Impact-7**), and **minor, negative, and temporary (6 years) impacts** to state-listed species **(Biology Impact-8)**. NASA would implement **Biology BMP-5,** avoidance of Santa Susana tarplant, and **Biology Mitigation-1,** agreed-upon mitigation with USFWS, under Alternative D.

3.2.2.4.4 Species with Native American Cultural Uses

Impacts to species with Native American cultural uses under Alternative D would be the same as those described for Alternative B. There would be **minor, negative, and temporary (6 years) impacts (Biology Impact-9)**. The use of less intrusive methodologies around coast live oaks under **Biology BMP-6** would be applied under Alternative D.

3.2.2.4.5 Wetlands

Excavation of soil for cleanup purposes could affect wetlands identified within the ROI (NASA, 2012). USACE has determined these areas to be waters of the U.S. and subject to CWA Section 404 and Section 401 permitting (Allen, pers. comm., 2013). Expected impacts to wetlands would be **moderate, negative, and permanent (Biology Impact-10)**. NASA would implement **Biology Mitigation-2** (CWA permitting) under Alternative D.

3.2.2.5 No Action Alternative

3.2.2.5.1 Vegetation

Under the No Action Alternative, native vegetation **(Biology Impact-1)**, and sensitive habitats **(Biology Impact-2)** would not be disturbed by soil remediation activities. However, these resources would continue to be disturbed as a result of ongoing NASA activities, including groundwater cleanup, demolition, and general maintenance activities. These impacts would be considered **negligible, negative, and temporary**. Likewise, the effect of noxious weeds on natural communities would continue, resulting in **minor, negative, and temporary impacts (Biology Impact-3)**.

3.2.2.5.2 Wildlife

Wildlife species, including birds, would be disturbed as ongoing remediation and sampling at SSFL are being implemented. These impacts would be **minor, negative, and temporary (Biology Impact-4)**. Bioaccumulation of chemicals through continued long-term exposure of wildlife to soil contamination could have a **minor, negative, and permanent impact** on wildlife species **(Biology Impact-5)**.

3.2.2.5.3 Sensitive Species

There are **no expected impacts** to federally or state-listed species under the No Action Alternative **(Biology Impact-6, Impact-7, and Impact-8).**

3.2.2.5.4 Species with Native American Cultural Uses

Impacts to species with Native American cultural uses are expected to be **negligible, negative, and temporary (Biology Impact-9)** under the No Action Alternative.

3.2.2.5.5 Wetlands

Minor, negative, and temporary impacts (Biology Impact-10) would be expected to wetlands during ongoing operations at SSFL.

3.2.3 Best Management Practices and Mitigation Measures

This subsection provides a brief description of the mitigation measures and BMPs that were previously discussed in detail.

- **Biology BMP-1** (All Action Alternatives): Areas where soil has been removed will be backfilled based on the availability of backfill material. Remediated areas will be revegetated using the Boeing seed mix, and native trees and shrubs will be replanted in some areas. A remediation goal of 50 percent plant cover within 3 years of revegetation efforts will be established. However, it may take much longer to establish shrub and tree species and vegetation cover in areas that differ from existing soil conditions. If gravel backfill is used, native vegetation, particularly deep-rooted species, may never reestablish in these areas.
- **Biology BMP-2** (All Action Alternatives): When possible, the least impactful soil remediation technology will be implemented in CDFW high-priority conservation areas.
- **Biology BMP-3** (All Action Alternatives): Soil will not be stockpiled in designated CDFW high-priority conservation areas.
- **Biology BMP-4** (All Action Alternatives): NASA will develop a weed mitigation plan for soil remediation areas. Efforts will be made as early as possible to avoid the establishment of weeds.
- **Biology BMP-5** (All Action Alternatives): NASA will avoid the Santa Susana tarplant to the extent possible. Individuals working on soil cleanup activities will be trained to identify and avoid the Santa Susana tarplant.
- **Biology BMP-6** (All Action Alternatives): The least impactful soil remediation technology will be implemented around coast live oaks; when possible, a vacuum truck will be used to remove soil around the oaks.
- **Biology Mitigation-1** (All Action Alternatives): The following mitigation measures were identified by the USFWS to mitigate potential impacts to federally threatened or endangered species (Phillips, pers. comm., 2013). Prior to any construction activities, NASA will conduct protocol-level surveys in all suitable habitats for Braunton's milk-vetch, California red-legged frog, Least Bell's vireo, Riverside fairy shrimp, and vernal pool fairy shrimp. If a federally listed species is identified, activities will halt, and NASA will initiate formal consultation with the USFWS, during which time additional mitigation measures will be developed. Individuals working on cleanup and demolition activities will be trained to identify federally and state-listed species. Additional dialogue will occur with the USFWS if rock basins

would be affected by the Proposed Action. Where rock basins occur near construction areas, exclusion fencing will be set up.

- **Biology Mitigation-2** (All Action Alternatives): NASA will work to update the 2013 USACE jurisdictional determination and obtain a CWA Section 404 permit from USACE and Section 401 certification from the RWQCB for the discharge of dredge into jurisdictional waters of the U.S. The Section 404 permits would include necessary measures to avoid, minimize, and otherwise mitigate impacts to wetlands and other waters of the U.S.

3.2.4 Summary of Impacts

Table 3.2-7 provides a summary of the impacts on biological resources, as described in this section.

TABLE 3.2-7
Summary of Biological Resources Impacts
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Impacts	Alternative A AOC Cleanup	Alternative B Revised LUT Levels Cleanup	Alternative C Suburban Residential Cleanup	Alternative D Recreational	No Action Alternative
Biology Impact-1: Impacts to native vegetation communities	Significant, negative, and permanent	Moderate, negative, and temporary (12 years)	Minor, negative, and temporary (8 years)	Minor, negative, and temporary (6 years)	Negligible, negative, and temporary
Biology Impact-2: Impacts to high priority conservation habitats	Moderate, negative, and permanent	Minor, negative, and permanent	Minor, negative, and permanent	Minor, negative, and permanent	Negligible, negative, and temporary
Biology Impact-3: Impacts from invasive weeds	Significant, negative, and permanent	Moderate, negative, and temporary (12 years)	Minor, negative, and temporary (8 years)	Minor, negative, and temporary (6 years)	Minor, negative, and temporary
Biology Impact-4: Impacts to wildlife	Moderate, negative, and temporary (25+ years)	Moderate, negative, and temporary (12 years)	Minor, negative, and temporary (8 years)	Minor, negative, and temporary (6 years)	Minor, negative, and temporary
Biology Impact-5: Reduction in contamination	Minor, beneficial, and permanent	Minor, beneficial, and permanent	Minor, beneficial, and permanent	Minor, beneficial, and permanent	Minor, negative, and permanent
Biology Impact-6: Impacts to Santa Susana tarplant	Moderate, negative, and temporary (25+ years)	Minor, negative, and temporary (12 years)	Minor, negative, and temporary (8 years)	Minor, negative, and temporary (6 years)	No impact
Biology Impact-7: Impacts to federally listed species	No impact	No impact	No impact	No impact	No impact
Biology Impact-8: Impacts to state-listed species	Minor, negative, and temporary (25+ years)	Minor, negative, and temporary (12 years)	Minor, negative, and temporary (8 years)	Minor, negative, and temporary (6 years)	No impact
Biology Impact-9 Impacts to species of Native American concern	Moderate, negative, and permanent	Minor, negative, and temporary (12 years)	Minor, negative, and temporary (8 years)	Minor, negative, and temporary (6 years)	Negligible, negative, and temporary
Biology Impact-10: Impacts to wetlands and protected waters	Moderate, negative, and permanent	Moderate, negative, and permanent	Moderate, negative, and permanent	Moderate, negative, and permanent	Minor, negative, and temporary

3.3 Air Quality

This subsection describes the environmental setting associated with air quality for the NASA-administered areas of SSFL. The ROI for air quality emissions includes Ventura County, which is in the South-Central Coast Air Basin (SCCAB) and the jurisdiction of the VCAPCD, and the western part of Los Angeles County, which is in the South Coast Air Basin (SCAB) and jurisdiction of the SCAQMD. The overlapping boundaries for counties, air basins, and air districts in the vicinity of SSFL are shown on Figure 3.3-1. For this analysis, the ROI is expanded to include a nearby representative landfill located in Kern County, California. The Kern County landfill is in the San Joaquin Valley Air Basin (SJVAB), which is in the jurisdiction of the San Joaquin Valley Air Pollution Control District (SJVAPCD).

3.3.1 Affected Environment

3.3.1.1 Regional Settings

The existing conditions that affect air quality are described in the following sections.

3.3.1.1.1 Meteorology

The regional meteorology depicts how pollutants released within the region might be dispersed by the predominant wind and temperature patterns. Weather conditions for the SCCAB and SCAB, which are bordered by the Pacific Ocean and mountain ranges, include a persistent temperature inversion, which acts as a lid that prevents air pollutants from escaping upward. Depending on the season, the pollution produced during an individual day is either moved out (flushed) or retained within the SCCAB and SCAB. This variation is a result of the daytime sea breeze (onshore), which transports pollutants through the mountain passes, and of the nighttime land breeze (offshore), which transports pollutants back toward the Pacific Ocean. On most spring and early summer days, the sea breeze predominates; from late summer through the winter months, the two breezes are matched more equally (VCAPCD, 2003; SCAQMD, 1993).

Unlike the SCCAB and SCAB, the SJVAB is bounded by mountain ranges to the east, south, and west. As a result, the SJVAB's weather conditions include frequent temperature inversions: long, hot summers and stagnant, foggy winters. Each of these patterns is conducive to the formation and retention of air pollutants year-round (SJVAPCD, 2015).

3.3.1.1.2 Attainment Status

The Clean Air Act (CAA) (42 U.S.C. 7401 et. seq.) requires EPA to set National Ambient Air Quality Standards (NAAQS) (40 CFR Part 50) for pollutants considered harmful to public health and the environment. Table 3.3-1 summarizes the NAAQS for the EPA-identified criteria pollutants.

TABLE 3.3-1
National Ambient Air Quality Standards
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Pollutant (Averaging Time)	NAAQS Primary Standard	NAAQS Secondary Standard
Ozone (8 hours)	0.07 ppm	0.07 ppm
Ozone (1 hour)	None	None
CO (8 hours)	9 ppm	None
CO (1 hour)	35 ppm	None
NO_2 (Annual arithmetic mean)	0.053 ppm	0.053 ppm
NO_2 (1 hour)	0.100 ppm	None
SO_2 (Annual arithmetic mean)	0.030 ppm (certain areas)	None
SO_2 (24 hours)	0.14 ppm (certain areas)	None
SO_2 (3 hours)	None	0.5 ppm
SO_2 (1 hour)	0.075 ppm	None
PM_{10} (Annual arithmetic mean)	None	None
PM_{10} (24 hours)	150 µg/m^3	150 µg/m^3
$PM_{2.5}$ (Annual arithmetic mean)	12 µg/m^3	15 µg/m^3
$PM_{2.5}$ (24 hours)	35 µg/m^3	35 µg/m^3
Lead (Calendar quarter)	1.5 µg/m^3	1.5 µg/m^3
Lead (Rolling 3-month Average)	0.15 µg/m^3	0.15 µg/m^3
Lead (30-day Average)	None	None

Source: EPA, 2019b

Notes:
µg/m^3 = microgram(s) per cubic meter
CO = carbon monoxide
NO_2 = nitrogen dioxide
PM_{10} = particulate matter having an aerodynamic equivalent diameter of 10 microns or less
$PM_{2.5}$ = particulate matter having an aerodynamic equivalent diameter of 2.5 microns or less
ppm = part(s) per million
SO_2 = sulfur dioxide

Areas that meet the NAAQS for the criteria pollutants are designated as being “in attainment.” Areas that do not meet the NAAQS for one of the criteria pollutants could be subject to the formal rule-making process, known as the General Conformity Rule, and are designated as being “in nonattainment” for that standard (40 CFR Parts 51 and 93). Areas that currently meet the NAAQS but were previously classified as nonattainment are “in maintenance” for that standard; maintenance areas are also subject to the General Conformity Rule. Table 3.3-2 summarizes the federal attainment status for the counties that potentially would be affected by the Action Alternatives.

TABLE 3.3-2
Federal Attainment Status by Pollutant
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

County	California Air Basin	Ozone	CO	NO_2	SO_2	PM_{10}	$PM_{2.5}$	Lead
Ventura	SCCAB	Serious N	A	A	A	A	A	A
Los Angeles	SCAB	Extreme N	Serious M	A	A	Serious M	Moderate N	A
Kern	SJVAB	Extreme N	M	A	A	Serious M	Moderate N	A

Source: EPA, 2019a
Notes:
A = Attainment
M = Maintenance
N = Nonattainment

Of the counties potentially affected by the Action Alternatives, Ventura, Los Angeles, and Kern Counties are in nonattainment or maintenance for several pollutants, and as a result, the Action Alternatives are subject to review under the General Conformity Rule with regard to those pollutants, as listed in Table 3.3-2. The General Conformity Rule provides *de minimis* threshold values for each criteria pollutant in nonattainment and maintenance areas (40 CFR Parts 51 and 93). These lower thresholds are based on the following nonattainment and maintenance area classifications: Marginal, Moderate, Serious, Severe, or Extreme. Areas that are in attainment should use the EPA's Prevention of Significant Deterioration (PSD) threshold for new major sources (250 tons per year [tpy] of a pollutant) under 40 CFR Sections 51.166 and 52.21. If the annual emissions generated by a project on an area-wide basis (i.e., per air basin) are less than the applicable *de minimis* or PSD values, a General Conformity analysis is not required.

Table 3.3-3 shows the *de minimis* or PSD emission thresholds, as applicable, for each county within the ROI. Lead was not included in this table because it is not emitted by the Action Alternatives and will not be evaluated in this analysis.

TABLE 3.3-3
Applicable De Minimis or PSD Emission Thresholds (tpy) by Pollutant
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

County within the ROI	VOC	CO	NOx	SO_2	PM_{10}	$PM_{2.5}$
Ventura County and area adjacent to SSFL (SCCAB)	50	250	50	250	250	250
Western Los Angeles County (SCAB)	10	100	10	250	70	100
Nearby Disposal Site in Kern County (SJVAB)	10	100	10	250	70	100

Source: EPA, 2019a

Notes:
CO = carbon monoxide
NOx = nitrogen oxides
PM_{10} = particulate matter having an aerodynamic equivalent diameter of 10 microns or less
$PM_{2.5}$ = particulate matter having an aerodynamic equivalent diameter of 2.5 microns or less
PSD = Prevention of Significant Deterioration
ROI = region of influence
SO_2 = sulfur dioxide
tpy = ton(s) per year
VOC = volatile organic compound

Precursors are compounds known to contribute to the formation of established criteria pollutants and are evaluated against the General Conformity *de minimis* threshold values for the criteria pollutants they form. VOCs and nitrogen oxides (NOx) are considered ozone precursors, and sulfur dioxide (SO_2), NOx, and VOCs are considered precursors to particulate matter having an aerodynamic equivalent diameter of 2.5 microns or less ($PM_{2.5}$). For ozone, project NOx and VOC emissions are estimated and compared to the ozone General Conformity *de minimis* threshold value. Because NOx is also a $PM_{2.5}$ precursor, the General Conformity *de minimis* threshold value used for comparison to the project NOx emissions would be the most conservative threshold (the minimum threshold) available. The threshold values presented in Table 3.3-3 take precursors into consideration.

Regional air district significance thresholds may also be considered to determine whether the emissions have a significant effect on the environment according to California Guidelines (Section 15064.7). The significance thresholds for the California counties within the ROI are presented in Table 3.3-4. Because the Action Alternatives have construction-related emission sources, the construction mass daily thresholds are considered appropriate for use, where available.

TABLE 3.3-4
Regional Air District Thresholds (lb/day) by Pollutant
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Air Basin within the ROI	VOC	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
SCCAB (VCAPCD jurisdiction)	25	not applicable	25	not applicable	not applicable	not applicable
SCAB (SCAQMD jurisdiction)	75	550	100	150	150	55
SJVAB (SJVAPCD jurisdiction)	55	548	55	148	82	82

Sources: VCAPCD, 2003; SCAQMD, 2015; SJVAPCD, 2015
Notes:
lb/day = pound(s) per day

3.3.1.1.3 Emissions Inventories

The most recent published emissions inventory data (2015 estimates) for Ventura, Los Angeles, and Kern Counties are summarized as follows:

- In Ventura County, mobile source emissions account for more than 60, 80, and 90 percent of the county’s CO, NOx, and SOx emissions, respectively. Area sources account for more than 80 percent of the county’s particulate emissions. Natural (non-constructed) sources account for more than 40 percent of the county’s VOC emissions (ARB, 2019).
- In Los Angeles County, mobile source emissions account for more than 90, 80, 70, and 40 percent of the county’s CO, NOx, SOx, and VOC emissions, respectively. Area sources account for more than 70 percent of the county’s particulate emissions (ARB, 2019).
- In Kern County, mobile source emissions account for more than 60 percent of the county's CO emissions and 60 percent of the county's NOx emissions. Stationary sources account for more than 80 percent of the county’s SOx emissions and 30 percent of the county’s VOC emissions. Natural sources also account for 30 percent of the county’s VOC emissions. Area sources account for more than 70 percent of the county’s particulate emissions (ARB, 2019).

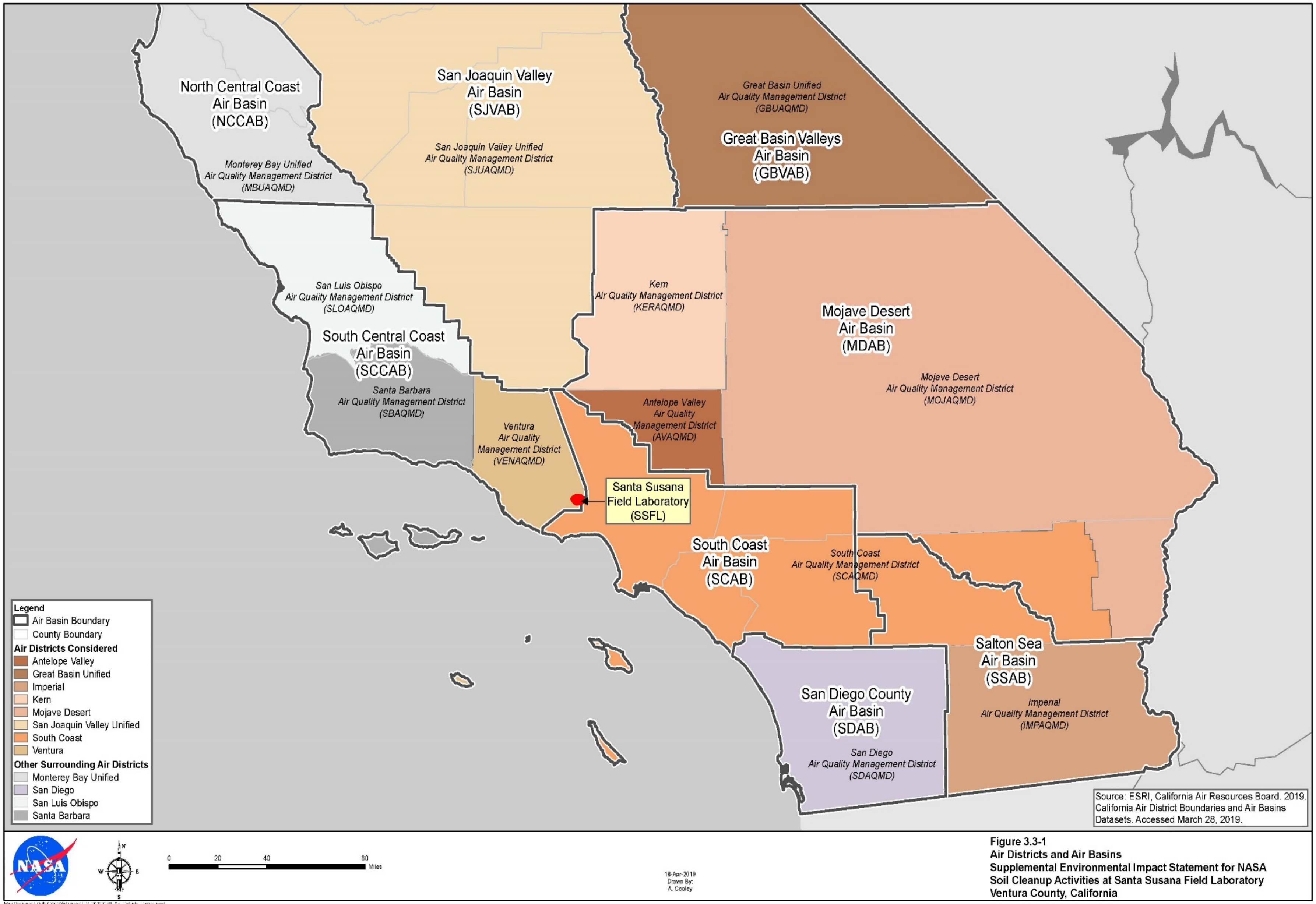

Figure 3.3-1
Air Districts and Air Basins
Supplemental Environmental Impact Statement for NASA
Soil Cleanup Activities at Santa Susana Field Laboratory
Ventura County, California

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3.3.2 Environmental Consequences

This subsection describes the potential impacts to air quality within the ROI. The most impactful soil remediation technologies to air quality were analyzed in this section. A brief explanation of the relevant components of the technologies follows.

- **Excavation and Offsite Disposal:** This treatment technology would impact air quality through the release of criteria pollutant emissions from the onsite excavation equipment and trucks, offsite trucking to landfills, road repairs, and worker commutes. Fugitive dust emissions from excavation, stockpiling, and loading haul trucks would occur as well.
- **Ex Situ Treatment Using Soil Washing:** This treatment would reduce the amount of soil that would be stockpiled and transported by truck to a landfill. Some emissions would be associated with the soil washing equipment; however, these emissions would be less than the emissions associated with transporting an equivalent amount of soil offsite to a landfill.
- **Ex Situ Treatment Using Land Farming:** This treatment would reduce the amount of soil that would be stockpiled and transported by truck to a landfill. Some emissions would be associated with the landfarming equipment; however, these emissions would be less than the emissions associated with transporting an equivalent amount of soil offsite to a landfill.
- **Ex Situ Chemical Oxidation*:*** This treatment would reduce the amount of soil that would be stockpiled and transported by truck to a landfill. Temporary emissions would be associated with constructing a mixing structure and powering equipment by fuel; however, these emissions would be less than the emissions associated with transporting an equivalent amount of soil offsite to a landfill.
- **Ex Situ Treatment Using Thermal Desorption:** This treatment would reduce the amount of soil that would be stockpiled and transported by truck to a landfill. Some emissions would be associated with constructing a temporary thermal desorption chamber and powering equipment by fuel; however, these emissions would be less than the emissions associated with stockpiling and transporting an equivalent amount of soil offsite to a landfill.
- **SVE:** This treatment would reduce the amount of soil that would be stockpiled and transported by truck to a landfill. Some emissions would be associated with constructing SVE wells and powering equipment by fuel; however, these emissions would be less than the emissions associated with stockpiling and transporting an equivalent amount of soil offsite to a landfill.
- **In Situ Chemical Oxidation:** This treatment would reduce the amount of soil that would be stockpiled and transported by truck to a landfill. Some emissions would be associated with constructing injection wells and powering equipment by fuel; however, these emissions would be less than the emissions associated with stockpiling and transporting an equivalent amount of soil offsite to a landfill.
- **In Situ Anaerobic or Aerobic Biological Treatment:** This treatment would reduce the amount of soil that would be stockpiled and transported by truck to a landfill. Temporary emissions would be associated with constructing injection wells and powering equipment by fuel; however, these emissions would be less than the emissions associated with stockpiling and transporting an equivalent amount of soil offsite to a landfill.
- **MNA:** This technology would result in no impacts to air quality.

To obtain an understanding of the greatest potential impact by alternative and to provide decision makers with a comparative analysis by which to make a fully informed decision, it was assumed that excavation and offsite disposal would be the technology applied to most of the site. Consequently, the soil excavation quantities and truck traffic explained in Table 2.2-2 were used to analyze the greatest potential impact as a conservative assumption.

3.3.2.1 Fugitive Dust

PM_{10} and $PM_{2.5}$, or fugitive dust, emitted during excavation activities is likely to be dispersed some distance by winds in the vicinity of SSFL. The 2014 FEIS concluded that fugitive dust emissions from excavation activities generally would be expected to be contained within or near the SSFL property boundary, even considering potential dispersion by winds in the vicinity of SSFL (NASA, 2014a). As described in Section 2.1, soil would be stockpiled temporarily before being transported offsite. The stockpile sites would be graded to a level surface. Stockpiles would be used from the start of excavation activities to the end of material-hauling activities, which would coincide with the total material-hauling duration. Each stockpile would be limited to an area of 0.14 acre, per VCAPCD Rule 74.29 (VCAPCD, 2008). Although not subject to SCAQMD Rule 1157 (SCAQMD, 2006), NASA would adhere to a stockpile height limit of 8 ft, which was used to estimate the number of stockpiles. The size limitations on the stockpiles would help reduce fugitive dust emissions.

3.3.2.2 Valley Fever

Because the environmental cleanup activities will generate fugitive dust emissions, Valley fever also may be a concern. Valley fever is caused by a fungus, *Coocidiodes immitis* or *Coccidioides posadasii*, which is found in arid desert soil. When the soil is disturbed, spores are released into the air and can be carried on the wind. People are exposed when they breathe in the spores. Most people who are exposed do not get sick; however, Valley fever can cause flu-like symptoms and, in rare cases, meningitis and death. The release of dust during remediation and demolition will be controlled by wetting the soil; limiting the stockpiles to an area of 0.14 acre and height of 8 ft; covering the roads with gravel; limiting the speed of vehicles; placing tarps over, or barriers around, stockpiles of soil; and ceasing bulk material loading and removal activities (from trucks) during high winds or storms. After remediation, the previously vegetated areas will be planted with a native seed mix, thereby greatly reducing the potential exposure to spores associated with Valley fever.

3.3.2.3 Potential Emissions

Potential emissions associated with excavation and offsite disposal at the SSFL site are documented in the NASA SSFL FEIS (NASA, 2014a). These emissions have been applied to this analysis using the following assumptions, with results presented in Tables 3.3-5 and 3.3-6:

- These emissions and resulting impacts were estimated assuming a 2-year cleanup period (2016 and 2017) requiring 71 round trips by truck per day for disposal to offsite landfills and to deliver backfill to the site. A transportation agreement was signed in 2015 by NASA, DOE, and Boeing to limit the total trucks entering and leaving the site to 96 for all three parties (NASA, DOE, Boeing, 2015). NASA's portion of the agreement is an annual average of 16 round-trip truckloads per day, with a maximum of 32 trips by truck. These results may be applied to the current analysis by scaling the emissions by 16/71 for annual emissions and 32/71 for peak daily emissions.
- The previous analysis used 2016 and 2017 emissions data and included worker commutes and road repair. Using these emissions in the current analysis would be conservative because emission factors diminish over time, as vehicle emissions are continually reduced by improved technology.
- The previous analysis used the following models or methodology to estimate emissions: *California Emissions Estimator Model (CalEEMod) User's Guide* (Environ International Corporation [Environ], 2013); Sacramento Metropolitan Air Quality Management District's (SMAQMD's) Road Construction Emissions Model (Version 6.3.2) (SMAQMD, 2009); ARB's OFFROAD 2011 (Version 3) model (ARB, 2013a); ARB's EMFAC2011-PL (Version 1.1) model (ARB, 2013b); and URBEMIS2007 for Windows (Jones & Stokes Associates, 2007). Using these emissions in the current analysis would be conservative because newer versions of these models are available, which likely incorporate refined and diminished emission factors more reflective of current conditions.

- Uncontrolled fugitive dust emissions were estimated in the previous analysis. These emissions can be lowered by 73 percent with fugitive dust controls (DOE, 2018). Both uncontrolled and controlled fugitive dust emissions are presented in Tables 3.3-5 and 3.3-6.

TABLE 3.3-5
Criteria Pollutant Annual Average Emissions (tpy)
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

County within the ROI	VOC	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Ventura County and area adjacent to SSFL (SCCAB)	0.4	3.0	4.8	0	248.2 (uncontrolled) 67.2 (controlled)	51.9 (uncontrolled) 14.0 (controlled)
Western Los Angeles County (SCAB)	0.2	1.5	4.9	0	0.5 (uncontrolled) 0.1 (controlled)	0.2 (uncontrolled) 0.1 (controlled)
Disposal Site in Kern County (SJVAB)	0.1	0.7	3.0	0	0.1 (uncontrolled) 0 (controlled)	0.1 (uncontrolled) 0 (controlled)

Notes:
NASA 2014 emission estimates were scaled for the results used in the table.

TABLE 3.3-6
Criteria Pollutant Peak Daily Emissions (lb/day)
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Air Basin within the ROI	VOC	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
SCCAB (VCAPCD jurisdiction)	6.8	48.2	**76.6**	0	3,982.4 (uncontrolled) 1,075.3 (controlled)	831.1 (uncontrolled) 224.4 (controlled)
SCAB (SCAQMD jurisdiction)	3.6	24.3	78.9	0.5	7.7 (uncontrolled) 2.1 (controlled)	3.2 (uncontrolled) 0.9 (controlled)
SJVAB (SJVAPCD jurisdiction)	1.8	11.3	47.3	0	2.3 (uncontrolled) 0.6 (controlled)	1.4 (uncontrolled) 0.4 (controlled)

Notes:
NASA 2014 emissions estimates were scaled to estimate the results used in the table.
Bold shows an exceedance.

3.3.2.4 Impact Analysis

Table 3.3-7 identifies the impact thresholds for air quality.

TABLE 3.3-7
Impact Thresholds for Air Quality
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Impact	Description
No Impact	No impacts to air quality would be expected.
Negligible	Impacts to air quality would not be detectable and would not alter air quality conditions.
Minor	Impacts would result in a measurable change to air quality, but the change would be small, localized, and of little consequence.
Moderate	Impacts would result in a measurable and consequential change to air quality; however, impacts could be compensated for with mitigation such that the impact would not be substantial.
Significant	Impacts would result in an extreme change to air quality; the change would result in an exceedance of an air quality standard.
Quality:	Beneficial–would have a positive effect Negative–would have an adverse effect
Duration:	Temporary–would occur only during the remediation period, even if remediation took years. Permanent–would continue beyond the remediation period.

3.3.2.5 Alternative A: AOC Cleanup

Under Alternative A, up to 870,000 yd^3 of contaminated soil would be excavated over more than 25 years. This would require an average of 16 round-trip truckloads each working day to transport the soil to the representative landfills. The annual average emissions from this material loading and truck hauling (Table 3.3-5) does not exceed General Conformity *de minimis* and PSD threshold values (Table 3.3-3). However, the peak daily emissions from a maximum of 32 round-trip truckloads per day (Table 3.3-6) would exceed the regional air district significance thresholds for NOx (Table 3.3-4).

Fugitive dust emissions would be controlled by measures prescribed by VCAPCD Rule 55 and Rule 74.29. The relevant measures available to reduce both onsite and offsite fugitive dust emissions are summarized in the following bullets. Implementation of these measures would be described further in the Dust Control Plan.

- **Unpaved Roads:** Cover road with a low silt content material such as recycled road base or gravel to a minimum of 4 inches or reduce speed to 15 miles per hour (mph); restrict public access to cleanup areas; and treat with water, mulch, or a non-toxic chemical dust suppressant that complies with the applicable air and water quality government standards. It is expected that reduced vehicle speeds could reduce fugitive dust emissions by up to 57 percent, whereas application of water or non-toxic dust suppressants could reduce fugitive dust emissions by up to 55 and 84 percent, respectively (Countess Environmental, 2006).
- **Stockpiles:** Enclose material in a three- or four-sided barrier equal to the height of the material; apply water at a sufficient quantity and frequency to prevent wind-driven dust; apply a non-toxic dust suppressant that complies with the applicable air and water quality government standards; or install and anchor tarps, plastic, or other material. It is expected that enclosing the material could reduce fugitive dust emissions by up to 75 percent, whereas application of water or non-toxic dust suppressants could reduce fugitive dust emissions by up to 90 percent (Countess Environmental, 2006).

- **Material Loading:** Load materials carefully to minimize the potential for spills or dust creation. Implement water spraying as needed to suppress potential dust generation during loading operations. Take care to apply dust suppression water to the top of the load or source material to avoid wetting the truck tires. Do not perform loading during unfavorable weather conditions, such as high winds or storms. Material spilled during loading would be collected for subsequent loading. After loading, trucks would pass through the decontamination and inspection station before weighing and departure from SSFL. Decontaminate trucks by dry brushing before they leave the staging and loading areas to prevent track out. Collect materials from the truck decontamination and haul out with the last load of soil. It is expected that application of water during loading operations could reduce fugitive dust emissions by up to 69 percent, whereas ceasing loading operations during unfavorable weather conditions could reduce fugitive dust emissions by up to 98 percent (Countess Environmental, 2006). Fugitive dust emissions after loading would be addressed through the paved road measures described in the following text.
- **Material Hauling:** Use properly secured tarps that cover the entire surface area of the load or use a container-type enclosure, maintain a minimum of 6 inches of freeboard, or water or otherwise treat bulk materials to minimize the loss of material to wind or spillage. It is expected that using secured tarps and maintaining 6 inches of freeboard could reduce fugitive dust emissions by up to 91 percent, whereas watering bulk materials could reduce fugitive dust emissions by up to 69 percent (SCAQMD, 2007). Fugitive dust emissions during offsite material hauling would be further minimized by the paved road measures described in the following bullet.
- **Paved Roads:** Install a pad near the SSFL exit consisting of washed gravel to a depth of at least 6 inches, extending at least 30 ft wide and 50 ft long; pave the surface near the SSFL exit at least 100 ft long and 20 ft wide; use a rumble grate to remove bulk material from tires and vehicle undercarriages before vehicles exit SSFL; or install and use a wheel washing system to remove bulk material from tires and vehicle undercarriages before vehicles exit SSFL. It is expected that installation of a pad or paved surface could reduce fugitive dust emissions by up to 46 percent, whereas installation of a rumble grate or wheel washing system could reduce fugitive dust emissions by up to 80 percent (Countess Environmental, 2006).
- **Soil Aeration:** Use a certified organic vapor analyzer at least once every 15 minutes during excavation and grading activities to confirm the aeration of contaminated soil is minimized or prevented. Records must be kept throughout the environmental cleanup period, consistent with VCAPCD Rule 74.29 **(Air Quality Mitigation Measure-1)**.

The project will also comply with the applicable equipment and vehicle regulations enforced by ARB and/or VCAPCD. All construction and excavation equipment, such as compressor engines, generator engines, screens, crushers, conveyors, lighting, and drilling rigs, shall be registered with ARB's Portable Equipment Registration Program (PERP). In some cases, the equipment may not meet the applicability requirements of PERP, such as function and time at facility; instead, NASA would obtain a VCAPCD air permit. Equipment such as backhoes, bulldozers, front-end loaders, and dump trucks may not require PERP registration or a VCAPCD air permit but must comply with ARB's Diesel Off-Road Online Reporting System Program and Regulation for In-Use Off-Road Diesel Fueled Fleets (17 California Code of Regulations 2449). If a VCAPCD air permit is applied for, the permit application shall comply with the best available control technology and emission offset requirements of VCAPCD Rule 26.2 (VCAPCD, 2006). The air permit application shall also demonstrate compliance with VCAPCD Rules 33, 35, and 76, as applicable (VCAPCD, 2011a, 2011b, 2011c) **(Air Quality Mitigation Measure-2)**.

NASA could purchase NOx offsets for the affected air basins **(Air Quality BMP-1)**. The quantity of NOx offsets purchased by NASA would equal the quantity by which the regional air district significance thresholds are exceeded, as shown in Table 3.3-6. With this commitment to conform, the potential emissions from the excavation and offsite disposal technology would be below the corresponding regional air district significance thresholds.

To the extent feasible, NASA would consider using newer model-year haul trucks or alternative-fueled construction equipment, which would have a co-benefit of reducing criteria pollutant emissions associated with material hauling and construction equipment **(Air Quality BMP-2)**.

NASA, DOE, and Boeing evaluated baseline air quality at SSFL in 2017 and will continue air quality monitoring throughout remediation activities (NASA, Boeing, and DOE, 2017) **(Air Quality BMP-3)**.

Exposed soil is susceptible to creating fugitive dust; thus, revegetation would be the preferred method to reduce fugitive dust emissions, as explained in Section 3.2, *Biology* **(Biology BMP-1)**.

While the unmitigated impacts associated with the soil remediation activities could result in an exceedance in established NAAQS and regional requirements, the commitments described previously should keep the emissions associated with the Proposed Action below the established *de minimis* and PSD thresholds (Table 3.3-3). Consequently, the air quality impacts associated with the Proposed Action are expected to be **moderate, negative, and temporary (25+ years) (Air Quality Impact-1).**

3.3.2.6 Alternative B: Revised LUT Levels Cleanup

Under Alternative B, up to 384,000 yd^3 of soil would be excavated and transported offsite over approximately 12 years. The annual average emissions for Alternative B would be the same as those described for Alternative A; consequently, **moderate, negative, and temporary (12 years) impacts (Air Quality Impact-1)** would be expected. However, the period of time for the emissions would be 13 years shorter than under Alternative A. NASA would implement the same mitigation measures described for Alternative A.

3.3.2.7 Alternative C: Suburban Residential Cleanup

Under Alternative C, up to 247,000 yd^3 of soil would be excavated and transported offsite over approximately 8 years. The annual average emissions for Alternative C would be the same as those described for Alternative A; consequently, **moderate, negative, and temporary (8 years) impacts (Air Quality Impact-1)** would be expected. However, the period of time for the emissions would be 17 years shorter than under Alternative A. NASA would implement the same mitigation measures described for Alternative A.

3.3.2.8 Alternative D: Recreational Cleanup

Under Alternative D, up to 176,500 yd^3 of soil would be excavated and transported offsite over approximately 6 years. The annual average emissions for Alternative D would be the same as those described for Alternative A; consequently, **moderate, negative, and temporary (6 years) impacts (Air Quality Impact-1)** would be expected. However, the period of time for the emissions would be 19 years shorter than under Alternative A. NASA would implement the same mitigation measures described for Alternative A.

3.3.2.9 No Action Alternative

Under the No Action Alternative, emissions resulting from proposed soil cleanup activities onsite and the corresponding truck traffic along the haul routes would not occur. The current emissions would remain the same, which includes ongoing activities at SSFL, some of which include construction and haul trucks. As a result, air quality impacts under the No Action Alterative would be considered **minor, negative, and permanent (Air Quality Impact-1)**.

3.3.3 Best Management Practices and Mitigation Measures

This subsection provides a brief description of the mitigation measures and BMPs identified previously:

- **Air Quality Mitigation Measure-1** (All Action Alternatives): NASA will prepare and implement a dust control plan for the excavation and construction activities at SSFL.
- **Air Quality Mitigation Measure-2** (All Action Alternatives): NASA will comply with all applicable equipment and vehicle regulations and obtain necessary air permits.

- **Air Quality BMP-1** (All Action Alternatives): NASA will purchase NOx offsets for affected air basins.
- **Air Quality BMP-2** (All Action Alternatives): NASA will consider using new model-year haul trucks or alternative-fueled construction equipment.
- **Air Quality BMP-3** (All Action Alternatives): NASA will continue air quality monitoring throughout remediation activities.

3.3.4 Summary of Impacts

Table 3.3-8 provides a summary of the air quality impacts under each Action Alternative. These impacts are conservative because it was assumed the most impactful soil technology (Excavation and Offsite Disposal) would be used throughout the site.

TABLE 3.3-8
Summary of Air Quality Impacts
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Impacts	Alternative A AOC Cleanup	Alternative B Revised LUT Levels Cleanup	Alternative C Suburban Residential Cleanup	Alternative D Recreational Cleanup	No Action Alternative
Air Quality Impact-1: Criteria pollutant emissions for excavation and vehicle trips	Moderate, negative, and temporary (25+ years)	Moderate, negative, and temporary (12 years)	Moderate, negative, and temporary (8 years)	Moderate, negative, and temporary (6 years)	Minor, negative, and permanent

3.4 Water Resources

This subsection describes the water resources at the NASA-administered areas of SSFL, including surface water, groundwater, and water supply. The ROI for surface water resources includes SSFL and connected watersheds, specifically the Los Angeles River and Calleguas Creek watersheds (Figure 3.4-1). The ROI for groundwater resources includes the saturated subsurface underneath the SSFL property to a depth where the groundwater becomes saline. The ROI for water supply includes the service area for the Calleguas Municipal Water District. Erosion and sedimentation are discussed in Section 3.5, *Geology*; wetlands are discussed in Section 3.2, *Biology*.

3.4.1 Affected Environment

3.4.1.1 Surface Water

Within the NASA-administered portion of SSFL, the primary surface water bodies are the R-2 Ponds, which are permanent surface water bodies actively used as part of the stormwater detention system. Other surface water bodies within the ROI are limited to ponds that formerly supported rocket engine testing operations. These ponds are no longer a part of NASA operations, but they collect natural and artificial flows generated from throughout the ROI.

Most surface water that collects in, and drains from, the ROI is intermittent and is conveyed offsite via one of two drainages (USGS, 2018a). Figure 3.4-1 shows the drainage patterns related to the Northern Drainage and the Southwestern Drainage. Most of the surface water from the NASA-administered portion of SSFL originates in the larger Southwestern Drainage, which is part of the Los Angeles River watershed. The Northern Drainage is part of the Calleguas Creek watershed, with unnamed surface water features that discharge into Arroyo Simi, within the incorporated Simi Valley city limits.

Beneficial uses of water (water that meets State water quality standards) are not being met in the Los Angeles River (Southwestern Drainage) or Calleguas Creek (Northern Drainage) or their tributaries. Because the water in these features is not meeting State water quality standards, they are listed as impaired pursuant to the federal CWA (Section 303(d)) of the 1972 Federal Water Pollution Control Act. In response to the 303(d) listings, total maximum daily loads have been developed for a number of stressors listed for both the Los Angeles River and Calleguas Creek watersheds.

Stormwater traversing SSFL has contained elevated concentrations of contaminants as a result of past operations at the site. Because stormwater is also an active vehicle for transporting contamination in sediment, it is a focus of environmental management and has been a focus of source-specific soil remedial actions. The discharge of stormwater runoff is subject to the NPDES permit effluent limitations, discharge specifications, and benchmarks. Constituent concentrations are monitored and measured in accordance with the NPDES Permit Monitoring and Reporting Program. Discharges from SSFL are regulated under NPDES Permit No. CA0001309, issued to Boeing by the Los Angeles RWQCB. Monitoring data from 2006 to 2018 indicate violations for a number of constituents (Boeing, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015a, 2015b, 2015c, 2016a, 2016b, 2016c, 2016d, 2016e, 2017b, 2017c, 2017d, 2017e, 2018a, 2018b, 2018c).

3.4.1.2 Groundwater

Groundwater beneath SSFL is divided into the following two categories (MWH, 2003):

- **Near-surface Groundwater (NSGW)** – Groundwater that occurs within the alluvium and weathered bedrock. The site soil and NSGW are referred to as the Surficial Media Operable Unit.
- **Chatsworth Formation Groundwater (CFGW)** – Groundwater that occurs in the competent bedrock aquifer and is deeper than the NSGW. This is also referred to as the CFOU at SSFL.

NASA has conducted groundwater sampling on its portion of SSFL for more than 25 years and the results indicate that VOCs, SVOCs, and metals are present in the NSGW and CFGW (NASA, 2017b). The cleanup of existing groundwater contamination was the subject of the 2014 FEIS and a detailed analysis of the impacts associated with groundwater cleanup is included in that document (NASA, 2014a). NASA issued a ROD for groundwater cleanup in 2018 (NASA, 2018b) based on the 2014 FEIS, and groundwater cleanup activities have commenced per the agreements made in the AOC. Potential groundwater remedial actions are discussed in the NASA Groundwater Corrective Measures Study (NASA, 2018a).

3.4.1.3 Water Supply

Water at SSFL is provided by Ventura County Waterworks District 17. The District imports 100 percent of its water from the California State Water Project through the Metropolitan Water District of Southern California, Calleguas Municipal Water District, and Ventura County Waterworks District No. 8 (city of Simi Valley) (Ventura County, 2018).

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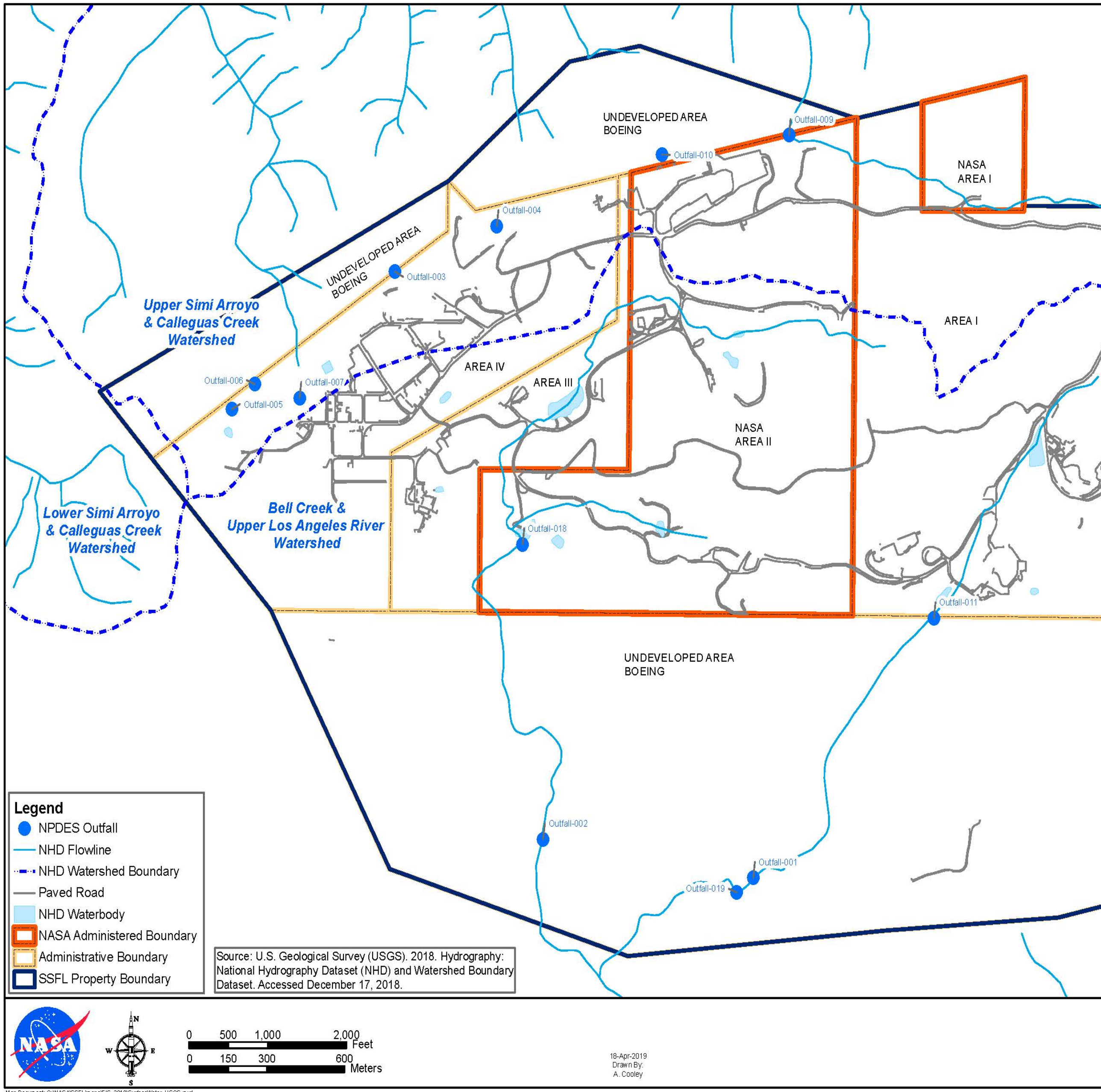

Figure 3.4-1
Surface Water Map
Supplemental Environmental Impact Statement for NASA
Soil Cleanup Activities at Santa Susana Field Laboratory
Ventura County, California

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3.4.2 Environmental Consequences

This subsection includes the summaries of the impact analysis to site water resources under the Action Alternatives and the No Action Alternative. Potential impacts to water resources resulting from the proposed remedial activities generally would include changes to surface water and/or groundwater hydrology, effects on water quality, and effects on water supply.

Soil remediation technologies with the most impacts to water resources were analyzed in this section. The following descriptions provide a brief explanation of the relevant components of the technologies:

- **Excavation and Offsite Disposal:** During remediation activities, this technology would affect surface water by increasing the potential for erosion and sediment transportation from excavation. Additional water would be needed for dust suppression during excavation activities, soil stockpiling, and compaction of backfill. Backfilled areas would be sloped to minimize ponding and would be revegetated; however, the soil function (e.g., filtering) would be permanently altered. Soil excavation also would affect site drainage conditions, thereby creating new ponded areas that would increase infiltration, decrease runoff, and increase discharges from existing seeps[2].
- **Ex Situ Treatment Using Soil Washing:** During remediation activities, this treatment technology would require water to create a slurry and would create wastewater requiring disposal. The addition of this technology to excavation and offsite disposal would increase the availability of soil for backfilling and result in the creation of fewer ponded areas after remediation.
- **Ex Situ Treatment Using Land Farming:** During remediation activities, this treatment technology would require water for the biological reaction. This treatment technology would reduce the amount of surface water runoff and groundwater infiltration because the excavated soil would be placed on polyethylene plastic sheeting. The sheeting would be placed on flat areas and runoff from rainfall would be contained and evaporate; however, this would be a relatively small amount of area compared to the total excavation area. The addition of this technology to excavation and offsite disposal would increase the availability of soil for backfilling and result in the creation of fewer ponded areas after remediation.
- **Ex situ Chemical Oxidation:** During remediation activities, this treatment technology would reduce the amount of surface water runoff and groundwater infiltration because the excavated soil would be placed on polyethylene plastic sheeting. The sheeting would be placed on flat areas and runoff from rainfall would be contained and evaporate; however, this would be a relatively small amount of area compared to the total excavation area. The addition of this technology to excavation and offsite disposal would increase the availability of soil for backfilling and result in the creation of fewer ponded areas after remediation.
- **Ex situ Treatment Using Thermal Desorption:** During remediation activities, this treatment technology would reduce the amount of surface water runoff and groundwater infiltration because the excavated soil would be placed on polyethylene plastic sheeting. The sheeting would be placed on flat areas and runoff from rainfall would be contained and evaporate; however, this would be a relatively small amount of area compared to the total excavation area. The addition of this technology to excavation and offsite disposal would increase the availability of soil for backfilling and result in the creation of fewer ponded areas after remediation.
- **SVE:** During remediation activities, this treatment technology would not affect water resources. The addition of this technology to excavation and offsite disposal would increase the availability of soil for backfilling and result in the creation of fewer ponded areas after remediation.

[2] A seep is a moist or wet place where water, usually groundwater, reaches the earth's surface from an underground aquifer. Seeps are usually not of sufficient volume to flow beyond their aboveground location.

- **In Situ Chemical Oxidation:** During remediation activities, this treatment technology would not affect water resources. Chemicals used in this treatment technology would be selected to minimize effects to water resources, and the majority of chemicals used for remediation would be consumed during oxidation. The addition of this technology to excavation and offsite disposal would increase the availability of soil for backfilling and result in the creation of fewer ponded areas after remediation.
- **In Situ Anaerobic or Aerobic Biological Treatment:** During remediation activities, this treatment technology would require water for the biological reaction. The addition of this technology to excavation and offsite disposal would increase the availability of soil for backfilling and result in the creation of fewer ponded areas after remediation.
- **MNA:** This technology would result in no impacts to water resources.

To obtain an understanding of the greatest potential impact by alternative and to provide decision makers with a comparative analysis by which to make a fully informed decision, it was assumed that excavation and offsite disposal would be the technology applied to the majority of the site. Consequently, the soil excavation quantities and truck traffic explained in Table 2.2-2 were used to analyze the greatest potential impact as a conservative assumption.

Table 3.4-1 identifies the impacts thresholds for water resources.

TABLE 3.4-1
Impact Thresholds for Water Resources
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Impact	Description
No Impact	No impacts to water resources would be expected.
Negligible	Impacts to water resources would not be detectable and would not alter water resources conditions.
Minor	Impacts to water resources would be within historical hydrologic or desired water quality conditions.
Moderate	Impacts to water resources would appreciably alter resource conditions. Historical baseline or desired water quality conditions would be altered temporally.
Significant	Impacts would alter the long-term water resources from the historical hydrologic baseline or desired water quality conditions or water supply.
Quality:	Beneficial–would have a positive effect Negative–would have an adverse effect
Duration:	Temporary–would occur only during the remediation period, even if the remediation took years. Permanent–would continue beyond the remediation period.

3.4.2.1 Alternative A: AOC Cleanup

This subsection discusses the potential effects of Alternative A soil cleanup activities on water resources.

3.4.2.1.1 Surface Water

Up to 870,000 yd^3 of excavated soil from within the NASA-administered portion of SSFL would be transported offsite under Alternative A. Excavation would affect approximately 220 acres of the NASA-administered area. Even with the replacement of excavated soil with fill, excavation of soil would alter site drainage conditions and potentially create new ponded areas. Although surface flow would be decreased, the additional infiltration would increase discharges from existing seeps, thereby increasing surface flow downstream of the seeps. A portion of the increased infiltration, however, would be lost to deep percolation, resulting in an overall net decrease in surface flow. Furthermore, the soil function (e.g., filtering) would be greatly affected by removal of this quantity of soil. The filtering function offered by plants and soil chemistry would be altered at the site, and while this function may return to some degree after the reestablishment of vegetation, it is highly unlikely the existing conditions would ever be the same. The overall effect to site hydrology would be considered a **significant, negative, and permanent impact** (**Water Impact-1**).

Stormwater runoff has the potential to increase soil transport away from the excavation site into surface waters. Local and offsite drainages could be affected negatively by these sedimentation and contamination impacts. Generally, as an area of disturbed soil increases, the potential for sediment transport and surface water contamination increases. Additionally, staging and stockpiling soil would have some impact through runoff during the wet season, though measures would be implemented to mitigate this occurrence. The potential for surface water sedimentation and contamination impacts from the excavation phase would be a **moderate, negative, and temporary (25+ years) impact** (**Water Impact-2**).

Site activities would take place in accordance with the statewide General Permit for Stormwater Discharges Associated with Construction Activity (Order No. 2009-0009-DWQ, updated January 23, 2013, as amended by 2010-0014-DWQ and 2012-0006-DWQ [NPDES No. CAS000002]). NASA would prepare a Stormwater Pollution Prevention Plan (SWPPP) that specifies site management activities to manage stormwater runoff and minimize erosion during remediation and post-remediation. These management activities would include stormwater BMPs, such as silt fences, sand bags, straw waddles, and tire washes; dewatering runoff controls; containment for chemical storage areas; and construction equipment decontamination. NASA also would continue to monitor offsite drainages for increased sediment load and contamination. The SWPPP would include the protocol for proper storage and use of hazardous materials, as well as spill response procedures (**Water Mitigation-1)**.

Groundwater

Soil excavation and offsite disposal could result in the accidental release of hazardous materials, such as diesel fuel, from construction equipment. However, the mitigations discussed in Section 3.6, *Hazardous and Nonhazardous Materials and Waste*, would lessen the effect of these accidental spills. The resulting impact to groundwater would be **minor, negative, and temporary (25+ years)** (**Water Impact-3**).

In the long term, soil cleanup levels likely would reduce groundwater contaminant concentrations, both within the CFOU and the soil, because lower soil concentrations would be susceptible to leaching. Contaminant flux from the plume could decrease gradually to background concentrations through the action of natural processes (adsorption, geochemical degradation, and dispersion), as fresh groundwater is introduced to the plume area from recharge areas and the contaminant mass in the groundwater is depleted. Impacts would be considered **moderate, beneficial, and permanent** (**Water Impact-4**).

Water Supply

Dust control, soil compaction, and treatment water demand during excavation and offsite disposal may require an additional 185 acre feet of water for each of the approximately 25 years, which is approximately 0.15 percent of Calleguas Municipal Water District’s projected 2020 water supply. Impact of increased water use would be considered **minor, negative, and temporary (25+ years)** (**Water Impact-5**).

3.4.2.2 Alternative B: Revised LUT Levels Cleanup

This subsection discusses the potential effects of Alternative B soil cleanup activities on water resources.

3.4.2.2.1 Surface Water

Up to 384,000 yd^3 of excavated soil from within the NASA-administered portion of SSFL would be transported offsite under Alternative B. Excavation would affect approximately 78 acres of the NASA-administered area. The overall net decrease in surface flow and soil function from this amount of excavation would be considered a **moderate, negative, and permanent impact** (**Water Impact-1**).

Stormwater runoff has the potential to increase soil transport away from the excavation site into surface water in a manner similar to that described for Alternative A. However, as the area of disturbed soil decreases, the potential for sediment transport and surface water contamination also decreases. Nonetheless, the potential for surface water sedimentation and contamination impacts under Alternative B would remain **moderate, negative, and temporary (12 years)** (**Water Impact-2**), because water quality conditions would be noticeably altered. NASA would also implement **Water Mitigation-1** under Alternative B.

Groundwater

The potential for groundwater contamination under Alternative B would be similar to the impacts described for Alternative A. Consequently, a **minor, negative, and temporary (12 years) impact** (**Water Impact-3**) would be expected.

In the long term, soil cleanup levels likely would reduce groundwater contaminant concentrations, resulting in a **moderate, beneficial, and permanent impact** (**Water Impact-4**).

Water Supply

The annual water supply requirements for Alternative B would be similar to those described for Alternative A, though the number of years of water usage would be greatly reduced. The impact of increased water use would be considered **minor, negative, and temporary (12 years)** (**Water Impact-5**).

3.4.2.3 Alternative C: Suburban Residential Cleanup

This subsection discusses the potential effects of Alternative C soil cleanup activities on water resources.

3.4.2.3.1 Surface Water

Up to 247,000 yd^3 of excavated soil from within the NASA-administered portion of SSFL would be transported offsite under Alternative C. Excavation would affect approximately 36 acres of the NASA-administered area. The overall net decrease in surface flow and soil function from this amount of excavation would be a **minor, negative, and permanent impact** (**Water Impact-1**).

The potential for surface water sedimentation and contamination impacts during the excavation phase of Alternative C would be similar to the impacts described for Alternative A and would remain a **moderate, negative, and temporary (8 years) impact** (**Water Impact-2**). NASA would also implement **Water Mitigation-1** under Alternative C.

Groundwater

The potential for groundwater contamination under Alternative C would be similar to the impacts described for Alternative A. Consequently, **minor, negative, and temporary (8 years) impacts** (**Water Impact-3**) would be expected.

In the long term, soil cleanup levels likely would reduce groundwater contaminant concentrations, resulting in a **moderate, beneficial, permanent effect** (**Water Impact-4**).

Water Supply

The annual water supply requirements for Alternative C would be similar to those described for Alternative A, though the number of years of water usage would be greatly reduced. The impact of increased water use would be considered **minor, negative, temporary (8 years)** (**Water Impact-5**).

3.4.2.4 Alternative D: Recreational Cleanup

This subsection discusses the potential effects of Alternative D soil cleanup activities on water resources.

3.4.2.4.1 Surface Water

Up to 176,500 yd^3 of excavated soil from within the NASA-administered portion of SSFL would be transported offsite under Alternative D. Excavation would affect approximately 26 acres of the NASA-administered area. Similar to Alternative A, the likely outcome of this significant excavation would be to create new ponded areas and alter the current drainage pattern. However, given the reduced acreage of potential excavation, the overall net decrease in surface flow would be a **minor, negative, permanent impact** (**Water Impact-1**).

The potential for surface water sedimentation and contamination impacts during the excavation phase of Alternative D would be similar to those under Alternative A and would remain **moderate, negative, and temporary (6 years)** (**Water Impact-2**). NASA would also implement **Water Mitigation-1** under Alternative D.

Groundwater

The potential for groundwater contamination under Alternative D would be similar to the impacts described for Alternative A. Consequently, **minor, negative, and temporary (6 years) impacts** (**Water Impact-3**) would be expected.

In the long term, soil cleanup levels likely would reduce groundwater contaminant concentrations, resulting in a **moderate, beneficial, and permanent effect** (**Water Impact-4**).

Water Supply

The annual water supply requirements for Alternative D would be the same as those described for Alternative A, though the number of years of water usage would be greatly reduced. The impact of increased water use would be considered a **minor, negative, temporary (6 years) impact** (**Water Impact-5**).

3.4.2.5 No Action Alternative

Under the No Action Alternative, ongoing groundwater and surface water sampling and restoration activities at the site would continue, but soil cleanup activities would not occur. This impact on surface and groundwater quality would be considered **moderate, negative, and permanent** (**Water Impact-4**). There would be **no impacts** to other water resources **(Water Impact-1, Impact-2, Impact-3, Impact-5)**.

3.4.3 Mitigation Measures

This subsection provides a brief description of the mitigation measure, previously discussed in detail.

- **Water Mitigation-1** (All Action Alternatives): NASA will prepare and implement a SWPPP and appropriate BMPs for the excavation and construction activities at SSFL.

3.4.4 Summary of Impacts

Table 3.4-2 provides a summary of the impacts on water resources, as described in this subsection.

TABLE 3.4-2
Summary of Water Resources Impacts
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Impacts	Alternative A AOC Cleanup	Alternative B Revised LUT Levels Cleanup	Alternative C Suburban Residential Cleanup	Alternative D Recreational Cleanup	No Action Alternative
Water Impact-1: Effects to existing surface water flows	Significant, negative, and permanent	Moderate, negative, and permanent	Minor, negative, and permanent	Minor, negative, and permanent	No Impact
Water Impact-2: Effects on surface water quality	Moderate, negative, and temporary (25+ years)	Moderate, negative, and temporary (12 years)	Moderate, negative, and temporary (8 years)	Moderate, negative, and temporary (6 years)	No Impact
Water Impact-3: Effects of remediation activities on groundwater quality	Minor, negative, and temporary (25+ years)	Minor, negative, and temporary (12 years)	Minor, negative, and temporary (8 years)	Minor, negative, and temporary (6 years)	No Impact
Water Impact-4: Effects on groundwater quality	Moderate, beneficial, and permanent	Moderate, beneficial, and permanent	Moderate, beneficial, and permanent	Moderate, beneficial, and permanent	Moderate, negative, and permanent
Water Impact-5: Effects to water supply	Minor, negative, and temporary (25+ years)	Minor, negative, and temporary (12 years)	Minor, negative, and temporary (8 years)	Minor, negative, and temporary (6 years)	No Impact

3.5 Geology

This subsection describes the geology at the NASA-administered areas of SSFL, including soils, topography, landslide potential, and paleontological resources. The ROI for geology is the NASA-administered areas of SSFL.

3.5.1 Affected Environment

SSFL lies within the Transverse Ranges, an area dominated by mountain ranges and valleys running east-west. Marine sedimentary rocks dominate the ROI (MWH, 2009). These sedimentary rocks have been uplifted and rotated by extensive faults in the region over the past several million years, and these processes continue today (Nicholson et al., 1994). The shallow bedrock is often weathered as a result of natural physical, biological, and chemical processes, and in places, a thin layer of soil has formed. The geologic unit underlying the NASA-administered areas of SSFL is the upper Cretaceous Chatsworth Formation, which consists of sandstone with interbedded shale, siltstone, and conglomerate (MWH, 2009). The geologic units generally dip towards the northwest at the site. The sandstone strata are generally resistant to erosion, while the finer-grained siltstones and shales are more susceptible to weathering processes. The geological features of SSFL are shown on Figure 3.5-1.

3.5.1.1 Soils

Available information on soil potentially affected in various areas of the ROI was compiled through previous soil investigations of the site, as well as from the National Resources Conservation Service (NRCS) online database (NRCS, n.d.). As shown on Figure 3.5-2, the predominant soil types in the ROI include sedimentary rock land, gaviota rock sandy loam (15 to 50 percent slopes), and saugus sandy loam (5 to 30 percent slopes).

3.5.1.1.1 Sedimentary Rock Land

Sedimentary rock covers 64 percent of the NASA-administered area of SSFL. Sedimentary rock land consists of weathered and unweathered bedrock with slopes from 30 to 75 percent. Sedimentary rock does not have an erosion potential (NRCS, 2019).

3.5.1.1.2 Gaviota rock sandy loam

This soil covers 16 percent of the NASA-administered area of SSFL. Graviota soil consists of very shallow or shallow, well-drained soil that formed in material weathered from hard sandstone or meta-sandstone. Gaviota soil is on hills and mountains and has slopes from 2 to 100 percent. The erosion potential is low (NRCS, 2019).

3.5.1.1.3 Saugus Sandy Loam

This soil covers 20 percent of the NASA-administered area of SSFL. Saugus Sandy Loam consists of deep, well-drained soil that formed from weakly consolidated sediments. Saugus soil is on dissected terraces and foothills and has slopes from 9 to 50 percent. The erosion potential is moderate (NRCS, 2019).

3.5.1.2 Topography

SSFL occupies approximately 2,850 acres of hilly terrain that expresses approximately 1,100 ft of topographic relief near the crest of the Simi Hills as shown on Figure 3.5-3. The highest surface elevation at SSFL occurs in the center of the site at an approximate elevation of 2,100 to 2,200 ft above mean sea level (msl). The lowest elevation occurs in the southeastern area of SSFL at an approximate elevation of 1,300 to 1,400 ft msl.

3.5.1.3 Landslide Potential

Landslides, or sudden slope failures, are known hazards in the region (State of California, 1998). Landslides can be triggered by a number of causes, such as earthquakes, heavy rain, or increased loads (for example, increased traffic on nonpaved roads). No landslides are known to have occurred within SSFL since development began, and the Chatsworth Formation is not known to be highly susceptible to landslides (Parise and Jibson, 2000).

SSFL is in an area that is seismically active and small portions of the NASA-administered property have been identified as within the Earthquake-Induced Landslide Zones (State of California, 1998), as shown on Figure 3.5-4. These zones coincide with areas of steeper topology.

Following the Woolsey Canyon Fire, the USGS determined that the SSFL has a 0 to 20 percent likelihood of a landslide in response to a rainstorm with a peak 15-minute rainfall intensity of 24 millimeters per hour (USGS, 2018b).

3.5.1.4 Paleontological Resources

Paleontological resources include fossils or the remains of ancient plants and animals and are considered non-renewable scientific resources. Numerous paleontological studies have been conducted for the SSFL site. The Santa Susana Field Laboratory Paleontological Resources Assessment (NASA, 2011c) provides an analysis of the potential impacts to paleontological resources. It was concluded that the upper portion of the Chatsworth Formation, which underlays SSFL, is considered to possess low paleontological sensitivity. It was concluded in a paleontological resources assessment for Boeing Administrative Areas I, III, and Southern Undeveloped Land that the upper member of the Chatsworth Formation is not known to contain significant fossils and has low-to-moderate paleontological sensitivity (Minch, 2014). For this reason, paleontology is not analyzed further in this SEIS.

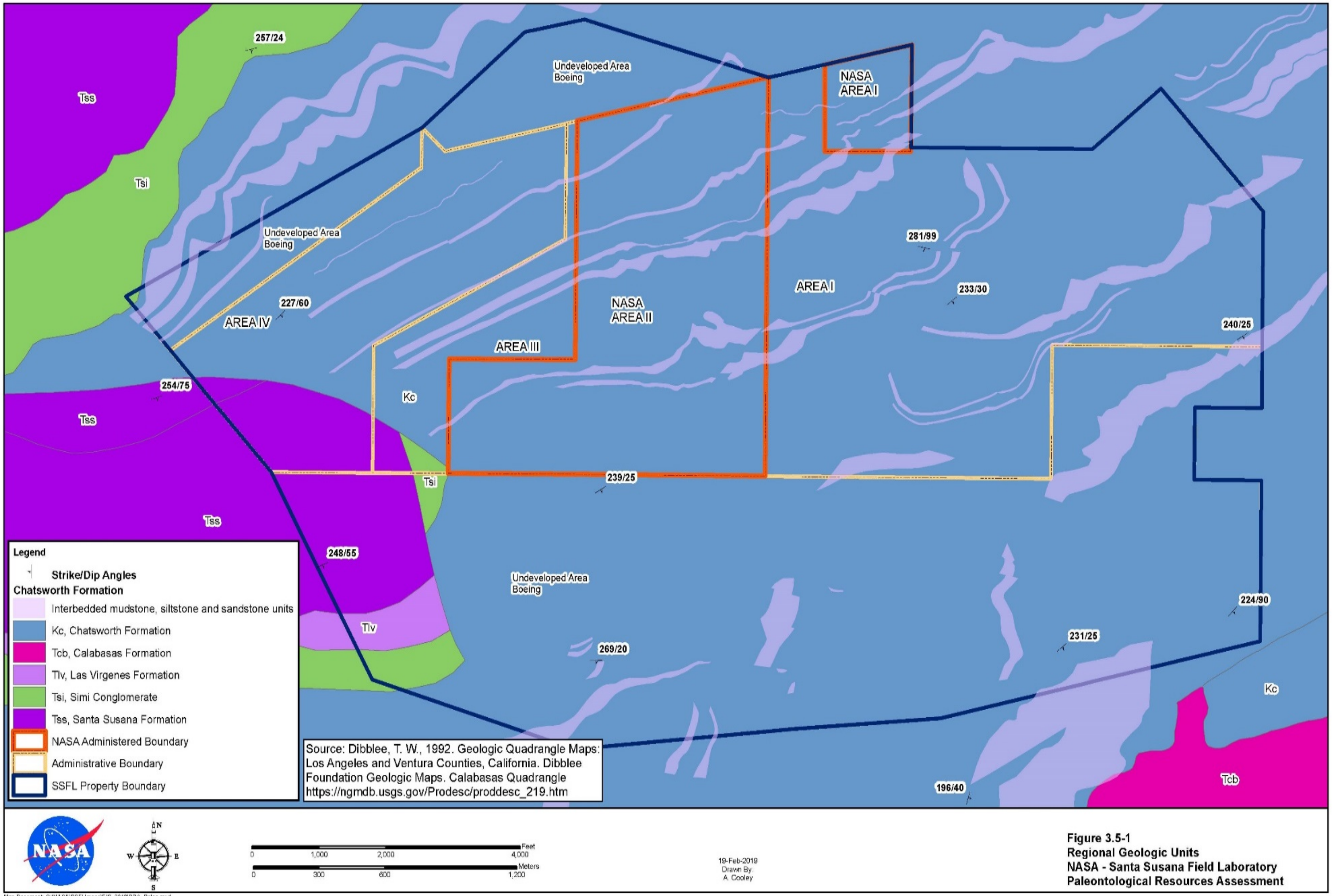

Figure 3.5-1
Regional Geologic Units
NASA - Santa Susana Field Laboratory
Paleontological Resources Assessment

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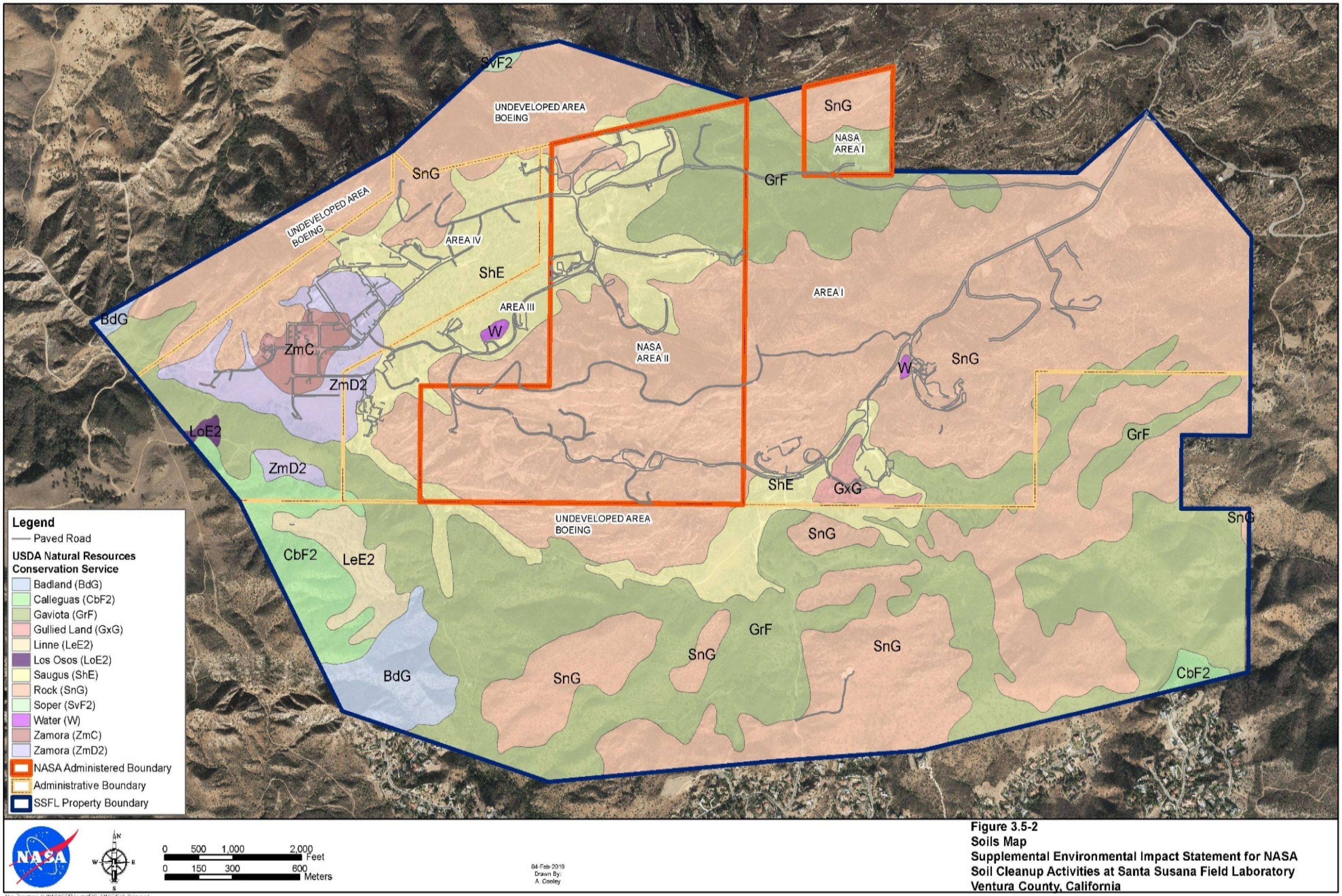

Figure 3.5-2
Soils Map
Supplemental Environmental Impact Statement for NASA Soil Cleanup Activities at Santa Susana Field Laboratory
Ventura County, California

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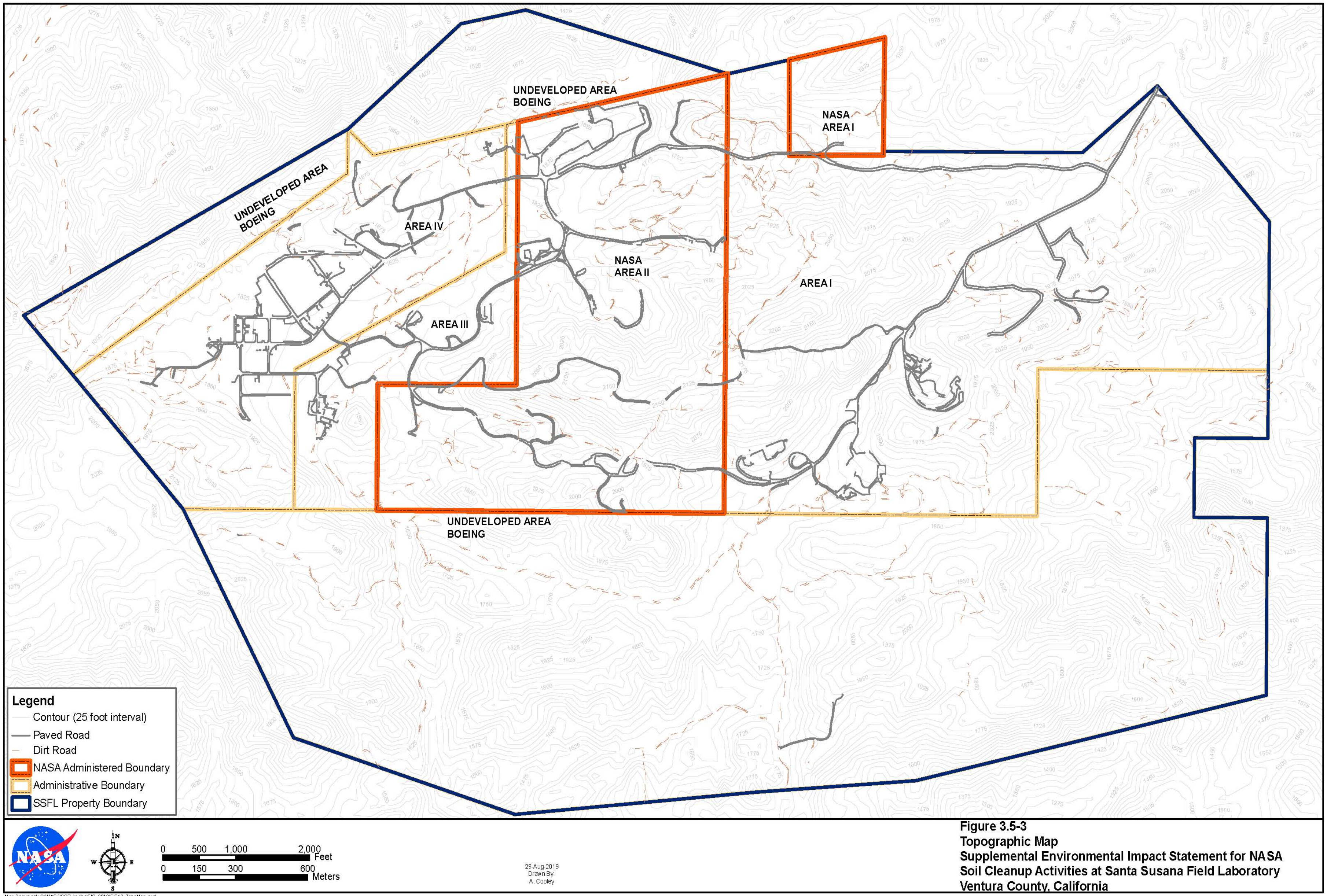

Figure 3.5-3
Topographic Map
Supplemental Environmental Impact Statement for NASA Soil Cleanup Activities at Santa Susana Field Laboratory
Ventura County, California

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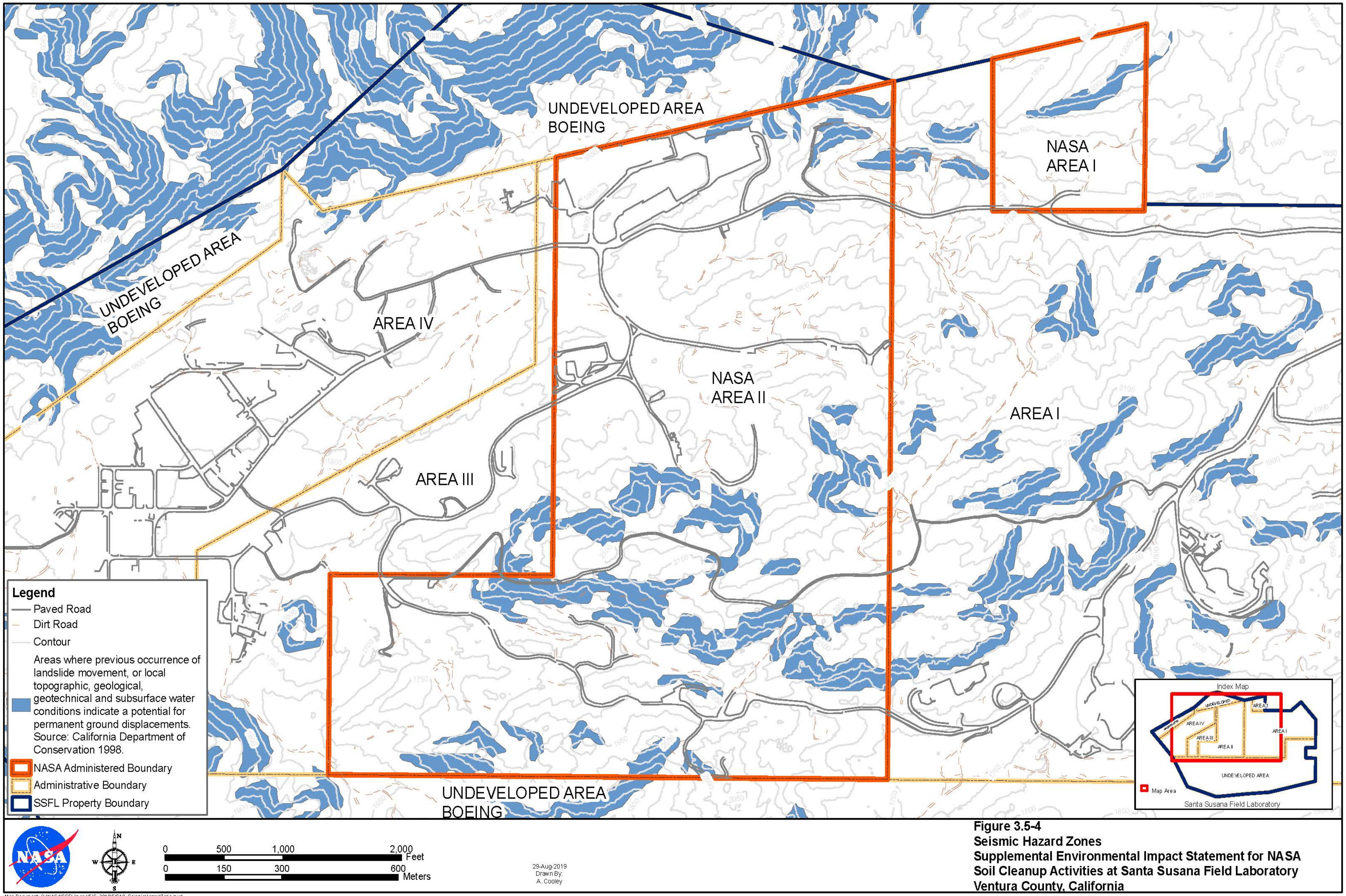

Figure 3.5-4
Seismic Hazard Zones
Supplemental Environmental Impact Statement for NASA Soil Cleanup Activities at Santa Susana Field Laboratory
Ventura County, California

Map Document: O:\NASA\SSFL\maps\EIS_2018\EIS18_SeismicHazardZone.mxd

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3.5.2 Environmental Consequences

This subsection describes the potential impacts to geology including soil, topography, and landslide potential. The most impactful soil remediation technologies to geology were analyzed in this section. A brief explanation of the relevant components of the technologies follows.

- **Excavation and Offsite Disposal:** This treatment technology would result in the excavation of a large quantity of soil and a change in the overall site topography and soil function. Erosion potential would increase through construction activities and the removal of topsoil.
- **Ex Situ Treatment Using Soil Washing:** The impacts would be similar to excavation and offsite disposal; however, a greater quantity of backfill would be available to backfill the site.
- **Ex Situ Treatment Using Land Farming:** This treatment technology would have the same impacts as the other ex situ treatments. Please see the soil washing description.
- **Ex Situ Chemical Oxidation*:*** This treatment technology would have the same impacts as the other ex situ treatments. Please see the soil washing description.
- **Ex Situ Treatment Using Thermal Desorption:** This treatment technology would have the same impacts as the other ex situ treatments. Please see the soil washing description.
- **SVE:** This treatment technology would include the construction of vapor recovering wells spaced at 10- to 20-ft intervals and possible pneumatic enhancement before installation. The impact of the well installation to geology would be less than full excavation of the area. Overall, less area would be excavated.
- **In Situ Chemical Oxidation:** This treatment technology would include the construction of a network of injection wells to inject chemicals into the upper 10 ft of the areas to be treated, which would have less impact to geology than excavating the same area. Overall, less area would be excavated.
- **In Situ Anaerobic or Aerobic Biological Treatment:** This treatment technology would include the construction of a network of injection wells to inject oxygen releasing compounds and nutrients into the upper 10 ft of the areas to be treated, which would have less impact to geology than excavating the same area. Overall, less area would be excavated.
- **MNA:** This technology would result in no impacts to geology.

To obtain an understanding of the greatest potential impact by alternative and to provide decision makers with a comparative analysis by which to make a fully informed decision, it was assumed that excavation and offsite disposal would be the technology applied to the majority of the site. Consequently, the soil excavation quantities and truck traffic explained in Table 2.2-2 were used to analyze the greatest potential impact as a conservative assumption.

Table 3.5-1 identifies the impacts thresholds for geology.

TABLE 3.5-1
Impact Thresholds for Geology
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Impact	Description
No Impact	No impacts to geology would be expected.
Negligible	Impacts to geology would not be detectable and would not alter resource conditions.
Minor	Impacts to geology would result in little, if any, loss of integrity and would cause a measurable but not visually noticeable change to soil, landslide potential, or the topography. The change would be small, localized, and of little consequence.

Impact	Description
Moderate	Impacts to geology would result in disturbance to natural physical resources or soil; in visually noticeable but minor changes in topography; or in landslide potential.
Significant	Impacts to geology would be measurable and would result in changes to natural physical resources or soil; result in visually noticeable and substantial changes in topography; or in landslide potential.
Quality:	Beneficial–would have a positive effect Negative–would have an adverse effect
Duration:	Temporary–would occur only during the remediation period, even if remediation took years. Permanent–would continue beyond the remediation period.

3.5.2.1 Alternative A: AOC Cleanup

This subsection discusses the potential effects of the Alternative A soil cleanup activities on geology.

3.5.2.1.1 Soils

Up to 870,000 yd^3 of soil from within the NASA-administered portion of SSFL would be excavated and transported offsite under Alternative A. An attempt will be made to match the backfill material with existing soil types; however, this will not always be feasible and the existing soil profiles and corresponding functions would likely be substantially changed under Alternative A. Excavation also would affect soil through increased erosion. Proposed soil cleanup activities could increase erosion in several ways, including through the removal of ground cover, loosening of soil, temporary stockpiling of soil, increased slopes, grading of stockpiling and staging locations, use of unpaved temporary access roads, onsite excavation and placement of backfill material, and differential compaction from the construction and use of access roads. The resulting impacts to soil would be **significant, negative, and permanent (Geology Impact-1)**.

Mitigations to lessen the effect of soil erosion would include erosion control BMPs and replanting vegetation. These mitigations are described in more detail in Section 3.4, *Water Resources*, and Section 3.2, *Biological Resources*.

3.5.2.1.2 Topography

Excavation would affect the topography within SSFL. The excavation would generally be shallow; however, excavation could reach maximum depths of approximately 20 ft bgs in isolated areas. Excavated areas are expected to be backfilled, partially by excavated soil that is treated onsite and partially by clean backfill brought to the site. Because the topographic relief of the region is more than 1,000 ft, the maximum change of topography would be less than 2 percent, with most excavations being significantly less. Therefore, impacts to topography from soil cleanup activities would be **minor, negative, and permanent (Geology Impact-2)**.

3.5.2.1.3 Landslide Potential

Under Alternative A, excavation would affect approximately 13 acres of soil within an identified seismic hazard zone (Figure 3.5-4). Because of the site's topography, no offsite downgradient development would be impacted by potential landslides. Additionally, because most structures have been removed within the NASA-administered areas, few people or structures would be at risk from landslides. Consequently, the impact resulting from the increase in landslide potential would be **minor, negative, and temporary (25+ years)** (**Geology Impact-3**).

If new roads or other facilities are necessary, they would be located to avoid the areas identified on Figure 3.5-3 and areas where geologists have identified the potential for rock falls. If avoidance of such area is impossible, appropriate engineering design and construction measures would be incorporated into the project designs to minimize potential damage to project facilities (**Geology BMP-1)**.

3.5.2.2 Alternative B: Revised LUT Levels Cleanup

This subsection discusses the potential effects of the Alternative B soil cleanup activities on geology.

3.5.2.2.1 Soils

Up to 384,000 yd^3 of excavated soil from within the NASA-administered portion of SSFL would be transported offsite under Alternative B. Soil erosion would be impacted in a similar manner as Alternative A; however, as the excavation area is decreased, the potential for erosion would also decrease. The increase in soil erosion would result in a **significant, negative, and permanent impact (Geology Impact-1)**. NASA would also implement the mitigations described in Alternative A.

3.5.2.2.2 Topography

Excavation would affect the topography within the ROI in the same manner as Alternative A. However, the scale of the excavation would be reduced; therefore, impacts to topography from soil cleanup activities under Alternative B would be **negligible, negative, and permanent (Geology Impact-2)**.

3.5.2.2.3 Landslide Potential

Under Alternative B, excavation would affect approximately 3 acres of soil within the seismic hazard zones (Figure 3.5-4). Because the topography and risk is substantially less than those described in Alternative A, the impact due to the increase in landslide potential would be **negligible, negative, and temporary (12 years)** (**Geology Impact-3**). NASA would also implement **Geology BMP-1** under Alternative B.

3.5.2.3 Alternative C: Suburban Residential Cleanup

This subsection discusses the potential effects of the Alternative C soil cleanup activities on geology.

3.5.2.3.1 Soils

Up to 247,000 yd^3 of excavated soil from within the NASA-administered portion of SSFL would be transported offsite under Alternative C. Soil erosion would be impacted in a similar manner as Alternative A; however, as the excavation area decreases, the potential for erosion would also decrease. The increase in soil erosion would result in a **moderate, negative, and permanent impact (Geology Impact-1)**. NASA would also implement the mitigations described in Alternative A.

3.5.2.3.2 Topography

Excavation would affect the topography within the ROI in the same manner as Alternative A. However, the scale of the excavation would be reduced; therefore, impacts to topography from soil cleanup activities under Alternative C would be **negligible, negative, and permanent (Geology Impact-2)**.

3.5.2.3.3 Landslide Potential

Under Alternative C, excavation would affect approximately 2 acres of soil within the seismic hazard zones (Figure 3.5-4). Because the topography and risk is substantially less than those described in Alternative A, the impact due to the increase in landslide potential would be **negligible, negative, and temporary (8 years)** (**Geology Impact-3**). NASA would also implement **Geology BMP-1** under Alternative C.

3.5.2.4 Alternative D: Recreational Cleanup

This subsection discusses the potential effects of the Alternative D soil cleanup activities on geology.

3.5.2.4.1 Soils

Up to 176,500 yd^3 of excavated soil from within the NASA-administered portion of SSFL would be transported offsite under Alternative D. Soil erosion would be impacted in a similar manner as Alternative A; however, as the excavation area decreases, the potential for erosion would also decrease. The increase in soil erosion would result in a **moderate, negative, and permanent impact (Geology Impact-1)**. NASA would also implement the mitigations described in Alternative A.

3.5.2.4.2 Topography

Excavation would affect the topography within the ROI in the same manner as Alternative A. However, the scale of the excavation would be reduced; therefore, impacts to topography from soil cleanup activities under Alternative D would be **negligible, negative, and permanent (Geology Impact-2)**.

3.5.2.4.3 Landslide Potential

Under Alternative D, excavation would affect approximately 2 acres of soil within the seismic hazard zones (Figure 3.5-4). Because the topography and risk is substantially less than those described in Alternative A, the impact due to the increase in landslide potential would be **negligible, negative, and temporary (6 years)** (**Geology Impact-3**). NASA would also implement **Geology BMP-1** under Alternative D**.**

3.5.2.5 No Action Alternative

Under the No Action Alternative, no excavation that could affect erosion would occur beyond what has been done under separate regulatory direction (the 2013 ISRA NPDES action). This program would continue to follow program management plans, which include erosion and dust control and soil management BMPs. Ongoing soil and groundwater remediation, restoration, sampling activities, and off-road vehicle use on the NASA-administered property would have a **negligible, negative, and permanent impact** on soil (**Geology Impact-1**). There would be **no impacts** to topography (**Geology Impact-2**). The potential for landslides to affect the project would remain, because hills and other areas where slopes potentially could fail currently exist onsite; however, no further activities that might exacerbate these hazards would occur. This landslide impact would be considered as **no impact** (**Geology Impact-3**).

3.5.3 Best Management Practices

This subsection provides a brief description of BMPs.

- **Geology BMP-1** (All Action Alternatives): NASA would use facilities currently in place and site future facilities to minimize the potential impacts of landslides.

3.5.4 Summary of Impacts

Table 3.5-2 provides a summary of the impacts on geology, as described in this subsection.

TABLE 3.5-2
Summary of Geologic Resource Impact
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Impacts	Alternative A AOC Cleanup	Alternative B Revised LUT Levels Cleanup	Alternative C Suburban Residential Cleanup	Alternative D Recreational Cleanup	No Action Alternative
Geology Impact-1: Impacts to soil	Significant, negative, and permanent	Significant, negative, and permanent	Moderate, negative, and permanent	Moderate, negative, and permanent	Negligible, negative, and permanent
Geology Impact-2: Topological impacts	Minor, negative, and permanent	Negligible, negative, and permanent	Negligible, negative, and permanent	Negligible, negative, and permanent	No Impact
Geology Impact-3: Impacts from landslide potential	Minor, negative, and temporary (25 years)	Negligible, negative, and temporary (12 years)	Negligible, negative, and temporary (8 years)	Negligible, negative, and temporary (6 years)	No Impact

3.6 Hazardous and Nonhazardous Materials and Waste

This subsection describes the handling of hazardous and nonhazardous materials and waste associated with NASA soil cleanup activities at SSFL. The ROI for this evaluation includes the NASA-administered area of SSFL, the areas of soil remediation just outside the boundary that will be remediated by NASA, and the potential landfills that would receive the soil from SSFL.

3.6.1 Affected Environment

According to the Resource Conservation and Recovery Act of 1976 (RCRA), a solid waste is “any discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities.” A hazardous waste is “a waste which because of its quantity, concentration, or physical, chemical, or infectious characteristics may pose a substantial hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.”

Hazardous and nonhazardous materials and waste are regulated by a combination of laws. Federal regulations governing the assessment and disposal of hazardous and nonhazardous waste include RCRA; the RCRA Hazardous and Solid Waste Amendments; The Atomic Energy Act of 1954; Low-level Radioactive Waste Policy Amendments Act of 1985; CERCLA; the Solid Waste Act; and the Toxic Substances Control Act of 1976.

3.6.1.1 Waste Management

This section describes the general categories of waste that would be generated by the proposed soil remediation Action Alternatives. Section 1.3 provides a discussion of activities conducted at SSFL that resulted in a release of contamination within and adjacent to the NASA-administered property at SSFL and an overview of the remedial investigations conducted to characterize the site.

Three primary waste types are found at SSFL: nonhazardous, hazardous, and radioactive. Radioactive waste does not originate from the NASA-administered areas of SSFL as nuclear materials were not used, stored, or disposed of on the NASA-administered areas of SSFL. Radioactive waste may be found in the adjacent Area IV, which is owned by Boeing and leased by the DOE. Past operations conducted by the DOE in Area IV included the development and operation of reactors. Past operations of Boeing and its predecessors at SSFL also included research, development, assembly, disassembly, and testing of nuclear reactors (CRWQCB, 2009), all of which were terminated in 1989. Some of the associated contamination may be located on property adjoining NASA-administered areas. In DTSC’s draft PEIR, it is estimated that, approximately 3 percent of NASA’s portion of soil cleanup may contain low-level radioactive material (DTSC, 2017). Low-level radioactive waste is waste that exceeds the provisional radiological LUT values but is less than values regulated by RCRA (42 U.S.C. 69-1 et seq.), state statute, or state regulation.

DTSC has estimated that approximately 17 percent of the excavated soil would be nonhazardous, and the remaining 83 percent would be classified as hazardous (including up to 3 percent of low-level radioactive materials). The estimates used by DTSC in the PEIR for hazardous and nonhazardous classification are based on screening levels and concentrations governed by state and federal regulations independent of LUT values; therefore, the ratio of hazardous materials would increase if the AOC cleanup LUT values are applied, as the LUT values exceed federal and state regulations. The estimates in the PEIR are based on soil volumes resulting from ISRA targeting analytes that are characteristically hazardous. The ratio of hazardous to nonhazardous soil (83:17) in future remedial activities is likely to decrease given the broader areas of remediation. For comparison purposes, the ratio presented by DTSC is carried through each of the cleanup alternatives. Because the hazardous to nonhazardous ratio could either increase if the AOC cleanup alternative is selected or decrease because the remediation area would be expanded beyond the hazardous areas that were targeted by the ISRA activities, additional ratio assumptions would be arbitrary and would not add value to the waste management discussion at this time.

3.6.1.2 Landfills

Solid waste generated through soil cleanup activities would be transported for disposal to various landfills throughout California and other states. The landfills may be categorized as Class I (Hazardous), Class II (Designated Nonhazardous), Class III (Nonhazardous), and RCRA Subtitle C.

Table 3.6-1 lists the possible candidate landfills that may accept nonhazardous waste from SSFL.

TABLE 3.6-1
Possible Landfills for Nonhazardous Waste Disposal
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Site Name (Owner)	Location	Road Distance (miles)	Description	Waste Limit (yd^3/day)	Remaining Landfill Capacity as of 2018 (yd^3)
McKittrick Waste Treatment Site (Waste Management)	McKittrick, California	134	Class II landfill. Accepts asbestos-non-friable; auto shredder fluff; construction and demolition debris; drum management-liquids; drum management solids; industrial and special waste; Liquifix (Solidification Services)	2,333	2,600,000
Antelope Valley (Waste Management)	Palmdale, California	59	Class III landfill. Accepts agricultural, asbestos, construction and demolition, contaminated soil, green materials, industrial, inert, mixed municipal	3,699	16,610,365
Mesquite Regional	El Centro, California	270	Class III landfill. Accepts mixed municipal waste	13,000	400,000,000

Sources: CalRecycle, 2019; Mesquite Regional Landfill, 2019; Amirseyedian, pers. comm., 2017; WMI, 2019

Table 3.6-2 lists the possible candidate landfills that may accept hazardous waste from SSFL.

TABLE 3.6-2
Possible Landfills for Hazardous Waste Disposal
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Site Name (Owner)	Location	Road Distance (miles)	Description	Waste Limit (yd^3/day)	Remaining Landfill Capacity as of 2018 (yd^3)
Beatty (US Ecology)	Beatty, Nevada	330	RCRA Subtitle C landfill. Accepts RCRA hazardous waste, PCB waste, state-designated hazardous wastes and nonhazardous wastes.	None	8,600,000
Grandview (US Ecology Idaho)	Grand View, Idaho	1,020	RCRA Subtitle C landfill. Accepts RCRA hazardous waste; PCB waste; nonhazardous industrial waste; naturally occurring radioactive materials; accelerator produced radioactive materials; NRC-exempt low-activity radioactive materials	None	7,900,000

Sources: State of Nevada, 2019; US Ecology, 2019; EPA, 2015

Table 3.6-3 lists the possible candidate landfills that may accept radioactive waste from SSFL.

TABLE 3.6-3
Possible Landfills for Radioactive Waste Disposal
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Site Name (Owner)	Location	Road Distance (miles)	Description	Waste Limit (yd^3/day)	Remaining Landfill Capacity as of 2018 (yd^3)
Clive (Energy Solutions)	Clive, Utah	780	Accepts Class A low-level radioactive material ; naturally occurring and accelerator produced material; radioactive waste that is also determined to be hazardous (mixed waste); uranium and thorium by-product material	None	4,200,000
Waste Control Specialists	Andrews, Texas	1,160	Accepts low-level radioactive waste (LLRW) and mixed LLRW.	None	2,100,000

Sources: EPA, 2019c; Rogers, 2016; Utah DEQ, 2019; WCS, 2019

3.6.2 Environmental Consequences

This subsection describes the potential impacts from the remediation of hazardous and nonhazardous materials and waste, including waste management and landfills. The most impactful soil remediation technologies with regard to hazardous and nonhazardous materials and waste were analyzed in this section. A brief explanation of the relevant components of the technologies follows:

- **Excavation and Offsite Disposal**: Excavation and offsite disposal would require waste characterization sampling after excavation to verify the contents and identify appropriate handling and disposal. The soil would require proper handing and/or management to avoid the accidental release of contaminants to the environment.
- **Ex Situ Treatment Using Soil Washing:** Fine-grained soil containing contaminants would be separated in the process, and along with the solids captured in the filters, would require disposal at a landfill. Polyethylene plastic sheeting, concrete or asphalt, and wood is required for the construction of treatment cells. Small amounts of chemicals such as lubricants may be used to support the treatment technology equipment. The volume of material requiring disposal in a landfill would be substantially less than the volume of soil related to excavation and offsite disposal.
- **Ex Situ Treatment Using Land Farming:** This treatment technology requires polyethylene plastic sheeting, concrete or asphalt, and wood for the construction of treatment cells. Small amounts of chemicals such as lubricants may be used to support the treatment technology equipment. After these materials are no longer needed, they would require disposal in a landfill, but the volume of these materials would be substantially less than the volume related to excavation and offsite disposal.
- **Ex Situ Chemical Oxidation:** The hazardous material and solid waste conditions for this technology would be the same as those described for ex situ treatment using land farming.
- **Ex Situ Treatment Using Thermal Desorption:** This treatment technology requires small amounts of chemicals such as lubricants to support the treatment technology equipment. After these materials are no longer needed, they would require disposal in a landfill, but the volume of these materials would be substantially less than the volume of soil related to excavation and offsite disposal.
- **SVE:** This treatment technology would not generate significant volumes of soil or water waste; waste would be generated in small quantities during the installation of SVE equipment and soil sampling. The equipment may be used at another site or recycled when no longer needed.
- **In Situ Chemical Oxidation:** This treatment technology would include the construction of injection wells and temporary storage of oxidants and fracturing chemicals. The oxidants and fracturing chemicals

would be used through the process; however, the containers used for storage would require disposal. Following treatment, the well materials would require disposal, and during treatment, there would be a small amount of waste generated by soil sampling. The volume of these materials would be substantially less than the volume of soil related to excavation and offsite disposal.

- **In Situ Anaerobic or Aerobic Biological Treatment:** The hazardous material and solid waste conditions for this technology would be the same as those described for in situ chemical oxidation.
- **MNA:** This treatment technology would include small amounts of soil sampling waste.

To obtain an understanding of the greatest potential impact by alternative and to provide decision makers with a comparative analysis by which to make a fully informed decision, it was assumed that excavation and offsite disposal would be the technology applied to the majority of the site. Consequently, the soil excavation quantities and truck traffic explained in Table 2.2-2 were used to analyze the greatest potential impact as a conservative assumption.

Table 3.6-4 identifies the impact thresholds for hazardous and nonhazardous materials and waste.

TABLE 3.6-4
Impact Thresholds for Hazardous and Nonhazardous Materials and Waste
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Impact	Description
No Impact	No impacts to hazardous and nonhazardous materials and wastes would be expected.
Negligible	Impacts from the generation of hazardous and nonhazardous materials and wastes would not be detectable. There would be no new areas or releases of contamination.
Minor	Impacts from the generation of hazardous and nonhazardous materials and wastes would be measurable, but wastes would be well within the capacity of the affected landfill or treatment system to absorb the change. Any releases of hazardous materials or solid waste would be easy to respond to and remove offsite.
Moderate	Increases from the generation of hazardous and nonhazardous materials and wastes would be measurable, but wastes would be within the capacity of the affected landfill or treatment system to absorb the change. Any releases of hazardous materials or solid waste would be responded to in accordance with applicable regulations.
Significant	Impacts from the generation of hazardous and nonhazardous materials and wastes would be measurable; wastes would not be within the capacity of the affected landfill or treatment system to absorb the change; resulting impacts could be severe and long lasting. Project activities would result in disturbance to human health and the environment from the potential release of hazardous materials and waste.
Quality:	Beneficial–would have a positive effect Negative–would have an adverse effect
Duration:	Temporary–would occur only during the remediation period, even if remediation took years. Permanent–would continue beyond the remediation period.

3.6.2.1 Alternative A: AOC Cleanup

This subsection discusses the potential effects of the Alternative A soil cleanup activities on hazardous and nonhazardous materials and waste, including waste management and disposal facilities.

3.6.2.1.1 Waste Management

Under Alternative A, up to 870,000 yd^3 of excavated soil would be characterized and containerized based on its content in accordance with a sitewide waste management plan. Proper management and handling would avoid the potential for new releases of contamination and would maintain a healthy and safe working environment.

Hazardous materials and waste from the operation of remediation technologies would be handled in compliance with applicable federal regulation, including licensing, training of personnel, accumulation limits and times, prevention and response to spills and releases, reporting, and record keeping. Per these regulatory standards, hazardous waste would be loaded directly into bins for transport and offsite disposal; however, containment, if needed, would be used to prevent the release of material or hazardous content. Bins containing hazardous waste would be kept securely closed during transport for offsite disposal (NASA, 2011d) **(Haz Mitigation-1)**.

A hazardous materials business plan would be developed. This plan would describe appropriate storage, containment, and safety protocols for the use of hazardous materials during remediation; emergency procedures to be followed in the event of a release; instructions for performing fueling and maintenance operations on vehicles and equipment onsite; and other protocols so that hazardous materials would be stored and handled appropriately **(Haz Mitigation-2)**.

By implementing these mitigation measures and plans, **Haz Impact-1** would be maintained as a **minor, negative, and temporary (25+ years) impact**.

3.6.2.1.2 Landfills

Of the 870,000 yd^3 of waste excavated and disposed of under Alternative A, DTSC estimates that approximately 17 percent or 147,900 yd^3 is nonhazardous. This volume is less than 1 percent of the total estimated 2018 remaining capacity of the possible landfills for nonhazardous waste disposal listed in Table 3.6-1. The maximum daily disposal rate of 426 yd^3 per day (32 round trips by truck and 13.3 yd^3 per truck) is under the waste acceptance limits for all potential landfills listed in Table 3.6-1.

DTSC estimates approximately 80 percent or 696,000 yd^3 of the soil excavated and disposed of under Alternative A is hazardous. This volume is less than 5 percent of the total capacity of the possible landfills for hazardous waste disposal listed in Table 3.6-2. The maximum daily disposal rate of 426 yd^3 per day is under the waste acceptance limits for all potential landfills listed in Table 3.6-2.

Approximately 3 percent or 26,100 yd^3 of the soil excavated and disposed of under Alternative A is classified as low-level radioactive. This volume is less than 1 percent of the total capacity of the possible landfills for radioactive waste disposal listed in Table 3.6-3. The maximum daily disposal rate of 426 yd^3 per day is under the waste acceptance limits for all potential landfills listed in Table 3.6-3.

Offsite transport of up to 870,000 yd^3 volume of soil would be anticipated to be minimal compared to the remaining landfill capacity and would constitute a **minor, negative, and permanent impact (Haz Impact-2)**.

3.6.2.2 Alternative B: Revised LUT Levels Cleanup

3.6.2.2.1 Waste Management

Under Alternative B, up to 384,000 yd^3 of excavated soil would be characterized and containerized based on its content in accordance with a sitewide waste management plan. Similar to Alternative A, proper management and handling would avoid the potential for new releases of contamination and would maintain a healthy and safe working environment. NASA would implement **Haz Mitigation-1** and **Haz Mitigation-2** under Alternative B; therefore, the impact would be considered **minor, negative, and temporary (12 years) (Haz Impact-1)**.

3.6.2.2.2 Landfills

Alternative B would result in up to 384,000 yd^3 of waste excavated and disposed of offsite. However, this estimate is conservative, as it is more likely the ex situ and in situ treatments, which would result in more soil staying onsite, could be used under Alternative B. As demonstrated for Alternative A, the regional hazardous and nonhazardous landfills have more than enough capacity to accept this waste. Therefore, the landfill impacts associated with Alternative B would be **minor, negative, and permanent (Haz Impact-2).**

3.6.2.3 Alternative C: Suburban Residential Cleanup

3.6.2.3.1 Waste Management

Under Alternative C, up to 247,000 yd^3 of excavated soil would be characterized and containerized based on its content in accordance with a sitewide waste management plan. Similar to Alternative A, proper management and handling would avoid the potential for new releases of contamination and would maintain a healthy and safe working environment. NASA would implement **Haz Mitigation-1** and **Haz Mitigation-2** under Alternative C; therefore, the impact would be considered **minor, negative, and temporary (8 years) (Haz Impact-1)**.

3.6.2.3.2 Landfills

Alternative C would result in up to 247,000 yd^3 of waste excavated and disposed of offsite. However, this estimate is conservative, as it is more likely the ex situ and in situ treatments, which would result in more soil staying onsite, could be used under Alternative C. As demonstrated for Alternative A, the regional hazardous and nonhazardous landfills have more than enough capacity to accept this waste. Therefore, the landfill impacts associated with Alternative C would be **minor, negative, and permanent (Haz Impact-2).**

3.6.2.4 Alternative D: Recreational Cleanup

3.6.2.4.1 Waste Management

Under Alternative D, up to 176,500 yd^3 of excavated soil would be characterized and containerized based on its content in accordance with a sitewide waste management plan. Similar to Alternative A, proper management and handling would avoid the potential for new releases of contamination and would maintain a healthy and safe working environment. NASA would implement **Haz Mitigation-1** and **Haz Mitigation-2** under Alternative D; therefore, the impact would be considered **minor, negative, and temporary (6 years) (Haz Impact-1)**.

3.6.2.4.2 Landfills

Alternative D would result in up to 176,500 yd^3 of waste excavated and disposed of offsite. However, this estimate is conservative, as it is more likely the ex situ and in situ treatments, which would result in more soil staying onsite, could be used under Alternative D. As demonstrated for Alternative A, the regional hazardous and nonhazardous landfills have more than enough capacity to accept this waste. Therefore, the landfill impacts associated with Alternative D would be **minor, negative, and permanent (Haz Impact-2).**

3.6.2.5 No Action Alternative

Under the No Action Alternative, NASA would not conduct soil remediation at the site beyond the groundwater cleanup and demolition activities currently being conducted. Once those ongoing programs are concluded, no further remedial action would occur.

Activities associated with these ongoing remediation activities under the No Action Alternative could require the storage and use of hazardous materials, generate hazardous and nonhazardous waste materials, and require the transport of hazardous and nonhazardous waste materials. The impact on the hazardous and nonhazardous materials and waste would be considered **minor, negative, and temporary** for **Haz Impact-1** and **minor, negative, and permanent** for **Haz Impact-2**.

3.6.3 Mitigation Measures

This subsection provides a brief description of mitigation measures.

- **Haz Mitigation-1** (All Action Alternatives): Hazardous materials and wastes would be handled in compliance with the applicable federal, state, and local laws and regulations, including licensing, training of personnel, accumulation limits and times, prevention and response to spills and releases, reporting, and record keeping. Per these regulatory standards, hazardous wastes would be loaded directly into bins for transport and offsite disposal; however, containment, if needed, would be used to prevent the release of material or hazardous content. Bins containing hazardous wastes would be kept securely closed during transport for offsite disposal.

- **Haz Mitigation-2** (All Action Alternatives): A hazardous materials business plan would be developed. This plan would describe the appropriate storage, containment, and safety protocols to use for hazardous materials during the remediation; emergency procedures to be followed in the event of a release; instructions for performing fueling and maintenance operations on vehicles and equipment onsite; and other protocols so that hazardous materials would be stored and handled appropriately.

3.6.4 Summary of Impacts

Table 3.6-5 provides a summary of the impacts on hazardous and nonhazardous materials and wastes, as described in this subsection.

TABLE 3.6-5
Summary of Hazardous and Nonhazardous Materials and Waste
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Impacts	Alternative A AOC Cleanup	Alternative B Revised LUT Levels Cleanup	Alternative C Suburban Residential Cleanup	Alternative D Recreational Cleanup	No Action Alternative
HAZ Impact-1: Impacts from hazardous materials and solid waste	Minor, negative, and temporary (25+ years)	Minor, negative, and temporary (12 years)	Minor, negative, and temporary (8 years)	Minor, negative, and temporary (6 years)	Minor, negative, and temporary
HAZ Impact-2: Impacts to landfill capacity	Minor, negative, and permanent	Minor, negative, and permanent	Minor, negative, and permanent	Minor, negative, and permanent	Minor, negative, and permanent

3.7 Health and Safety

This subsection describes the existing health and safety conditions at the NASA-administered areas of SSFL and the associated environmental consequences from the Action Alternatives and the No Action Alternative. The ROI selected for this evaluation includes the NASA-administered property of SSFL (Area I former LOX Plant and Area II) and local access routes to the entrance of SSFL in Los Angeles and Ventura Counties. The regional and local roadway network traveled by heavier vehicles within the primary ROI includes Woolsey Canyon Road, Valley Circle Boulevard, Roscoe Boulevard, and State Route (SR) 27 (Topanga Canyon Road). Local access routes for site workers travelling to SSFL include Box Canyon Road, Plummer Street, and Santa Susana Pass Road in addition to the roadways identified for heavy vehicles. The ROI also includes Brandeis Bardin campus to the north, Sage Ranch Park/Mountain Recreational Conservancy Authority land, and the Bell Canyon neighborhood to the south of SSFL, which are the nearest communities at the borders of SSFL.

The larger 8- to 10-lane highways, such as US 101 to the south of SSFL and SR 118 to the north of SSFL, are not included in the ROI, since they are designated by Caltrans as non-radioactive hazardous materials (NRHM) routes for the transport of hazardous materials and, therefore, are considered suitable for offsite transport of hazardous materials from NASA-administered areas. A variety of factors are considered in the designation process, such as population density, type of highway, emergency response capabilities, terrain, congestion, and accident history. SR 27 is also designated as an NRHM route; however, it was retained in the ROI because it is an arterial roadway. The primary ROI for health and safety is shown on Figure 3.7-1.

Within the ROI, potential health and safety hazards to the following population groups that could be affected by the Proposed Action are considered:

- Onsite workers
- Hypothetical future onsite users of SSFL
- Offsite neighbors to SSFL
- Offsite residents and sensitive populations along local roadways, including populations in schools, children’s daycare centers, hospitals, and convalescent homes

The categories of health and safety hazards considered by alternative in this analysis and defined in Section 3.7.1, *Affected Environment*, include the following:

- Worker health and safety
- Exposure to contamination
- Increased large truck traffic
- Accidental spills of hazardous material
- Protection of children

Material, operational, and structural hazards in the NASA-administered property at SSFL were evaluated in the 2014 FEIS and are typically associated with buildings and developed areas. Material hazards are associated with the presence of hazardous materials. Operational safety hazards potentially exist in working buildings; their associated utilities, including underground and overhead utilities near buildings; and occasionally in undeveloped portions of the site. Physical hazards include those typical at industrial facilities, such as slip, trip, and fall hazards; low utility lines and uneven walkways, which present overhead and underfoot hazards; and abandoned buildings and structures. Because these hazards were previously evaluated, a ROD for demolition was completed (NASA, 2014b), and the buildings were removed or are slated for demolition, these material, operational, and structural hazards are not addressed further in the SEIS.

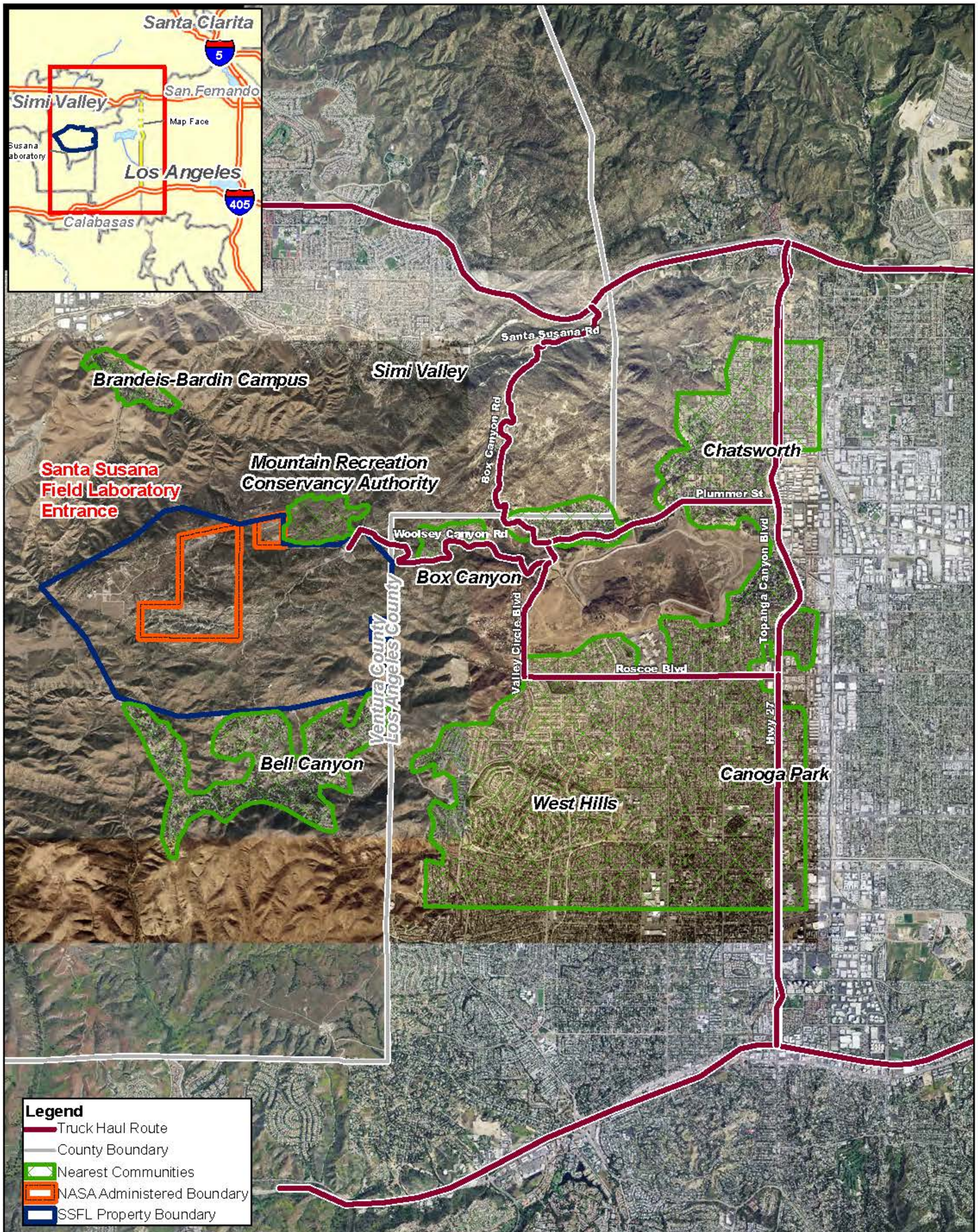

Figure 3.7-1
Health and Safety Region of Influence
Supplemental Environmental Impact Statement for NASA
Soil Cleanup Activities at Santa Susana Field Laboratory
Ventura County, California

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3.7.1 Affected Environment

3.7.1.1 Onsite Natural Hazard

Natural hazards are those posed by the site's weather, geography, and biology. The average summer temperature of the region is 70 °F (Miles and Goudey, 1998); however, temperatures can reach much higher during the day, presenting a risk of heat stress and related health and safety concerns. Winter temperatures are milder, averaging 40°F (Miles and Goudey, 1998). Daytime temperatures in the winter are higher, but in the evenings and mornings, temperatures can be much lower and present a risk of cold stress. Sunburn is also a sitewide hazard throughout the year. Low humidity can contribute to dehydration. As a result of wildfires in 2018, the risk of fires is expected to be somewhat lower in the near term. However, given the relatively dry summers and fire adapted vegetation, fire hazards are likely to remain a concern in the future (NASA, 2011c).

Geographically, the NASA-administered property at SSFL is rugged, with as much as 1,100 ft of topographic relief. Cliffs could present hazards for equipment and vehicles that travel off-road (for example, drill rigs traveling off-road for well installation). Rock falls and other hazards associated with unstable and steep slopes could occur near the cliffs. Woolsey Canyon Road, which is a primary access road to the site is steep and winding, and though guardrails are present in areas, there is the potential for a truck to run off the narrow road.

Botanical hazards include poisonous plants common in developed and undeveloped areas, such as poison oak. Another botanical hazard is the yucca plant (*Hesperoyucca whipplei*), which has sharp leaves that can puncture even thick clothing (NASA, 2011c). Hazardous wildlife common to the region include stinging insects such as scorpions, ticks, spiders, mosquitoes, and bees. Rattlesnakes, large predators such as feral dogs, coyotes, and mountain lions could also be found onsite (NASA, 2011a).

3.7.1.2 Onsite Contaminated Soils

As described in Section 1.3, NASA has conducted environmental sampling for more than 25 years. The results of previous studies indicate that VOCs, including trichloroethene, SVOCs, metals, dioxins, and PCBs, are present in the soil. ISRA activities were conducted at SSFL between 2009 and 2013 following NPDES permit exceedances for stormwater on the facility. The sources of the NPDES exceedances on the NASA-administered portions of SSFL included areas near the Area II Landfill, Ash Pile/Sewage Treatment Plant, Expendable Launch Vehicle, and the former LOX Plant.

3.7.1.3 Offsite Communities

The nearest residential areas are the park ranger's house in Sage Ranch Park/Mountain Recreation Conservancy Authority and residential communities north of the site, east of the site, and in Bell Canyon directly south of the site. The closest residential communities are approximately 0.3 mile east of SSFL (DTSC, 2017).

Schools and daycare centers are also located within a quarter mile of the haul routes. Generally, the haul routes start at Woolsey Canyon Road, continue to Valley Circle Boulevard, and proceed to SR 118 or US 101. Intermediate roads used to access SR 118 or US 101 include Lake Manor Drive, Roscoe Boulevard, Plummer Avenue, and Topanga Canyon Boulevard (SR 27). Within a quarter mile of the haul routes used to access SR 118 are the following six preschool, elementary school, and colleges:

- Casa Dei Maria Montessori School, 8230 Fallbrook Avenue, West Hills, along Roscoe Boulevard
- Valley College of Medical Careers, 8399 Topanga Canyon Boulevard, West Hills
- Nevada Avenue Elementary School, 22120 Chase Street, West Hills, along Topanga Canyon Boulevard
- Chatsworth Park Elementary School, 22005 Devonshire Street, Chatsworth, along Topanga Canyon Boulevard
- Oakridge Preschool, 10433 Topanga Canyon Boulevard, Chatsworth

- Montessori of Chatsworth, 10616 Andora Avenue, Chatsworth, along Topanga Canyon Boulevard

Within a quarter mile of the haul routes used to access US 101 are the following eight schools, ranging from preschool to high school:

- Ivy Academia Entrepreneurial Charter School, 7353 Valley Circle Boulevard, West Hills
- West Hills Montessori, 24373 Vanowen Street, West Hills
- Stepping Stones Montessori, 24385 Vanowen Street, West Hills
- Hill Point Montessori Preparatory School, 6601 Valley Circle Boulevard, West Hills
- St. Bernardine Children’s Center, 24425 Calvert Street, Woodland Hills
- St. Bernardine of Siena Catholic School, 6061 Valley Circle Boulevard, Woodland Hills
- Temple Aliyah Jewish Preschool and Early Childhood Education Center, 6025 Valley Circle Boulevard, Woodland Hills
- El Camino Real Charter High School, 5440 Valley Circle Boulevard, Woodland Hills

3.7.1.4 Offsite Health Risks

The existing offsite health risks posed by the contamination resulting from historical operations at SSFL have been evaluated by numerous studies over the years. In a public statement, DTSC concluded the following (DTSC, n.d.):

> DTSC has conducted extensive reviews of environmental data relating to the Santa Susana Field Laboratory, including data collected by other government agencies. To date, DTSC has not found any evidence that contamination from research and testing operations at SSFL has posed or would pose a threat to human health or the environment outside the SSFL site boundaries.

DTSC has documented the results of these studies in *Summary of Cancer Study and Exposure Assessment Activities and Document Release Dates Related to the Santa Susana Field Lab (Rocketdyne) Site (*DTSC, 2011). The studies were conducted or reviewed by the following organizations:

- California Department of Health Services (CDHS)
- University of California, Los Angeles (UCLA)
- Tri-Counties Regional Cancer Registry
- Cal EPA
- Agency for Toxic Substances and Disease Registry (ATSDR)
- Boeing (International Epidemiology Institute, Vanderbilt University and Vanderbilt-Ingram Cancer Center, Oak Ridge Associated Universities, Oak Ridge National Laboratory, Lovelace Respiratory Research Institute, and University of Southern California, Los Angeles)
- SSFL Advisory Panel funded by the California State Legislature through the Citizens’ Monitoring and Technical Assistance Fund
- California Cancer Registry

The results of the studies that addressed offsite health effects are summarized here.

A study conducted by the CDHS reviewed cancer among the residents living in five census tracts in Los Angeles County within 5 miles of SSFL. The study reported the following conclusion (CDHS, 1990):

> Given the large number of comparisons made (five census tracts, two time periods, eleven sites), these findings are consistent with random variation in cancer incident rates.

The 1997 Tri-Counties Regional Cancer Registry study concluded that the residents within the study area appeared to have cancer incidence risk similar to that of the other residents of the Tri-Counties Region, except for leukemia in women, which was significantly lower, and cancer of the lung and bronchus, which was higher (DTSC, 2011).

A second Tri-Counties Regional Cancer Registry publication was in response to an inquiry about cancer incidents in the Simi Valley. The study indicated that the occurrence of newly diagnosed invasive cancers in the identified census tract was normal, and in fact, decreased between 1988 and 2004 (Nasseri, pers. comm., 2006).

The three studies conducted by CDHS were reviewed by Cal EPA in 1999; it was found that the "combined evidence from all three studies did not indicate an increased rate of cancer incidence in the regions examined." The investigation report further noted that "the results do not support the presence of any major environmental hazard" (DTSC, 2011).

The study conducted by ATSDR in 1999 concluded the following (DTSC, 2011):

> Although chemicals and radionuclides were released from the site, the likelihood of those releases resulting in human exposure is limited by a number of factors, including; 1) the distance from the release sources to the offsite residential areas that results in rapid dispersion and degradation of oxidants and solvents in air; 2) the predominant wind patterns that normally blow away from the nearest residential areas; 3) other meteorological conditions at the site such as the atmospheric mixing height; and 4) drawdowns in ground water levels that reduce the rates of contaminant migration. Considering these factors, it is unlikely that residents living near the site were exposed to SSFL-related chemicals and radionuclides at levels that would result in adverse human health effects. Changes in site operations, such as reduced frequency of rocket engine testing, discontinuation of trichloroethylene use, and shut down of nuclear operations make it unlikely that future exposures to the offsite community will occur.

The recommendation of the study was to conduct additional evaluation of exposure pathways that may affect offsite areas.

The results from a UCLA study funded by ATSDR evaluated the incidence of cancer for populations between 2 and 5 miles of SSFL during two different time periods (1988–1995 and 1996–2002). The results indicated there was no association between distance from SSFL for total and radiosensitive cancers among adults. However, the incidence rate of chemo-sensitive cancers was slightly elevated during both timeframes for populations living within 2 miles of SSFL. Specifically, the standardized incidence rate ratio was greater than 1.6 for cancers of blood and lymph tissue, bladder, thyroid, and upper aero-digestive tract for the time period of 1988 through 1995. For the time period of 1996 through 2002, the rate ratio among persons living within 2 miles of SSFL was greater than 1.6 for thyroid cancer and in the range of 1.2 to 1.6 for bladder and upper aero-digestive tract cancer. Melanoma, blood and lymph tissue, lung, and prostate cancer had a rate ratio in the range of 1.0 to 1.19. Colorectal and breast cancer had a rate ratio less than 1.0. The overall conclusion of the study indicated the following (ATSDR, 2007):

> It is important to recognize that the distance from SSFL and the incidence of specific cancers are based on small numbers of cases within strata of the regions closest to SSFL. Thus, precision of effect estimation is often poor (resulting in wide confidence

> intervals[3]), and statistical power for detecting effects is low—which implies that some of our estimates may be chance finding and should be interpreted cautiously. Furthermore, we have no direct evidence that the associations we observed—even if they reflect real differences among the three regions—necessarily reflect the effects of environmental exposures originating at SSFL.

The California Cancer Registry performed a study in 2007 of the incidences of retinoblastoma in children in Los Angeles and Ventura Counties. The study concluded that the number of cancer incidents expected was calculated to be 7.5, and the number of cases observed was 11. The number of reported incidences observed was within the 99 percent confidence interval (4.3 to 22.8); therefore, it was concluded that the "incidence of retinoblastoma in the area of interest was not statistically significantly elevated" (DTSC, 2011).

More recently, an environmental and radiological investigation performed by Tetra Tech at the Brandeis-Bardin Campus (BBC) north and adjacent to SSFL concluded (Tetra Tech, 2016):

> Tetra Tech's risk evaluation is consistent with prior risk assessments for off-site areas that found no appreciable risks at the BBC through soil exposure pathways. It demonstrates that human health risks associated with BBC soils are well below levels of concern and are consistent with background levels. Tetra Tech's risk evaluation, literature review, and background comparison analysis of all available site data indicate that the environmental and radiological conditions at the BBC pose no unacceptable human health risk to campers, camp counselors, visitors, or residents at the site.

Onsite contamination from the NASA-administered property at SSFL has not been documented in these studies to result in offsite health effects to nearby residential communities or park users; therefore, offsite contamination is not evaluated further, and the impact assessment will focus on health and safety impacts associated with the proposed soil remediation activities and exposure to onsite contamination.

3.7.2 Environmental Consequences

This subsection provides a description of the potential onsite and offsite health and safety hazards associated with the Action Alternatives and No Action Alternative.

A brief explanation of how the relevant components of the soil cleanup technologies could affect health and safety follows:

- **Excavation and Offsite Disposal:** This technology is a proven technology for removing contamination from the site. The treatment would result in an increase in truck traffic; the maximum number of truck trips per day on local roads would be 32 individual trips or 16 round trips.
- **Ex Situ Treatment Using Soil Washing:** This treatment is a proven technology for removing contamination from soil. This treatment would reduce the amount of soil that would be transported by truck to a landfill. However, heavy equipment would be required to implement the technology.
- **Ex Situ Treatment Using Land Farming:** This treatment technology would have the same health and safety conditions as the other ex situ treatments. Please see the soil washing description.
- **Ex Situ Chemical Oxidation*:*** This treatment technology would have the same health and safety conditions as the other ex situ treatments. Please see the soil washing description.
- **Ex Situ Treatment Using Thermal Desorption:** This treatment technology would have the same health and safety conditions as the other ex situ treatments. Please see the soil washing description.
- **SVE:** This treatment is a proven technology for removing contamination from soil. Some safety concerns would be associated with the construction of SVE wells and the powering of equipment by fuel. In

[3] A confidence interval is a range of values defined that there is a degree of confidence that the value of a parameter lies within it. (Walpole and Myers, 1989)

addition, spent activated carbon would be removed offsite using dump trucks. However, the quantity of offsite trucks would be substantially less than with the excavation and offsite disposal technology.

- **In Situ Chemical Oxidation:** This treatment would reduce the amount of soil that would be stockpiled and transported by truck to a landfill. Some safety concerns would be associated with the construction of injection wells and the powering of equipment by fuel. Overall, potential public safety issues would be less than those for the excavation and offsite disposal technology.
- **In Situ Anaerobic or Aerobic Biological Treatment:** This treatment technology would have the same health and safety conditions explained for in situ chemical oxidation.
- **MNA:** This treatment would be used in combination with other treatment technologies or in areas below thresholds of concern for human health. Very little, if any, heavy equipment would be required for this technology.

Table 3.7-1 identifies thresholds of impacts relevant to the health and safety analysis.

TABLE 3.7-1
Impact Thresholds for Health and Safety
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Impact	Description
No Impact	No potential for impact on human health and safety.
Negligible	There might be a slight increased risk to human health and safety, but at a level that would not warrant a change to current protocols.
Minor	There would be an increased risk to human health and safety at a level easily offset by proper management and planning.
Moderate	There would be an increased risk to human health and safety that would require changes to current protocol, protection measures, or access.
Significant	There would be an increased risk to human health and safety that would require substantial changes to current protocol, protection measures, or access and could result in severe and long-lasting effects.
Quality:	Beneficial–would have a positive effect Negative–would have an adverse effect
Duration:	Temporary–would occur only during the remediation period, even if remediation took years. Permanent–would continue beyond the remediation period.

3.7.2.1 Alternative A: AOC Cleanup

Under Alternative A, excavation and offsite disposal would require approximately 99,098 truckloads to remove up to 870,000 yd^3 of soil to landfills and import 448,000 yd^3 of backfill soil. However, truck trips would be limited to 16 round trips per day; consequently, soil cleanup activities would require 25+ years for completion.

3.7.2.1.1 Onsite Health and Safety

Onsite Worker Health and Safety

As with any construction project, health and safety concerns are associated with the use of heavy equipment such as backhoes, bulldozers, loaders, dump trucks, and paving equipment. SSFL activities follow a worker health and safety plan that is prepared or updated prior to each activity and customized to that activity. The health and safety plan covers day-to-day operations to provide workers with a plan, list, or knowledge of potential conditions and natural hazards to cover worker safety. Adherence to standard health and safety protocols, such as the use of personal protective equipment and proper training, along with implementation of the health and safety plan, will greatly mitigate the risks to onsite workers **(H&S BMP-1)**, resulting in a **minor, negative, and temporary (25+ years)** health and safety impact **(H&S Impact-1)**. Impacts associated with exposure to air quality pollutants, noise, and hazardous materials and their associated mitigation measures are discussed in their respective resource sections (Section 3.3, *Air Quality*; Section 3.6 *Hazardous Materials and Solid Waste*, and Section 3.9, *Noise*).

Onsite Exposures to Contamination

The AOC LUT values for Alternative A are based on either naturally occurring threshold values derived from DTSC's background study or an MRL for chemicals without a background threshold value. Removal of existing soil contamination to meet AOC LUT requirements would result in a **significant, beneficial, and permanent** impact (**H&S Impact-2**) to future onsite health and safety conditions.

3.7.2.1.2 Offsite Public Health and Safety

Offsite Transportation Impacts

The primary safety hazard to offsite populations is an increase in large truck traffic along residential roads. Truck trips generated by remediation activities would introduce large trucks to a local roadway network primarily used by passenger vehicles, bicyclists, and pedestrians. In general, most neighborhoods along the proposed truck routes with parks or schools have controlled locations with traffic signals at intersections or crosswalks with warning lights at crossing points (DTSC, 2017). The project-related truck trips proposed for Alternative A represent a negligible increase in traffic on the study roadways, as discussed in Section 3.8, *Traffic and Transportation*. Although the potential for a crash does exist, the truck crash rate would not be expected to change with the project-added truck trips, considering the negligible increase in traffic. To minimize the potential for truck-related crashes, the project would implement a construction traffic control plan (CTCP), which would include a truck safety plan (**Transportation BMP-1**). The impact on roadway safety and the likelihood of a crash would be considered **negligible, negative, and temporary (25+ years)** (**H&S Impact-3**).

Offsite Accidental Spill

In the unlikely event an accident were to occur and result in the release of hazardous waste or material to the environment, a potentially significant impact could result. However, with contained transport of hazardous material, safety protocols, and the development of emergency response procedures to be followed in the event of a release **(H&S BMP-2)**, the probability of a spill is remote, and the impact would be considered **moderate, negative, and temporary (25+ years)** (**H&S Impact-4**).

3.7.2.1.3 Protection of Children

EO 13045, Protection of Children from Environmental Health Risks and Safety Risks, requires federal agencies to consider unique or disproportionate risks to the health and safety of children. Child-centric resources, including schools, parks and residential areas, are located throughout the ROI. However, children would be prohibited from accessing cleanup areas and the risks to children from increased traffic and accidental spills would not be disproportionate to the rest of the population. Therefore, the risks to offsite children would be considered the same as those described in the proceeding section and result in a **negligible, negative, and temporary (25+ years)** impact from transportation **(H&S Impact-5)** and a **moderate, negative, and temporary (25+ years)** impact (**H&S Impact-6**) from exposure to spills.

Children who may use the site in the future would benefit from the cleanup of existing contamination, resulting in a **significant, beneficial, and permanent impact** (**H&S Impact-7**).

3.7.2.2 Alternative B – Revised LUT Levels Cleanup

Under Alternative B, excavation and offsite disposal would require approximately 47,895 truckloads to remove up to 384,000 yd^3 of soil and import 253,000 yd^3 of backfill soil. As with Alternative A, truck trips would be limited to 16 round trips per day, making the duration of cleanup-related traffic impacts the primary difference between the Action Alternatives. Because Alternative B has a smaller area of disturbance and fewer total truck loads than Alternative A, it would require only an estimated 12 years to complete.

3.7.2.2.1 Onsite Health and Safety

Onsite Worker Health and Safety

The risks to workers for Alternative B would be the same as those described for Alternative A, though of shorter duration because remediation would occur within a 12-year time period. NASA would also implement **H&S BMP-1** for Alternative B. Consequently, onsite health and safety impacts to workers associated with the Alternative B are expected to be **minor, negative, and temporary (12 years) (H&S Impact-1)**.

Onsite Exposures to Contamination

The Alternative B revised LUT values for soil cleanup were developed for this SEIS using the Cal EPA Office of Environmental Health Hazard Assessment (Cal EPA, 2005a), Los Angeles County screening levels for contaminants (Los Angeles, 1996), and EPA screening levels (EPA, 2018a). These values are based on levels used by the above-referenced agencies to help identify areas, contaminants, and conditions that require further attention at a site. These revised screening levels represent concentrations of chemicals in soil that are below thresholds of concern for risks to human health (Cal EPA, 2005b) and are considered by these organizations to be protective for humans, including sensitive groups and children, over a lifetime in a residential scenario. Therefore, the reduction of contamination in Alternative B would be expected to result in a **significant, beneficial, and permanent impact** (**H&S Impact-2**) to future onsite health and safety conditions.

3.7.2.2.2 Offsite Public Health and Safety

Offsite Transportation Impacts

Potential safety effects from truck trips under Alternative B would be the same as those for Alternative A, though of shorter duration. With the implementation of **Transportation BMP-1**, the impact on roadway safety and the likelihood of a crash would be considered **negligible, negative, and temporary (12 years) (H&S Impact-3).**

Offsite Accidental Spill

In the unlikely event an accident were to occur and result in the release of hazardous waste or material to the environment, a potentially significant impact could result. However, **H&S BMP-2** also would be implemented for Alternative B and the impact would be considered **moderate, negative, and temporary (12 years)** (**H&S Impact-4**).

3.7.2.2.3 Protection of Children

Risks to offsite children from the cleanup activities in Alternative B would be considered the same as those described in the proceeding section and result in a **negligible, negative, and temporary (12 years) impact** from transportation **(H&S Impact-5)** and a **moderate, negative, and temporary (12 years) impact** (**H&S Impact-6**) from exposure to spills. Children who use the site in the future would benefit from the cleanup of existing contamination, resulting in a **significant, beneficial, and permanent impact** (**H&S Impact-7**).

3.7.2.3 Alternative C: Suburban Residential Cleanup

Under Alternative C, excavation and offsite disposal would require approximately 32,782 truckloads to remove up to 247,000 yd^3 of soil and import 189,000 yd^3 of backfill soil. As with Alternatives A and B, truck trips would be limited to 16 round trips per day, making the duration of cleanup-related traffic impacts the primary difference between the Action Alternatives. Because Alternative C has a smaller area of disturbance and fewer total truckloads than Alternatives A and B, it would require only an estimated 8 years to complete.

3.7.2.3.1 Onsite Health and Safety

Onsite Worker Health and Safety

The risks to workers for Alternative C would be the same as those described for Alternative A, though of shorter duration because remediation would occur within an 8-year time period. NASA would also implement **H&S BMP-1** for Alternative C. Consequently, onsite health and safety impacts to workers associated with the Alternative C are expected to be **minor, negative, and temporary** (**8 years) (H&S Impact-1).**

Onsite Exposures to Contamination

A suburban residential cleanup (Alternative C) is considered to be protective for humans living onsite, including sensitive groups, over a lifetime (EPA, 2018b). The EPA uses the target of 1×10^{-6} (or 1 in a 1,000,000) as the guide for managing health concerns related to cancer under a risk-based cleanup (EPA, 1991). In other words, there would be an approximately 1 in 1,000,000 possibility for an exposed individual to experience health concerns, such as cancer, under the Suburban Residential risk-based cleanup scenario. Exposure areas that have excess lifetime cancer risk estimates of less than 1 in a 1,000,000 (1×10^{-6}) are characterized as not posing a threat to human health for the evaluated exposed populations, per established EPA guidelines (EPA, 2018b). Alternative C cleanup is protective to a hypothetical future suburban residential land use and is considered protective for humans that might live onsite; therefore, the reduction of contamination would be expected to result in a **significant, beneficial, and permanent impact** (**H&S Impact-2**) to future onsite health and safety conditions. Section 2.2.3, *Alternative C: Suburban Residential Cleanup*, provides a detailed explanation of the assumptions concerning future suburban residential land use.

3.7.2.3.2 Offsite Public Health and Safety

Offsite Transportation Impacts

Potential safety effects from truck trips under Alternative C would be the same as those for Alternative A, though of shorter duration. With the implementation of **Transportation BMP-1**, the impact on roadway safety and the likelihood of a crash would be considered **negligible, negative, and temporary (8 years)** (**H&S Impact-3**).

Offsite Accidental Spill

In the unlikely event an accident were to occur under Alternative C and result in the release of hazardous waste or material to the environment, a potentially significant impact could result. However, with the implementation of **H&S BMP-2**, the impact would be considered **moderate, negative, and temporary (8 years)** (**H&S Impact-4**).

3.7.2.3.3 Protection of Children

The risks to offsite children resulting from the cleanup activities in Alternative C would be considered the same as those described in the proceeding sections and result in a **negligible, negative, and temporary (8 years) impact** from increased truck traffic **(H&S Impact-5)** and a **moderate, negative and temporary (8 years) impact** (**H&S Impact-6**) from exposure to spills.

Risks to infants and children were included in the EPA calculations for suburban residential cleanup levels (EPA, 2018b). Therefore, the risks calculated to the general public based on future residential land use considered the proportionate health effects for infants and children. Consequently, children who use the site in the future would benefit from the cleanup of existing contamination, resulting in a **significant, beneficial, and permanent impact** (**H&S Impact-7**).

3.7.2.4 Alternative D: Recreational Cleanup

Under Alternative D, excavation and offsite disposal would require approximately 23,873 truckloads to remove up to 176,500 yd^3 of soil and import 141,000 yd^3 of backfill soil. As with the other Action Alternatives, truck trips would be limited to 16 round trips per day, making the duration of cleanup-related traffic impacts the primary difference between the Action Alternatives. Because Alternative D has a smaller area of disturbance and fewer total truckloads than the other Action Alternatives, it would require only an estimated 6 years for completion.

3.7.2.4.1 Onsite Health and Safety

Onsite Worker Health and Safety

The risks to workers for Alternative D would be the same as those described for Alternative A, though of shorter duration because remediation would occur within a 6-year time period. NASA would implement **H&S BMP-1** for Alternative D. Consequently, onsite health and safety impacts to workers associated with Alternative D are expected to be **minor, negative, and temporary** (**6 years) (H&S Impact-1).**

Onsite Exposures to Contamination

A recreational cleanup (Alternative D) is considered to be protective for humans using the site, including sensitive groups, over a lifetime (EPA, 2018b). The EPA uses the target of 1×10^{-6} (or 1 in a 1,000,000) as the guide for managing health concerns related to cancer under a risk-based cleanup (EPA, 1991). Alternative D would meet the EPA's target risk requirements for future recreational users of the site. Therefore, the reduction of contamination would be expected to result in a **significant, beneficial, and permanent impact** (**H&S Impact-2**) to future onsite health and safety conditions.

3.7.2.4.2 Offsite Public Health and Safety

Offsite Transportation Impacts

Potential safety effects from truck trips under Alternative D would be the same as those for Alternative A, though of shorter duration. With the implementation of **Transportation BMP-1**, the impact on roadway safety and the likelihood of a crash would be considered **negligible, negative, and temporary (6 years)** (**H&S Impact-3**).

Offsite Accidental Spill

In the unlikely event an accident were to occur under Alternative D and result in the release of hazardous waste or material to the environment, a potentially significant impact could result. However, with the implementation of **H&S BMP-2**, the impact would be considered **moderate, negative, and temporary (6 years)** (**H&S Impact-4**).

3.7.2.4.3 Protection of Children

The risks to offsite children resulting from the cleanup activities in Alternative D would be considered the same as those described in the proceeding sections and result in a **negligible, negative, and temporary (6 years) impact** from increased truck traffic **(H&S Impact-5)** and a **moderate, negative, and temporary (6 years) impact** (**H&S Impact-6**) from exposure to spills.

Risks to infants and children onsite were included in the EPA risk calculations for recreational cleanup levels (EPA, 2018b). Therefore, the risks calculated to the general public based on future recreational land use considered the proportionate health effects for infants and children. Consequently, children who use the site in the future would benefit from the cleanup of existing contamination, resulting in a **significant, beneficial, and permanent impact** (**H&S Impact-7**).

3.7.2.5 No Action Alternative

Under the No Action Alternative (as required by 40 CFR 1502.14(d)), there would be **no new impacts** to worker safety **(H&S Impact-1)** and no increased truck traffic **(H&S Impact-3)** or increased spill risk **(H&S**

Impact-4). There would also be no new impacts to offsite children from truck traffic **(H&S Impact-5)** or increased spill risk **(H&S Impact-6)**.

However, under this alternative, NASA would not conduct soil remediation beyond what has already been done under separate regulatory direction. Contaminants not captured by this program would remain in place and may attenuate naturally over time; however, no monitoring would occur as part of this natural attenuation. While natural attenuation without monitoring may reduce some contamination, it is expected that the majority of onsite contamination would remain in place. Consequently, the resulting impacts to onsite health and safety conditions would be **significant, negative, and permanent (H&S Impact-2);** the impact to onsite children who may use the site in the future also would be **significant, negative, and permanent (H&S Impact-7).**

3.7.3 Best Management Practices

This subsection provides a brief description of BMPs.

- **H&S BMP-1** (All Proposed Action Alternatives): A health and safety plan, which would include general hazard controls, project-specific hazard controls, and controls for physical and biological hazards, would be created for all remediation activities. Workers would be required to use personal protection equipment and attend appropriate training.
- **H&S BMP-2** (All Proposed Action Alternatives): Emergency spill response procedures will be developed for the offsite transportation of hazardous materials.

3.7.4 Summary of Impacts

Table 3.7-2 provides a summary of the health and safety impacts on resources under each Action Alternative. These impacts are conservative because it was assumed the most impactful soil technology (Excavation and Offsite Disposal) would be used throughout the site.

TABLE 3.7-2
Summary of the Health and Safety Impacts
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Impacts	Alternative A AOC Cleanup	Alternative B Revised LUT Levels Cleanup	Alternative C Suburban Residential Cleanup	Alternative D Recreational Cleanup	No Action Alternative
H&S Impact-1: Onsite worker safety	Minor, negative, and temporary (25+ years)	Minor, negative, and temporary (12 years)	Minor, negative, and temporary (8 years)	Minor, negative, and temporary (6 years)	No Impact
H&S Impact-2: Onsite exposure to contamination	Significant, beneficial, and permanent	Significant, beneficial, and permanent	Significant, beneficial, and permanent	Significant, beneficial, and permanent	Significant, negative, and permanent
H&S Impact-3: Offsite exposure to truck traffic	Negligible, negative, and temporary (25+ years)	Negligible, negative, and temporary (12 years)	Negligible, negative, and temporary (8 years)	Negligible, negative, and temporary (6 years)	No impact
H&S Impact-4: Offsite exposure to hazardous material spills	Moderate, negative, and temporary (25+ years)	Moderate, negative, and temporary (12 years)	Moderate, negative, and temporary (8 years)	Moderate, negative, and temporary (6 years)	No impact
H&S Impact-5: Child exposure to offsite truck traffic	Negligible, negative, and temporary (25+ years)	Negligible, negative, and temporary (12 years)	Negligible, negative, and temporary (8 years)	Negligible, negative, and temporary (6 years)	No impact

Impacts	Alternative A AOC Cleanup	Alternative B Revised LUT Levels Cleanup	Alternative C Suburban Residential Cleanup	Alternative D Recreational Cleanup	No Action Alternative
H&S Impact-6: Child exposure to offsite hazardous material spills	Moderate, negative, and temporary (25+ years)	Moderate, negative, and temporary (12 years)	Moderate, negative, and temporary (8 years)	Moderate, negative, and temporary (6 years)	No impact
H&S Impact-7: Child exposure to onsite contamination	Significant, beneficial, and permanent	Significant, beneficial, and permanent	Significant, beneficial, and permanent	Significant, beneficial, and permanent	Significant, negative, and permanent

3.8 Traffic and Transportation

This subsection describes the existing traffic and transportation conditions surrounding SSFL and the associated environmental consequences from the Action Alternatives and the No Action Alternative. Railroads and airports were found to be unaffected by the project; thus, these transportation-related resources were eliminated from further analysis, as discussed in Section 2.4.

The primary ROI for traffic and transportation includes local access routes to the entrance of SSFL in Los Angeles and Ventura Counties. For heavy vehicles, the regional and local roadway network within the primary ROI includes Woolsey Canyon Road, Valley Circle Boulevard, Roscoe Boulevard, SR 118, SR 27 (Topanga Canyon Road), and US 101. Local access routes for site workers travelling to SSFL include Box Canyon Road, Plummer Street, and Santa Susana Pass Road, in addition to the roadways identified for heavy vehicles. The primary ROI is shown on Figure 3.8-1. Roadways within SSFL are included in the primary ROI. Although workers could access the project site via roads other than those mentioned herein, such as Black Canyon Road, these routes are not discussed further because the number of workers using those routes is anticipated to be low.

The secondary ROI for traffic and transportation includes regional access routes to the project site and potential dump or landfill sites for hazardous wastes. These routes are expected to include Interstate (I)-405, I-5, I-210, and SR 14. Some heavy vehicles carrying waste or equipment or bringing in treatment equipment might travel on roadways outside California to destinations in Nevada, Utah, or Idaho. Roadways near the landfill sites have not been included, because the project-related volumes would be low relative to the available capacity or the existing volume on the roads.

3.8.1 Affected Environment

3.8.1.1 Regional and Local Transportation Facilities

The following discussion summarizes the existing roadways in the primary SSFL ROI and nearby facilities in the secondary SSFL ROI, including existing configurations, traffic volumes, and operating conditions. These are the main roadways that heavy trucks or crew members accessing SSFL would use. Figure 3.8-1 shows the regional and local roadway network within the primary ROI. The current primary route for trucks hauling waste from SSFL is Woolsey Canyon Road, Valley Circle Boulevard, Roscoe Boulevard, and SR 27/Topanga Canyon Boulevard to SR 118. SR 118 is the primary arterial linking into the local highway system, including I-405 and I-5. US 101 may also be used as an alternate to SR 118; however, daytime traffic and congestion make it less desirable.

3.8.1.1.1 Primary ROI

Freeways

US 101. US 101, which has an east-west alignment in the vicinity of SSFL, is 5 miles south of SSFL. US 101 connects with I-5 in downtown Los Angeles to the south and with San Luis Obispo, San Jose, and San Francisco to the north. In the vicinity of the project site, US 101 is an 8- to 10-lane urban freeway. According to traffic counts published by the California Department of Transportation (Caltrans) in 2015, the average annual daily traffic (AADT) near the SR 27/Topanga Canyon Boulevard interchange was 229,000 vehicles per day (Caltrans, 2015).

Other State Highways

SR 118. SR 118 is an east-west urban freeway approximately 3 miles north of SSFL. SR 118 connects with I-210 to the east and terminates at the SR 126 interchange to the west. Near SSFL, SR 118 is a 10-lane roadway. According to traffic counts published by Caltrans in 2015, the AADT near the Roscoe Boulevard intersection was 126,000 vehicles per day (Caltrans, 2015).

SR 27/Topanga Canyon Boulevard. This road is a north-south route approximately 4 miles east of SSFL. SR 27/Topanga Canyon Boulevard connects with SR 118 to the north and SR 1 (Pacific Coast Highway) to the south. Near SSFL, SR 27/Topanga Canyon Boulevard is generally a 6-lane principal arterial roadway. According to traffic counts published by Caltrans in 2015, the AADT at the Roscoe Boulevard intersection was 46,000 vehicles per day (Caltrans, 2015).

Arterial Streets

Roscoe Boulevard. Roscoe Boulevard is an east-west principal arterial in Los Angeles County, approximately 2 miles southeast of SSFL. Roscoe Boulevard connects Valley Circle Boulevard to SR 27/Topanga Canyon Boulevard. Near SSFL, Roscoe Boulevard is a 2- to 5-lane roadway. Traffic counts conducted by DTSC in 2015 indicated an average daily traffic (ADT) volume near the SR 27/Topanga Boulevard intersection of 31,073 vehicles per day (DTSC, 2017).

Woolsey Canyon Road. Woolsey Canyon Road is a 2-lane east-west local street in Los Angeles County that serves as the primary access road connecting the SSFL entrance to Valley Circle Boulevard. Traffic counts conducted by DTSC in 2015 indicated an ADT volume of 2,417 vehicles per day (DTSC, 2017).

Valley Circle Boulevard. Valley Circle Boulevard is a north-south principal arterial in Los Angeles County, approximately 1.5 miles east of SSFL. Valley Circle Boulevard connects Woolsey Canyon Road to Roscoe Boulevard, Plummer Street, and Box Canyon Road. Valley Circle Boulevard is a 2-lane roadway. Traffic counts conducted by DTSC in 2015 indicated an ADT volume of 9,487 (DTSC, 2017).

Plummer Street. Plummer Street is an east-west minor arterial in Los Angeles County, approximately 3 miles east of SSFL. Plummer Street, which connects Valley Circle Boulevard to SR 27/Topanga Canyon Boulevard, is a 3- to 4-lane roadway. Traffic counts conducted by DTSC in 2015 indicated an ADT volume of 6,811 vehicles per day (DTSC, 2017).

Box Canyon Road. Box Canyon road is a north-south local street approximately 1.5 miles east of SSFL. Box Canyon Road, which connects Valley Circle Boulevard in Los Angeles County to Santa Susana Pass Road in Ventura County, is a 2-lane roadway. Traffic counts conducted by Caltrans in 2010 indicated an ADT volume of 3,690 vehicles per day (DTSC, 2017).

Santa Susana Pass Road. Santa Susana Pass Road is an east-west minor arterial street in Ventura County, approximately 2.5 miles northeast of the project site. For project purposes, Santa Susana Pass Road connects Box Canyon Road to SR 118 and is a 2-lane roadway. Traffic counts conducted by DTSC in 2015 indicted an ADT volume of 3,324 vehicles per day (DTSC, 2017).

Roadways within SSFL

Roadways within SSFL include both paved and unpaved roads. Paved roadways generally provide one lane of travel in each direction with limited shoulder area. Unpaved roadways generally provide a single lane of travel with no shoulder. Traffic volumes vary depending on the types of activities occurring on the site. Access to SSFL and the use of these roadways are restricted to the operations of Boeing, DOE, NASA, and their subcontractors, vendors, and visitors.

3.8.1.1.2 Secondary ROI

Freeways

Interstate 5. I-5 is a north-south freeway approximately 15 miles east of SSFL. I-5 connects the Canadian and Mexican borders through the major metropolitan areas of Seattle, Portland, Sacramento, Los Angeles, and San Diego. Near SSFL, I-5 is generally a 10- to 12-lane roadway. According to traffic counts published by Caltrans in 2015, the AADT near the SR 118 interchange was 290,000 vehicles per day (Caltrans, 2015).

Interstate 210. I-210 is an east-west freeway approximately 21 miles east of SSFL. I-210 connects with I-5 to the north near the City of Los Angeles' border and with I-10 in the City of Redlands. In the vicinity of SSFL, I-210 is generally an 8-lane roadway. According to traffic counts published by Caltrans in 2015, the ADT volume near the La Tuna Canyon interchange, about 25 miles from SSFL, was 121,000 vehicles per day (Caltrans, 2015).

Interstate 405. I-405 is a north-south freeway approximately 12 miles east of SSFL. I-405 connects with I-5 to the north, near the City of Los Angeles' border and with I-5 to the south within the City of Irvine. Near SSFL, I-405 is generally a 10-lane roadway. According to traffic counts published by Caltrans in 2015, the ADT volume near the SR 118 interchange was 215,000 vehicles per day (Caltrans, 2015).

Other State Highways

State Route 14. SR 14 is an east-west route approximately 12 miles northeast of SSFL. SR 14 connects with US 395 near Inyokern to the north and with I-5 near the Los Angeles' border to the south. Near SSFL, SR 14 is generally an 8- to 10-lane roadway. According to traffic counts published by Caltrans in 2015, the ADT volume at the I-5 interchange was 172,000 vehicles per day (Caltrans, 2015).

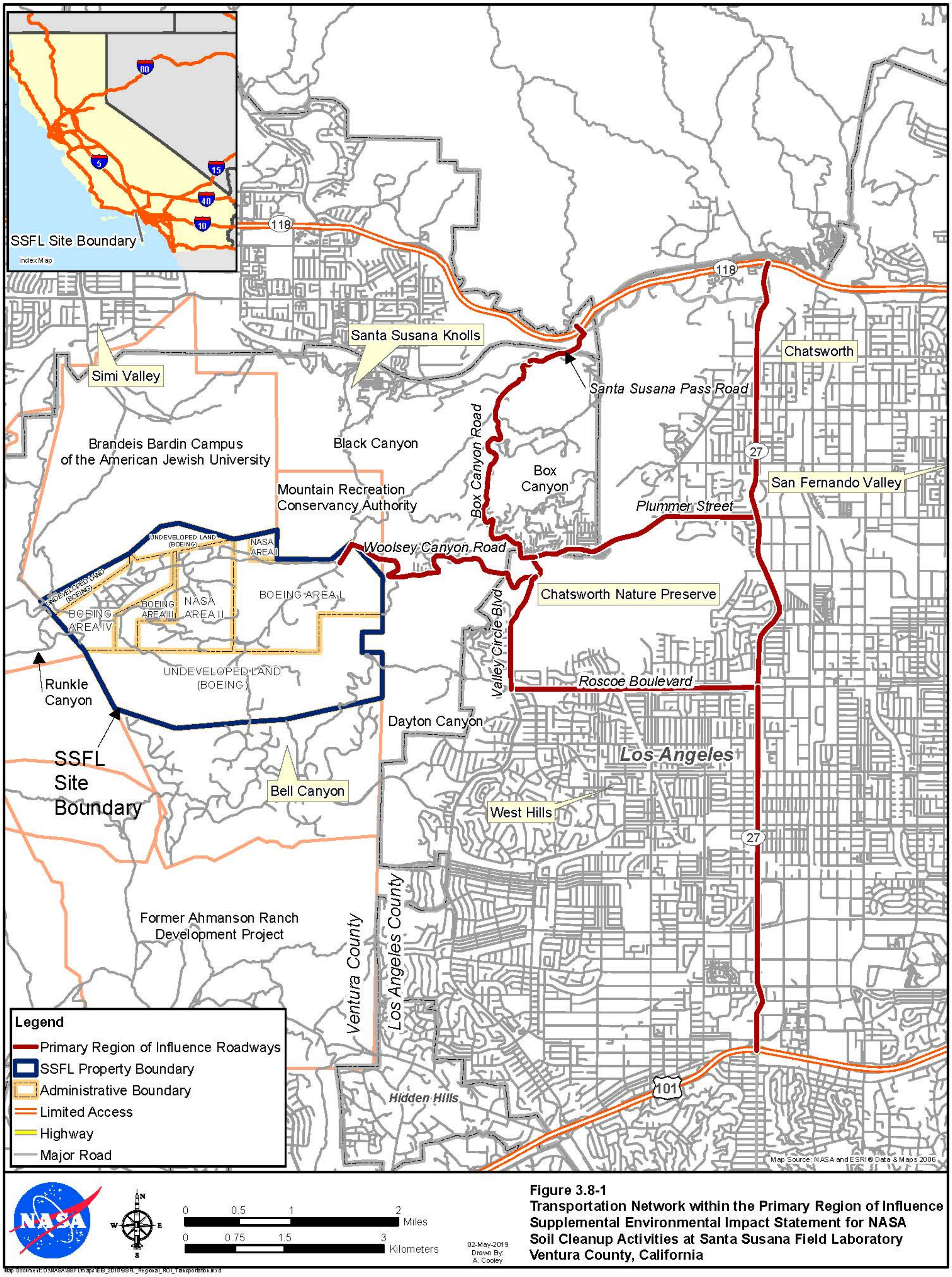

Figure 3.8-1
Transportation Network within the Primary Region of Influence
Supplemental Environmental Impact Statement for NASA
Soil Cleanup Activities at Santa Susana Field Laboratory
Ventura County, California

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3.8.1.2 Existing Traffic Conditions and Level-of-Service Analysis

NASA conducted this evaluation according to the methodologies and procedures outlined in the *Highway Capacity Manual* (HCM) (TRB, 2010) and applicable provisions from NEPA. NASA evaluated the local streets and the freeways based on peak-hour traffic conditions. The analysis was based on traffic counts collected by DTSC and Caltrans for the year 2015.

The 2010 HCM includes a set of criteria for assessing the performance of the highway systems and the capacity of roadways by measuring the flow of traffic. For roadway segment operations, the volume to capacity (V/C) ratio is a general indicator for traffic flow characteristics. Table 3.8-1 lists the roadway traffic flow characteristics for different level-of-service (LOS) values.

TABLE 3.8-1
Level of Service Characteristics
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

LOS	Volume to Capacity (V/C) Ratio	Traffic Flow Characteristics
A	0.00 – 0.60	Highest quality of service. Free traffic flow, with low volumes and densities. Little or no restriction on maneuverability or speed.
B	> 0.60 – 0.70	Stable traffic flow, speed becoming slightly restricted. Low restriction on maneuverability.
C	> 0.70 – 0.80	Stable traffic flow, but less freedom to select speed, change lanes, or pass. Density increasing.
D	> 0.80 – 0.90	Approaching unstable flow. Speeds tolerable, but subject to sudden and considerable variation. Less maneuverability and driver comfort.
E	> 0.90 – 1.00	Unstable traffic flow with rapidly fluctuating speeds and flow rates. Short headways, low maneuverability, and low driver comfort.
F	Greater than 1,000	Forced traffic flow. Speed and flow might drop to zero with high densities.

Source: Los Angeles County Metropolitan Transportation Authority, 2010

This evaluation is based on peak-hour volumes for the roadway segments within the primary ROI. Peak-hour capacities were developed using 2010 HCM methodologies:

- Peak-hour lane capacity for freeway facilities in the primary ROI (SR 118 and US 101) was obtained from the 2010 HCM Exhibit 10-5 using a conservative 55 mph free-flow speed.
- Peak-hour lane capacity for SR 27/Topanga Canyon Boulevard was assumed using the 2010 HCM Exhibit 16-14 daily service volume for LOS D/E threshold for a 6-lane roadway, assuming a peak-hour factor of 0.10 and a directional distribution of 0.55.
- All other peak period capacities were obtained from the DTSC 2017 traffic report (DTSC, 2017).

Vehicle volumes were obtained from counts conducted by DTSC and Caltrans in 2015. Table 3.8-2 lists the existing conditions (2015) within the primary ROI. As shown in the table, traffic congestion exists on some roadways within the primary ROI, including segments of Roscoe Boulevard, Valley Circle Boulevard, and US 101, which are all operating at lower than LOS D.

3.8.1.3 Public Transit Network

Los Angeles County Metropolitan Transportation Authority operates transit service within Los Angeles County. Within the primary ROI, Routes 152 and 353 operate along Roscoe Boulevard and Routes 245, 150, 169, and 750 operate along SR 27/Topanga Canyon Boulevard. In addition, Route 791, operated by Santa Clarita Transit, and Route 422, operated by Los Angeles Department of Transportation Commuter Express, operate along SR 27/Topanga Canyon Boulevard.

TABLE 3.8-2
2015 Traffic Conditions along Roadways within Primary Region of Influence
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Roadway	Segment	Travel Lanes[a]	Peak Period	Peak Hour Volume[b]	Peak Hour Capacity[c]	V/C Ratio	LOS
Roscoe Boulevard	Woodlake Avenue to Shoup Avenue	4	A.M.	999	2,500	0.40	A
Roscoe Boulevard	Woodlake Avenue to Shoup Avenue	4	P.M.	1,019	2,500	0.41	A
Roscoe Boulevard	Shoup Avenue to Farralone Avenue	4	A.M.	2,126	2,500	0.85	D
Roscoe Boulevard	Shoup Avenue to Farralone Avenue	4	P.M.	2,607	2,500	1.04	F
Valley Circle Boulevard	Woolsey Canyon Road to Chatlake Drive	2	A.M.	1,247	1,050	1.19	F
Valley Circle Boulevard	Woolsey Canyon Road to Chatlake Drive	2	P.M.	962	1,050	0.92	E
Plummer Street	Valley Circle Boulevard to Farralone Avenue	2	A.M.	733	1,050	0.70	B
Plummer Street	Valley Circle Boulevard to Farralone Avenue	2	P.M.	686	1,050	0.65	B
Woolsey Canyon Road	Valley Circle Boulevard to Knapp Ranch Road	2	A.M.	214	1,050	0.20	A
Woolsey Canyon Road	Valley Circle Boulevard to Knapp Ranch Road	2	P.M.	254	1,050	0.24	A
Box Canyon Road	Santa Susana Pass Road to Robertson Road	2	A.M.	509	1,050	0.48	A
Box Canyon Road	Santa Susana Pass Road to Robertson Road	2	P.M.	452	1,050	0.43	A
Santa Susana Pass Road	Rocky Peak Road to Box Canyon Road	2	A.M.	365	1,050	0.35	A
Santa Susana Pass Road	Rocky Peak Road to Box Canyon Road	2	P.M.	345	1,050	0.33	A
SR 27/Topanga Canyon Boulevard	Roscoe Boulevard to Devonshire Street	6	Daily Peak[d]	4,250	4,890	0.87	D
SR 27/Topanga Canyon Boulevard	Devonshire Street to SR 118	6	Daily Peak[d]	3,900	4,890	0.80	C
SR 118	SR 27 to De Soto Avenue	10	Daily Peak[d]	12,900	22,500	0.57	A
US 101	SR 27 to Canoga Avenue	8	Daily Peak[d]	22,700	18,000	1.26	F

Notes:
[a] Based on the most constricted profile of the roadway segment.
[b] DTSC 2015 Traffic Counts (DTSC, 2017) and Caltrans 2015 Traffic Counts (Caltrans, 2015)
[c] Peak period lane capacity based on HCM 2010 methodology and DTSC 2017 Traffic Report (DTSC, 2017).
[d] A.M. and P.M. peak volumes were not available for these roadways so daily peak-hour volumes are shown.
A.M. = morning peak period
P.M. = evening peak period
LOS = level of service

3.8.2 Environmental Consequences

This subsection provides a description of the potential impacts from implementing the Action Alternatives or the No Action Alternative on traffic and transportation. For this evaluation, primary and secondary areas of impact were used. For site worker vehicles, the local access routes included Plummer Street, Box Canyon Road, and Santa Susana Pass Road, in addition to the roadways identified for heavy vehicles. The secondary ROI area was defined as the regional access routes to the project site and potential dump or landfill sites for construction and hazardous wastes, including I-405, I-5, I-210, and SR 14.

The primary traffic and transportation impacts to the environment would result from truck traffic along the haul routes accessing SSFL. The total number of trucks to be used for the cleanup would be 48 round trips to be shared by the three responsible parties (NASA, DOE, and Boeing) along the same haul routes. NASA's share of this total is 16 round-trip truckloads per day (32 trucks total) (NASA, DOE, and Boeing, 2015), for a total of 250 days per year. Additionally, it was assumed that 15 site workers would access the site during soil cleanup activities.

For the purposes of this analysis, it was assumed that major project remediation activities would begin in the year 2020. As discussed in the previous section, traffic congestion currently exists in the SSFL area on some roadways within the primary ROI at some time periods during the day. If the population in the area of SSFL grows during the time required for remediation activities (as many as 25+ years under Alternative A), then the level of traffic congestion near SSFL could also grow independent of soil cleanup activities by NASA. Consistent with the traffic study performed by DTSC, a 1 percent annual traffic growth rate was assumed for traffic conditions independent of NASA soil cleanup activities. This is a conservative estimate, as the traffic growth projections for the West San Fernando Valley area in the current 2010 *County of Los Angeles Congestion Management Program* is 0.41 percent annually (DTSC, 2017). NASA selected the year 2032 to evaluate future-year project impacts in the interest of consistency with DTSC and DOE analyses and because NASA believes that traffic projections to 2032 would be sufficient to reach meaningful conclusions from the analysis.

A brief explanation of the relevant components of the technologies is provided below:

- **Excavation and Offsite Disposal:** Tractor-trailers, dump trucks, and flatbed trucks would be used over the course of the remediation activities, and workers would commute daily to the site. Large (19 yd^3) dump trucks will be required to move soil offsite and then return with backfill material. The maximum number of truck trips per day for NASA activities is 32 individual trips or 16 round trips.
- **Ex Situ Treatment Using Soil Washing:** Tractor-trailers, dump trucks, and flatbed trucks would be used over the course of the remediation activities, and workers would commute daily to the site. Only a small proportion of soil would be transported offsite, thereby reducing the number of truck trips necessary.
- **Ex Situ Treatment Using Land Farming:** Tractor-trailers, dump trucks, and flatbed trucks would be used over the course of the remediation activities, and workers would commute daily to the site. Soil would be remediated onsite, thereby limiting the need for large dump trucks.
- **Ex Situ Chemical Oxidation:** The transportation conditions would be similar to those described for ex situ treatment using land farming.
- **Ex Situ Treatment Using Thermal Desorption:** The transportation conditions would be similar to those described for ex situ treatment using land farming.
- **SVE:** Some heavy equipment would be required for this technology and the spent activated carbon would be removed offsite using dump trucks, but the quantity of offsite trucks would be substantially less than the quantity for the excavation and offsite disposal technology.
- **In Situ Chemical Oxidation:** Some heavy equipment would be required for this technology and the spent drill cuttings and purge water would be removed offsite using dump and tanker trucks, but the quantity

of offsite trucks would be substantially less than the quantity for the excavation and offsite disposal technology.

- **In Situ Anaerobic or Aerobic Biological Treatment:** The transportation conditions would be similar to those described for in situ chemical oxidation.
- **MNA:** Very little, if any, heavy equipment would be required for this technology. There would be no need for dump trucks.

To obtain an understanding of the greatest potential impact by alternative and to provide decision makers with a comparative analysis by which to make a fully informed decision, it was assumed that excavation and offsite disposal would be the technology applied to the majority of the site. Consequently, the soil excavation quantities and truck traffic explained in Table 2.2-2 were used to analyze the greatest potential impact as a conservative assumption.

Table 3.8-3 identifies the thresholds of impacts relevant to the traffic and transportation analysis.

TABLE 3.8-3
Impact Thresholds for Traffic and Transportation
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Impact	Description
No Impact	No impacts to traffic conditions or transportation resources would be expected.
Negligible	Changes to traffic conditions or transportation resources would be so small that they would not be noticeable.
Minor	Impacts would result in a noticeable change in traffic on the roadway network or to transportation resources within the ROI; however, the change would not exceed roadway capacity or cause delays on the roadway network.
Moderate	Impacts would result in a measurable and consequential change in traffic or transportation resources within the ROI; while some delays could occur, roadway capacity would not be exceeded.
Significant	Impacts could result in a substantial change in traffic on the roadway network or to transportation resources within the ROI; noticeable delays would occur, and roadway capacity would be exceeded.
Quality:	Beneficial–would have a positive effect Negative–would have an adverse effect
Duration:	Temporary–would occur only during the remediation period, even if remediation took years. Permanent–would continue beyond the remediation period.

3.8.2.1 Methodology

NASA performed a quantitative roadway operations evaluation of the potential effects of truck and site worker traffic to analyze the impacts of remediation traffic on V/C ratios and LOS within the ROI. The traffic analysis focused on the primary ROI because the majority of the project trips would use these roadways.

3.8.2.1.1 Project Trip Generation

Truck and automobile trips for the proposed remediation activities were estimated to evaluate impacts. To represent the most realistic upper bounds for the purpose of a conservative analysis, the following assumptions were used to develop the project trip generation:

- For the purposes of the traffic analysis, the number of daily truckloads and site workers does not differ between the alternatives. Instead, the duration of cleanup activities is the differentiating factor. Soil excavation volumes, off haul truckloads, backfill import volumes, backfill import truckloads, and total duration of remediation activities are summarized in Section 2.2.5, *Alternatives Comparison*.
- NASA will use no more than 16 round trips by truck per day to transport soil offsite (DTSC, 2017) and the truck trips will be evenly divided over an 8-hour work day. Each truck will have the capacity to haul 13.3

yd^3 of soil in a single load. The daily truck trips were agreed upon by NASA, Boeing, and DOE in the Transportation and Road Agreement signed between all three parties in 2015 (NASA, Boeing, and DOE, 2015).

- For LOS calculations, the truck trips were converted to passenger car equivalents at a ratio of 2.5 passenger cars for each truck, consistent with the 2010 HCM guidelines for rolling terrain.
- It was estimated that 15 site workers are needed for soil remediation activities. As a conservative analysis, it was assumed that none of the construction workers would carpool and that 50 percent of the employees would travel to and from the site during the peak hour.
- A post-remediation analysis was not performed because the SSFL site will not generate new trips after the site cleanup is completed.
- As described previously, the annual traffic growth rate will be 1 percent. This rate was used to adjust 2015 traffic counts to estimate peak-hour volumes for the start of remediation year (2020) and future year (2032) conditions.
- As described previously, NASA selected the year 2032 to evaluate future-year project impacts in the interest of consistency with DTSC and DOE analyses and because NASA believes that traffic projections to 2032 are sufficient to reach meaningful conclusions from the analysis.

Table 3.8-4 summarizes the anticipated trip generation for the project based on the previously stated assumptions, which would apply to all the Action Alternatives.

TABLE 3.8-4
Project Passenger Car Equivalent Trip Generation
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Trip Type	Daily Total	A.M. Peak Hour – In	A.M. Peak Hour – Out	A.M. Peak Hour – Total	P.M. Peak Hour – In	P.M. Peak Hour – Out	P.M. Peak Hour- Total
Site workers[a]	30	8	0	8	0	8	8
Haul trucks[b]	80	5	5	10	5	5	10
Total	110	13	5	18	5	13	18

Notes:
[a] Daily worker trips are the total trips attributed to the 15 construction workers arriving to the site and leaving the site daily, which equals 30 trips; half of the workers are assumed to arrive at SSFL during the A.M. peak hour and depart during the P.M. peak hour.
[b] Haul trucks were converted to passenger car equivalents at a ratio of 2.5 passenger cars for each truck per *Highway Capacity Manual* (TRB, 2010) guidance; two trucks will arrive during the A.M. peak hour and depart during the P.M. peak hour.

The total daily trips in Table 3.8-4 represent the inbound and outbound trips by site workers (30 trips per day) and the passenger car equivalent haul truck trips (80 trips per day). Based on the peak-hour assumptions previously described, the A.M. and P.M. peak hours would each have a total of 18 trips per day.

3.8.2.1.2 Project Traffic Distribution

The primary ROI has a number of possible routes to and from SSFL for haul trucks and site workers. To represent the most conservative estimate of traffic impacts, NASA evaluated traffic impacts by applying the total peak-hour trips to each of the potential routes to and from the site, with the exception of Box Canyon Road and Santa Susana Pass Road, where heavy truck traffic is not allowed. On those routes, traffic impacts were analyzed by applying the total number of peak-hour site worker trips. Although it is unlikely that all the project-related trips would occur on one roadway during the peak hour, this methodology presents a worst-case scenario for project-related traffic impacts during soil remediation.

3.8.2.1.3 Large Truck Considerations

In the United States in 2010, large trucks accounted for 4 percent of all registered vehicles and 10 percent of the total vehicle miles traveled. These large trucks accounted for 8 percent of all vehicles involved in fatal crashes and 3 percent of all vehicles involved in injury and property-damage-only crashes. In California, trucks were involved in only 6.5 percent of fatal crashes in 2010, which is less than the national average (DOT, 2012). The overall crash rate in the United States for all vehicles was 1.22 fatal crashes per 100 million miles traveled and 20 injury crashes per 100 million miles traveled.

Tractor-trailers, dump trucks, and flatbed trucks would be used over the course of the remediation activities. These vehicles come in a variety of sizes. Federal and state regulations mandate a specific limit in dimensions on interstate and state highways. The average tractor-trailer is just over 80 ft long, 13 ft 6 inches high, and about 8 ft wide. The fully loaded weight limit for most tractor-trailers is 80,000 pounds, per federal mandates. The weight with an empty trailer can vary between 30,000 and 45,000 pounds. A bobtail (just the truck with no trailer) weighs between 15,000 and 20,000 pounds (Caltrans, 2013a).

The average passenger car accelerates from 0 to 60 mph in approximately 8 seconds and can decelerate from that speed within about 140 ft. Compared to such cars, a 550-horsepower tractor-trailer accelerates from 0 to 60 mph in approximately 35 seconds when fully loaded and in 20 seconds when empty. However, that same truck can go from 0 to 60 mph in just over 10 seconds without a trailer, which is comparable to many passenger cars. Stopping distance for a fully loaded truck traveling 60 mph averages 400 ft or more (Caltrans, 2013a).

Federal and state regulations also govern the operation of commercial motor vehicles. For example, no one can drive a commercial motor vehicle without a commercial driver's license (CDL), and drivers are only allowed to have one CDL. An employer cannot let anyone drive a commercial motor vehicle if he or she has more than one license or if that person's CDL is suspended or revoked. In addition, there are minimum training requirements for operators of longer-combination vehicles. Federal and state laws require a pre-trip vehicle inspection to be completed by the driver, and federal and state inspectors also inspect commercial vehicles. An unsafe vehicle can be put out of service until the driver or owner has it repaired (DOT, 2013). These regulations, among others, have been established to help reduce or prevent truck crashes, fatalities, and injuries.

3.8.2.2 Start of Remediation Year (2020) Traffic Conditions

This subsection provides the analysis of traffic conditions for the year 2020, which is when, for the purposes of this SEIS, remediation activities are assumed to begin. The traffic conditions presented in this section reflect the ambient traffic growth anticipated without the project (No Action Alternative), as well as the application of anticipated project trips to determine the impacts of the Action Alternatives for the year 2020. As stated previously, the total number of peak-hour trips will not vary between Action Alternatives; instead, the duration of remediation activities will be the differentiator between the alternatives. Anticipated impacts are discussed by alternative in the following subsections.

To forecast year 2020 baseline traffic volumes, the annual ambient growth rate of 1 percent per year was applied to existing (2015) peak-hour volumes, which is a 5-year compounded factor of 1.05. As noted previously, this is a conservative growth rate because it is higher than the 0.41 percent annual growth rate for the region (DTSC, 2017).

Table 3.8-5 presents the No Action Alternative traffic impacts (2020 Baseline) and Table 3.8-6 presents the Action Alternatives traffic impacts for the start of remediation year 2020. By the year 2020, segments of Roscoe Boulevard, Valley Circle Boulevard, SR 27/Topanga Canyon Boulevard, and US 101 would be operating below a LOS D during the peak hour under the No Action Alternative. However, LOS would not be reduced under the Action Alternatives in the start of remediation year 2020 for any of the roadways within the primary ROI. Given its lower baseline volumes, Woolsey Canyon Road would see the highest overall percentage increase in traffic under the Action Alternatives, with 7.8 percent increase in the A.M. peak hour and 6.6 percent in the P.M. peak hour. Traffic on the freeways in the ROI would experience the lowest overall percentage increase of the roadways in the primary ROI with a growth of only 0.1 percent.

TABLE 3.8-5
No Action Alternative Traffic Impacts (2020 Baseline)
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Roadway	Segment	A.M. Peak Hour Volume	P.M. Peak Hour Volume	Daily Peak Hour Volume	A.M. Peak Hour V/C Ratio	P.M. Peak Hour V/C Ratio	Daily Peak V/C Ratio	A.M. Peak Hour LOS	P.M. Peak Hour LOS	Daily Peak LOS
Roscoe Boulevard	Woodlake Avenue to Shoup Avenue	1,050	1,071	N/A	0.42	0.43	N/A	A	A	N/A
Roscoe Boulevard	Shoup Avenue to Farralone Avenue	2,234	2,740	N/A	0.89	1.10	N/A	D	F	N/A
Valley Circle Boulevard	Woolsey Canyon Road to Chatlake Drive	1,311	1,011	N/A	1.25	0.96	N/A	F	E	N/A
Plummer Street[a]	Valley Circle Boulevard to Farralone Avenue	770	721	N/A	0.73	0.69	N/A	C	B	N/A
Woolsey Canyon Road	Valley Circle Boulevard to Knapp Ranch Road	225	267	N/A	0.21	0.25	N/A	A	A	N/A
Box Canyon Road[a]	Santa Susana Pass Road to Robertson Road	535	475	N/A	0.51	0.45	N/A	A	A	N/A
Santa Susana Pass Road[a]	Rocky Peak Road to Box Canyon Road	384	363	N/A	0.37	0.35	N/A	A	A	N/A
SR 27/Topanga Canyon Boulevard	Roscoe Boulevard to Devonshire Street	N/A[b]	N/A[b]	4,467	N/A[b]	N/A[b]	0.91	N/A[b]	N/A[b]	E
SR 27/Topanga Canyon Boulevard	Devonshire Street to SR 118	N/A[b]	N/A[b]	4,099	N/A[b]	N/A[b]	0.84	N/A[b]	N/A[b]	D
SR 118	SR 27 to De Soto Avenue	N/A[b]	N/A[b]	13,558	N/A[b]	N/A[b]	0.60	N/A[b]	N/A[b]	A
US 101	SR 27 to Canoga Avenue	N/A[b]	N/A[b]	23,858	N/A[b]	N/A[b]	1.33	N/A[b]	N/A[b]	F

Notes:
[a] Heavy truck trips were assumed not to use these roadways; passenger trips only.
[b] A.M. and P.M. peak volumes were not available for these roadways, so daily peak-hour volumes are shown.

TABLE 3.8-6

Comparison of Peak-Hour Traffic Conditions: Action Alternatives Traffic Impacts for Start of Remediation Year (2020)

NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Roadway	Segment	Project Only Volume	A.M. Peak Hour Volume	P.M. Peak Hour Volume	Daily Peak Volume	A.M. Change over Baseline	P.M. Change over Baseline	Daily Change over Baseline	A.M. Peak Hour V/C Ratio	P.M Peak Hour V/C Ratio	Daily Peak V/C Ratio	A.M Peak Hour LOS	P.M Peak Hour LOS	Daily Peak LOS
Roscoe Boulevard	Woodlake Avenue to Shoup Avenue	18	1,067	1,088	N/A	1.7%	1.6%	N/A	0.43	0.44	N/A	A	A	N/A
Roscoe Boulevard	Shoup Avenue to Farralone Avenue	18	2,252	2,757	N/A	0.8%	0.6%	N/A	0.90	1.10	N/A	D	F	N/A
Valley Circle Boulevard	Woolsey Canyon Road to Chatlake Drive	18	1,328	1,029	N/A	1.3%	1.7%	N/A	1.26	0.98	N/A	F	E	N/A
Plummer Street[a]	Valley Circle Boulevard to Farralone Avenue	18	788	738	N/A	2.3%	2.4%	N/A	0.75	0.70	N/A	C	B	N/A
Woolsey Canyon Road	Valley Circle Boulevard to Knapp Ranch Road	18	242	284	N/A	7.8%	6.6%	N/A	0.23	0.27	N/A	A	A	N/A
Box Canyon Road[a]	Santa Susana Pass Road to Robertson Road	8	542	483	N/A	1.4%	1.6%	N/A	0.52	0.46	N/A	A	A	N/A
Santa Susana Pass Road[a]	Rocky Peak Road to Box Canyon Road	8	391	370	N/A	2.0%	2.1%	N/A	0.37	0.35	N/A	A	A	N/A
SR 27/Topanga Canyon Boulevard	Roscoe Boulevard to Devonshire Street	18	N/A[b]	N/A[b]	4,848	N/A[b]	N/A[b]	0.4%	N/A[b]	N/A[b]	0.92	N/A[b]	N/A[b]	E
SR 27/Topanga Canyon Boulevard	Devonshire Street to SR 118	18	N/A[b]	N/A[b]	4,116	N/A[b]	N/A[b]	0.4%	N/A[b]	N/A[b]	0.84	N/A[b]	N/A[b]	D
SR 118	SR 27 to De Soto Avenue	18	N/A[b]	N/A[b]	13,575	N/A[b]	N/A[b]	0.1%	N/A[b]	N/A[b]	0.60	N/A[b]	N/A[b]	A
US 101	SR 27 to Canoga Avenue	18	N/A[b]	N/A[b]	23,875	N/A[b]	N/A[b]	0.1%	N/A[b]	N/A[b]	1.33	N/A[b]	N/A[b]	F

Notes:

[a] Heavy truck trips were assumed not to use these roadways; passenger trips only.

[b] A.M. and P.M. peak volumes were not available for these roadways, so daily peak-hour volumes are shown.

3.8.2.3 Future Year (2032) Traffic Conditions

This subsection provides the analysis of traffic conditions for the year 2032, which was the year selected to evaluate future-year project impacts for this SEIS in the interest of consistency with DTSC and DOE analyses. The traffic conditions presented in this section reflect the ambient traffic growth anticipated without the project (No Action Alternative), as well as the application of the anticipated project trips to determine the impacts of the Action Alternatives for the year 2032. As previously explained, the total number of peak-hour trips will not vary between the Action Alternatives; instead, the duration of remediation activities will be the differentiator between the alternatives. Based on the anticipated duration of soil cleanup activities described in Section 2.2.5, *Alternatives Comparison*, it is assumed that only Alternatives A and B will be ongoing in the year 2032.

To forecast year 2032 baseline traffic volumes, the annual ambient growth rate of 1 percent per year was applied to existing (2015) peak-hour traffic volumes, which is a 17-year compounded factor of 1.18. As noted previously, this is a conservative growth rate because it is higher than the 0.41 percent annual growth rate for the region (DTSC, 2017).

Table 3.8-7 presents the No Action Alternative traffic impacts for future year 2032 and Table 3.8-8 presents the Action Alternatives traffic impacts for future year 2032. By 2032, traffic conditions along the roadways, which had previously been operating below LOS, will continue to degrade, but no additional roadways would be operating below LOS D compared to 2020. Most jurisdictions have revised their target LOS during the peak hours from LOS D to LOS E because of limited ability to provide capacity improvements that can accommodate increasing volume demands. LOS would not be reduced below LOS D under the Action Alternatives in the future year 2032 for any of the roadways within the primary ROI. Similar to the start of remediation year 2020 traffic conditions, the highest percent increase in traffic would be on Woolsey Canyon Road, given its lower future year 2032 baseline volumes. Traffic on the freeways in the ROI would experience the lowest overall percentage increase of the roadways in the primary ROI with a growth of only 1 percent.

TABLE 3.8-7

No Action Alternative Traffic Impacts for Future Year (2032)

NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Roadway	Segment	A.M. Peak Hour Volume	P.M. Peak Hour Volume	Daily Peak Volume	A.M. Peak Hour V/C Ratio	P.M. Peak Hour V/C Ratio	Daily Peak V/C Ratio	A.M. Peak Hour LOS	P.M. Peak Hour LOS	Daily Peak LOS
Roscoe Boulevard	Woodlake Avenue to Shoup Avenue	1,183	1,207	N/A	0.47	0.48	N/A	A	A	N/A
Roscoe Boulevard	Shoup Avenue to Farralone Avenue	2,518	3,087	N/A	1.01	1.23	N/A	F	F	N/A
Valley Circle Boulevard	Woolsey Canyon Road to Chatlake Drive	1,477	1,139	N/A	1.41	1.09	N/A	F	F	N/A
Plummer Street[a]	Valley Circle Boulevard to Farralone Avenue	868	812	N/A	0.83	0.77	N/A	D	C	N/A
Woolsey Canyon Road	Valley Circle Boulevard to Knapp Ranch Road	253	301	N/A	0.24	0.29	N/A	A	A	N/A
Box Canyon Road[a]	Santa Susana Pass Road to Robertson Road	603	535	N/A	0.57	0.51	N/A	A	A	N/A
Santa Susana Pass Road[a]	Rocky Peak Road to Box Canyon Road	432	409	N/A	0.41	0.39	N/A	A	A	N/A
SR 27/Topanga Canyon Boulevard	Roscoe Boulevard to Devonshire Street	N/A[b]	N/A[b]	5,033	N/A[b]	N/A[b]	1.03	N/A[b]	N/A[b]	F
SR 27/Topanga Canyon Boulevard	Devonshire Street to SR 118	N/A[b]	N/A[b]	4,619	N/A[b]	N/A[b]	0.94	N/A[b]	N/A[b]	E
SR 118	SR 27 to De Soto Avenue	N/A[b]	N/A[b]	15,277	N/A[b]	N/A[b]	0.68	N/A[b]	N/A[b]	B
US 101	SR 27 to Canoga Avenue	N/A[b]	N/A[b]	26,884	N/A[b]	N/A[b]	1.49	N/A[b]	N/A[b]	F

Notes:

[a] Heavy truck trips were assumed not to use these roadways; passenger trips only.

[b] A.M. and P.M. peak volumes were not available for these roadways, so daily peak-hour volumes are shown.

TABLE 3.8-8

Comparison of Peak-Hour Traffic Conditions: Action Alternatives Traffic Impacts for Future Year (2032)

NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Roadway	Segment	Project Only Volume	A.M. Peak Hour Volume	P.M. Peak Hour Volume	Daily Peak Volume	A.M. Change over Baseline	P.M. Change over Baseline	Daily Change over Baseline	A.M. Peak Hour V/C Ratio	P.M. Peak Hour V/C Ratio	Daily Peak V/C Ratio	A.M. Peak Hour LOS	P.M. Peak Hour LOS	Daily Peak LOS
Roscoe Boulevard	Woodlake Avenue to Shoup Avenue	18	1,201	1,224	N/A	1.5%	1.5%	N/A	0.48	0.49	N/A	A	A	N/A
Roscoe Boulevard	Shoup Avenue to Farralone Avenue	18	2,535	3,105	N/A	0.7%	0.6%	N/A	1.01	1.24	N/A	F	F	N/A
Valley Circle Boulevard	Woolsey Canyon Road to Chatlake Drive	18	1,494	1,157	N/A	1.2%	1.5%	N/A	1.42	1.10	N/A	F	F	N/A
Plummer Street[a]	Valley Circle Boulevard to Farralone Avenue	18	886	830	N/A	2.0%	2.2%	N/A	0.84	0.79	N/A	D	C	N/A
Woolsey Canyon Road	Valley Circle Boulevard to Knapp Ranch Road	18	271	318	N/A	6.9%	5.8%	N/A	0.26	0.30	N/A	A	A	N/A
Box Canyon Road[a]	Santa Susana Pass Road to Robertson Road	8	610	543	N/A	1.2%	1.4%	N/A	0.58	0.52	N/A	A	A	N/A
Santa Susana Pass Road[a]	Rocky Peak Road to Box Canyon Road	8	440	416	N/A	1.7%	1.8%	N/A	0.42	0.40	N/A	A	A	N/A
SR 27/Topanga Canyon Boulevard	Roscoe Boulevard to Devonshire Street	18	N/A[b]	N/A[b]	5,051	N/A[b]	N/A[b]	0.3%	N/A[b]	N/A[b]	1.03	N/A[b]	N/A[b]	F
SR 27/Topanga Canyon Boulevard	Devonshire Street to SR 118	18	N/A[b]	N/A[b]	4,636	N/A[b]	N/A[b]	0.4%	N/A[b]	N/A[b]	0.95	N/A[b]	N/A[b]	E
SR 118	SR 27 to De Soto Avenue	18	N/A[b]	N/A[b]	15,295	N/A[b]	N/A[b]	0.1%	N/A[b]	N/A[b]	0.68	N/A[b]	N/A[b]	B
US 101	SR 27 to Canoga Avenue	18	N/A[b]	N/A[b]	26,901	N/A[b]	N/A[b]	0.1%	N/A[b]	N/A[b]	1.49	N/A[b]	N/A[b]	F

Notes:

[a] Heavy truck trips were assumed not to use these roadways; passenger trips only.

[b] A.M. and P.M. peak volumes were not available for these roadways, so daily peak-hour volumes are shown.

3.8.2.4 Alternative A: AOC Cleanup

Under Alternative A, excavation and offsite disposal would require approximately 99,098 truckloads to remove up to 870,000 yd^3 of soil and import 448,000 yd^3 of backfill soil. However, truck trips would be limited to 16 round trips per day; thus, soil cleanup activities would require 25+ years for completion. This subsection discusses the potential effects of Alternative A soil cleanup activities on traffic and transportation.

3.8.2.4.1 Roadway Operations and Levels of Service During Proposed Activities

As shown in Table 3.8-4, soil cleanup activities, including both haul trucks and site workers, are estimated to generate 18 equivalent trips during the A.M. and P.M. peak hours and the total equivalent daily trips would be 110. The estimated A.M. and P.M. peak-hour trips were added to the anticipated start of remediation year 2020 volumes to determine anticipated roadway operations and LOS impacts. Traffic impacts were also considered for the future year 2032 because remediation activities under Alternative A would still be occurring at that time. As shown in Tables 3.8-6 and 3.8-8, Alternative A would not reduce LOS below the level of D for any of the roadways within the primary ROI in either year. The largest contributing factor to congestion on the roadways within the primary ROI is background traffic increases caused by growth in the project region. The addition of project-related truck traffic would be noticeable, especially on Woolsey Canyon Road, where a 7.8 percent traffic increase is anticipated in the A.M. peak in 2020 and a 6.9 percent traffic increase in the A.M. peak in 2032. However, it would not cause delays on the roadway network or exceed roadway capacity; therefore, Alternative A would result in a **minor, negative, and temporary (25+ years)** impact to roadway operations **(Traffic Impact-1)**.

The number of heavy vehicle and construction worker trips on individual roadways within the secondary ROI, including I-405, I-5, I-210, and SR 14, would not be measurable under Alternative A. This impact on roadway operations would be considered **negligible, negative, and temporary (25+ years) (Traffic Impact-2)**.

Within the project site, only a limited number of construction vehicles would operate along the roadways at any given time. Although it would not be a large volume of traffic, it would result in a measurable increase of traffic on the limited roadway facilities within the project site, thereby resulting in a **minor, negative, and temporary (25+ years) impact (Traffic Impact-1)**.

3.8.2.4.2 Potential Safety Effects from Project Related Truck-Trips

Alternative A would contribute 16 round-trip truckloads per day (32 trucks total) for an estimated 250 days per year to the primary ROI, which is a minor increase in traffic on the study roadways. Although the potential for a crash to occur would exist, the truck crash rate would not change with the project-added truck trips. To minimize the potential for truck-related crashes, the project would implement a CTCP, which would include a truck safety plan **(Transportation BMP-1)**. With the implementation of mitigation, the impact on roadway safety and the likelihood of a crash would be considered a **minor, negative, temporary (25+ years) impact (Traffic Impact-3)**.

3.8.2.4.3 Potential Effects on Pavement Conditions and Parking

The use of heavy trucks during soil cleanup activities could affect road conditions and driving safety on the roadways within the ROI by increasing the rate of road wear. The degree to which the degradation would occur depends on the pavement type and thickness and the existing condition of the road when soil cleanup activities begin. The pavement of local streets is generally not thick enough to withstand substantial truck traffic and therefore affected roads could need repair sooner than anticipated. The Transportation and Road Agreement signed by NASA, Boeing, and DOE in 2015 identifies a repair plan for onsite road pavement repair **(Transportation Mitigation-2)**, however, no repairs were identified for offsite roads except for the repair of damage to Woolsey Canyon resulting from an accident or incident involving a heavy truck. With mitigation, the impact on paving conditions due to the increase in the rate of road wear would be **moderate,**

negative, and temporary (25+ years) (Traffic Impact-4). Freeways and major arterials are designed to accommodate a mix of vehicle types, including heavy trucks; therefore, no significant wear and tear would be expected on the remaining roadways within the primary and secondary ROIs.

Sufficient parking would be provided onsite to meet the anticipated parking needs of Alternative A and no offsite parking would be needed. As a result, the project would have **no impact** on parking capacity during soil cleanup activities.

3.8.2.5 Alternative B: Revised LUT Levels Cleanup

Under Alternative B, excavation and offsite disposal would require approximately 47,895 truckloads to remove up to 384,000 yd^3 of soil and import 253,000 yd^3 of backfill soil. As with Alternative A, truck trips would be limited to 16 round trips per day, making the duration of cleanup-related traffic impacts the primary difference between the Action Alternatives. Because Alternative B has fewer total truckloads than Alternative A, it would require only an estimated 12 years for completion. This subsection discusses the potential effects of Alternative B soil cleanup activities on traffic and transportation.

3.8.2.5.1 Roadway Operations and Levels of Service During Proposed Activities

Anticipated peak-hour traffic volumes under Alternative B would be the same as those presented for Alternative A for both start of remediation year 2020 and future year 2032 conditions. Therefore, Alternative B would also result in a **minor, negative, and temporary (12 years)** impact to roadway operations **(Traffic Impact-1)**.

The number of heavy vehicle and construction worker trips on individual roadways within the secondary ROI would be similar to Alternative A and considered **negligible, negative, and temporary (12 years) (Traffic Impact-2)**.

3.8.2.5.2 Potential Safety Effects from Project Related Truck-Trips

Potential safety effects from truck trips under Alternative B would be the same as those for Alternative A. With the implementation of **Transportation BMP-1**, the impact on roadway safety and the likelihood of a crash would be considered a **minor, negative, temporary (12 years) impact (Traffic Impact-3)**.

3.8.2.5.3 Potential Effects on Pavement Conditions and Parking

Potential effects on pavement and parking conditions would be the same as those for Alternative A, except the duration of soil cleanup activities would be reduced to 12 years. With **Transportation Mitigation-2**, the deterioration of pavement conditions due to the increase in the rate of road wear for local streets would result in a **moderate, negative, and temporary (12 years) impact (Traffic Impact-4**).

3.8.2.6 Alternative C: Suburban Residential Cleanup

Under Alternative C, excavation and offsite disposal would require approximately 32,782 truckloads to remove up to 247,000 yd^3 of soil and import 189,000 yd^3 of backfill soil. As with Alternatives A and B, truck trips would be limited to 16 round trips per day, making the duration of cleanup-related traffic impacts the primary difference between the Action Alternatives. Because Alternative C has fewer total truckloads than Alternatives A and B, it would require only an estimated 8 years for completion. This subsection discusses the potential effects of Alternative C soil cleanup activities on traffic and transportation.

3.8.2.6.1 Roadway Operations and Levels of Service During Proposed Activities

Anticipated peak-hour traffic volumes under Alternative C would be the same as those presented for Alternatives A and B for the Start of Remediation year (2020); however, given its shorter duration there would be no project related traffic by the Future Year (2032) scenario. Alternative C would not reduce LOS below the level of D for any of the roadways within the primary ROI in 2020. Therefore, Alternative C would result in a **minor, negative, and temporary (8 years)** impact to roadway operations **(Traffic Impact-1)**.

The number of heavy vehicle and construction worker trips on individual roadways within the secondary ROI is the same as for Alternative A and would be considered **negligible, negative, and temporary (8 years) (Traffic Impact-2)**.

3.8.2.6.2 Potential Safety Effects from Project Related Truck-Trips

Potential safety effects from truck trips under Alternative C would be the same as those for Alternative A. With the implementation of **Transportation BMP-1**, the impact on roadway safety and the likelihood of a crash would be considered a **minor, negative, temporary (8 years) impact (Traffic Impact-3)**.

3.8.2.6.3 Potential Effects on Pavement Conditions and Parking

Potential effects on pavement and parking conditions would be the same as those for Alternatives A and B, except the duration of soil cleanup activities would be reduced to 8 years. With **Transportation Mitigation-2**, the deterioration of pavement conditions due to the increase in the rate of road wear for local streets would result in a **moderate, negative, and temporary (8 years) impact (Traffic Impact-4**).

3.8.2.7 Alternative D: Recreational Cleanup

Under Alternative D, excavation and offsite disposal would require approximately 23,873 truckloads to remove up to 176,500 yd^3 of soil and import 141,000 yd^3 of backfill soil. As with the other Action Alternatives, truck trips would be limited to 16 round trips per day, making the duration of cleanup-related traffic impacts the primary difference between Action Alternatives. Because Alternative D has fewer total truckloads than the other Action Alternatives, it would require only an estimated 6 years for completion. This subsection discusses the potential effects of Alternative D soil cleanup activities on traffic and transportation.

3.8.2.7.1 Roadway Operations and Levels of Service During Proposed Activities

Anticipated peak-hour traffic volumes under Alternative D would be the same as those presented for the other Action Alternatives for the start of remediation year 2020; however, given its shorter duration, there would be no project-related traffic under the future year 2032 scenario. Alternative D would not reduce LOS below the level of D for any of the roadways within the primary ROI in 2020. Therefore, Alternative D would result in a **minor, negative, and temporary (6 years)** impact to roadway operations (**Traffic Impact-1**).

The number of heavy vehicle and construction worker trips on individual roadways within the secondary ROI is the same as for Alternative A. Therefore, impacts would be considered **negligible, negative, and temporary (6 years) (Traffic Impact-2)**.

3.8.2.7.2 Potential Safety Effects from Project Related Truck-Trips

Potential safety effects from truck trips under Alternative D would be the same as those for the other Action Alternatives. With the implementation of **Transportation BMP-1**, the impact on roadway safety and the likelihood of a crash would be considered a **minor, negative, temporary (6 years)** impact **(Traffic Impact-3)**.

3.8.2.7.3 Potential Effects on Pavement Conditions and Parking

Potential effects on pavement and parking conditions would be the same as those for the other Action Alternatives, except the duration of soil cleanup activities would be reduced to 6 years. With **Transportation Mitigation-2**, the deterioration of pavement conditions due to the increase in the rate of road wear for local streets would result in a **moderate, negative, and temporary (6 years) impact (Traffic Impact-4)**.

3.8.2.8 No Action Alternative

The No Action Alternative would not increase traffic volumes beyond the existing or background levels, as summarized in Tables 3.8-5 and 3.8-7. These existing volumes include ongoing activities at SSFL, some of which include offsite construction and haul trucks. These existing volumes are included in Tables 3.8-5 and 3.8-7. Of the existing and future baseline traffic volumes, only SR 27/Topanga Canyon Boulevard, Roscoe Boulevard, Valley Circle Boulevard, and US 101 operate below a LOS D. The No Action Alternative would result in **no impact** to roadway operations within the primary **(Traffic Impact-1)** and secondary ROIs **(Traffic Impact-2)**.

The No Action Alternative would not change safety effects from truck traffic beyond those of the current conditions, resulting in **no impact (Traffic Impact-3)**.

Pavement conditions would continue to degrade at the existing rate, resulting in a **minor, negative, and temporary impact** on pavement conditions **(Traffic Impact-4)**.

3.8.3 Best Management Practices and Mitigation Measures

This subsection provides a brief description of BMPs and mitigation measures.

- **Transportation BMP-1** (All Action Alternatives): As a standard industry practice for efficient and safe traffic management, a NASA CTCP would be developed and incorporate the agreements identified between NASA, Boeing, and DOE in the Transportation and Road Agreement signed by all three parties in 2015. NASA's CTCP would be similar to Boeing's existing CTCP, which includes a traffic control plan, parking plan, existing and construction traffic operations, motorist information strategies, truck safety plan, hazardous materials transport plan, and ridesharing plan. NASA will coordinate traffic control plans with Boeing and DOE.
- **Transportation Mitigation-2** (All Action Alternatives): In accordance with the Transportation and Road Agreement signed by NASA, Boeing, and DOE in 2015, NASA will adhere to the repair plan outlined for onsite road pavement repair during soil cleanup activities.

3.8.4 Summary of Impacts

Table 3.8-9 provides a summary of the traffic and transportation impacts on resources under each Action Alternative. These impacts are conservative because it was assumed that all soil remediation-related trips (truck and site worker) would use the same routes instead of dispersing on the various routes available to access SSFL, because the assumed growth rate of 1 percent annually for the background traffic is higher than the 0.41 percent annual growth rate for the region and because the only remediation technology considered was excavation and offsite disposal.

TABLE 3.8-9
Summary of Traffic and Transportation Impacts
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Impacts	Alternative A AOC Cleanup	Alternative B Revised LUT Levels Cleanup	Alternative C Suburban Residential Cleanup	Alternative D Recreational Cleanup	No Action Alternative
Traffic Impact-1: Impacts to roadway operations and LOS on primary ROI	Minor, negative, and temporary (25+ years)	Minor, negative, and temporary (12 years)	Minor, negative, and temporary (8 years)	Minor, negative, and temporary (6 years)	No impact
Traffic Impact-2: Impacts to roadway operations and LOS on secondary ROI	Negligible, negative, and temporary (25+ years)	Negligible, negative, and temporary (12 years)	Negligible, negative, and temporary (8 years)	Negligible, negative, and temporary (6 years)	No impact

Impacts	Alternative A AOC Cleanup	Alternative B Revised LUT Levels Cleanup	Alternative C Suburban Residential Cleanup	Alternative D Recreational Cleanup	No Action Alternative
Traffic Impact-3: Safety effects from truck traffic	Minor, negative, and temporary (25+ years)	Minor, negative, and temporary (12 years)	Minor, negative, and temporary (8 years)	Minor, negative, and temporary (6 years)	No impact
Traffic Impact-4: Pavement conditions	Moderate, negative, and temporary (25+ years)	Moderate, negative, and temporary (12 years)	Moderate, negative, and temporary (8 years)	Moderate, negative, and temporary (6 years)	Minor, negative, and temporary

3.9 Noise

This subsection describes the existing noise conditions at the NASA-administered areas of SSFL and the associated environmental consequences from the Action Alternatives and the No Action Alternative. The ROI for noise includes local access routes to the entrance of SSFL, as well as the nearest sensitive receptors to the boundaries of SSFL. The ROI includes Woolsey Canyon Road, Valley Circle Boulevard, Roscoe Boulevard, SR 118, SR 27, US 101, and local arterial roads, including Plummer Street, Santa Susanna Pass Road, and Box Canyon Road, as well as Brandeis Bardin campus to the north and the Bell Canyon neighborhood to the south of SSFL (Figure 3.9-1).

Acoustics is the study of sound, and noise is defined as unwanted sound. Table 3.9-1 provides a summary of the acoustical terms used in this subsection.

TABLE 3.9-1
Definitions of Acoustical Terms
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Term	Definition
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise or sound at a given location. The ambient level typically is defined by the Equivalent Noise level (L_{eq}) level.
Background Noise Level	The underlying, ever-present lower level noise or sound that remains in the absence of intrusive or intermittent sounds. Distant sources, such as traffic, typically make up background noise. The background noise level is generally defined by the L_{90} percentile noise level.
Sound Pressure Level Decibel (dB)	A unit describing the amplitude of noise or sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micropascals.
Sound Pressure Level in Decibels (A-weighted) (dBA)	The noise or sound level in decibels as measured on a sound level meter using the A-weighted filter network. The A-weighted filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. All sound levels discussed in this SEIS are A-weighted.
Equivalent Noise Level (L_{eq})	The average A-weighted noise or sound level, on an equal energy basis, during the measurement period.
Community Noise Equivalent Level (CNL)	The average A-weighted noise or sound level during a 24-hour day, obtained after the addition of 5 dB from 7:00 p.m. to 10:00 p.m. and 10 dBA from 10:00 p.m. to 7:00 a.m. The decibels added after 7:00 p.m. serve as a penalty for time periods during which the community is more sensitive to noise or sound.
Day-Night Noise Level (L_{dn} or DNL)	The average A-weighted noise or sound level during a 24-hour day, obtained after the addition of 10 dB from 10:00 p.m. to 7:00 a.m. The decibels added after 10:00 p.m. serve as a penalty for time periods during which the community is more sensitive to noise or sound.

Notes:
L_{eq} = The descriptor most commonly used in environmental noise analysis that is the equivalent steady state sound level. This value is representative of the same amount of acoustic energy that is contained in a time-varying sound measurement over a specified period. The average of multiple sounds is measured during a specific time. The average measurement results in one sound measurement representative of all the sound measured in the period.

The most common noise metric is the overall A-weighted sound level measurement, which regulatory bodies worldwide have adopted. The A-weighting network measures sound based on how a person perceives or hears sound, providing a measure for evaluating acceptable and unacceptable sound levels.

Noise affects people in the following ways:

- Subjective effects of annoyance, nuisance, and dissatisfaction
- Interference with activities such as speech, sleep, and learning
- Physiological effects such as startling and hearing loss

Table 3.9-2 lists the relative A-weighted noise levels of common sounds measured in the environment and in industry for various sound levels.

TABLE 3.9-2
Typical Sound Levels Measured in the Environment and Industry
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Noise Source at a Given Distance	A-Weighted Sound Level in Decibels (dBA)
Rock band	110
Jet flyover at 1,000 feet	105
Gas lawnmower at 3 feet	95
Garbage disposal at 3 feet	80
Vacuum cleaner at 10 feet	70
Heavy traffic at 300 feet	60
Quiet urban daytime	50
Quiet urban nighttime	40
Library	30
Quiet rural nighttime	25
Recording studio	15

Source: Technical Noise Supplement (Caltrans, 2013b)

3.9.1 Affected Environment

Noise-sensitive land uses generally are defined as locations where people reside or where the presence of unwanted sound could adversely affect the designated use of the land. Typically, noise-sensitive land uses include residential areas, hospitals, places of worship, libraries, and schools, as well as nature and wildlife preserves and parks. Noise-sensitive locations in the ROI include the residential areas along the haul routes, including Woolsey Canyon Road, Roscoe Boulevard, Plummer Street, and Topanga Canyon Boulevard, as well as the residential area of Bell Canyon south of the site and Sage Ranch Park/Mountain Recreation Conservancy Authority to the north of the site (Figure 3.9-1). These residential areas are assumed to have a background sound level of 50 dBA, corresponding to the sound level of quiet urban daytime (Table 3.9-2). Daytime noise measurements were taken at three locations in the Bell Canyon neighborhood in 2015 that confirm this assumption. These half-hour measurements ranged from 44 to 53 dBA Leq $_{\text{-1/2 hour}}$. (Ricks, pers. comm., 2015). The existing noise environment in the ROI primarily consists of occasional aircraft flying overhead and noise from traffic on the local roadways, which is a mix of automobiles and medium and heavy trucks.

3.9.1.1 Regulations

The Noise Control Act of 1972, as amended (42 U.S.C. 4901 et seq.), requires facilities to maintain noise levels that do not jeopardize the health and safety of the public, and this requirement applies to construction noise. The Los Angeles County Noise Control Ordinance (Ord. 11778; County of Los Angeles, 1978) regulates the roadway network accessing SSFL. SSFL is within Ventura County, which does not currently have a noise ordinance.

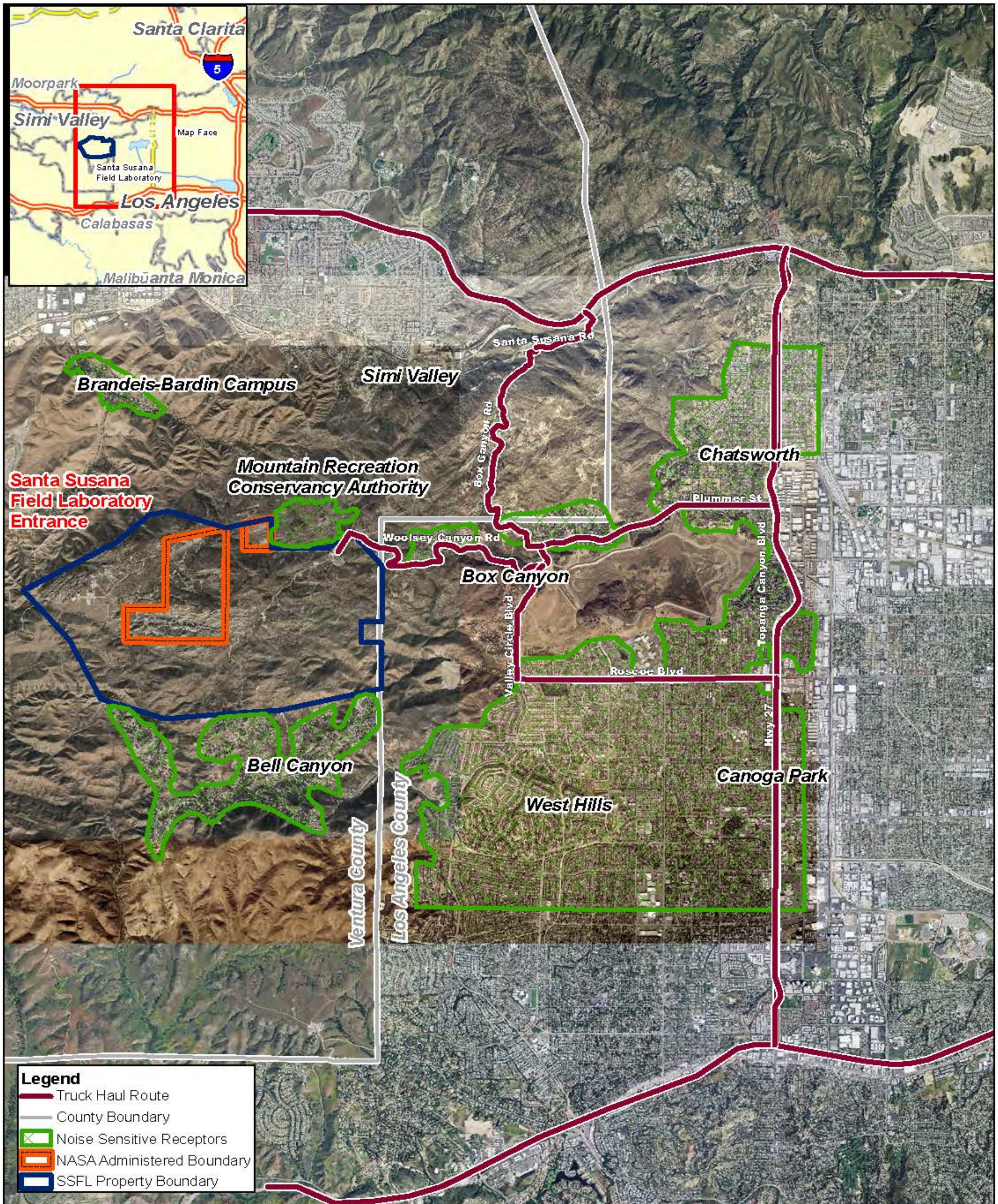

Figure 3.9-1
Noise Region of Influence
Supplemental Environmental Impact Statement for NASA
Soil Cleanup Activities at Santa Susana Field Laboratory
Ventura County, California

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3.9.2 Environmental Consequences

This subsection describes the potential noise impacts within the ROI that could result from implementing the Action Alternatives or the No Action Alternative. The ROI is defined as the sensitive noise areas around SSFL and local access routes leading to SSFL. The primary noise impacts to the environment would result from onsite soil cleanup activities and from truck traffic along the haul routes accessing SSFL.

3.9.2.1 Noise from Onsite Soil Cleanup

Construction equipment associated with the Action Alternatives would generate onsite noise. Typical noise levels from these types of equipment have been measured and published in various reference documents. One of the most recent and complete compilations of construction equipment noises is the Roadway Construction Noise Model (RCNM) prepared by the Federal Highway Administration (FHWA) in the *Roadway Construction Noise Model User's Guide* (FHWA, 2006). RCNM data were used to generate noise profiles for the following proposed cleanup technologies:

- **Excavation and Offsite Disposal**: The types of heavy equipment used for excavation and offsite disposal include backhoes, bulldozers, front-end loaders, and dump trucks. This equipment emits noise between 80 and 85 dBA at 50 ft.
- **Ex Situ Treatment Using Soil Washing:** This technology uses excavation equipment, including backhoes, bulldozers, front-end loaders, and dump trucks. This equipment emits noise between 80 and 85 dBA at 50 ft.
- **Ex Situ Treatment Using Land Farming:** This technology includes soil mixing equipment and excavation equipment. Soil mixing equipment emits a noise level of 84 dBA at 50 ft.
- **Ex Situ Chemical Oxidation:** This technology includes soil mixing equipment and excavation equipment. Soil mixing equipment emits a noise level of 84 dBA at 50 ft.
- **Ex Situ Treatment Using Thermal Desorption:** This technology includes rotary dryers and excavation equipment. Rotary dryers emit a noise level of 85 dBA at 50 ft.
- **SVE:** This technology includes soil sampling augers and pumps and possibly pneumatic tools. Soil sampling augers emit a noise level of 85 dBA at 50 ft; pumps emit a noise level of 77 dBA at 50 ft; and pneumatic tools emit a noise level of 85 dBA at 50 ft.
- **In Situ Chemical Oxidation:** This technology includes pumps and possibly pneumatic tools. Pumps emit a noise level of 77 dBA at 50 ft, and pneumatic tools emit a noise level of 85 dBA at 50 ft.
- **In Situ Anaerobic or Aerobic Biological Treatment:** This technology includes pumps, which emit a noise level of 77 dBA at 50 ft.
- **MNA:** This technology does not include equipment that emits noticeable noise or sound.

Although the noise level of the equipment for all the technologies is similar, the soil excavation and offsite disposal cleanup technology would result in the greatest number of truckloads leaving the site and the greatest offsite noise. Therefore, to understand the greatest potential impact under the Action Alternatives and to provide decision makers with a comparative analysis by which to make a fully informed decision, it was assumed that Excavation and Offsite Disposal would be the technology applied to most of the site. The soil excavation quantities and truckloads, which are explained in Table 2.2-2, were used to analyze the greatest potential impact as a conservative assumption.

Noise for any specific receptor would be dominated by the closest and loudest equipment. Table 3.9-3 provides construction equipment noise levels at various distances. These estimated noise levels are conservative because the only sound buffering mechanism considered was distance from the source. Additional buffering would be provided by vegetation, structures, atmospheric absorption, and terrain features. This additional buffering was not considered in the evaluation.

TABLE 3.9-3
Equipment Noise Levels Versus Distance
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Distance from Sensitive Receptor (feet)	L_{eq} Noise Level (dBA)
50	85
100	79
200	74
400	69
800	63
1,600	58
3,200	52
6,400	46

Note:
L_{eq} = equivalent noise level

3.9.2.2 Noise from Truck Traffic

Noise contours for truck traffic from SSFL were developed by DOE using the FHWA Traffic Noise Model, FHWA's Highway Noise Prediction Model FHWA-RD-77-108, and traffic counts from a 2017 traffic study (KOA, 2017). Existing noise levels at 13 sample locations were compared to estimated future noise level contours associated with the Action Alternatives to evaluate the potential for impacts. The total number of trucks to be used for the cleanup would be 48 round trips to be shared by the three responsible parties along the same haul routes. NASA's share of this total is 16 round-trip truckloads per day (32 trucks total) (DTSC, 2017). These 32 truck trips would result in noise levels between 33.4 and 72.5 dBA CNL along the designated haul routes at 30 to 100 ft, resulting in an estimated maximum 1.3-dBA increase in future levels above existing levels. Table 3.9-4 identifies the impacts thresholds for noise.

TABLE 3.9-4
Impact Thresholds for Noise
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Impact	Description
No Impact	No change in noise conditions would be expected.
Negligible	Changes in noise conditions would be expected to increase by less than 3 dBA and the resulting levels would comply with applicable noise standards (i.e., the Noise Control Act and the Los Angeles County Noise Control Ordinance). Generally, a change of 3 dBA would be considered a barely perceivable difference.
Minor	Impacts would result in an increase in noise conditions of between 3 and 5 dBA. A 5-dBA change would be readily perceivable but would not interfere with daily activities and would comply with applicable noise standards.
Moderate	Impacts would result in a measurable and consequential change to noise conditions, which would equate to an increase of between 5 and 10 dBA. A 10-dBA change would be considered a doubling of the noise level. While this increase could affect daily activities, it would still comply with applicable noise standards.
Significant	Impacts could result in a severe change to noise conditions, involve a noise increase greater than 10 dBA, and would exceed applicable noise standards.

Impact	Description
Quality:	Beneficial–would have a positive effect Negative–would have an adverse effect
Duration:	Temporary–would occur only during the remediation period, even if remediation took years. Permanent–would continue beyond the remediation period.

3.9.2.3 Alternative A: AOC Cleanup

The Bell Canyon residential area (south of SSFL) is the nearest sensitive receptor at approximately 2,000 ft from soil cleanup areas (Figure 2.2-1). At that distance, the L_{eq} noise level from the excavation and offsite disposal equipment would be approximately 55 dBA, which is 5 dBA over the 50 dBA background for quiet urban daytime (Table 3.9-3). Soil cleanup noise impacts on the NASA-administered property would be **minor, negative, and temporary (25+ years) (Noise Impact-1)**.

Excavation and offsite disposal would require a large number of offsite trucks to remove approximately 870,000 yd^3 of contaminated soil. With the truckloads limited to 16 round trips (32 trucks total) per day, the future traffic noise level for offsite disposal would result in an estimated maximum 1.3-dBA increase (community noise exposure) above existing levels over approximately 25 years (KOA, 2017). The 16 round-trip truckloads result in a maximum CNEL of 72.5 dBA, which is less than the Los Angeles County Noise Control Ordinance Limit of 75 dBA for mobile equipment during daytime in a single-family residential area (DOE, 2018). Excavation and offsite disposal noise impacts would be **negligible, negative, and temporary (25+ years) (Noise Impact-2).**

3.9.2.4 Alternative B: Revised LUT Levels Cleanup

This subsection discusses the potential effects of Alternative B soil cleanup activities on noise. Sage Ranch Park/Mountain Recreation Conservancy Authority (north of SSFL) is the nearest sensitive receptor at approximately 2,300 ft from soil cleanup areas (Figure 2.2-2). At that distance, the L_{eq} noise level from the excavation and offsite disposal equipment would be approximately 54 dBA, which is 4 dBA over the 50 dBA background for quiet urban daytime (Table 3.9-3). Soil cleanup noise impacts on the NASA-administered property would be **minor, negative, and temporary (12 years) (Noise Impact-1)**.

Excavation and offsite disposal would require a large number of offsite trucks to remove approximately 384,000 yd^3 of contaminated soil. Similar to Alternative A, the truckloads are limited to 16 round trips (32 trucks total) per day, however the duration of cleanup is 12 years. Excavation and offsite disposal noise impacts would be **negligible, negative, and temporary (12 years) (Noise Impact-2).**

3.9.2.5 Alternative C: Suburban Residential Cleanup

This subsection discusses the potential effects of Alternative C soil cleanup activities on noise. Sage Ranch Park/Mountain Recreation Conservancy Authority (north of SSFL) is the nearest sensitive receptor at approximately 2,300 ft from soil cleanup areas (Figure 2.2-3). At that distance, the L_{eq} noise level from the excavation and offsite disposal equipment would be approximately 54 dBA, which is 4 dBA over the 50 dBA background for quiet urban daytime (Table 3.9-3). Soil cleanup noise impacts on the NASA-administered property would be **minor, negative, and temporary (8 years) (Noise Impact-1)**.

Excavation and offsite disposal would require a large number of offsite trucks to remove approximately 247,000 yd^3 of contaminated soil. Similar to Alternative A, the truckloads are limited to 16 round trips (32 trucks total) per day, however the duration of cleanup is 8 years. Excavation and offsite disposal noise impacts would be **negligible, negative, and temporary (8 years) (Noise Impact-2).**

3.9.2.6 Alternative D: Recreational Cleanup

This subsection discusses the potential effects of Alternative D soil cleanup activities on noise. Sage Ranch Park/Mountain Recreation Conservancy Authority (north of SSFL) is the nearest sensitive receptor at approximately 2,300 ft from soil cleanup areas (Figure 2.2-4). At that distance, the L_{eq} noise level from the excavation and offsite disposal equipment would be approximately 54 dBA, which is 4 dBA over the 50 dBA background for quiet urban daytime (Table 3.9-3). Soil cleanup noise impacts on the NASA-administered property would be **minor, negative, and temporary (6 years) (Noise Impact-1)**.

Excavation and offsite disposal would require a large number of offsite trucks to remove approximately 176,500 yd^3 of contaminated soil. Similar to Alternative A, the truckloads are limited to 16 round trips (32 trucks total) per day, however the duration of cleanup is 6 years. Excavation and offsite disposal noise impacts would be **negligible, negative, and temporary (6 years) (Noise Impact-2).**

3.9.2.7 No Action Alternative

Under the No Action Alternative, noise resulting from proposed soil cleanup activities onsite and the corresponding truck traffic along the haul routes would not occur. The noise environment would remain the same, which includes ongoing activities at SSFL, some of which involve offsite construction and haul trucks. As a result, **no new impacts** are expected under the No Action Alterative **(Noise Impact-1 and Impact-2)**.

3.9.3 Best Management Practices

This subsection provides a brief description of BMPs.

- **Noise BMP-1** (All Action Alternatives): NASA would limit the proposed soil cleanup activities and truck traffic along haul routes to daytime hours.
- **Noise BMP-2** (All Action Alternatives): Construction equipment and trucks would be maintained in good working order; construction equipment and trucks would be maintained per the manufacturers' recommendations.

3.9.4 Summary of Impacts

Table 3.9-5 provides a summary of the noise impacts on resources under each Action Alternative. These impacts are conservative because it was assumed the most impactful soil technology (Excavation and Offsite Disposal) would be used throughout the site.

TABLE 3.9-5
Summary of Noise Impacts
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Impacts	Alternative A AOC Cleanup	Alternative B Revised LUT Levels Cleanup	Alternative C Suburban Residential Cleanup	Alternative D Recreational Cleanup	No Action Alternative
Noise Impact-1: Noise from onsite soil cleanup activities	Minor, negative, and temporary (25+ years)	Minor, negative, and temporary (12 years)	Minor, negative, and temporary (8 years)	Minor, negative, and temporary (6 years)	No impacts
Noise Impact-2: Noise from truck hauling activities	Negligible, negative, and temporary (25+ years)	Negligible, negative, and temporary (12 years)	Negligible, negative, and temporary (8 years)	Negligible, negative, and temporary (6 years)	No impacts

3.10 Cumulative Impacts

The CEQ regulations for implementing NEPA (40 CFR Section 1508.7) define a "cumulative impact" as follows:

> Cumulative impact is the impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes the actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Cumulative impacts occur if the incremental effects of the Proposed Action result in an increased impact when added to the environmental effects of past, ongoing, and reasonably foreseeable future activities. Reasonably foreseeable future activities are defined as those that have an application for operations pending and would occur in the same timeframe as the Proposed Action. Past activities are considered only when their impacts would still be present during implementation of the Proposed Action. For the analysis, the Proposed Action impacts are based on the overall impact estimates of all activities. It is also assumed that the mitigation measures described in each resource section would be implemented.

For a past, ongoing, or reasonably foreseeable future activity to be considered in the cumulative analysis, the incremental impacts of the activity and the Proposed Action must be related in space and time. The following criteria were used to identify cumulative activities:

- Actions of a similar character that could affect the same environmental resources within the ROI, as defined in each of the resource sections.
- Actions occurring from 1955, when the test stands were first constructed at SSFL, through 2045, the maximum estimated end of cleanup activities under the Proposed Action.

The Proposed Action consists of the following four Action Alternatives:

- Alternative A: AOC Cleanup
- Alternative B: Revised LUT Levels Cleanup
- Alternative C: Suburban Residential Cleanup
- Alternative D: Recreational Cleanup

For the cumulative analysis, the overall impacts are conservatively based on Alternative A. The cumulative impacts analysis for each resource involved the following process:

- Identifying the cumulative activities that might occur in the same area and timeframe as the Proposed Action (Section 3.10.1).
- Assessing the resource-specific impacts resulting from the cumulative activities. If the cumulative activity was found not to occur in the same area and timeframe as the Proposed Action, it was not included in the cumulative resource analysis.
- Identifying the overall potential cumulative impacts of these activities when considered together with the project-related impacts.

The level of cumulative analysis for each resource studied in the SEIS varies, depending on the sensitivity of the resource to potential cumulative impacts.

3.10.1 Cumulative Activities

The actions discussed in this subsection have the potential to occur in either the same space or at the same time as the Action Alternatives and, therefore, could result in cumulative impacts.

ISRA: Under the direction of the RWQCB Cleanup and Abatement Order, Boeing and NASA initiated the ISRA to remove surface soil contamination and comply with waste discharge requirements in NPDES Permit No. CA001309. The specific objective of the ISRA RWQBC Cleanup and Abatement Order is to improve surface water quality within the Outfall 008 and 009 watersheds by identifying, evaluating, and remediating areas of contaminated soil to eliminate the COCs, specifically, dioxin, cadmium, copper, lead, and mercury, that exceeded the NPDES permit limits and benchmark limits. As a part of this program, NASA began soil removal activities in the northeastern portion of Area II in early November 2009. NASA finished the soil removal activities in 2014 and no cumulative impacts are expected.

Groundwater Cleanup Activities: NASA began groundwater cleanup activities in 2009 with the Groundwater Extraction and Treatment System (GETS), which became operational in 2009, as an interim groundwater cleanup measure. The system, owned and operated by Boeing, is designed to extract groundwater from 14 wells across SSFL. The treatment facility was shut down in 2012 for maintenance and upgrades and to enable NASA to complete its groundwater investigations to characterize the nature of the extent of groundwater contamination on its sites, determine the groundwater flow direction and rate, and understand the behavior of groundwater flow with respect to bedrock faults and fractures. GETS upgrades were completed in 2017 (NASA, 2019).

Per the 2007 Consent Order, NASA submitted its groundwater investigation reports in 2017 to help select the appropriate remediation technologies. While awaiting DTSC's concurrence, NASA published a separate NEPA ROD in October 2018 for its proposed groundwater cleanup activities, with remediation work anticipated to begin in 2020. The active cleanup of groundwater could take up to 25 years, with monitoring expected to continue for many years afterwards.

DOE Energy Technology Engineering Center (ETEC) Closure: The ETEC, which was used for nuclear research and testing, is a 90-acre area of SSFL Area IV, which is leased by DOE. The research and testing activities occurred from the 1950s through 1980s and included nuclear energy operations (development, fabrication, disassembly, and examination of nuclear reactors, reactor fuel, and other radioactive materials) and large-scale liquid sodium reactor experiments. Several incidents occurred during the operating history of the sodium reactor that may have resulted in the release of radionuclides to the environment. The concentrations present depend on the residual persistence of the radionuclides in the environment after more than 30 years of decay and prior remediation efforts (Rucker, 2009). To evaluate contamination levels, EPA collected samples at SSFL Area IV and a portion of the northern undeveloped area and determined these areas were affected by the experiments. In December 2018, DOE published an FEIS to analyze a range of remediation alternatives pertaining to the cleanup of the leased areas. Subsequently, the DOE identified the Conservation of Natural Resource Alternative – Open Space Scenario for soil remediation. DOE's total volume of soil to be excavated and disposed of under the open space scenario is 38,200 yd^3 over less than a 2-year period (DOE, 2018). DOE's soil remediation is an ongoing action occurring adjacent to the NASA-administered property.

Boeing SSFL Cleanup Project: Boeing's remediation efforts include demolition activities, soil remediation, and groundwater remediation on Boeing-owned parcels at SSFL, including Areas I, III, and IV, the Southern Undeveloped Land (Southern Buffer Zone), and the adjacent northern undeveloped areas. Boeing has completed the demolition and removal of all buildings and other structural features in Areas I, III, and IV, except for three remaining buildings in Area I, which will remain for future use. Soil and water contamination remediation work is ongoing at Boeing-owned properties. In 2017, Boeing filed a conservation easement in partnership with the North American Land Trust for its portion of SSFL (Boeing, 2017a). The easement restricts future land use by prohibiting residential or agriculture development on the site in perpetuity; however, the easement alone does not designate a cleanup standard. Subsequently, Boeing announced soil remediation plans to be designated as recreational cleanup levels for its area of SSFL. As of April 2019, the DTSC had not accepted Boeing's proposed recreational cleanup levels. The Boeing project is an ongoing action occurring adjacent to the NASA-administered property.

Test Stand Removal: Test stands, ancillary facilities, and hazardous material storage tanks are being removed throughout the NASA-administered and Boeing-administered areas. When possible, building and test stand foundations are left in place to minimize soil disturbance. However, when foundations are removed, the sidewalls of the resulting depression are being collapsed and the sites graded to an even surface to prevent surface water ponding.

In April 2014, NASA issued a Programmatic Agreement signed with the California SHPO, the Advisory Council on Historic Preservation (ACHP), and the Santa Ynez Band of the Chumash Indians that details measures NASA plans to take to protect and preserve cultural resources during cleanup at SSFL. NASA has delayed its decision on whether to demolish or preserve the six remaining test stands and three control houses at SSFL until soil cleanup is complete, unless they pose a risk to safety or human health. NASA's test stand removal is an ongoing action occurring within NASA-administered property.

Woolsey Canyon and Topanga Wildfires: SSFL is an area prone to wildfires because of its warm weather and dry climate. In September 2005, 2,000 of the 2,849 acres of SSFL, including most of NASA-administered Area II, burned in the 24,000-acre Topanga Wildfire (NASA, 2014a). Many site structures were damaged or destroyed; however, none of the structures were individually NRHP-eligible or contributing resources to historic districts. After the fire, BMPs were implemented to decrease the amount of soil, ash, and burned vegetation migrating from the site. In 2018, the Woolsey Canyon Fire occurred in Simi Valley. Wildfires produce some toxic chemicals, including dioxin, from the burning of brush and building materials. Consequently, some of the dioxin found in the remediation areas could be associated with the Topanga or Woolsey Canyon wildfires. The 2005 Topanga Wildfire and the 2018 Woolsey Canyon Fire are both past actions that affect the NASA-administered property (DTSC, 2018a).

Residential Development: One residential development project has been proposed immediately surrounding or within a 1-mile radius of SSFL. The Sterling Development Project is a 373-acre development located west of the intersection of Roscoe Boulevard and Valley Circle Boulevard in Dayton Creek/West Hills, California. The project consists of building up to 143 single family homes on 63 of the 373 acres (Pulte Homes, 2019). The housing development is approximately a half mile from the eastern property boundary of SSFL. Traffic impacts from this project are expected to be fully mitigated; therefore, cumulative traffic impacts are not expected to occur (Pulte Homes, 2019). No new residential developments have been identified within 100 ft of the potential arterial street haul routes. Residential development near the highway haul routes were not considered because the resource impact would be negligible.

Rim of the Valley Special Resources Study and Environmental Assessment: The NPS finished conducting a special resource study and environmental assessment of the area referred to as the Rim of the Valley Corridor. The Rim of the Valley encompasses the mountains of Los Angeles and Ventura Counties, including the Santa Susana Mountains. The purpose of this special resource study is to determine whether any portion of the Rim of the Valley Corridor study area is eligible to be designated a unit of the national park system or added to an existing national park. SSFL was included in the initial study area of *Rim of the Valley Corridor Draft Special Resource Study and Environmental Assessment,* issued in April 2015 (NPS, 2015a). The NPS finalized the project with the publication of the Environmental Assessment Errata (NPS, 2015b), a finding of no significant impact (NPS, 2015c), and the Final Special Resource Study (NPS, 2016). The NPS selected the Santa Monica Mountains National Recreation Area Boundary Adjustment with Cooperative Conservation Emphasis alternative, which encompasses the NASA-administered areas of SSFL as part of future national park designations by the U.S. Congress. Because NASA anticipates the future land use of the NASA-administered portion of SSFL designated as open space, no cumulative impacts are expected to occur from the preservation of SSFL.

3.10.2 Cumulative Impacts to Individual Resources

The following subsections explain the cumulative impacts of the Action Alternatives and cumulative activities to individual resources.

3.10.2.1 Cultural Resources

The Action Alternatives could combine with the ongoing and reasonably foreseeable activities described in the following subsections to result in cumulative impacts to cultural resources.

Groundwater Cleanup Activities

NASA's groundwater remediation involves digging wells. These ground-disturbing activities could impact archeological resources.

DOE ETEC Closure

The DOE ETEC closure includes soil remediation and demolition of buildings and structures. These DOE remediation activities require ground-disturbing activities, which could impact archeological resources. DOE is currently developing a Programmatic Agreement under Section 106 of the NHPA, which includes measures to minimize and mitigate adverse effects.

Boeing Remediation Project

The Boeing remediation project requires soil remediation and building demolition. The Boeing remediation activities require ground-disturbing activities, which could impact archeological resources.

Test Stand Removal

Test stands, ancillary facilities, and storage tanks have been removed from the NASA-administered property. When possible, building and test stand foundations were left in place to minimize soil disturbance. However, when foundations were removed, the sidewalls of the resulting depression were collapsed, and the sites graded to an even surface to prevent surface water ponding. NASA has delayed its decision on whether to demolish or preserve the six remaining test stands and three control houses at SSFL unless they pose a risk to safety, human health, or the environment or until remediation of soil at SSFL is complete.

3.10.2.1.1 Cumulative Impacts to Cultural Resources

The Action Alternatives would contribute to cumulative impacts on cultural resources. Cultural resources at SSFL have been, and would continue to be, impacted by previous and future actions, particularly ground-disturbing activities such as soil excavation and test stand removal, which could impact archeological deposits. The cumulative impacts of NASA, DOE, and Boeing activities would result in **increased significant and negative** impacts to cultural resources at SSFL **(Cumulative Impact-1)**.

3.10.2.2 Biological Resources

The Action Alternatives could combine with the ongoing and reasonably foreseeable activities described in the following subsections to result in cumulative impacts to biological resources.

Groundwater Cleanup Activities

The GETS and other groundwater projects consist primarily of treatment plants, a series of wells, and associated infrastructure, which are located outside sensitive vegetation communities, wetland areas, and known listed species habitat. The only direct impact is from the installation of piping; therefore, the GETS system has a minor impact to biological resources. The overall objective of groundwater cleanup is to remediate groundwater contamination, which otherwise could be ingested by wildlife or absorbed by vegetation; the remediation of groundwater contamination has a permanent benefit to biological resources within the ROI.

DOE ETEC Closure

The vegetation communities and wildlife species present in Area IV, the location of the DOE ETEC site, are similar to those found in NASA-administered areas (Area I and Area II), including large populations of Santa Susana tarplant and approximately 3 acres of Venturan coastal sage scrub habitat. There are no known federally listed species or critical habitats within DOE's administered areas. DOE would consult with USFWS to minimize impacts to listed species and sensitive areas.

Boeing Remediation Project

Because of the large area involved with Boeing's cleanup efforts, the impact to natural communities and wildlife could be significant. Much of the Boeing-owned portion of Area I encompasses an important migration corridor, and sensitive plant and wildlife species have been identified within Boeing-administered areas, though threatened and endangered species such as Braunton's Milk-vetch have been identified onsite. In accordance with CEQA, the DTSC and Boeing would consult with CDFW and USFWS to minimize future impacts to listed species. The Boeing remediation project also would have a beneficial effect on biological resources because of the remediation of onsite contamination.

Test Stand Removal

Previous test stand removal occurred in developed areas and away from sensitive vegetation communities, wetlands, and listed species habitats. Once the test stands and support facilities were removed, the area was brought back to grade and allowed to revegetate naturally, thereby increasing available vegetative habitat.

Future test stand removal could impact high-priority conservation habitats and sensitive species. Specifically, southern willow scrub, a high-priority conservation habitat, occurs adjacent to the Coca and Alfa Test Stands. Migratory birds also have been observed nesting on test stands. However, once test stands and support facilities are removed, the area would be brought back to grade and allowed to revegetate naturally.

Wildfires

The 2005 Topanga and 2018 Woolsey Canyon wildfires burned within the cumulative ROI and deposited significant ash and debris throughout SSFL. In areas with limited vegetation, such as rock outcrops, the effects were minimal. However, naturally vegetated areas were substantially affected by burning and subsequent deposition of ash and burned debris. Perennial shrubs and live oak trees will require many years to regenerate to their former state. The Topanga and Woolsey Canyon wildfires both had a significant direct impact to vegetation communities on SSFL.

3.10.2.2.1 Cumulative Impacts to Biological Resources

The identified effects of the Action Alternatives could combine with the previously mentioned activities to result in cumulative impacts to biological resources. The collective cumulative impacts to biological resources from the implementation of the Action Alternatives and groundwater cleanup, DOE ETEC Closure, Boeing remediation project, test stand removal, and wildfires would result in **increased significant and negative** impacts to biological resources at SSFL **(Cumulative Impact-2)**.

3.10.2.3 Air Quality

The Action Alternatives could combine with the ongoing and reasonably foreseeable activities described in the following subsections to result in cumulative impacts to air quality.

Groundwater Cleanup

The groundwater cleanup projects require minimal construction activity or new emissions. Although operations would emit NAAQS criteria pollutants, the emissions are below the significance thresholds for the General Conformity rule and fugitive dust. These emissions are conservatively assumed to be less than half of the emissions for the Action Alternatives, as detailed in Section 3.3, *Air Quality*.

Boeing Remediation and DOE ETEC Closure Projects

Conformity analyses have been completed on these projects. Boeing and DOE have the same truck haul assumptions as NASA, so the emissions resulting from Boeing's and DOE's actions would be similar to the emissions for the Action Alternatives, which are detailed in Section 3.3, *Air Quality*. The dust emissions from the proposed soil remediation activities would remain below General Conformity *de minimis* threshold levels for the NAAQS criteria pollutants.

3.10.2.3.1 Cumulative Impacts to Air Quality

The Action Alternatives could combine with the current and reasonably foreseeable actions to increase air pollution in the ROI. General Conformity is evaluated on a project-specific basis and not a cumulative basis. However, emissions from these activities could collectively contribute to significance thresholds for NAAQS criteria pollutants and fugitive dust. Boeing and DOE are expected to implement mitigation measures similar to those described in Section 3.3, *Air Quality*, and the cumulative impacts to air quality and fugitive dust would be approximately 3.5 times greater than those for the Action Alternatives. Only NOx would exceed threshold criteria, which could be mitigated with credits. As a result of the significant material hauling activities performed by the three responsible parties and on the groundwater cleanup projects, the cumulative impacts to air quality would **remain moderate and negative (Cumulative Impact-3)**.

3.10.2.4 Water Resources

The Action Alternatives could combine with the ongoing and reasonably foreseeable activities described in the following subsections to result in cumulative impacts to water resources.

Groundwater Cleanup

The groundwater cleanup projects would remediate groundwater contamination at SSFL. Mitigation measures would be implemented during remediation activities to minimize any impacts to water resources, including implementing a SWPPP and BMPs for excavation and construction activities at SSFL. These projects also would be beneficial because of the reduction of contamination in groundwater.

Boeing Remediation and DOE ETEC Closure Projects

The Boeing and DOE projects involve remediating soil and groundwater contamination. The activities would cause ground disturbance, which would result in soil erosion and runoff. However, both of these sites also would be subject to the requirements of the statewide General Permit and an SWPPP would be developed.

Wildfires

The 2018 Woolsey Canyon Fire generated large quantities of ash and debris, exposed large areas of unvegetated soil, and burned the coastal live oak, which negatively affected surface water quality within the ROI. However, NASA worked with local agencies to implement mitigation measures such as stormwater BMPs and groundcover.

3.10.2.4.1 Cumulative Impacts to Water Resources

The Action Alternatives could combine with the previously mentioned activities to result in **increased significant and negative** cumulative impacts to water resources **(Cumulative Impact-4)**.

3.10.2.5 Geology

The Action Alternatives could combine with the ongoing and reasonably foreseeable activities described in the following subsections to result in cumulative impacts to geology.

Boeing Remediation and DOE ETEC Closure Projects

Boeing and DOE remediation activities would result in the excavation of soil within SSFL. The impacts on geology are anticipated to be similar to the Action Alternatives.

Previous Test Stand Removal

During previous test stand demolition, some concrete foundations were left in place, resulting in minimal soil disturbance. In other cases, concrete building foundations were removed, which disturbed soil and increased the potential for landslides immediately beneath, and adjacent to, the foundation. NASA has deferred demolition of the remaining test stands and control houses. Thus, depending on whether the concrete foundations remain in place or are demolished, the cumulative effects to geology would fluctuate.

3.10.2.5.1 Cumulative Impacts to Geology

The previously mentioned activities include mitigation measures and BMPs to limit the potential for landslides and the negative impacts to the topography. However, cumulative impacts would **remain significant and negative** for soil **(Cumulative Impact-5)**.

3.10.2.6 Hazardous and Nonhazardous Materials and Wastes

The Action Alternatives could combine with the ongoing and reasonably foreseeable activities described in the following subsections to result in cumulative impacts to hazardous and nonhazardous materials and wastes.

Groundwater Cleanup

GETS and other groundwater cleanup activities would occur in conjunction with the Action Alternatives for up to 25 years. The GETS project has contained contamination to the site, thereby avoiding offsite migration and reducing impacts from hazardous materials. The objective of GETS and other groundwater cleanup activities is to reduce the level of contamination in the project area to reduce the hazardous material exposure risk. However, these projects also will result in the use of hazardous materials, such as fuels, oils, and lubricants.

Boeing Remediation and DOE ETEC Closure Projects

Boeing and DOE remediation activities also would generate materials and wastes and increase the potential for an accidental release of hazardous materials. All three responsible parties will transport material and waste to be disposed of in various landfills across California and other states. Boeing's remediation activities pertaining to soil, groundwater, and demolition are expected to produce 264,000 yd^3 of material and waste. DOE's remediation activities are expected to produce up to 900,640 yd^3 of material and waste (DOE, 2018). Since the responsible parties will generate different types of wastes, multiple facilities have been identified by each party. Also, the total waste capacities for all identified facilities exceed the estimated volumes of material and waste that would be generated at SSFL.

Wildfires

The 2018 Woolsey Canyon Fire produced toxic chemicals from the burning of vegetation, fabricated materials, and waste. Contaminants released onsite from the fire were limited to those typically created by burning brush, building materials, and so forth. The lasting effect to hazardous materials from the fire would be increased levels of dioxin and metals within the ROI.

3.10.2.6.1 Cumulative Impacts to Hazardous and Nonhazardous Materials and Wastes

The cumulative impact of the Action Alternatives and previously mentioned activities would **increase to moderate and negative (Cumulative Impact-6)**.

3.10.2.7 Health and Safety

The Action Alternatives could combine with the ongoing and reasonably foreseeable activities described in the following subsection to result in cumulative impacts to health and safety.

Boeing Remediation and DOE ETEC Closure Projects

The Action Alternatives would combine with the Boeing and DOE activities to result in cumulative impacts, because the Boeing and DOE projects also would result in increased passenger and truck traffic within the ROI. Per the Transportation and Road Agreement, the responsible parties combined daily truck traffic is up to 48 round trips by truck per day (16 round trips per day per responsible party). The potential for truck-related crashes would be minimized by implementing CTCPs on these projects; however, there would be a moderate potential for a release of hazardous waste or materials to the environment.

Boeing and DOE activities also would require workers to operate machinery and be exposed to contaminated materials. However, these projects would have similar health and safety plans to the Action Alternatives, as regulated by the Occupational Safety and Health Act (29 CFR) and the California Occupational Safety and Health Administration (Cal OSHA). These plans would cover the potential for encountering underlying contamination.

The remediation activities by Boeing and DOE would result in significant beneficial impacts to onsite health and safety conditions. The permanent significant beneficial impacts outweigh the minor, moderate temporary health and safety impacts from increased traffic and onsite worker activities.

3.10.2.7.1 Cumulative Impacts to Health and Safety

The Action Alternatives could combine with the previously mentioned activities to result in cumulative impacts to health and safety. The combined health and safety impacts of the Action Alternatives with the identified cumulative activities would **remain significant and beneficial (Cumulative Impact-7)**.

3.10.2.8 Traffic and Transportation

The Action Alternatives could combine with the ongoing and reasonably foreseeable activities described in the following subsections to result in cumulative impacts to traffic and transportation.

Boeing Remediation and DOE ETEC Closure Projects

The Action Alternatives would combine with the Boeing and DOE activities to result in cumulative impacts, because the DOE and Boeing projects also would result in increased passenger and truck traffic within the ROI. Per the Transportation and Road Agreement, the responsible parties combined daily truck traffic is up to 48 round trips by truck per day (16 round trips per day per responsible party). The cumulative effect to traffic could be three times the Action Alternatives but would not cause delays on the roadway network or exceed roadway capacity.

Roadway damage may occur from the Boeing and DOE increased passenger and truck traffic. The Transportation and Road Agreement signed by NASA, Boeing, and DOE in 2015 identifies a repair plan for onsite road pavement repair.

Residential Development

The housing development is approximately a half mile from the eastern property boundary of SSFL. Traffic impacts from this project are expected to be fully mitigated; therefore, cumulative traffic impacts are not expected to occur.

3.10.2.8.1 Cumulative Impacts to Traffic and Transportation

The Action Alternatives could combine with the previously mentioned activities to result in cumulative impacts to traffic and transportation. The cumulative impact would **remain moderate and negative (Cumulative Impact-8)**.

3.10.2.9 Noise

The Action Alternatives could combine with the ongoing and reasonably foreseeable activities described in the following subsection to result in cumulative impacts to noise.

Boeing Remediation and DOE ETEC Closure Projects

The Boeing and DOE remediation projects would also result in increased construction, demolition, and traffic noise. The increased noise levels from these actions are expected to be similar to the Action Alternatives.

3.10.2.9.1 Cumulative Impacts to Noise

Under a scenario in which all three parties are conducting construction activities simultaneously and generating equal noise levels, noise levels at the closest sensitive receptor could likely be more than 5 dBA above the 50 dBA noise background for a quiet urban daytime area.

The total number of trucks to be used for cleanup would be 48 round trips shared by the three responsible parties along the same haul routes. The 48 round trips by truck result in less than a 3 dB increase and a maximum CNEL of 72.6 dBA, which is less than the Los Angeles County Noise Control Ordinance Limit of 75 dBA for mobile equipment during daytime in a single-family residential area.

The cumulative noise impacts resulting from the Action Alternatives and the Boeing and DOE activities could result in an increased annoyance to the local community, if the actions occur concurrently. The activities would occur only during daylight hours and the overlap would be limited; therefore, the cumulative activities would **increase** the impact to **moderate and negative (Cumulative Impact-9)**.

3.11 Other Required Analyses

Per NEPA and NASA Procedural Requirements 8580.1 (NASA, 2017a), this section discusses two mandatory subsections of NEPA analysis:

- **The Relationship between Local Short-Term Use of the Human Environment and the Maintenance and Enhancement of Long-Term Productivity**, which addresses possible conflicts with the objectives of federal, state, tribal, and local land use plans and policies or private party plans for the affected area.
- **Irreversible and Irretrievable Commitments of Resources**, which addresses the use of nonrenewable energy resources, natural and depletable resources, and scarce materials and the conservation potential of the action under evaluation, including associated mitigation measures.

This section also discusses incomplete and unavailable information that is pertinent to the analysis of specific environmental issues but is not available or has yet to reach the stage where it can be used.

3.11.1 Relationship between Local Short-term Use of the Human Environment and the Maintenance and Enhancement of Long-term Productivity

NEPA requires an analysis of the relationship between a project's short-term impacts on the environment and the effects of those impacts on the maintenance and enhancement of the long-term productivity of the environment. Impacts that limit future uses of the site are a concern. In other words, this analysis considers whether one Action Alternative limits the flexibility of future reuse of the NASA-administered property compared to another Action Alternative. The analysis also considers whether a project alternative might commit a resource to a certain use, thereby eliminating the possibility for other uses of that resource.

"Short term" refers to the total duration of soil cleanup activities until the property is recognized as suitable for transfer, while "long term" refers to an indefinite period beyond the transfer of the property. The timeframe for meeting the cleanup levels varies by alternative (up to 25+ years for Alternative A) and is considered temporary.

The Proposed Action Alternatives would result in both short-term and long-term impacts. Although the Proposed Action Alternatives would prepare the site for future reuse, long-term impacts reduce environmental productivity, such as a reduction in native vegetation, which affects species of concern to Native Americans and results in significant impacts to the Indian Sacred Site and the TCP. The beneficial long-term impact is the regional reduction of contaminants.

The Proposed Action Alternatives are not in conflict with federal, state, or local land use plans.

3.11.2 Irreversible and Irretrievable Commitments of Resources

NEPA and NASA Procedural Requirements 8580.1 (NASA, 2017a) require that a lead agency analyze the extent to which the Proposed Action Alternatives could commit non-renewable resources to uses that would be irreversible or irretrievable to future generations. A commitment would be irreversible when an impact limits the future options for a resource. An irretrievable commitment refers to the consumption of resources that are not renewable or recoverable for future use.

Implementation of the soil remediation technologies would consume energy and a small quantity of building materials, such as casings, staging pavement, treatment areas, injection wells, and containment material. Fuels would be used by construction equipment (e.g., backhoes, bulldozers, front-end loaders, and dump trucks), transportation vehicles, and crew vehicles. Operation of soil remediation technologies would also consume energy. Water would be consumed for some ex situ soil remediation technologies and would be needed for dust suppression during remediation activities. Excavation and offsite disposal and ex situ soil remediation technologies may require the disturbance of jurisdictional water bodies, including wetlands, drainages, and ponds; however, these technologies require Section 404 and 401 permitting under the CWA, which would help mitigate impacts.

The number of haul trips and corresponding amount of fuel consumed depends on the alternative selected. The quantity of soil excavated to achieve LUT cleanup values has increased significantly, resulting in a much greater quantity of excavated soil that needs to be transported offsite for disposal.

Archeological resources and historic resources have been documented on the NASA-administered property at SSFL. These cultural resources are analyzed in Section 3.1 of this SEIS. These resources are considered non-renewable and, if affected, the impact would be irreversible. NASA will continue to consult with SHPO, ACHP, tribes, and the consulting parties to develop appropriate mitigation measures for addressing the impacts to cultural resources. Consultation will culminate with measures to address the adverse effect to historic properties stipulated in the ROD.

Trade and non-skilled laborers would be used during certain soil remediation technologies, including construction, hauling, and soil monitoring, if implemented. Labor generally is not considered a resource in short supply and NASA's Proposed Action Alternatives would not have a negative impact on the continued availability of these resources.

3.11.3 Incomplete and Unavailable Information

NEPA requires that "when an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an EIS and there is incomplete or unavailable information, the agency shall always make clear that such information is lacking" (40 CFR Section 1502.22). The purpose of this section of a NEPA analysis is to communicate the uncertainty within an analysis and to justify how NASA has reasonably dealt with that uncertainty to analyze the potential effects of the Proposed Action sufficiently.

NASA acknowledges that studies are ongoing to evaluate the specific areas where soil treatment is needed to meet the alternative cleanup goals and the effectiveness of each of the soil remediation technologies. Several studies are ongoing to further evaluate the suitability of the backfill for long-term sustained plant growth, given that traditional soil amendments may exceed LUT values. If other studies identify new data that conflict with the analysis or findings of this SEIS and show an increase in potential effects to one or more resource areas, this analysis will be updated or supplemented.

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SECTION 4

Public Engagement

4.1 Introduction

Pursuant to NEPA and NASA Procedural Requirements 8580.1, federal and state agencies, Native American tribes, other organizations, and members of the public were consulted during NASA's environmental review process as part of the NASA SSFL NEPA process. This section provides a summary of NASA's public outreach and consultation efforts associated with the NEPA process, though NASA has been involving the public outside the NEPA process for many years and using various formats.

Public and agency involvement included informational materials, public meetings, agency meetings, and notification and circulation of the 2014 FEIS and this SEIS. NASA has posted meeting notices, materials, and public documents on its website at https://ssfl.msfc.nasa.gov.

4.2 Current SEIS

- On March 19, 2019, the NASA Office of Inspector General released an audit titled *NASA's Progress with Environmental Remediation Activities at the Santa Susana Field Laboratory*. The audit questioned the reasonableness and feasibility of the previous AOC agreement and recommended that all available options be pursued to ensure that soil cleanup is performed in an environmentally and financially responsible manner.
- On April 5, 2019, a Notice of Intent (NOI) for this SEIS was published in the *Federal Register*. The purpose of the NOI was to apprise interested agencies, organizations, tribal governments, and individuals of NASA's intent to prepare this SEIS.
- On October 25, 2019 a Notice of Availability (NOA) was published for the draft SEIS, which initiated a 45-day public comment period.
- On November 20 and 21, 2019 NASA hosted the public meetings to allow the public to express comments on the draft SEIS.

4.3 Original 2014 FEIS

NASA provided project updates pertaining to the EIS in the following ways:

- On July 6, 2011, NASA published an NOI in the *Federal Register* and distributed a notice via e-mail to more than 600 e-mail addresses announcing NASA' s intent to create an EIS for cleanup activities at SSFL.
- In July 2011, NASA held a series of public scoping meetings to gather public input on the proposed cleanup activities.
- On August 2, 2013, NASA published an NOA in the *Federal Register* and posted the Draft EIS on NASA's website for public review. NASA also distributed a notice via e-mail to more than 600 e-mail addresses.
- On August 27 and 28, 2013, NASA hosted public meetings to present the Draft EIS and provide the public with an opportunity to comment on the Draft EIS. All verbal comments were captured in meeting transcripts.
- On September 11, 2013, NASA published a notice in the *Federal Register* to advise the public that the comment period would be extended by 15 days to October 1, 2013.
- On March 14, 2014, NASA published an NOA of the FEIS in the *Federal Register*.

- On April 25, 2014, the ROD for demolition activities was signed, and the NOA was published in the *Federal Register*.
- On October 4, 2018, the ROD for groundwater activities was signed, and the NOA was published in the *Federal Register* on October 17, 2018.

4.4 Consultation under Section 106 of the National Historic Preservation Act

The NHPA requires NASA to consult with federal, state, and local agencies, Native American tribes, other organizations, and members of the public having a potential interest in the Proposed Action. NASA posted on its website a form for interested parties to request participation in the Section 106 consultation process under NHPA regulations (36 CFR Part 800). More than 35 individuals were involved with the consultation. Consulting parties had varying interests in the site and included individuals from the neighboring areas; scientists; archeologists; representatives from the Santa Ynez Band of Chumash Indians, a federally recognized tribe; and members of state-recognized tribes. Consulting parties met onsite at SSFL and via teleconference to discuss the impacts to historic properties such as the Burro Flats Painted Cave and the historic test stand districts. The consulting parties participated in, and commented on, the development of the 2014 Programmatic Agreement (NASA, 2014c).

Consultation was completed with the execution of the 2014 Programmatic Agreement (NASA, 2014c), of which a copy is attached as Appendix 3.1A. The 2014 Programmatic Agreement stipulates the measures to be carried out to address the adverse effects to historic properties. The Programmatic Agreement is active, and NASA continues to complete the stipulated measures and conduct the requisite consultations. No additional consultation under Section 106 of the NHPA is required as part of this SEIS because soil cleanup was included in the identified impacts to be mitigated in the Programmatic Agreement. The signatories to the Programmatic Agreement and the identified consulting parties will have an opportunity to review and comment on the SEIS, but it is not anticipated that any new or additional requirements will be identified as part of the SEIS.

4.4.1 Tribal Consultation

The NHPA requires consultation with Native Americans who have religious and cultural attachments to properties. This mandatory consultation was conducted throughout the NEPA process for the FEIS. In addition, in accordance with 2014 Programmatic Agreement Stipulation II.A., the Sacred Sites Council was created by NASA and representatives of federally and state-recognized tribes in the SSFL area “with an interest in the protection of Native American sites on NASA SSFL” (NASA, 2014c). The Sacred Sites Council serves to advise NASA on matters of interest to the tribes. It operates independently of NASA and contacts NASA on an as-needed basis. The Sacred Sites Council remains in effect until the 2014 Programmatic Agreement expires in 2024 or until the parties agree it is no longer needed (NASA, 2014c). No additional tribal consultation is required as a part of this SEIS.

4.5 Endangered Species Act Section 7 Consultation

NASA sent letters to the USFWS on August 12, 2011, to provide a brief introduction to the project, including a summary of biological issues at the site, and to initiate informal consultation under Section 7 of the ESA. On December 21, 2011, NASA sent USFWS a letter requesting a species list pertaining to the NASA-administered property at SSFL. USFWS responded on January 6, 2012, initiating an informal consultation process. NASA sent a biological assessment to USFWS on July 11, 2013, with a revision on November 6, 2013 (Appendix 3.2A). On December 13, 2013, the USFWS issued a letter of concurrence with NASA’s determination that the project may affect, but is not likely to adversely affect, federally threatened and endangered species. In meetings with NASA, DOE, Boeing, and DTSC on May 3, 2018, USFWS confirmed that the 2013 biological assessment and the associated species characterizations were still acceptable (DTSC, 2018b).

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SECTION 5

List of Preparers

The primary persons responsible for preparing and reviewing this SEIS are listed in Table 5-1.

TABLE 5-1
List of Preparers and Reviewers
NASA Supplemental EIS for Soil Cleanup Activities, SSFL, Ventura County, California

Name	Role	Experience
Michelle Rau, PMP	Project Manager; NEPA Lead	MS, Business Administration; BS, Ecology and Evolutionary Biology; 22 years of experience
Val Ross	Lead Technical Review	MS, Regional Planning; BS, Biology; 30 years of experience
Christina McDonough, PE	Deputy Project Manager	MS, Environmental Engineering; BS, Civil Engineering; 27 years of experience
Allen Elliott	Senior Support	BS, Civil Engineering; 38 years of experience
Jason Glasgow, PE	Senior Review	MS, Environmental Engineering; BS, Chemical Engineering; 30 years of experience
Randy Dean	SSFL Site Expert	MS, Geology; BS, Earth Science; 20 years of experience
Sara Orton	Cultural Resources	MS, Preservation Studies; BA, Political Science; 20 years of experience
Phil Reid	Archeologist	MA, Anthropology; BA, Anthropology; Professional Archeologist; 18 years of experience
Jeremy Hollins	Senior Cultural Support	MA, Public History; BA, History; 13 years of experience
Richard Reaves, PhD	Senior Biologist	PhD, Wetland and Wildlife Ecology; BS, Wildlife Ecology and Resource Management; 30 years of experience
Denny Mengel, PhD	Senior Biologist	PhD, Soil Science; MS, Forest Resources; BS, Wildlife Biology; 35 years of experience
Gary Santolo	Wildlife Biologist	MS, Avian Sciences; BS, Avian Sciences; 30 years of experience
Steven Long	Botanist	MS, Soil Physics, BS, Forestry; 35 years of experience
Michael Singer, PG	Geology Reviewer	MS, Geology; BS, Geology; 35 years of experience
Laura Dreher	Traffic and Transportation	BS, Civil Engineering; 20 years of experience
Jacqueline Dowds Bennett, PE	Transportation Safety Expert	MS, Engineering; BS, Civil Engineering; 26 years of experience
David Patterson	Soils Expert	BS, Environmental Engineering and Geology; 15 years of experience
Elyse Engel	Air Quality Expert	BS, Chemical Engineering; 10 years of experience

Name	Role	Experience
Kat Brown	Water Expert	MS, Contaminant Hydrology; BS, Geoscience; 18 years of experience
Emily Gulick	NEPA Support	BA, Environmental Studies; BA, Geography; 3 years of experience
Karen Sanders	Lead Editor	JD, Law; BA, Anthropology; 25 years of experience

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SECTION 7

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