Final
Programmatic Environmental Assessment
NASA Jet Propulsion Laboratory Facility Master Plan Updates

Prepared for NASA Jet Propulsion Laboratory
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NASA

JPL

PROGRAMMATIC ENVIRONMENTAL ASSESSMENT
NASA JET PROPULSION LABORATORY
FACILITY MASTER PLAN UPDATES

NASA Jet Propulsion Laboratory
California Institute of Technology
4800 Oak Grove Drive
Pasadena, CA

Lead Agency: National Aeronautics and Space Administration
Proposed Action: Implement NASA JPL Facility Master Plan Updates
Date: February 2012

ABSTRACT

The National Aeronautics and Space Administration (NASA) is proposing to implement Facility Master Plan updates for NASA Jet Propulsion Laboratory (JPL) facilities to strategically prepare the Center for the future. This Programmatic Environmental Assessment (EA) evaluates individual Facility Master Plan updates for each of three NASA facilities programmatically assigned to the JPL: (1) the NASA JPL facility in Pasadena, California; (2) the Table Mountain Facility in Wrightwood, California; and (3) the Goldstone Deep Space Communications Complex, Fort Irwin National Training Center, California. In the EA, NASA analyzes the potential impacts of feasible alternatives, including the No-Action Alternative, for facilities improvements identified within each Master Plan.

This Programmatic EA has been prepared in accordance with the National Environmental Policy Act and the National Historic Preservation Act to evaluate the proposed Facility Master Plan updates on the human and physical environment and provide an opportunity for the public to review and comment on the project. This EA serves as notification to the public of proposed actions, consistent with Section 800.2(d) of Title 36 Code of Federal Regulations (CFR), and seeks the views of the public and consulting parties on the effects, if any, on historic properties in accordance with Section 800.5 of Title 36 CFR.

This EA was carried out at the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

Finding of No Significant Impact

Programmatic Environmental Assessment for the
NASA Jet Propulsion Laboratory Facility Master Plan Updates
January 2012

INTRODUCTION

Pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321, et seq.), the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 CFR Parts 1500-1508), and NASA policy and procedures (14 CFR Part 1216, Subpart 1216.3), NASA has made a finding of no significant impact (FONSI) with respect to the proposed NASA Jet Propulsion Laboratory (JPL) Facility Master Plan Updates. NASA has reviewed the Programmatic Environmental Assessment (PEA) prepared for the JPL Master Plans and determined that it presents an accurate and adequate analysis of the scope and level of associated environmental impacts. NASA hereby incorporates the PEA by reference in this FONSI.

The PEA considers the individual Facility Master Plan updates (Master Plans) for each of the three NASA facilities programmatically assigned to the Jet Propulsion Laboratory (JPL): (1) the main NASA JPL facility in Pasadena, California; (2) the Table Mountain Facility (TMF) in Wrightwood, California; and (3) the Goldstone Deep Space Communications Complex (GDSCC), Fort Irwin National Training Center, California. Each Facility Master Plan would serve as a comprehensive facility planning strategy, which would cover the next two decades through the concurrent implementation of Master Plans for the three NASA facilities managed by JPL.

Each of the Master Plans will guide and coordinate physical development at their respective NASA JPL site in terms of buildings, utilities, roadways, landscaping and amenities over the next 20 years. The Master Plans do not commit NASA to any of the projects proposed since implementation of any project would depend on funding, and some projects may ultimately not be selected for implementation. Nonetheless, the Master Plans are intended to be flexible to meet NASA needs at the three facilities. Proposed facilities and planning criteria and guidelines for each of the three NASA JPL sites are detailed within their respective Master Plan documents.

When NASA has determined that NEPA analysis would be required for a proposed facility action at either NASA JPL, TMF, or GDSCC, that Proposed Action would be evaluated for adequate coverage under the PEA through the use of an environmental checklist. If the Proposed Action is accurately and adequately covered under the PEA, a Record of Environmental Consideration (REC) would be prepared documenting the determination and no further NEPA documentation would be required.

If the checklist indicates the need for additional analysis, and if based upon that additional analysis and any appropriate mitigation measures, a determination of no substantial impact to environmental resources can be made, it would be documented in a REC and no further NEPA documentation would be required. If a specific action is expected to create impacts greater in magnitude, extent, or duration than those described in the PEA, then separate NEPA documentation would be prepared for that action.

PROPOSED ACTION

The NASA JPL, TMF, and GDSCC facilities are unique NASA assets, which directly support multiple NASA programs and can be classified as critical to the success of NASA programs. The purpose of the proposed actions are to affirm NASA's mission at JPL and provide a physical framework for implementing this mission over the next 20 years, while at the same time remaining consistent with NASA's Strategic Plan. The Master Plans identify facility and infrastructure needs and develop an implementation strategy that helps guide facilities renewal related to NASA research, building construction, administrative services, and security. The Master Plan alternatives analyzed for each of the three NASA JPL sites including TMF and GDSCC are the result of agency and internal scoping input. The proposed activities at NASA JPL, TMF, and GDSCC are described below.

Main NASA JPL Site in Pasadena, CA

On-site operations were organized into conceptual zones which correspond to NASA JPL operational and mission functions. Conceptual Alternatives A, B, and C were created to test various configurations for redeveloping the NASA JPL site. Based on a number of factors related to NASA JPL's operational efficiency and effectiveness of mission implementation, Composite Conceptual Alternative A was chosen as the preferred alternative. This preferred alternative incorporates the parking structure location of Conceptual Alternative A, the open space concepts of Conceptual Alternatives A and C, and the layout of other capital projects as determined by subsequent studies and discussions between the NASA JPL Master Planning team.

NASA JPL is proposing construction of approximately 78,914 square meters (sq m) (849,428 sq feet [ft]) of new or rehabilitated building space, plus parking areas. The consolidation envisioned anticipates an associated reduction in building area of about 9,569 sq m (103,000 sq ft). Constructing the facilities and projects that make up the 20-year focus period of the Master Plan would involve a continual and progressive process of more detailed project planning, project definition, project phasing, and project funding categorization. The proposed action includes the following major recapitalization building projects:

1) A new Flight Electronics Facility Class with class 100K clean rooms for the fabrication, assembly, and functional testing of flight hardware;
2) A new Advanced Robotics Research and Development Facility for the fabrication and field testing of robotic components;
3) A new Mechanical Development Facility for the research and fabrication of materials and storage of ground support equipment;
4) A new Research and Technology Development Facility that would include a laboratory and office space supporting a variety of science and engineering programs;
5) A new System Level Testing Facility that would drastically improve NASA JPL's ability to accurately and efficiently test components at all stages of development; and
6) Underground Utility Infrastructure upgrades needed to replace major utility systems that experience periodic failures, threaten facility safety, or are needed to accommodate and support the proposed new recapitalization buildings.

The principle features of the Master Plan include other capital projects including a new parking structure and surface parking, on-site traffic circulation, enhanced open space, and landscaping.

Table Mountain Facility in Wrightwood, CA

Three conceptual alternatives were developed: Conceptual Alternatives A, B, and C. While each of these conceptual alternatives accommodates future development, Conceptual Alternative C was identified as the preferred alternative because it affords the best sky view cone so that the proposed OCTL-2 project instruments can 'see' various deep and near space objects. Further, Alternative C would allow the pad spaces identified for placement of the new OCTL facility in Alternatives A and B to be used for other projects, if needed.

The TMF Master proposes up to 465 sq m (5,010 sq ft) for Optical Communications Telescope Laboratory- 2 (OCTL-2), and a Remote Sensing Facility of approximately 279 gross sq m (3,000 gross sq ft) within a 20-year planning horizon. Also proposed is an estimated 186 sq m (2,000 sq ft) of future use building space that could be accommodated in an area identified as 'NASA JPL Reserve'. This area could accommodate a to-be- determined user potentially having greater independence from the use of the core TMF activity area. Various site upgrades and support infrastructure such as a new perimeter fence, pavement, power, water, and sewer improvements would be needed to render the NASA JPL Reserve site usable.

Goldstone Deep Space Communication Complex in Fort Irwin National Training Center, CA

The future plan for GDSCC maintains the basic functional characteristics of the complex. Beyond this broad planned approach to the long term development of GDSCC, two specific projects have been identified for potential future NASA needs. The Master Plan divides the Proposed Action into two construction projects: 1) construct a 34-m (111.5 ft) Beam Wave Guide antenna at Apollo Site to meet the goals of the Deep Space Network Robustness Project; and 2) provide infrastructure improvements as necessary to maintain antenna reliability and comply with Federal and state regulations, including water, power, communications, and sewer.

ALTERNATIVES

One alternative to the Proposed Action was evaluated in detail in each of the three NASA JPL site Master Plans - the No Action Alternative. The No Action Alternative assumes that the employee population and overall facility area would remain approximately the same as exists currently, with no redevelopment. Facilities would be renovated or replaced in kind to meet building, operating, sustainability, and safety codes. There would be no changes to public thoroughfares or to any of the existing security checkpoints.

ANTICIPATED ENVIRONMENTAL IMPACTS

In addition to fulfilling the requirements of NEPA, its associated regulations, and the regulations of NASA, this PEA complies with all applicable environmental, natural resource, and cultural resource statutes, regulations, and guidelines. Such additional statutes, regulations, and guidelines may require permits, approvals, consultations with outside agencies, or implementation of mitigation measures. Those considerations are included in the separate analyses set forth in the PEA for NASA JPL, TMF, and GDSCC. Any additional statutes, regulations, and guidelines are included below, by resource area.

Land Use: The Proposed Actions would result in no off-site short or long-term adverse impacts because no changes to land use would occur outside of NASA JPL, TMF, or GDSCC. Negligible to minor on-site adverse impacts are anticipated because of demolition, construction, and infrastructure redevelopment. Minor beneficial impact to on-site land use at NASA JPL would result from a more cohesive setting.

Socioeconomics: The Proposed Actions would result in negligible short-term beneficial impacts at NASA JPL, TMF, and GDSCC due to temporary employment during construction. No long-term on-site or off-site adverse impacts to population, housing, or employment are anticipated at NASA JPL, TMF, or GDSCC

Environmental Justice: Under the Proposed Actions, and in accordance with Executive Order (EO) 12898, there would be no short- or long-term adverse impacts to low-income or minority populations due to land use not changing.

Traffic and Transportation: Under the Proposed Actions at NASA JPL, TMF, and GDSCC, negligible to minor short-term adverse impacts are anticipated on- and off-site from construction activities on traffic generation, traffic congestion, traffic volume, and parking availability. Minor long-term beneficial impacts are expected as current parking issues would be addressed with improvements to available parking at NASA JPL and TMF.

Utilities and Services: Under the Proposed Actions for NASA JPL, TMF, and GDSCC, there would be negligible short-term adverse impact from construction due to temporary disruptions in electrical power, natural gas supplies, and water, sanitary, and storm sewer lines. Long-term, there would be minor beneficial effects because of more reliable grid connections and updated technologies for greater efficiency and increases in safety.

Air Quality: General Conformity under the Clean Air Act Section 176(c) (as amended) has been evaluated for the Proposed Actions according to the requirements of 40 CFR 93, Subpart B. Analyses for NASA JPL, TMF, and GDSCC shows that the total direct and indirect emissions associated with the Proposed Actions were below the *de minimis* threshold levels, as promulgated in 40 CFR 93.153(b). Therefore, the Proposed Actions will not have an adverse impact in the regions ability meet the National Ambient Air Quality Standards.

Under the Proposed Actions, there would be minor short-term adverse impacts at the regional and local scale to air quality during construction. Impacts from construction activities include the generation of fugitive dust and particulates from the removal and grading of soil, excavation operations, and other associated construction activities. In addition, there would be minor, short-term emissions from vehicles that would travel in the construction area. During construction, dust suppression measures will be used to minimize fugitive dust emissions. No long-term adverse impacts are anticipated.

Noise and Vibration: Under the Proposed Actions, there would be minor adverse impacts on ambient noise from site preparation, excavation, and construction activities. Impacts would be short-term and minor because these activities would be carried out during normal working hours. No long-term adverse impacts are anticipated.

Geology and Soils: As a result of the Proposed Actions, short-term negligible adverse impacts would occur because construction activities would occur in developed areas. Negligible adverse impacts to soils, topography, and physiographic features would also occur. No adverse impacts to natural hazards or effects on pre-existing seismic conditions are anticipated. Erosion and sedimentation control measures would be implemented in accordance with base specifications for construction projects.

Water Resources: Under the Proposed Actions, there would be minor adverse impact to surface water during construction as the proposed activities would primarily be conducted in areas of existing facilities. The Proposed Actions would not pose new risks; however, minor adverse effects on groundwater would occur as a result of construction activities. Negligible adverse impacts on floodplain resources would occur under the Proposed Actions for NASA JPL, TMF, and GDSCC. In accordance with EO 11988, contractors at NASA JPL would avoid adverse impacts on the 100-year floodplain associated with the Arroyo Seco by limiting construction activities to the elevated ground above Arroyo Seco embankments.

Erosion and sedimentation controls will be implemented as a Best Management Practice (BMP) and National Pollutant Discharge Elimination System (NPDES) requirements will be met for soil disturbances. A Storm Water Pollution Prevention Plan (SWPPP) will be prepared to ensure low impact disturbances from proposed construction activities.

Biological Resources: Under the Proposed Actions, it is anticipated that there would be negligible to minor short-term adverse impact to vegetation and wildlife during construction activities. In accordance with EO 11990, no adverse impacts to wetlands are anticipated. No long-term adverse impacts are anticipated at NASA JPL, TMF, or GDSCC.

Threatened, Endangered, and Other Sensitive Species: Under the Proposed Actions at NASA JPL, TMF, and GDSCC, no short- or long-term adverse impacts to Federally-listed threatened, endangered or sensitive plants or animals within the project area are anticipated. No further consultation with the U.S. Fish and Wildlife Service (USFWS) under Section 7 of the Endangered Species Act is required for NASA JPL or TMF. Since critical habitat for the gopher tortoise is located on GDSCC, coordination with the USFWS would take place according to the terms of the *Programmatic Biological Opinion* prior to the start of any major on-site construction activity.

Further, if the endangered status of the Mojave Ground Squirrel is confirmed, the USFWS would subsequently make a determination on suitable critical habitat, which could affect areas of GDSCC. GDSCC would monitor this determination as to the potential effect of the proposed project on the Mojave Ground Squirrel's critical habitat determination.

Cultural Resources: Under the Proposed Actions, it is anticipated that there would be no short- or long-term adverse impact to cultural or historic resources at TMF or GDSCC. Minor short-term adverse impacts would result from the potential removal of seven structures determined to be eligible under Section 106 of the National Historic Preservation Act. NASA has initiated consultation through the Section 106 process with the California State Historic Preservation Office. As a result of this consultation, a Programmatic Agreement is being developed that identifies any mitigation measures to be implemented as well as preservation design guidelines for the defined character areas in NASA JPL, TMF, and GDSCC. Until such time that the Programmatic Agreement with the California State Historic Preservation Office is completed and implemented, any and all actions with potential impacts on historic properties will be addressed on a case by case basis.

Hazardous Materials and Waste: With proper housekeeping and maintenance, the Proposed Actions for NASA JPL, TMF, and GDSCC would have a negligible adverse impact on hazardous materials used during construction. Hazardous materials used would not be expected to increase. Minor adverse impacts on hazardous wastes would be generated from facility demobilization and demolition. Therefore, it is anticipated that the volume, type, classifications, and sources of hazardous wastes would be similar in nature with the baseline condition waste streams.

PUBLIC AVAILABILITY

NASA JPL issued the draft PEA for public comment on December 5, 2011 and made it available for public review at the following locations:

NASA Headquarters, Library, Room 1J
10300 E Street, SW
Washington, DC 20546

Jet Propulsion Laboratory, Visitors Lobby, Building 249
4800 Oak Grove Drive
Pasadena, CA 91109

NASA Headquarters Library,
1120 E. Street, SW
Washington, DC 20546

Altadena Public Library
East Mariposa
Altadena, CA 91001

Pasadena Public Library
285 East Walnut
Pasadena, CA 91101

La Canada Flintridge Public Library
4545 West Oakwood Avenue
La Canada, CA 91011

Wrightwood Public Library
6011 Pine Street
Wrightwood, CA 92397

Barstow Library
304 East Buena Vista Street
Barstow, CA 92311

Jet Propulsion Laboratory Library
Building 111
4800 Oak Grove Drive
Pasadena, CA 91109

NASA JPL also sent a draft PEA to Federal, State and local agencies and interested individuals. NASA JPL published a Notice of Availability (NOA) announcing the availability of the Draft PEA in the Pasadena Star News, La Canada Valley Sun, Desert Barstow Desert Dispatch, and Wrightwood Mountaineer Progress. The public review and comment period ended on January 6, 2012. NASA JPL received one comment from an agency. The Draft EA was modified to include the comment letter.

CONCLUSIONS

On the basis of the PEA for the proposed implementation of Master Plans for JPL, TMF, and GDSCC, and underlying Facility Master Plan Update reference documents, NASA has determined that the environmental impacts associated with the proposed action will not individually or cumulatively have a significant effect on the quality of the human environment.

Therefore, an environmental impact statement is not required and NASA JPL is issuing this FONSI.

Dr. Eugene Trinh
Director NASA Management Office

01/25/12
Date

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Common Metric/British System Equivalents

Length
1 centimeter (cm) = 0.3937 in
1 in = 2.54 cm
1 cm = 0.0328 foot (ft)
1 ft = 30.48 cm
1 meter (m) = 3.2808 feet
1 ft = 0.3048 m
1 kilometer (km) = 0.6214 mile (mi)
1 mi = 1.6093 km

Area
1 square centimeter (cm^2) = 0.1550 square inch (in^2)
1 in^2 = 6.4516 cm^2
1 square meter (m^2) = 10.7639 square feet (ft^2)
1 ft^2 = 0.09290 m^2
1 square kilometer (km^2) = 0.3861 square mile (mi^2)
1 mi^2= 2.5900 km^2
1 hectare (ha) = 2.4710 acres (ac)
1 ac = 0.4047 ha
1 ha = 10,000 m^2
1 m^2 = .0001 ha

Volume
1 cubic centimeter (cm^3) = 0.0610 cubic inch (in^3)
1 in^3 = 16.3871 cm^3
1 cubic meter (m^3) = 35.3147 cubic feet (ft^3)
1 ft^3 = 0.0283 m^3
1 m^3= 1.308 cubic yards (yd^3)
1 yd^3 = 0.76455 m^3
1 liter (l) = 1.0567 quarts (qt)
1 qt = 0.9463264 l
1 l = 0.2642 gallon (gal)
1 gal = 3.7845 l

Weight
1 gram (g) = 0.0353 ounce (oz)
1 oz = 28.3495 g
1 kilogram (kg) = 2.2046 pounds (lb)
1 lb = 0.4536 kg
1 metric ton (mt) = 1.1023 tons
1 ton = 0.9072 mt

Acronyms and Abbreviations

◦ C	degrees Celsius
◦ F	degrees Fahrenheit
µg/m3	micrograms per cubic meter
ac	acre
ACM	asbestos-containing material
ACRIMS	Active Cavity Radiometer Irradiance Monitor Satellite III
ACSB	Angeles Crest Scenic Byway
ACSBCMP	Angeles Crest Scenic Byway Corridor Management Plan
AHM	acutely hazardous materials
amsl	above mean sea level
ANF	Angeles National Forest
APCD	Air Pollution Control Districts
APE	area of potential effects
APEFZ	Alquist-Priolo Earthquake Fault Zones Act of 1972
AQCR	air quality control region
AQMD	Air Quality Management Districts
ARARs	applicable or relevant and appropriate requirements
ARTS	Pasadena Area Rapid Transit
AST	aboveground storage tank
AVAQMD	Antelope Valley Air Quality Management District
AVM	autonomous visibility monitoring
AVR	average vehicle ridership
AVSTC	Apple Valley Science and Technology Center
BLM	U.S. Bureau of Land Management
BMPs	best management practices
BP	before present
BWG	Beam Wave Guide
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
CalEPA	California Environmental Protection Agency
CalDTSC	California Department of Toxic Substance Controls
CalRecycle	California Department of Resources Recycling and Recovery
Caltech	California Institute of Technology
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CCAA	California Clean Air Act
CCD	Charge-Coupled Device
CCR	California Code of Regulations
CDFA	California Department of Food and Agriculture
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CGS	California Geological Survey
CIP	Capital Improvement Plan
CIWMB	California Integrated Waste Management Board
CLARS	California Laboratory for Atmospheric Remote Sensing
cm	Centimeter
CMBC	Circle Mountain Biological Consultants
CMP	Congestion Management Plan
CNDDB	California Natural Diversity Database
CNEL	community noise equivalent level
CNPS	California Native Plant Society
CO	carbon monoxide
CO^2	carbon dioxide
CPUC	California Public Utilities Commission
CRWQCB	California Regional Water Quality Control Board

Acronyms and Abbreviations (continued)

CTT	Compatibility Test Trailer
CWA	Clean Water Act
CWC	California Waste Code
CY	Calendar Year
dB	decibel
dBA	A-weighted decibel
DMJM	Daniel Mann Johnson and Mendenhall
DoD	Department of Defense
DPW	Department of Public Works
DSN	Deep Space Network
DSS	Deep Space Station
DTF	Development and Test Facility
EA	environmental assessment
EAPO	Environmental Affairs Program Office
EDL	entry, descent, and landing
EIR	Environmental Investigation Report
ELEC	electric
ELF	extra-low frequency
EM	emergency
EO	Executive Order
EOC	Emergency Operations Center
EPCRA	Emergency Planning & Community Right-to-Know Act
ERD	Environmental Resources Document
ERP	Environmental Restoration Program
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FBR	fluidized bed reactor
FEMA	Federal Emergency Management Agency
FFA	Federal Facilities Agreement
FFRDC	Federally Funded Research & Development Center
FHWA	Federal Highway Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
Forest Plan	ANF Land Management Plan
ft	foot/feet
FTUVS	Fourier Transform Ultraviolet Spectrometer
FY	fiscal year
g	gram
gal	gallon/gallons
GAVRT	Goldstone Apple Valley Radio Telescope
GDSCC	Goldstone Deep Space Communications Complex
GOLD	Ground-to-Orbiter Lasercom Demonstration
GOPEX	Galileo Optical Pointing Experiment
GOV	Government
gpm	gallons per minute
GRACE	Gravity Recovery and Climate Experiment
GRAIL	Gravity Recovery and Interior Laboratory
GSSR	Goldstone Solar System Radar
ha	hectare
HEF	High Efficiency
HP	horsepower
HUD	U.S. Department of Housing and Urban Development
HWP	Hahamongna Watershed Park
HVAC	Heating, Ventilation, and Air Conditioning
ICE	internal combustion engine
ICRMP	Integrated Cultural Resources Management Plan
ID	identification

Acronyms and Abbreviations (continued)

I/I	inflow and infiltration
in	inch(es)
INRMP	Integrated Natural Resources Management Plan
JPL	Jet Propulsion Laboratory
kBtu/sq ft/yr	British thermal units per square foot per year
kg	kilogram
km	kilometers
kph	kilometers per hour
kV	kilovolt
kVa	kilovolt-amps
kWh	kilowatt hours
l	liter
L_{10}	noise level exceeded 10% of the time
L_{90}	noise level exceeded 90% of the time
LACFD	Los Angeles County Fire Department
LACMTA	Los Angeles County Metropolitan Transit Authority
LACSD	Los Angeles County Sanitation District
LACDPW	Los Angeles County Department of Public Works
LADOT	Los Angeles Department of Transportation
LAN	local area network
LAWC	Lincoln Avenue Water Company
Ldn	day-night average sound level
LEED	Leadership in Energy and Environmental Design
Leq	equivalent noise levels
LGAC	liquid phase granular activated carbon
LIDAR	Light Detection and Ranging
Lmax	maximum sound level
LN	liquid nitrogen
LOS	level of service
LP	liquid propane gas
m	meter(s)
MCL	maximum contaminant level
MDAB	Mojave Desert Air Basin
MDAQMD	Mojave Desert Air Quality Management District
Metro	Metropolitan Transit Authority
mg/m^3	milligrams per cubic meter
MHN	Mountain High North
MHR	Mountain High Resorts Associates, LLC
mi	miles
ml	milliliter
MMBTU	Million British Thermal Units
Mo=	on the order of moment magnitude
MOA	memorandum of agreement
MOSUS	Modernization of South Utility System
MOU	memorandum of understanding
mph	miles per hour
MPOE	minimum point of entry
MVA	megavolt ampere
MW	megawatt
MWD	Metropolitan Water District
n.a.	not applicable
NAAQS	National Ambient Air Quality Standards
NAS	National Audubon Society
NASA	National Aeronautics and Space Administration
NAWC	Naval Air Weapons Center
NDACC	Network for the Detection of Atmospheric Composition Change

Acronyms and Abbreviations (continued)

NEO	Near Earth Object
NESHAP	National Emission Standards for Hazardous Air Pollutants
NEPA	National Environmental Policy Act
NHL	National Historic Landmark
NHPA	National Historic Preservation Act
NMO	NASA Management Office
NO^2	nitrogen dioxide
NO_X	nitrous oxides
NOCC	Network Operations Communications Center
NOPE	Network Operations Project Engineers
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List
NPR	NASA Procedural Requirement
NRHP	National Register of Historic Places
NSPS	New Source Performance Standards
NTC	National Training Center
O^3	ozone
Oak Grove	JPL Oak Grove Facility
OCTL	Optical Communications Telescope Laboratory
OHP	Office of Historic Preservation
OSHA	Occupational Safety and Health Administration
OU	operable unit
PA	Programmatic Agreement
Pb	lead
PCBs	polychlorinated biphenyls
PFD	City of Pasadena Fire Department
PLC	programmable logic controller
PM_{10}	10 microns in diameter
$PM_{2.5}$	2.5 microns in diameter
POL	petroleum, oil, and lubricants
POTW	publicly-owned treatment works
ppm	parts per million
psi	pounds per square inch
PTU	pressure, temperature, and humidity
PUE	Power Usage Effectiveness
PVC	polyvinyl chloride
qt	quart
R&D	research and development
RCN	rural conservation area
RCP	reinforced concrete pipe
RCRA	Resource and Conservation Recovery Act
RECLAIM	Regional Clean Air Incentives Market
RF	radio frequency
RI	Remedial Investigation
RO	reverse osmosis
ROC	Remote Operations Center
ROD	Record of Decision
ROG	reactive organic gases
ROI	region of influence
SAP	satellite accumulation point
SARA	Superfund Amendments and Reauthorization Act
SBNF	San Bernardino National Forest
SCAG	Southern California Association of Governments
SCAQMD	South Coast Air Quality Management District
SCE	Southern California Edison
SHMP	Seismic Hazard Mapping Program

Acronyms and Abbreviations (continued)

SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SO^{2}	sulfur dioxide
SO^{4}	sulfates
SOCAB	South Coast Air Basin
SoCalGas	Southern California Gas Company
SPC	Signal Processing Center
sq ft	square foot/feet
SQG	small quantity generator
sq m	square meter
SR	State Road
SRA	Source Receptor Areas
STEM	Science, Technology, Engineering, and Mathematics
STMC	JPL/NASA Science and Technology Management Council
SUP	special use permit
SVE	soil vapor extraction
SWRCB	State Water Resources Control Board
SWPPP	Storm Water Pollution Prevention Plan
TDS	total dissolved solids
TM	Table Mountain
TMDL	total maximum daily load
TMF	Table Mountain Facility
TMO	Table Mountain Observatory
TRTP	Tehachapi Renewable Transmission Project
TSCA	Toxic Substances Control Act
TSI	Total Solar Irradiance
TSP	total suspended particulates
UCLA	University of California at Los Angeles
UCSD	University of California at San Diego
UHWM	Uniform Hazardous Waste Manifest
ULF	ultra-low frequency
ULSD	ultra-low sulfur diesel
URBEMIS	URBan EMISsions 2007 model
U.S.	United States
USACE	U.S. Army Corps of Engineers
USACHPPM	United States Army Center for Health Promotion and Preventive Medicine
USC	U.S. Code
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	underground storage tank
UTP	Unshielded Twisted Pair
VdB	vibration decibels
VLBI	Very Long Baseline Interferometry
VOC	volatile organic compound
vpd	vehicles per day
WDR	Waste Discharge Requirements

1.0 PURPOSE AND NEED FOR ACTION

1.1 Introduction

The Jet Propulsion Laboratory (JPL) is a Federally Funded Research and Development Center (FFRDC) operated by the California Institute of Technology (Caltech) under a contract with the National Aeronautics and Space Administration (NASA). JPL is NASA's lead center for the robotic exploration of the solar system, and is responsible for operating NASA's Deep Space Network (DSN). JPL also conducts research and development work for other Federal agencies, creating international expertise in key fields such as space science instrumentation and telecommunications, spacecraft component design and systems integration, micro-devices, electronics, and software automation.

NASA's mission is "to pioneer the future in space exploration, scientific discovery and aeronautics research". NASA JPL is currently undertaking analysis of existing facilities and infrastructure, while simultaneously forecasting future needs and objectives to enable NASA to meets its mission. Therefore, NASA JPL is proposing the development of a comprehensive facility planning strategy, which would cover the next two decades through the concurrent implementation of Facilities Master Plan updates (Master Plans) for the three NASA JPL facilities in California: the main JPL facility on Oak Grove Drive in Pasadena (hereafter referred to as "NASA JPL"); (2) the Table Mountain Facility (TMF) in Wrightwood; and (3) the Goldstone Deep Space Communications Complex (GDSCC) at Fort Irwin National Training Center (NTC).

NASA is preparing a programmatic environmental assessment (EA) to analyze the potential impacts from implementing the Master Plans for JPL, TMF, and GDSCC. The Council on Environmental Quality (CEQ) Sec. 1500.4 titled "Reducing paperwork," encourages Federal agencies to reduce data and excessive paperwork by analyzing potential environmental impacts of similar actions in one EA. The proposed actions in all three Master Plans propose facilities that would be similar in overall design, sited in areas that are already developed or otherwise not ecologically sensitive, and are consistent with the mission of their respective sites. Therefore, this EA includes the master plans for these three JPL-managed facilities.

Recognizing its stewardship responsibilities, NASA is committed to integrating environmental considerations into its planning and decision-making activities consistent with the spirit of the National Environmental Policy Act (NEPA) of 1969. While NASA is the responsible Federal agency for the preparation of this EA, during the NEPA process NASA is coordinating closely with the United States Forest Service (USFS) for proposed actions pertaining to TMF; and with the Department of the Army, Fort Irwin NTC, for proposed actions at GDSCC. A review of the potential effects on historic resources from the proposed projects consistent with Section 106 of the National Historic Preservation Act (NHPA) has either been fulfilled to the extent possible at the master planning phase, or would be fulfilled as projects are approved and funded.

NASA has prepared this EA to be consistent with NEPA requirements and the Council on Environmental Quality's (CEQ's) regulations on implementing NEPA. The latest NASA NEPA Guidelines found in NASA Policy Requirement (NPR) 8580.1, *Implementing the National Environmental Policy Act and Executive Order 12114,* have been used in preparing this EA (NASA. 2001).

This Programmatic EA is based on the NASA JPL Master Plan Updates for NASA JPL, TMF, and GDSCC and best available information to date (AC Martin. 2011). The implementation of all features of the individual Master Plans would be dependent on the plans being reasonable and coinciding with anticipated funding.

The planning schedule for the proposed projects is not absolute. Modifications may be made to priorities and specific implementation dates of future facility requirements. Funding availability would be the primary driver of schedule compliance. Additionally, specific facility requirements could change over the life of the individual plans, especially during the last ten years of implementation. For these reasons, NASA would employ an adaptive management approach whereby it would evaluate and adjust features of proposed actions in consideration of internal and external factors (e.g., funding, new mission(s), new technologies, and changes in the natural or physical environment). Even with these changes, the overall concept of development is anticipated to remain intact and be implemented when NASA completes compliance with NEPA; Federal, state, and local regulations; and approval of state and local permits.

For these reasons, NASA JPL proposes the use of the NASA JPL Programmatic Facility Master Plan EA NEPA Checklist. When NASA JPL has determined that NEPA analysis would be required for a proposed facility action at any of the three NASA JPL sites (NASA JPL, TMF, and GDSCC), that proposed action would be evaluated for adequate coverage under this Facility Master Plan EA. The checklist (see **Appendix A**) would be completed for all proposed actions to determine if those actions are covered under this Facility Master Plan Updates EA.

If applicable sections of the Facility Master Plan EA NEPA Checklist have been completed and the Proposed Action is accurately and adequately covered under this EA, a Record of Environmental Consideration (REC) would be prepared documenting the determination and no further NEPA documentation would be required. If the checklist indicates the need for additional analysis, and if based upon that additional analysis and any appropriate mitigation measures, a determination of no substantial impact to environmental resources can be made, it would be documented in a REC and no further NEPA documentation would be required. If a specific action is expected to create impacts greater in magnitude, extent, or duration than those described in the Programmatic Facility Master Plan Updates EA, then separate NEPA documentation would be prepared for that action.

1.2 Background

This section describes NASA JPL, TMF, and GDSCC, including location, facility description and history, mission/capabilities, and a chronology of previous master plans. **Table 1-1** is a summary of the three facilities.

Table 1-1. Summary of NASA JPL, TMF, and GDSCC

Summary Metric	NASA JPL	TMF	GDSCC
Total Managed Land Area (hectares/acres)	73.3/181.2	15/38	11,396/28,160
On-site Workforce	5,000 FTE	12	178
Total Building Area (sq ft/sq m)	2,676,000/248,609	28,120/2,612	185,464/17,230
Current Replacement Value	$1,042 M	$10.8 M	$250 M

Source: Information obtained from JPL Oak Grove Master Plan Update 2011-2032, March 2011

Notes: TMF=Table Mountain Facility; GDSCC=Goldstone Deep Space Communications Complex; sq ft=square feet; sg m=square meters; FTE=full-time equivalents.

1.2.1 Facility Description

1.2.1.1 NASA JPL

The main NASA JPL facility is located in the northern metropolitan Los Angeles area, between the cities of Pasadena and La Cañada Flintridge, and the community of Altadena in unincorporated Los Angeles County (**Figure 1-1**). NASA JPL is separated from residential neighborhoods by the foothills of the San Gabriel Mountains to the north and the Arroyo Seco Canyon to the east. The residential neighborhood of La Cañada Flintridge borders NASA JPL on the west. An equestrian club (Flintridge Riding Club) and a Los Angeles County Fire Department (LACFD) facility lie to the southwest. A USFS Ranger station, La Cañada High School, Hahamongna Watershed Park (HWP), and Devil's Gate Dam are farther south (**Figures 1-3**).

NASA JPL encompasses 73.3 hectares (ha) (181.2 acres [ac]) and contains 244,335 square meters (sq m) (2,630,000 square feet [sq ft]) of space. Approximately 63.5 ha (156.9 ac) are federally owned. NASA JPL includes three parcels of leased land: 4.6 ha (11.4 ac) on the west side of the site is leased from the Flintridge Riding Club for use as surface parking; and a 3.6 ha (8.9 ac) parcel on the western edge of the Arroyo Seco and a 0.48 ha (1.2 ac) parcel on the east side of the site are leased from the City of Pasadena for use as surface parking;

NASA JPL has a usable site area of 29.5 ha (72.8 ac), or 40 percent of the total acreage, with the main developed area in the southern half of the site. Three areas are unsuitable or unavailable for development: the steep area to the north comprises 22.2 ha (54.8 ac); the earthquake fault zone that runs through the site occupies 11.5 ha (28.4 ac); and the Edison Power Substation located in the southeastern area of the Lab is a 0.36 ha (0.9-ac) parcel. There are 138 buildings and 20 trailers at JPL **(Appendix B)**.

Situated on the south-facing slope of the San Gabriel foothills, NASA JPL is surrounded by natural settings on the northern, eastern, and southern boundaries. The northern foothills of the Angeles National Forest (ANF) are covered with native chaparral. The Arroyo Seco to the east is typically a dry river bed and only contains water during periods of rainfall. The adjacent western residential area has an abundance of vegetation that contributes to the scenic vistas. The mesa ridge is the northern boundary of the facility. The majority of the facility slopes away from the steep hillside of the mesa. NASA JPL is situated above the surrounding community and is a prominent visual feature in the area. Built on sloping terrain, its buildings and roads are terraced into the hillside.

NASA JPL also includes two off-site complexes. In 2006, NASA JPL acquired the California Laboratory for Atmospheric Remote Sensing (CLARS) which is located within the Mt. Wilson Observatory complex of scientific instruments and facilities atop Mt. Wilson in the ANF, 16 km (10 mi) northeast of NASA JPL. The Woodbury Complex in Altadena is also leased, and it consists of four office buildings totaling 11,674 sq m (125,662 sq ft) and occupied by approximately 480 employees. Recurring lease costs for the facility have led to a proposed long term plan to relocate the Woodbury employees to NASA JPL.

1.2.1.2 Table Mountain Facility

TMF is located 116 kilometers (km) (72 miles [mi]) northeast of NASA JPL at an elevation of 2,286 m (7,500 ft) near Wrightwood. The site is in the Santa Clara/Mohave Rivers Ranger District of the ANF, and is occupied under the terms of a memorandum of understanding (MOU) granted by the USFS (**Figure 1-3**). It is recognized by astronomers on the basis of several telescope-site surveys as one of the better astronomical observatory sites in the southwestern U.S.

Figure 1-1. NASA JPL Regional Context Map

File Path:F:\GISDATA2\NASA_JPL_EA\GIS_Documents\Project_Maps\Master_Plan\JPL_MasterPlan_EA_Fig1_2.mxd

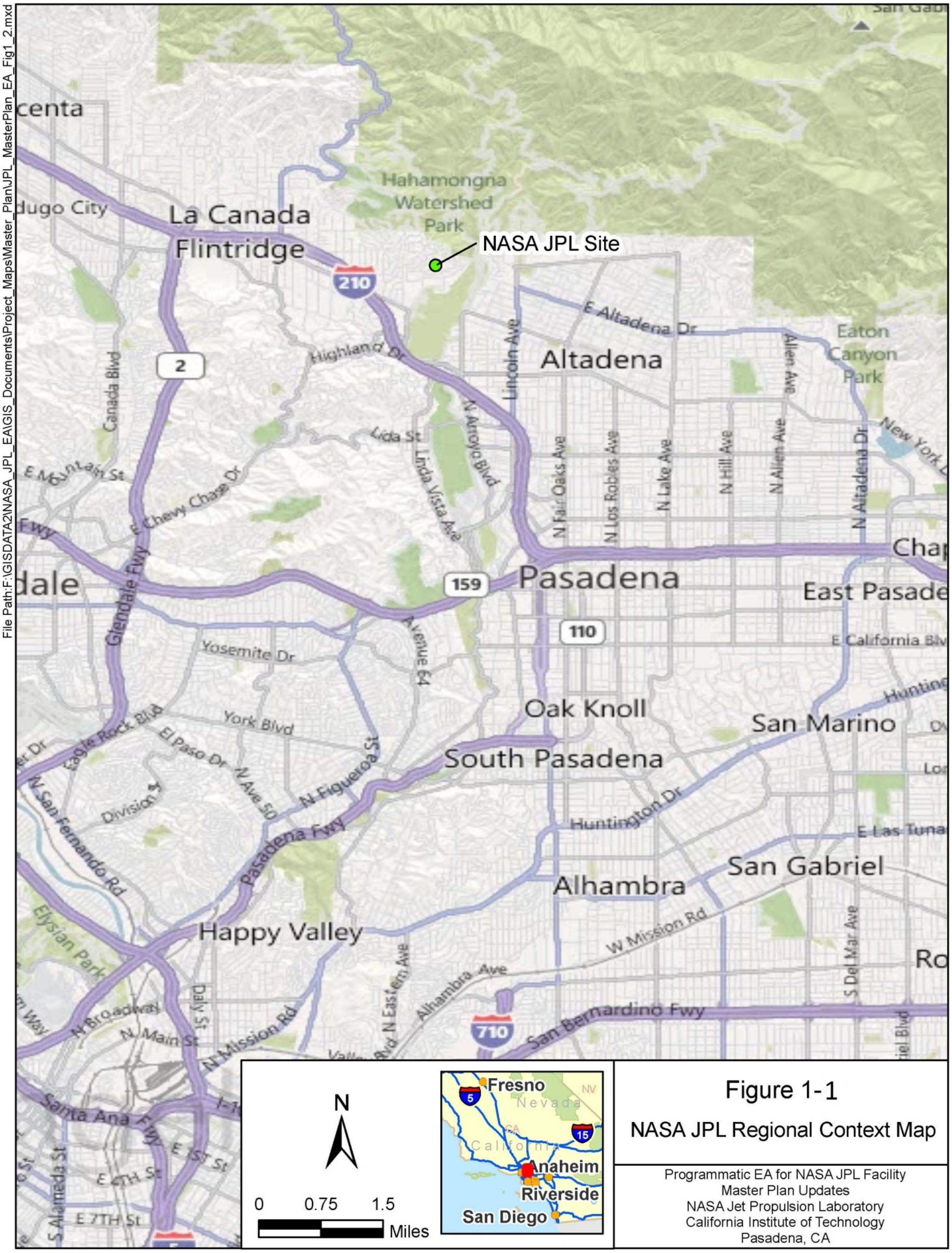
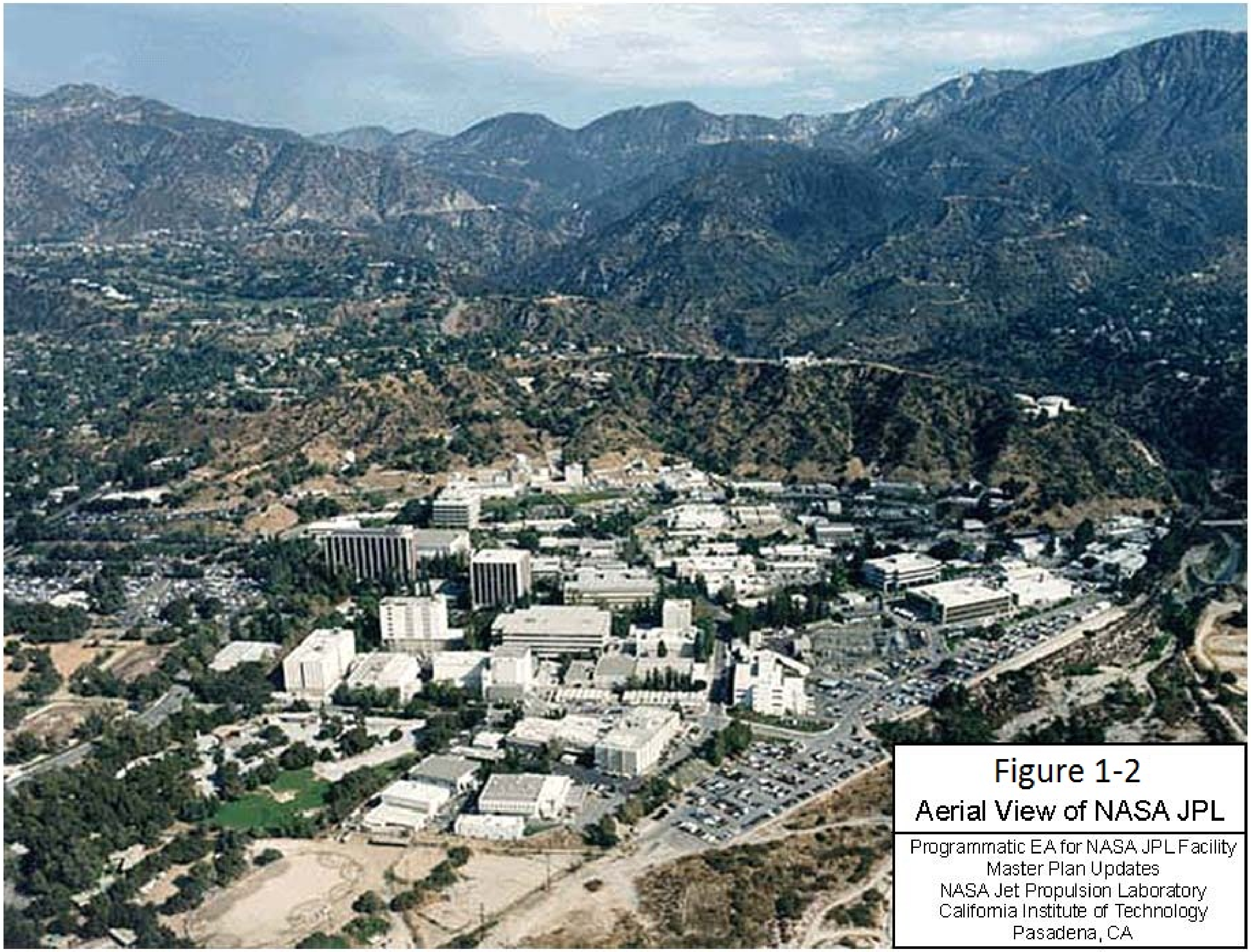
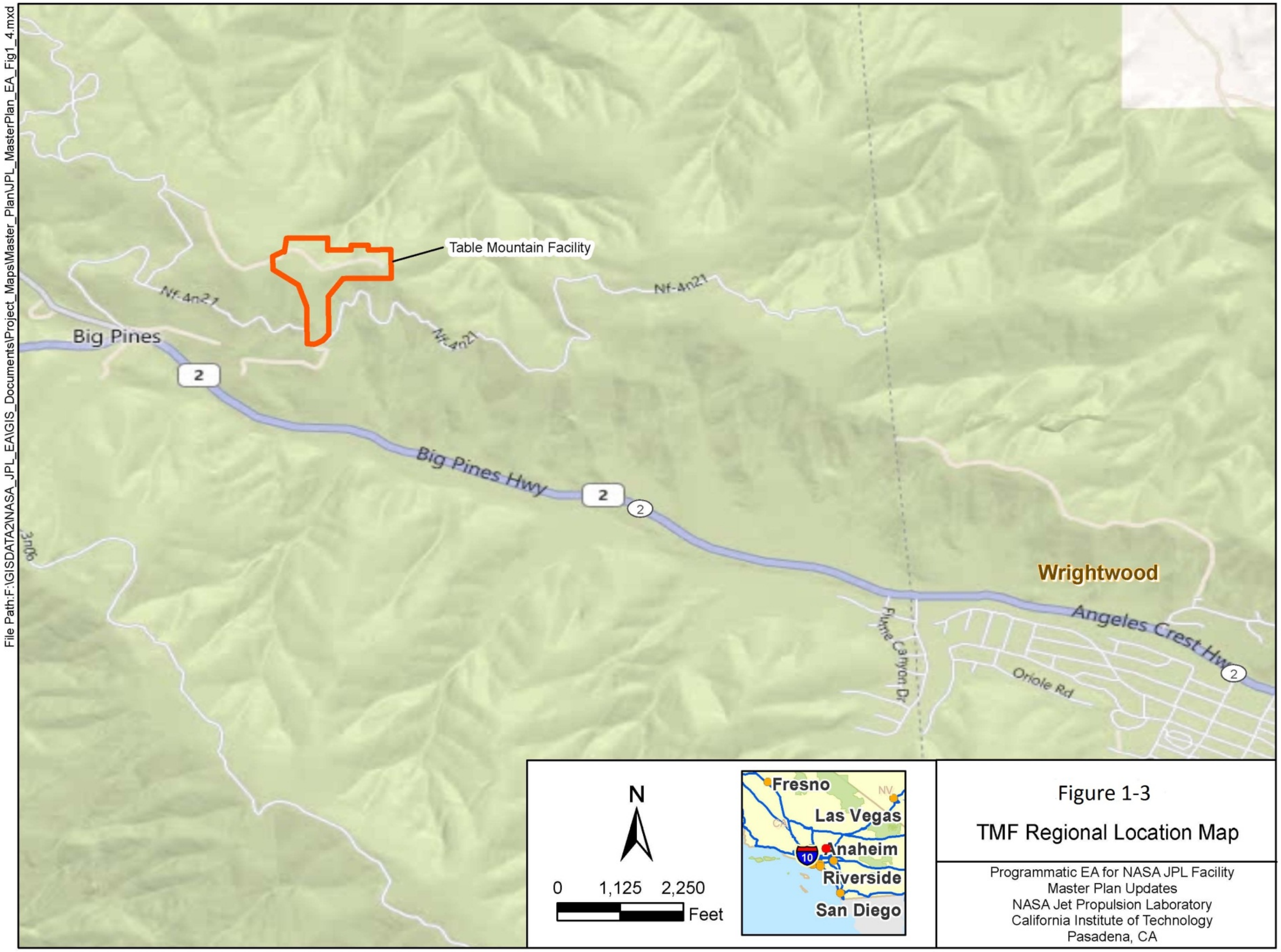


Figure 1-2. Aerial View of NASA JPL



Source: JPL Oak Grove Master Plan Update 2011-2032, March 2011

Figure 1-3. TMF Regional Location Map



Source: United States Department of the Interior, Bureau of Land Management

TMF is rapidly accessible to NASA JPL scientists and engineers, and because it includes dormitory, food service, office, and small conference capabilities, it can be used on a 24-hour basis for conducting various observational and research activities. Since the 1920s, TMF has been conducting various atmospheric and solar measurements, making it a valuable station for the comparison of temporal records and study of atmosphere and/or sun changes over time. TMF consists of 15 buildings that total approximately 2,612 gross sq m (28,120 gross sq ft) in area. These buildings are further described in Section 3.2.1.2. **Figure 1-4** presents the current facility site plan, and a summary of existing land use. All programs are supported in one way or another by the activities that take place in TM-17 (administration, offices, dormitory, kitchen/lounge, library/conference room) and TM-19 (maintenance shops and garage). Because there are multiple users of the TMF site, the maintenance and operation of TMF is largely funded through the NASA JPL Science and Technology Management Council (STMC).

1.2.1.3 Goldstone Deep Space Communications Complex

GDSCC is located in southern California in a natural, bowl-shaped depression area in the Mojave Desert, in San Bernardino County, 64.4 km (40 mi) north of Barstow, CA, and approximately 257.5 km (160 mi) northeast of Pasadena, CA, where JPL is located. **Figure 1-5** illustrates the regional location of GDSCC.

GDSCC is part of NASA's DSN, the world's largest and most sensitive scientific telecommunications and radio navigation network. GDSCC is managed, technically directed, and operated for NASA by JPL. The maintenance and operations of the GDSCC and Pasadena operations are currently (2011) provided by ITT Industries, Systems Division under contract to JPL. The 114-sq km (44-sq mi) GDSCC lies within the western part of the Fort Irwin NTC (**Figure 1-5**). A Use Permit for the land was granted to NASA by the Army in 1963, and NASA and the Army have entered into an MOU (Department of the Army, 2011) that governs coordination and cooperation between the two parties as they conduct their respective onsite activities and ensure any required regulatory compliance. The GDSCC is bordered by the NTC on the south, east, and southeast; the China Lake Naval Air Warfare Center (NAWC) on the northwest.

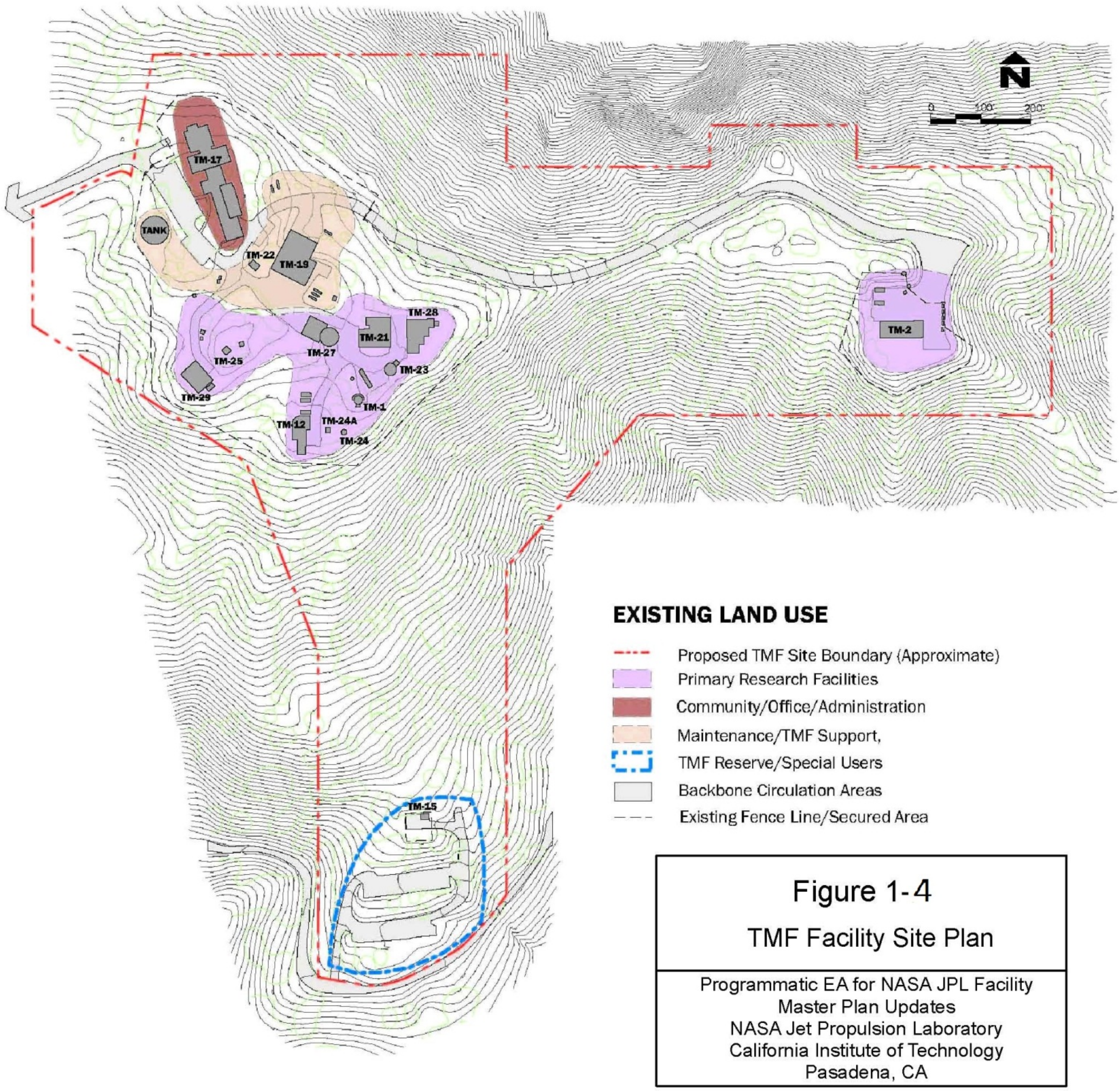
Site Description

The GDSCC is a working community (including Ft. Irwin, Southern California Edison, and outside contractors) with its own roads, airstrip, cafeteria, electrical power, and telephone systems, and it is equipped to conduct all necessary maintenance, repair, and domestic support services. Facilities at the GDSCC include approximately 90 buildings and structures that were constructed from the 1950s through the present. The upgrade and construction of additional facilities at GDSCC is anticipated to address obsolescence and reliability issues.

The GDSCC is one of three Deep Space Communications Complexes (DSCCs) operated by NASA. The three DSCCs are located on three continents:

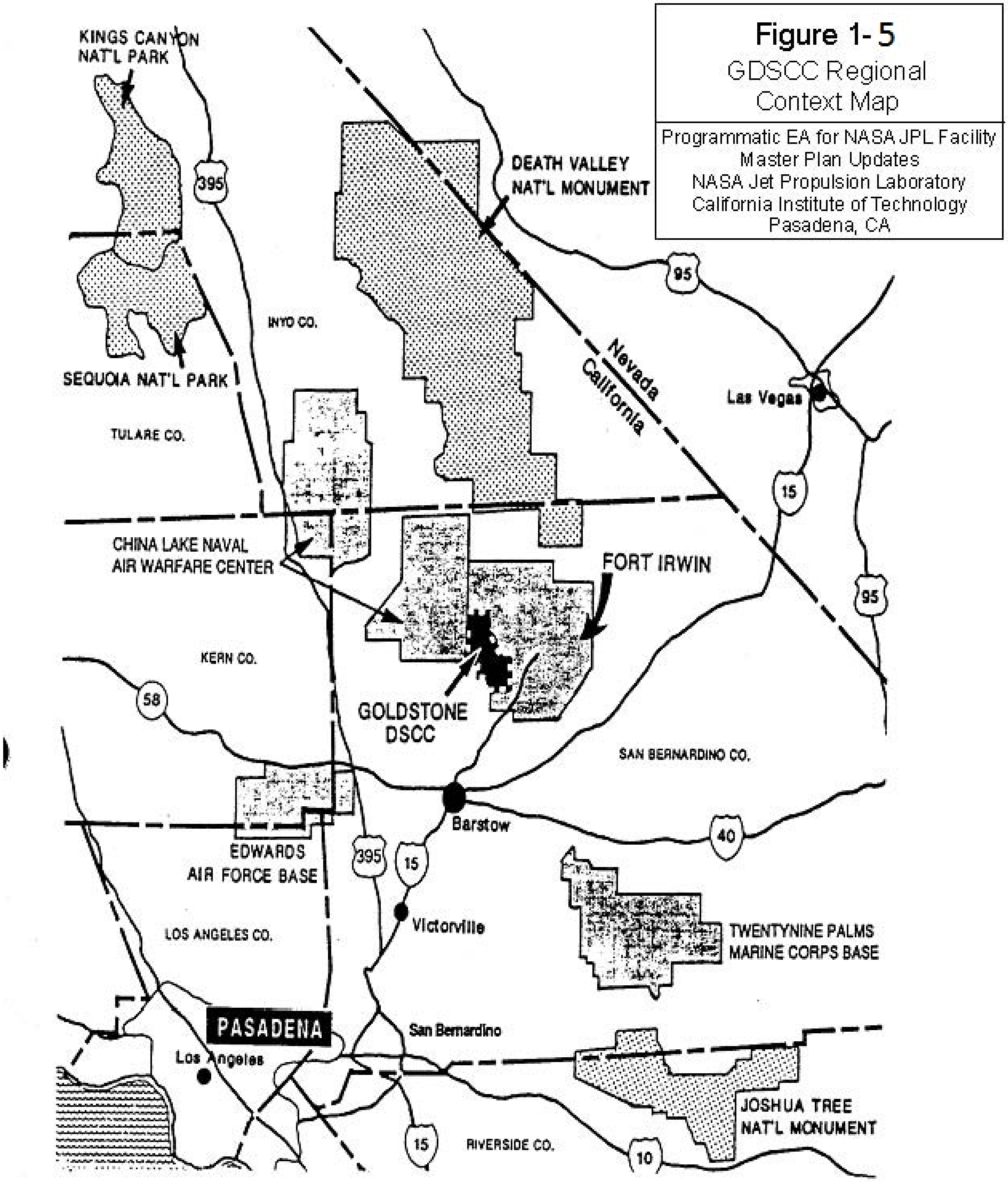
- North America at Goldstone in southern California's Mojave Desert;
- Europe in Spain, approximately 59.5 km (37 mi) west of Madrid at Robledo de Chavela; and
- Australia, near the Tidbinbilla Nature Reserve, 40 km (25 mi) southwest of Canberra.

Figure 1-4. TMF Facility Site Plan



Source: Table Mountain Facility Master Plan Update 2011-2032, March 2011

Figure 1-5. GDSCC Regional Context Map



Because these three DSCCs are approximately 120 degrees apart in longitude, a spacecraft is nearly always in view of one of the DSCCs as the Earth rotates on its axis. At present, DSN at GDSCC includes 6 parabolic dish antennas used for research and development (R&D) and their ancillary equipment and installations (that is, Deep Space Stations, or DSSs), at four sites (**Figure 1-6**). The DSN DSSs at GDSCC include:

- Venus Site: DSS 13 for R&D only;
- Mars/Uranus Site: DSS 14, DSS-15;
- Apollo Site: DSS 24, DSS 25, and DSS 26; and
- Gemini Site: DSS 27.

Spain and Australia each have DSSs that are similar to GDSCC DSSs that are operational for space missions. Thus, the NASA DSN has a worldwide network of DSSs operational for space missions. A Network Operations Communications Center (NOCC) located at NASA JPL in Pasadena, CA, controls and monitors the entire DSN.

This Programmatic EA will focus strictly on the proposed Master Plan activities at GDSCC. The DSCCs located in Spain and Australia are not subject to environmental review under NEPA and CEQ, but rather to the laws and environmental regulations governing those countries.

Additional DSSs not used for DSN operations also exist within the boundaries of GDSCC:

- Echo Site: DSS-12, used for educational purposes;
- Venus Site: DSS-13, deactivated;
- Apollo Site: DSS-16, deactivated
- Gemini Site: DSS-28, used for educational purposes; and
- Pioneer Site: DSS-11, National Historic Landmark (NHL) not in use.

DSS 12 is a 43-year-old, 34-m (112-ft) antenna situated at the Echo Site. The transmitter of DSS 12 has been taken away, but the antenna continues to operate as a "stargazer" in the receive mode as a radio-astronomy telescope in conjunction with the Goldstone Apple Valley Radio Telescope (GAVRT) project.

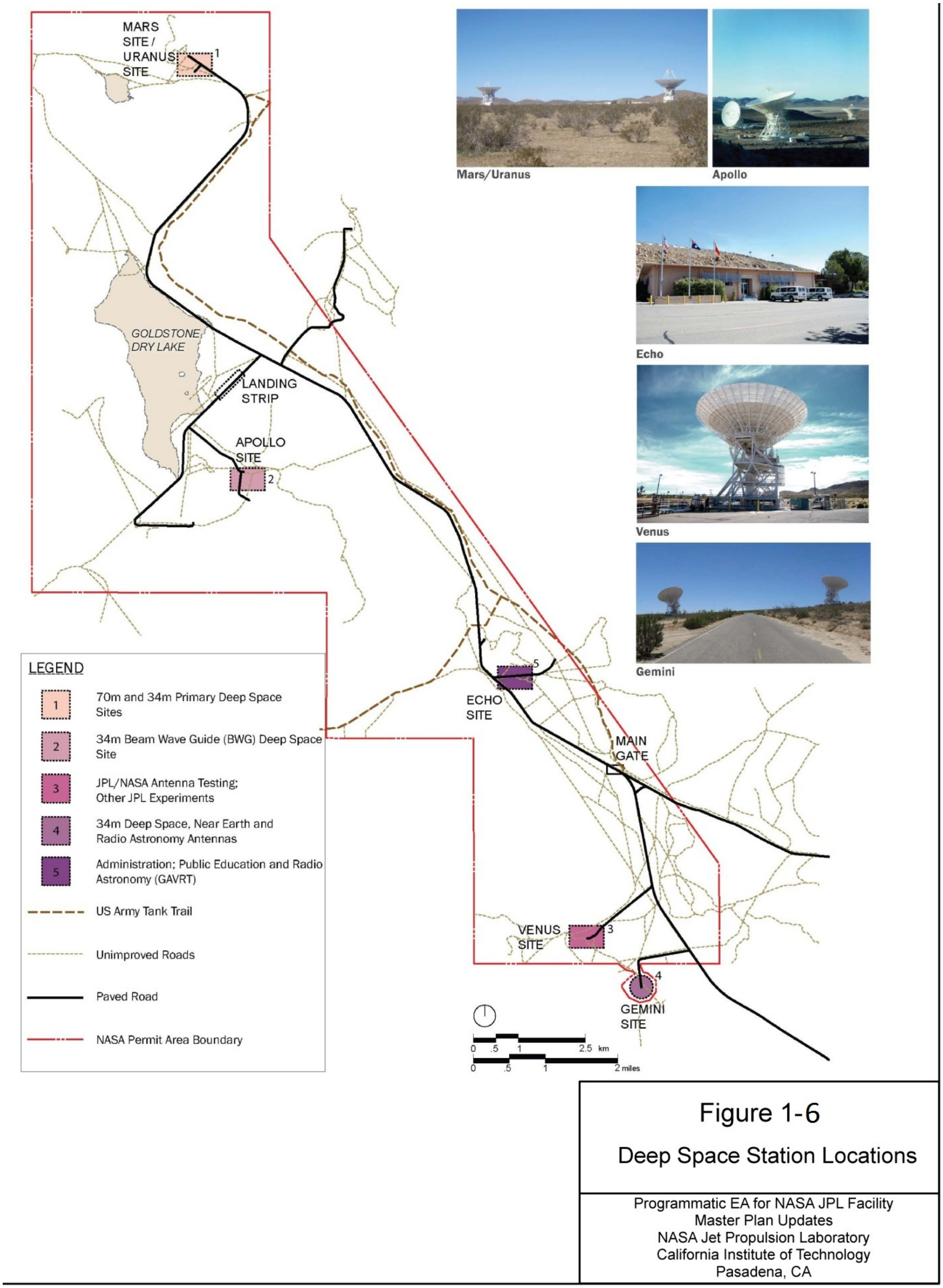
A 26-m (85-ft) antenna, located at the Pioneer Site, was deactivated in 1981. In 1985, the Pioneer antenna (DSS 11) was designated a NHL by the U.S. Department of the Interior, and the Pioneer Site was returned to the Army. These sites and associated buildings and antennas are further described in Section 3.3.1.2.

1.2.2 Facility History

1.2.2.1 NASA JPL

Historic maps indicate the property now associated with NASA JPL remained undeveloped until the late 1930s, and show no prior occupation of the area with the exception of impacts of the Mount Lowe railway in 1893 (McKenna et al. 1993). The NASA JPL site now covers some 181 acres adjacent to the site of Theodore von Kármán’s early rocket experiments. Few buildings survive from the Laboratory’s earliest years, and most of those that do have been significantly modified over the years. Development at JPL has proceeded through the following four generalized periods.

Figure 1-6. Deep Space Station Locations



Source: Deep Space Network Facilities Master Plan Update 2011-2032, March 2011

Military Period (ca. 1940-1958)

In July 1940, the U.S. Army Air Corps entered into a contract with Caltech, which provided funding for the first permanent structures in the area. This contract was the first of a series of contracts that span 67 years of research and development work at JPL by Caltech for various government agencies.

By 1944, the facility was called the Jet Propulsion Laboratory. Starting in 1945, the U.S. Federal Government began purchasing the parcels of land comprising JPL. By the 1950s, the U.S. owned JPL as it exists today, with the exception of a small area leased from Pasadena. In 1958, NASA became the executive agency with administrative responsibility for JPL. The first period of development, pre- NASA, followed the Laboratory's founding during World War II. Most of the surviving buildings from this period are located at the easterly end of the Laboratory and along Explorer Road through the north-central area of the site. These buildings are characterized by wood or metal construction, are today mainly encased in exoskeletons of retrofitted mechanical devices, and were mostly never expected to see more than fifty years of service.

Early NASA Period (1958-1970)

The advent of NASA in 1958 brought with it a busy period of development on the Laboratory, the most visible being the administrative center around the westerly end of Mariner Road, known as Mariner Mall. The Administration Building (Building 180), the Space Flight Operations Facility (Building 230) and the Physical Science Laboratory (Building 183) characterize the buildings of this period, with their large scale, multistory design and construction in steel and concrete.

Planetary Exploration Period (1970-1990)

Through the 1970's and 1980's, JPL embarked on a series of programs of unprecedented ambition and scale, and major new buildings were built to support these big projects. Buildings such as the Earth and Space Science Laboratory (Building 300), the Central Engineering Building (Building 301), and the Microdevices Laboratory (Building 302) are characteristic of this period: large floor plate and flexible office facilities in Building 301 for general engineering support; specialized laboratories and micro device fabrication facilities in Building 302.

Era of Small Missions (1990-Present)

Since 1990, NASA's and JPL's missions have changed in character and scale, with a consequent change in the pace of development and in the types of facilities built at the Laboratory. Most new buildings have housed highly specialized facilities, such as the In-Situ Instruments Lab (Building 317) or the Optical Interferometry Development Lab (Building 318). However, the need for a different kind of program space to accommodate engineering and project management support led to adaptation of Building 317 to its current use, conveniently supported by project offices in Modular facilities 1722 and 1723 for the Mars Exploration Rover program.

To minimize the need for such costly and inefficient conversions, and to reduce impacts on other areas of the Laboratory's programs, JPL identified new spatial needs, represented in the design for the Flight Projects Center (Building 321, constructed 2009). The Flight Projects Center was designed with larger floor plates (25,000 sq. ft.) and flexible floor layouts that would facilitate re-grouping of work teams to meet the small mission demands.

Today, Caltech performs research and development tasks at JPL under a prime contract with NASA. A distinct land use pattern for the main development area is apparent for each of JPL's periods of historical development. The Army was responsible for constructing single and double story structures in the northeastern section of the main area between 1940 and 1957. NASA-related development from 1958 to the present accounts for the higher density of structures covering the southwestern portion of the main development area. As NASA took a new direction toward expanded research and development, larger facilities were constructed to house new projects. These larger facilities consist of multi-story offices and laboratories. JPL has a university campus-like appearance aided by extensive landscaping and an enhanced central mall.

1.2.2.2 Table Mountain Facility

The TMF was originally occupied by the Smithsonian Institution of Washington, D.C. During the 1920s, while under the directorship of Charles G. Abbot, the Smithsonian Astrophysical Observatory began to establish field stations throughout the world, to augment its home observatory in Washington, D.C. The original purpose of the field stations was to give solar constant values over diverse locations. The first station was established on Mount Harqua Hala in Arizona. The second was at Mount Montezuma in Chile. The third Smithsonian field station was opened at Table Mountain in 1925.

Since the early 1900s, the Smithsonian had been aware of the advantageous astronomical observation characteristics at the Mount Wilson Observatory, located in the San Gabriel Mountains at an elevation of 1,524 m (5,000 ft), just north of Pasadena. During a visit to Mount Wilson, Director Abbot determined that Table Mountain, closer to the desert and more than 2,000 ft higher, would be a drier, clearer observing site for solar constant studies. The Mount Harqua Hala field station in Arizona had experienced bad weather due to monsoonal conditions since it had opened in 1920, and Abbot was looking for a drier mountain location in the West.

In 1924, negotiations with the County of Los Angeles, who owned the land as part of Big Pines County Park, resulted in permission to build the new field station on Table Mountain. A small observatory was constructed, and the scientific equipment from Mount Harqua Hala was moved to the California site. Astronomical observations began in late 1924, and the TMF officially opened in 1925. As the Smithsonian ended their tenure, JPL began negotiations with them and the USFS, which had assumed ownership of Big Pines County Park from Los Angeles County, to take over the TMF. In 1962, a USFS lease permit was issued to JPL. (AC Martin 2011).

The first new building completed at TMF by NASA JPL was TM-1 in 1962, which originally housed a darkroom on the ground floor and a 40.6-centimeter (cm) (16-inch [in]) astronomical telescope under its second-story observation dome (AC Martin 2011) NASA JPL expanded its radio astronomy program at TMF by modifying one of the old Smithsonian living quarters for use as a radio science control facility for a 2.4-m (8-ft) dish. A 6.1-m (20-ft) dish was added later.

By the early 1970s, most of the original Smithsonian buildings had been demolished. These were replaced by the current headquarters building (TM-17), a new garage and shop building (TM-19), and a new Radio Science building (TM-21). By the late 1970s, the last of the old Smithsonian buildings had been removed (AC Martin 2011). Expansion of scientific research programs, as well as construction of buildings to accommodate them, continued at TMF throughout the 1980s and 1990s.

1.2.2.3 Goldstone Deep Space Communications Complex

After the Space Act of 1958 had accelerated U.S. plans and programs for space exploration, the DSN was established when the Goldstone site, then part of the U.S. Army's Fort Irwin military reservation, was selected by NASA JPL for an early tracking station to meet the requirements of the Pioneer 3 mission. DSN officially began operations on December 6, 1958 with the launch of the Pioneer spacecraft. The Pioneer Site is no longer active but Goldstone now has active Stations at the Echo, Mars, Apollo, Uranus, and Gemini sites. The Venus Site is now reserved for DSN research and development activities.

In the 1960's, the advent of deep space missions that needed constant contact between Earth and spacecraft resulted in the expansion of DSN overseas. A bilateral agreement between U.S. and Australian governments led to the establishment of a tracking station outside Canberra in 1960. A similar agreement with the government of Spain resulted in the construction of another tracking station near Madrid in 1964. Today, the DSN operates 20 antennas in the three countries. DSN continues to be the principal means of communications with spacecraft beyond low Earth orbit for NASA missions, and continues to play a vital role in supporting major NASA missions such as Spirit and Opportunity (Mars Rovers), Cassini, Mars Reconnaissance Orbiter, Mars Odyssey, New Horizons, and the Mars Science Laboratory (MSL).

1.2.3 Mission and Capabilities

1.2.3.1 NASA JPL

NASA JPL is a world class space exploration facility, with a mission that calls for:

- Robotic Mission Formulation, Implementation, Operation, and Science;
- Multiple Unique NASA Research and Technology Capabilities and Strategic Assets; and
- JPL DSN Supporting Multiple Deep Space and Near Earth Mission Operations for NASA and International Agencies.

NASA JPL's primary mission is the planning, advocacy, and execution of unmanned exploratory scientific flight through the solar system. This includes activities in the areas of planetary exploration, earth science, astrobiology, telecommunications, and astrophysics. Each of these areas is described below:

Planetary Exploration

From the early Ranger and Surveyor missions to the Moon, NASA JPL's exploration of the solar system has subsequently led the world to Mercury, Venus, and Mars via the Mariner series, to Jupiter and the outer planets through the Voyager program, and continues today with the Mars Exploration Rovers, the Cassini and Galileo missions and Juno mission to Saturn and Jupiter.

Earth Science

In the late 1970's, JPL engineers and scientists realized that the sensors, radars and cameras they were developing for interplanetary missions could be turned upon Earth itself to better understand our home planet. This has led to a series of highly successful Earth-orbiting missions and instruments that have evolved into a segment of the Laboratory's activities, now sponsored by NASA's Office of Earth Sciences.

Astrobiology

The newly emerging field of astrobiology is the quest to understand the potential for life in other parts of the universe. The first search for life on Mars was conducted in 1975 when NASA launched the Viking mission's two orbiter spacecraft and two Martian Landers. The JPL-designed and -built Cassini mission to Saturn, launched in 1997, carried the European Space Agency's Huygens probe, which descended to the surface of Titan, Saturn's largest moon, upon arrival at the ringed planet in January 2005. Titan appears to host organic chemistry possibly like that which led to the existence of life on Earth.

Telecommunications

Among JPL's most recognized programs is NASA's DSN, a complex telecommunications system that provides tracking and communications for planetary spacecraft from antenna installations in California's Mojave Desert, Spain, and Australia.

Astrophysics

In addition to studying Earth and other bodies within the solar system, JPL has produced missions and instruments that have peered deeper into the universe and advanced the science of astrophysics. JPL designed and built the Wide Field/Planetary Camera, the main observing instrument on NASA's Hubble Space Telescope. Currently, the Exoplanet Exploration Program is studying the formation of galaxies, stars and planets.

JPL manages several important missions. The Gravity Recovery and Interior Laboratory (GRAIL) is the lunar counterpart of the very successful Gravity Recovery and Climate Experiment (GRACE), twin satellites that launched in 2002 to make detailed measurements of Earth's gravity field. Launched in 2011, the GRAIL spacecraft is flying in a low-altitude, near-circular, polar lunar orbit to perform high-precision range-rate measurements to precisely measure and map variations in the Moon's gravitational field.

The Juno mission involves a five-year cruise to Jupiter using a spacecraft built by Lockheed Martin Space Systems. Launched in August 2011, the mission would conduct an in-depth study of Jupiter through 33 eleven-day-long orbits upon arrival in July 2016. The mission would sample Jupiter's full range of latitudes and longitudes with the goal of understanding the origin and evolution of the planet, which will pave the way to a better understanding of the solar system and other planetary systems being discovered around other stars.

To summarize JPL's future missions, in the next ten to 15 years, it plans to be involved in some 25 flight missions and some 25 payload packages to be launched. These missions will require a new generation of spacecraft and instruments, new technology and new software.

1.2.3.2 Table Mountain Facility

This section describes the major science and observatory astronomy research conducted at TMF.

Science Research Programs

Atmospheric Science - NASA has built research and monitoring systems that use satellites, aircraft, balloons, and ground-based instruments. TMF is NASA's key station in the contiguous U.S. for ground-based atmospheric observations. Most of the atmospheric instruments at TMF provide data to the international Network for the Detection of Atmospheric Composition Change (NDACC). This international collaboration, involving more than 20 countries, aims to detect, measure, and understand long-term changes in the global atmosphere and their relation to ozone depletion, global warming, and climate change. Atmospheric Science projects at TMF include:

- LIDAR – an experiment using pulses of laser light to probe the atmosphere in a manner analogous to radar;
- FTUVS - a high resolution interferometric spectrometer for measuring atmospheric molecules;
- Microwave – uses a microwave radiometer to detect millimeter wavelength radiation emitted naturally by atmospheric molecules;

- Balloon Sondes - a program to launch weather type balloons to measure pressure, temperature, and humidity; and
- Weather Station - Local weather conditions at TMF are monitored and logged continuously.

Solar Science - In order to measure and then begin to understand relationships between our sun and climate, a solar variability program was established that would precisely measure total energy coming from the sun. In 1978, NASA's Earth Observation Mission Program Office supported efforts to precisely measure Total Solar Irradiance (TSI) from space. This was accomplished with the development of the ACRIM, which is one of four major spacecraft TSI measurement programs on our planet.

Earth Science Projects – Various earth science projects conducted at TMF include the UCLA Magnetic Array, U.S. Geological Survey (USGS) Seismic Monitoring, Stanford University ultra-low frequency (ULF), and the University of Alaska extra-low frequency (ELF). The projects are briefly described below.

Optical Communications - Optical communications enables high bandwidth communications from Earth-orbiting satellites and deep space probes. Over the past two decades, JPL has developed a variety of technologies to support deep space optical communications and has demonstrated several leading space-to-ground optical communications from TMF. The Galileo Optical Pointing Experiment (GOPEX) demonstrated the first optical communications link to a deep space probe. In the 1995 Ground-to-Orbiter Lasercom Demonstration (GOLD), TM-12 and TM-27 telescopes served as the transmitter and receiver, respectively, in a link to the Japanese ETS-VI spacecraft. Other optical communication technologies include the Optical Communications Telescope Laboratory (OCTL), autonomous visibility monitoring (AVM) stations, and CIMEL Sun-Photometer. The Optical Payload for Lasercomm Science Mission (OPALS), a JPL Phaeton Program instrument would launch in 2013 and would install a downlink laser system on the exterior of the ISS. The ground receiver and uplink laser would be located on the OCTL facility at TMF.

The OCTL houses a 100-cm (39.4-in) elevation/azimuth coudé focus telescope, designed for nighttime and daytime operation. The telescope is capable of tracking spacecraft from 249-km (155-mi) altitudes to deep space while pointing as close as 10 degrees of the sun. Laser transmission into space requires the coordination with the Federal Aviation Administration (FAA) and the U.S. Strategic Command's Laser Clearinghouse. OCTL has implemented remote control capability accessible via the web. Future instruments and facilities to be deployed at the OCTL include differential image motion monitoring sensor for atmospheric seeing measurement and future deployment of 2-m (6.6-ft) to 3-m (9.8-ft) class deep space receiving telescope arrays.

Three AVM stations (one of which is located at TMF) generate a long-term quantitative database of atmospheric transmission for the optical channel. The CIMEL Sun-Photometer is an automatic device that tracks the sun, measuring both sun and sky radiance.

Observatory Astronomy Research Programs

Optical astronomy has been a key component of TMF science since the Smithsonian Institution established the site in 1925. Planetary astronomy with relatively small telescopes is a growing contributor to JPL/NASA research, in particular the study of asteroids, comets, and planetary satellites at TMF.

Table Mountain Observatory (TMO) plays a major role in the recovery of newly discovered NEOs, i.e. asteroids and comets, supporting several automated NEO surveys funded by NASA and other international space agencies.

A major component of the astronomical research at TMO lies with the collaborative investigations of planetary atmospheres and asteroidal, comet, and natural satellite positions in support of spacecraft flyby, orbiter, and rendezvous missions with these targets. High precision astrometry obtained at TMO has been an important element with regard to NASA and international spacecraft navigation throughout their missions, including such notable recent ones as Cassini, Stardust, Deep Impact, and Rosetta.

TMO's main operating instrument is a Photometrics 1K couple-charged device (CCD) LN2 cooled camera, ready for instant operation while mounted on the telescope. This camera is used for extensive photometry and astrometry (NEOs, main belt asteroids, Centaurs, comets, and planetary satellites) by JPL astronomers and TMO staff. The high-precision Synnott 4K CCD LN2 cooled camera is used by JPL's Navigation Group to do asteroid, comet, and satellite astrometry for NASA spacecraft missions.

A 40.6-cm (16-in) telescope in TM- 24 can also be run remotely, and employs either a 1K or 2K Apogee CCD thermo-mechanically cooled camera. This telescope can be used for NEO searches and follow up for those newly discovered objects with highly uncertain preliminary orbits.

1.2.3.3 Goldstone Deep Space Communications Complex

The DSN has become a world leader in the development of low-noise receivers, tracking, telemetry, and command systems; digital signal processing; and deep-space radio navigation. The basic responsibilities of the DSN are to receive telemetry signals from spacecraft, to transmit commands that control the various spacecraft operations, and to generate the radio navigation data to locate and guide the spacecraft to their destinations along with conducting research in radio and radar astronomy. Because of its advanced technical ability to perform the above services, the DSN also is able to carry out the following functions: flight radio-science, Very Long Baseline Interferometry (VLBI), and precise measurement of minute earth movements (geodynamics).

GDSCC also is a R&D center both to extend the communication range and to increase the data acquisition capabilities of the DSN. It serves as a proving ground for new operational techniques. Prototypes of all new equipment are tested at GDSCC before they are duplicated for installation at the stations, including overseas stations.

One 70-m multi-frequency, and various 34-m (111.5-ft) Beam Wave Guide (BWG) and High Efficiency (HEF) antennas, are located at GDSCC that track near-Earth to deep-space missions. Acquisition antennas, for communications with spacecraft in high Earth orbit, are mounted at the apex of a 34-m (111.5-ft) BWG antenna. There are two additional 34-m (111.5-ft) high speed BWG antennas at GDSCC, one used for tracking low earth orbit missions and another dedicated to the previously mentioned GAVRT program. GDSCC also has administrative, operational and logistics facilities and utilities/services systems, all of which are required to support antenna operations on a daily basis.

Off-site locations provide the facilities for the tracking, data acquisition, engineering and testing processes designed to support the complex operations.

Signal Processing Center

The Signal Processing Center (SPC) at GDSCC performs continuous tracking of deep space missions. It acquires raw telemetry data from spacecraft, and provides the data to generate radio metric, radio science and Orbital VLBI data.

JPL Network Operations Communications Center

The NOCC processes the raw data received from the SPC Control Room at GDSCC. The NOCC produces VLBI, media, Earth orientation, calibration and trajectory data. In addition, NOCC schedules, monitors and predicts signal acquisition and validates spacecraft tracking procedures. The NOCC is located in Building 230 at JPL in Pasadena.

DSN DTF-21 / CTT-22

Development and Test Facility (DTF-21) and the Compatibility Test Trailer (CTT-22) are located in the Pasadena Operations Facility at Monrovia, California. CTT-22 is housed in a large mobile trailer committed to delivering testing services at the space craft vendor locations. The DTF facility is also used to test hardware and software at various stages in its development before being transferred to the DSN, and provides a simulated Deep Space Work Station to allow DSN engineers to test support products and operations procedures prior to releasing them to the DSN.

The Remote Operations Center

The Remote Operations Center (ROC) is also located in the Pasadena Maintenance and Operations Facility in Monrovia, California, and is an extension of the NOCC. The ROC is utilized by the Network Operations Project Engineers (NOPE) in support of the numerous types of activities required to monitor Level 1 and Level 2 Tracking events. The ROC supplies an area where personnel support critical activities under the direction of the NOPE team without interfering with the rest of network operations, and provides a location for the tests to be conducted to prepare the Network for the events.

1.2.4 Previous Master Plans

JPL Facilities Master Plan, 2003

The most current Master Plan was completed in 2003 (Johnson Fain, 2003). This Plan outlined measures to align JPL development with its strategic plan and business model, and to contribute to the overall improvement of facility quality and character. The Plan prescribed sustainable building and landscape interventions to improve the quality of the workplace and support the workforce with services and institutional amenities. The Plan was based on JPL's workforce organization concepts for mission performance, and included provisions for collocation of teams during the formulation, implementation, and operation phases of multiple missions, and new facilities were planned to account for new office and computational laboratory work space in flexible configurations to optimize functional adjacencies, uses, and workflow.

Facility-wide provisions were made for efficient access and circulation, adequate and convenient parking. The Master Plan identified development opportunities for facilities and open space, and provided a generalized 'road map' for achieving the physical development goals for the facility.

JPL Facilities Master Plan, 1988

A Master Plan was completed in 1988 (Boyle Engineering, 1988) that was similar in scope and focus to the previous JPL Master Plan, which was developed by Daniel Mann Johnson and Mendenhall (DMJM) in 1977. In addition to providing a comprehensive review of the physical state of JPL's facilities, the 1988 JPL Facilities Master Plan outlines significant developments that impacted JPL as an organization between 1977 and 1988. In particular, the Plan addresses the results of the *Master Plan Program – Building Condition Analysis,* a comprehensive evaluation of the building inventory at the JPL Facility, developed in December of 1979, and the

1984 Long Range Facilities Plan, which provided a conceptual development scenario for JPL based on projected personnel criteria and increasing limitations on growth imposed by a restricted facility.

JPL Facilities Master Plan, 1977

The 1977 Master Plan was developed for JPL by DMJM and is based on development in two distinct phases. A short-term plan recommended changes in the layout of JPL, with improvements completed over the subsequent five years. A long-term plan recommended direction for the development of the site, with improvements implemented over the subsequent fifteen years. The recommendations provided in the 1977 Master Plan established the basic context for future development.

TMF Facilities Master Plan, 2006

The most current TMF Facilities Master Plan was completed in 2006 (AC Martin 2006). This Master Plan was a 20-year plan and it serves as the basis for the current Master Plan. The impetus for the master planning effort stemmed from the basic need to guide future growth, development, and operations of the TMF site with the added need to fulfill programmatic and agency commitments to NASA and the USFS, which is the primary governmental steward of the lands upon which the TMF operates. A Master Plan Steering Group, composed of representatives of the scientific users of the TMF site, JPL Departments, and the NASA Management Office (NMO), was formed to guide the development of the Master Plan.

1.3 Purpose and Need for Action

Coinciding with and giving impetus to the development of the Master Plan updates is a renewed NASA-wide understanding that the majority of NASA's real property assets were built during the 1960s as part of the rapid development of the U.S. space program centered on the Apollo project. By 2010, over 80 percent of NASA's assets were older than 40 years and in need of renovation, removal, and/or replacement with modern facilities that are matched to modern technological demands. At JPL, some 57 percent of buildings were constructed during or prior to the 1960s period.

NASA has embarked on a program of facilities modernization planning, asking each NASA Center to prepare a detailed 20-year plan of recapitalization. The NASA recapitalization plan identifies projects that set NASA on the path of transforming its facilities through a process of renewal, sustainment, consolidation, and modernization. In 2010, the National Research Council conducted a study of six NASA centers, including JPL, that carry out fundamental research needed to further future NASA programs. The study, entitled "Capabilities for the Future: An Assessment of NASA Laboratories for Basic Research," found that over the 2005-2010 period, "…there has been a steady and significant decrease in NASA's laboratory capabilities, including equipment, maintenance, and facility upgrades." At NASA JPL, the study stated that "investment in infrastructure is limited, there is little ability to add new capabilities, and some maintenance is being deferred."

Guidance from NASA Headquarters on preparation of NASA center Master Plan Updates calls for the updates to be consistent with NASA's Strategic Plan. The Strategic Plan was updated in 2011 and the NASA JPL Master Plan updates identify facility-related projects that support JPL's role in directly meeting the following goals of the 2011 NASA Strategic Plan (NASA 2011):

- Goal 2: Expand scientific understanding of the Earth and the universe in which we live.
- Goal 5: Enable program and institutional capabilities to conduct NASA's aeronautics and space activities.

- Goal 6: Share NASA with the public, educators, and students to provide opportunities to participate in our mission, foster innovation and contribute to a strong National economy.

The NASA JPL, TMF, and GDSCC facilities are unique NASA assets, which directly support multiple NASA programs and can be classified as critical to the success of NASA programs. The purposes of the current Master Plan initiatives are to affirm NASA's mission at JPL and provide a physical framework for implementing this mission over the next 20 years, while at the same time remaining consistent with NASA's aforementioned Strategic Plan. The Master Plans identify facility and infrastructure needs and develop an implementation strategy that helps guide facilities renewal related to NASA research, building construction, administrative services, and security.

Although the scope of implementation has frequently been reduced and delayed owing to budget restraints, the preparation and maintenance of a master plan at all NASA field facilities is mandated by NASA policy guidelines.

The updated NASA JPL Master Plan will support the improvement and development of NASA JPL, TMF, and GDSCC facilities as they relate to the NASA mission, the surrounding communities, security, health and safety, access, natural resources and the environment, sustainability, and aesthetics. The undated JPL Master Plan will guide the need for repairs, modernization, upgrades, or new construction and identifies options and solutions to address the needs of NASA's FFRDC. Master Plans are not static; however, the updated JPL Master Plan will help guide planners and decision makers:

- Enhance effectiveness of facilities by: (1) progressively eliminating aging inefficient facilities; (2) constructing new efficient facilities; and (3) renewing and reconfiguring existing facilities;

- Consolidate compatible activities in to fewer facilities to attain operational efficiencies and enhanced workplace collaboration;

- Improve work flow capability;

- Develop facilities that promote NASA goals for education and public engagement;

- Achieve mandated physical, operational, and logical security readiness to protect the investments in facilities, technology and scientific data as well as the people that work and visit the NASA JPL facilities;

- Develop, design, and maintain site features and facilities that minimize risks to the people that work and visit the NASA JPL facilities;

- Create aesthetically pleasant work environments and mix of on-site community support uses;

- Maintain unobstructed vehicular access to the sites to assure 24-hour use by NASA JPL programmatic and support users;

- Provide efficient facility access for all employees, visitors, and contractors;

- Work with Federal and local agencies to protect, conserve, and/or mitigate any identified potential impacts to natural and cultural resources;

- Create highly sustainable facilities that conserve natural resources and promote human health;
- Develop facilities that promote collegiality and research collaboration; and
- Utilize site, facility designs, and design features that minimize discomfort in the human environment including noise, glare, stale air, and the extremes of heat and cold.

Updating the existing plans and developing new plans enable NASA JPL to continue its leadership in space exploration, science, education, and sustainability. While new Master Plans are fundamental tools to enable pursuit of new partnerships within the emerging commercial space sector, updated Master Plans are primarily needed to enable NASA JPL to upgrade its current facilities in order to fulfill its missions.

In order to achieve the goals of the mission, NASA JPL intends to use the Master Plans to identify ways to enhance the unique characteristics of JPL, TMF, and GDSCC land and facilities, while applying sound land-use practices and using environmentally sound materials. The master planning processes provide the opportunity for the transformation of NASA JPL's infrastructure and facilities to reflect long-range plan and mission, and NASA-wide goals and objectives. The primary objectives emphasized in the individual Master Plans for JPL, TMF, and GDSCC are described in Section 2.0 of this EA.

The JPL Facilities Management Committee was designated as the Master Plan Steering Committee and they conducted a series of scoping and sustainability workshops with JPL staff in June 2010 to further define the facilities needs at JPL, TMF, and GDSCC. Through these workshops and associated interviews, the team gained further understanding of the different needs of these NASA JPL locations. The team then developed concepts and alternatives to help resolve issues related to: entry and arrival; navigating the facilities; internal circulation; amenities; topography; facility accessibility; conflicts between service and employee access; and parking. The workshops and interviews confirmed the needs of NASA JPL as identified in the long-range plan. Identified alternatives for JPL, TMF, and GDSCC are described in Section 2.0 of this EA.

It is important to note that a master plan is a document of broad and general scope. It must be flexible, and is not a fixed blueprint. Variances within the constraints established in the individual Master Plan updates are expected to occur. Small projects needed for immediate ad hoc operations, routine maintenance and repair, and other projects that produce no significant permanent impact are not necessarily delineated.

All the growth and projects depicted in the Master Plans may not occur. NASA must respond to future Presidential and Congressional decisions regarding its mandated mission and within its allocated budget. These policy decisions, in turn, reflect demands and pressures applied by U.S. citizens. Agency history has shown that changes in policy can be expected over the next decade, and within its mission, directives to NASA could change as a result. Although the Master Plans extend to a planning horizon of 20 years, it is the intent of JPL to review and update the Master Plans at approximately 10-year intervals as it has done in the past.

1.4 Regulatory Framework

Table 1-2 lists statutes, regulations, executive orders, and NASA Procedural Requirements (NPRs), Policy Directives (NPDs), and Policy Guidance (NPG) that govern and/or influence the scope of this EA. A number of statutes were considered but found to have no influence on this project. Although this list is not all-inclusive, the proposed alternatives must comply with applicable regulatory requirements.

Table 1-2. Summary of Applicable Regulatory Requirements

Regulatory Requirement
Statutes
NEPA of 1969 (42 U.S.C. §4321-4347)
NHPA of 1966 (16 U.S.C. § 470, *et seq.*) (89 P.L.966)); (referred to herein as “Section 106”)
Clean Air Act (CAA) of 1970 as amended (42 U.S.C. § 7401, *et seq.*)
Clean Water Act (CWA) of 1977 as amended (33 U.S.C. § 1251, *et seq.*)
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (42 U.S.C. § 9601, *et seq.*)
Archaeological Resources Protection Act of 1979 (16 U.S.C. §470aa-mm)
Endangered Species Act of 1973 (16 U.S.C. §1531-1544)
Resource Conservation and Recovery Act (42 U.S.C. § 6901, *et seq.*)
Regulations
CEQ Regulations (40 Code of Federal Regulations [CFR] Parts 1500-1508)
36 CFR Part 800—Protection of Historic Properties
32 CFR Part 229—Protection of Archaeological Resources: Uniform Regulations
40 CFR 6, 51, and 93 – Conformity of General Federal Actions to State or Federal Implementation Plans
29 CFR Part 1910, Occupational Safety and Health Standards
CFR Title 40, Protection of the Environment
33 CFR 320-330 – U.S. Army Corps of Engineers (USACE) Regulations
40 CFR Parts 300 through 399 – Hazardous Substance Regulations
40 CFR Part 61 Subpart M – National Emission Standard for Asbestos
Secretary of the Interior Standards and Guidelines for Archeology and Historic Preservation (Federal Register, Vol. 48, No. 190, 44716-44742)
Executive Orders
EO 11593 – Protection and Enhancement of the Cultural Environment
EO 11988 – Floodplain Management

EO 11990 – Protection of Wetlands
EO 12898 – Environmental Justice
EO 13287 – Preserve America
EO 13327 – Federal Real Property Management
EO 13423 - Strengthening Federal Environmental, Energy, and Transportation Management
EO 13514 – Federal Leadership in Environmental , Energy, and Economic Performance
NASA Procedural Requirements, Policy Directives, and Policy Guidance
NPR 8553.1B, "NASA Environmental Management System", September 22, 2009
NPR 8580.1, "Implementing the National Environmental Policy Act and EO 12114", November 26, 2001
NPR 8810.1, Master Planning Procedural Requirements
NPR 8810.2A, Master Planning For Real Property
NPD 1600.2A, "NASA Security Policy"
NPG 1620.1B, "Security Procedures and Guidelines"
NPD 8831.1C and 2D, "Maintenance and Operations of Institutional and Program Facilities and Related Equipment"

1.5 Related Plans

Angeles National Forest Land Management Plan

The TMF site is situated within the ANF and is permitted to operate under an MOU with the USFS. This TMF Master Plan would be consistent with the MOU, which in turn is consistent with the ANF Land Management Plan (Forest Plan). The Forest Plan follows the provisions of the National Forest Management Act, its implementing regulations, and other guiding documents. In particular, the Forest Plan sets the strategic direction and program emphasis objectives that are expected to result in the sustainability (social, economic, and ecological) of the national forest and the maintenance of a healthy forest.

As part of the TMF Master Plan process, various consultants were retained to examine the TMF site from the standpoint of Natural Forest sustainability as defined above. In particular, the existing conditions addressed in Section 3 of this Programmatic EA document the geological, paleontological, biological and cultural dimensions of the resources present on the TMF site with a view towards preserving where possible those resources. Further, an analysis of the existing natural conditions was undertaken to define potentially hazardous conditions that need to be addressed so as to minimize risks to users of TMF and the surrounding community.

TMF Master Plan Process and the U.S. Forest Service

The NASA-directed Master Plan process coincides with the development of a Master Development Plan by the USFS. Mountain High Resorts Associates, LLC (MHR), who had operated two major winter ski resorts in Wrightwood, bought the rights to operate the Ski Sunrise area located north of and adjacent to TMF. This new MHR facility called Mountain High North (MHN) was granted a 40-year Special Use Permit (SUP) by the USFS and is currently under operation as a snow play and secondary ski area.

The comprehensive Master Planning process included the first aerial photogrammetric survey of the TMF site, a review of the earlier TMF permits with the USFS, and an examination of the MHN SUP. As such, NASA JPL realized that the TMF administrative boundary and related measured administrative area contained some inaccuracies and ambiguities that are now addressed in the current administrative boundary configuration indicated in the TMF Master Plan. As a result of discussions with both the USFS and MHR, an area to the west of the main TMF gate and south of Table Mountain Road which was part of the MHN administrative area, was found to be of no use to MHN but of potential long term use to TMF. This area, with the approval of MHN, is therefore now shown as part of the TMF administrative boundary.

The 15.4-ha (38-ac) TMF administrative boundary was adjusted to contain a small area to the northwest of TM-2 that is used by NASA JPL. This area was shown as part of the earlier TMF administrative area (1987 MOU), but after the updated site survey was completed, it was found to inappropriately lay outside the TMF administrative boundary, thus leading to the needed boundary adjustment.

A final issue discussed with the USFS and MHR involved the use of the 533.4-m (1,750-ft) long Table Mountain Road segment from the edge of the MHN parking area to the TMF main gate. This road was originally developed by the Smithsonian Institution and NASA JPL to serve TMF but is used by MHN for service access to their lift facility and to a lesser degree by the public. Although NASA JPL would like to see access to the road restricted to TMF users and MHN maintenance personnel, the USFS saw the need to keep it open to the public as part of the overall access to the ANF. A compromise solution was agreed to, whereby vehicular traffic on the road would be restricted to TMF users and MHN maintenance only - with the public allowed to use the road on foot. NASA JPL would be permitted to make vehicular access improvements at the entrance area of this road where it connects with the MHN parking area.

GDSCC Master Plan Process and the U.S. Army

The Master Plan process at GDSCC coincided with the development of a new MOU between the Department of Defense (DoD), Department of the Army (DoA), and NASA. The MOU provides a framework to assist both parties in complying with their respective missions, obligations and requirements on their respective facilities, while at the same time not interfering with the missions, obligation and requirements of the other party. The MOU details increased communication and coordination via periodic meetings regarding ongoing operational activities, strategic planning, and future mission needs. Moreover, to gain maximum results, both NASA and the DoA agree to meet during Quarterly Real Property Planning Board Meetings, Monthly Environmental Coordination Meetings, Quarterly RF Spectrum Meeting, Quarterly Airspace De-confliction Working Group Meeting, and when necessary, Installation Security Working Group Meetings.

Additionally, several Master Plan and EA development meetings have been held between NASA JPL and the DoA. These meetings served to apprise the DoA on the development of these documents and to request additional data.

1.6 Environmental Issues

Potential impacts of the proposed alternatives described in this document were assessed in accordance with NPR 8580.1, which requires that impacts to resources be analyzed in terms of their context, duration, and intensity. In order to help the public and decision-makers understand the implications of impacts, they are described in the short- and long-term, cumulatively, and within context, based on an understanding and interpretation by resource professionals and specialists.

As a result of internal scoping meetings and resource information specific to the proposed study area, resources were identified that could be affected by the alternatives being considered. Environmental issues analyzed in this Programmatic EA include land use; socioeconomics; Environmental Justice; traffic and transportation; public services and utilities; air quality; noise and vibration; geology and soils; water resources; biological resources; threatened, endangered, and other sensitive species; cultural resources; hazardous materials and waste.

2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

This section is structured to describe separately for NASA JPL, TMF, and GDSCC the process used in selecting the Proposed Action, including identification of conceptual alternatives eliminated from further consideration; a detailed description of the Proposed Action; a description of the No Action Alternative; and a comparison of environmental consequences between the alternatives.

The implementation of all features of the individual Master Plan Updates would be dependent on the plans being reasonable and coinciding with anticipated funding levels. The master plan implementation schedule for the proposed projects is not absolute. Modifications may be made to priorities and specific implementation dates of future facility requirements. Funding availability would be the primary driver of schedule compliance. Additionally, specific facility requirements could change over the life of the individual plans, especially during the last ten years of implementation. Even with these changes, the overall concept of development is anticipated to remain intact and be implemented when NASA completes compliance with NEPA; Federal, state, and local regulations; and approval of state and local permits.

Master planning is an ongoing process. It is possible that the Master Plans might be modified over the next 20 years. NASA JPL would review the Final EA every five years to determine if any or all of the individual plans have changed significantly or if there is new environmental information that would warrant additional environmental review. If appropriate, NASA would consider additional environmental documentation at that time.

The Master Plan alternatives analyzed in this document for NASA JPL, TMF, and GDSCC in accordance with NEPA are the result of agency and internal scoping input. The process for developing alternatives is described below in Section 2.1. This section includes planning objectives and conceptual alternatives that were developed, considered, and eliminated from further analysis for each of the three NASA JPL facilities. All alternatives considered must meet the purpose and need for the proposed action, the implementation of the individual Master Plans. The selected Proposed Actions for NASA JPL, TMF, and GDSCC are analyzed in Section 2.2 for potential impacts in this EA, followed by the No Action Alternative in Section 2.3. **Table 2-9** at the end of this chapter summarizes the impacts of the alternatives for this project at JPL, TMF, and GDSCC.

2.1 Process for Alternatives Development

The Master Planning Team developed discrete conceptual frameworks for NASA JPL, TMF, and GDSCC based on the analysis of existing conditions and needs. Planning elements were emphasized as a way to test the broad design concepts and development scenarios, and to guide discussion to the core topics of the individual Master Plans for facilities and infrastructure renewal (and away from exhibit planning and design, detailed programming, etc). Core planning objectives, sustainability goals, and conceptual alternatives are described below for NASA JPL, TMF, and GDSCC.

2.1.1 NASA JPL

2.1.1.1 Planning Objectives

The five objectives of the NASA JPL Master Plan are:

- Replace scattered aging, obsolete, and inefficient facilities with fewer modern facilities designed to match current and future NASA JPL mission requirements;

- Achieve work-flow efficiencies, synergies, and added safety through the consolidation of related activities into singular structures and building groups;
- Where possible, group similar facilities, such as clean rooms and data centers, to achieve energy, maintenance, and other operational savings;
- Build new facilities to state-of-the art standards in order to properly house high-tech equipment owned by NASA, fully support fabrication, assembly and testing of instruments and robotic spacecraft, achieve high levels of workplace health, and attain high levels of sustainability; and
- Create facilities that inspire space exploration activities among employees and visitors, and promote the learning of science, technology, engineering, and mathematics.

In addition to the objectives listed above, NASA JPL established long-term sustainability goals in the areas of energy, water, and transportation:

Energy

- New construction to be Net-Zero Energy and Net-Zero Carbon buildings (less than 30,000 British thermal units per sq ft per year (kBtu/sq ft/yr);
- All new construction projects are to achieve at least a Leadership in Energy and Environmental Design (LEED) Silver certification;
- All existing buildings (non data centers) are to achieve an overall energy intensity reduction of at least 60 percent;
- All data centers are to achieve a Power Usage Effectiveness (PUE) of 1; and
- Generate a minimum of 25 percent of the facility electricity base load – or currently 2.5 megawatts (MW) - from renewable energy (e.g. solar photo-voltaic).

Water

- No potable water use for irrigation, sewage/blackwater conveyance or process/industrial uses;
- All new construction projects to integrate purple piping to tie into municipally supplied reclaimed water once it becomes available; and
- Low or no water fixtures in all facility buildings.

Methods to achieve water sustainability would include efficient or waterless fixtures, conservation practices; efficient process water equipment (e.g., cooling towers and water pumps); recycled/reused water (e.g. rainwater harvesting; and condensate or blow down water recycling).

Transportation

- Develop a robust, integrated approach to developing the NASA JPL Comprehensive Transportation Management Plan that would enable NASA JPL to exceed Scope 1 and Scope 3 greenhouse gas emissions and relieve NASA JPL parking demands; and

- Reduce single occupancy vehicle trips to NASA JPL by at least 30 percent.

Methods to achieve transportation sustainability would include expansion of public and NASA JPL transportation access, offering on –site and off-site alternative fuels transportation options, and enhancing incentives for JPL staff not to drive to the facility.

2.1.1.2 Conceptual Alternatives

NPR 8810, which sets the Master Plan development framework, calls for exploring a range of alternative approaches to achieving a set of common goals as the 'Hypothesis and Testing' stage of the Master Plan process. Based on the conceptual framework of planning objectives and sustainability goals described above, three conceptual alternatives for the future of NASA JPL were identified. Conceptual Alternatives A, B, and C examined three major site layouts of facilities to accommodate the following principal facilities components:

- Locations for five major buildings that update/strengthen core mission-related capabilities within fewer consolidated and more sustainable facilities. Buildings are to be funded under NASA's 20-year recapitalization program (construction of new efficient and updated facility assets to replace aging, inefficient and/or otherwise deficient facilities for fulfilling NASA missions);

- Locations for several other administrative-type buildings needed to support the vision for NASA JPL established by NASA;

- Location for an approximately 1,500 space parking structure that would replace the leased Arroyo Seco parking lot. By building this parking structure on-site, NASA would fulfill its desire to reduce expense leased parking spaces; reduce uncontrolled stormwater runoff; enhance physical security; and support the City of Pasadena's groundwater improvement projects relative to beneficial use of its land as a spreading basin; and

- Configurations of open space proposed that emphasizes NASA JPL's built environment as one that encourages walking between buildings.

All of the five major recapitalization project buildings were placed in the same locations on each conceptual alternative scenario. The differences between Conceptual Alternatives A, B, and C were the locations examined for the proposed parking structure. During the master planning process, it was determined that the only available on-Lab parcel of land large enough to build a structure necessary to accommodate the anticipated loss of parking would be the existing surface parking area along the east border of the NASA JPL site abutting the Arroyo Seco, which was considered in Conceptual Alternative A.

A series of open space configurations were also explored in the development of Conceptual Alternatives A, B, and C. All three conceptual alternatives achieved open space configurations, but Conceptual Alternatives A and C achieved major central open spaces in the area that has been identified as 'Surveyor Square', and 'Mariner Plaza' a future reconfigured space oriented to visitors and NASA JPL community events and services.

One issue further explored during the alternatives development process was NASA's need to reduce expense leased space by bringing staff currently housed off-site at the Woodbury complex back to NASA JPL. This goal highlights the long-term need for a second parking structure if future need cannot be accommodated with: a) new surface lots to be created in the north part of the Lab in areas in fault zones; and/or b) the proposed parking structure identified in Conceptual Alternative A. The long-term need for new on-site parking is close to 3,000 spaces to accommodate Woodbury (or more if NASA JPL stopped using the spaces leased from the Flintridge Riding Club).

Conceptual Alternatives A, B, and C were presented at a sustainability and informational open house at NASA JPL on June 28-29, 2010. These scenarios were the framework for the development of a Composite Conceptual Alternative (**Figure 2-1**) and were eliminated from further analysis in favor of the composite concept. **Table 2-1** presents a comparison of the three concepts and reason(s) for their elimination.

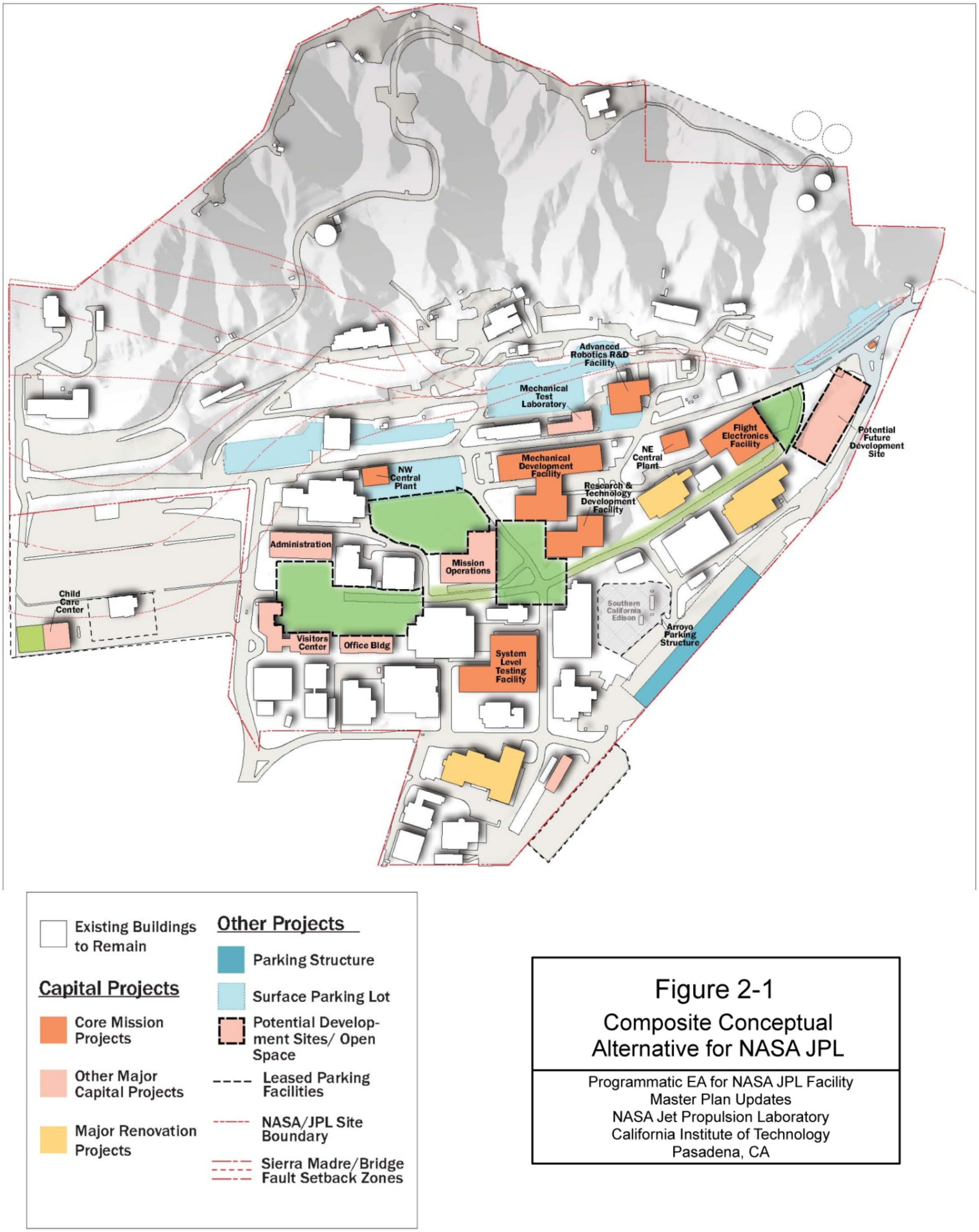
The Composite Conceptual Alternative as identified in **Table 2-1** is a modified version of Conceptual Alternative A and was chosen as the preferred alternative and finalized for more detailed consideration. It becomes the basis for the Proposed Action in this EA for NASA JPL and is described in Section 2.2.1. This Composite Conceptual Alternative incorporates the parking structure location of Conceptual Alternative A, the open space concepts of Conceptual Alternatives A and C, and the layout of other capital projects as determined by subsequent studies and discussions within the NASA JPL Master Planning Team (**Figure 2-1**).

Figure 2-1 indicates the location of the following major master plan elements:

- The locations, scaled size, and configuration of the five major recapitalization projects; Northeast Central Plant, which is part of the infrastructure of the recapitalization plan, and Arroyo Parking Structure;
- The locations of other proposed capital projects needed to improve Lab functionality, strengthen services to the JPL community and add to facility aesthetics;
- The basic vehicular circulation system and several new surface parking areas to be created with the removal of aging antiquated buildings and to be used to meet the future demands for parking; and
- Planned open spaces between buildings creating several large outdoor ‘quadrangles’ to provide views, vistas, and outdoor gathering areas.

Major elements of the preferred scenario developed after the initial scenarios development activity was completed included an evaluation of several alternative sites for the Child Care Facility and an examination of several additional sites where parking structures could be built under a future scenario that would have NASA build its own on-site parking so that it could discontinue the long term yearly lease payments it makes to the Flintridge Riding Club for use of the 1,252-space west parking area. In conjunction with the NEPA and NHPA processes of assessing potential impacts of the Proposed Action and No-Action alternatives, the alternatives will also be evaluated for funding and implementation feasibility.

Figure 2-1. Composite Conceptual Alternative for NASA JPL



Source: JPL Oak Grove Master Plan Update 2011-2032, March 2011

Table 2-1. Comparison of Conceptual Alternatives for NASA JPL

Master Plan Components	Conceptual Alternative A	Conceptual Alternative B	Conceptual Alternative C	Composite Conceptual Alternative
Major Recapitalization Building Projects				
Flight Electronics Facility	Common to Each Conceptual Alternative			
Advanced Robotics R&D Facility				
Mechanical Development Facility				
Research & Technology Development Facility				
Systems Assembly and Test Facility				
Other Capital Projects: Employee, Educational, and Administrative Buildings				
Missions Operations Facility	Common to Each Conceptual Alternative	Common to Each Conceptual Alternative	Common to Each Conceptual Alternative	Common to Each Conceptual Alternative
Visitor's Center	Mariners Plaza, Northwest	Mariners Plaza, Northwest	Mariners Plaza, Northwest	Mariners Plaza, Southwest
Child Care Facility	East Entry Location	East Entry Location	East Entry Location	West Parking Area location
Administration (B180) Replacement	Mariners Plaza, Northwest	Surveyor Square, Southeast	Mariners Plaza, Northwest	Mariners Plaza, Northwest
Future Development Site (Undefined or Data Center)	Development Site	Data Center	Data Center	Development Site/Parking
Arroyo Parking Structure (1,500 spaces)	East Edge/Arroyo	North Lab	South Lab	East Edge/Arroyo
Major Open Space	Two E-W Malls	Major Quad West of Surveyor/East of B230	Major Central Quad	Mariner Plaza; Surveyor Square; Earth Green Open Spaces
Reason(s) for Elimination	Open-space does not connect core buildings	Parking structure site does not provide convenient access for employees.	Parking structure site cannot be cleared within required time frame; and open-space area is too large.	

Source: Information obtained from JPL Oak Grove Master Plan Update 2011-2032, March 2011

2.1.2 Table Mountain Facility

2.1.2.1 Planning Objectives

Core TMF Master Plan objectives as they relate to the NASA mission, regional agencies, security, health and safety, access, natural resources and the environment, and sustainability are listed below:

- Provide physical facilities and spaces in support of current and future NASA programs requiring earth-based sky viewing opportunities unique to the high altitude atmospheric conditions present at TMF;
- Provide for the future reuse and retrofitting of current facilities to accommodate modified and new NASA JPL projects and programs;
- Identify needed support infrastructure associated with potential future programs;
- Cooperate with USFS plans for the surrounding ANF areas;
- Cooperate with neighboring users for the ANF to achieve mutually beneficial programs and facilities;
- Achieve the required level of security at TMF to protect NASA investments in facilities, technology and scientific data;
- Protect the people that work and visit TMF and avoid NASA liabilities associated with intended or unintended use of the TMF site by the public;
- Develop, design, and maintain site features and facilities that minimize risks to health and safety of TMF
- Provide for reasonable access to all TMF facilities in compliance with the Americans with Disabilities Act (ADA);
- Protect natural and cultural resources under management of USFS and NASA;
- Minimize, to the highest degree possible, disturbance to natural features on the TMF site and, where possible, maximize the use of site features in support of NASA JPL programs conducted at TMF; and
- For new construction at TMF, NASA will adhere to federally mandated site development and facility design that conserve and protect natural non-renewable and locally limited resources.

2.1.2.2 Conceptual Alternatives

TMF was analyzed for implementation of specific NASA projects and for the development of potential projects of the types likely to be considered for TMF in the future. Limiting factors of the site were factored into the analysis. The best sites at TMF are located in areas underlain by competent geological structures that in general are expressed along the Table Mountain ridge.

Specific areas at TMF were identified with the potential for further development of facilities capable of accommodating buildings ranging from a 74.3-sq m (800-sq ft) facility to a 464.5-sq m (5,000 sq ft) facility such as the proposed OCTL-2. These sites vary as to their optimal development size, their relative development cost, and their proximity to other potentially related facilities and/or infrastructure. Notwithstanding these variables, they all have the potential of providing space for future facilities.

Added to these locations are the future potentials for reusing existing buildings for new programs and/or observation instruments. Currently, TM-27 is not being utilized because its existing 1.2-m (3.9-ft) telescope does not match program requirements. However, candidate instruments are being considered as replacements which if found would make use of the TM-27 research building/space. In the future, if various existing programs were to be discontinued, the associated buildings in which they are located could be adapted to new program users.

Based on the conceptual framework of planning objectives described in Section 1.3, the planning team developed three conceptual alternatives, Conceptual Alternatives A, B, and C, for the future development of TMF, keeping in mind its goals and objectives. Each of the three conceptual alternatives accommodates the future development pattern (20-year planning horizon). Each conceptual alternative accommodates up to 465.4 sq m (5,010 sq ft) for an expanded Optical Communications Telescope Laboratory Phase 2 (OCTL-2) program and the Remote Sensing Facility of approximately 279 sq m (3,000 gross sq ft). Each concept also accommodates the planned infrastructure improvement projects identified by JPL/NASA. The exact location of the OCTL-2 expansion and Remote Sensing Facility varies by each conceptual alternative as indicated in **Table 2-2.** See **Figure 1-4** for a general orientation of the conceptual locations for these facilities.

Table 2-2. Conceptual Alternative Locations for OCTL-2 and Remote Sensing Facility, TMF

Alternative	Location of Remote Sensing Facility	Location of OCTL-2
A	Situated between TM-27 and TM-12	In core TMF activity area immediately northeast of TM-25
B	Southeast of the existing Water Tank.	In core TMF activity area between TM-27 and TM-12
C	Immediately adjacent and northeast of TM-25	Ridge/knoll area immediately northwest of TM-2

Source: Information provided in Table Mountain Facility Master Plan Update 2011-2032, March 2011

An estimated 186 sq m (2,000 sq ft) of building space could be accommodated in the TM- 15 area identified as ‘NASA JPL Reserve’. This area could accommodate a to-be-determined user potentially having greater independence from the use of the core TMF activity area. Various site upgrades and support infrastructure such as a new perimeter fence, pavement, power, water, and sewer improvements would be needed to render the TM-15/NASA JPL Reserve site usable.

After further analysis of the site view cone required for the proposed OCTL-2 project, Conceptual Alternative C was identified as the most appropriate alternative upon which the TMF Master Plan would be based largely because it identifies the ridge/knoll area immediately northwest of TM-2 as the best overall development location for the future OCTL-2 facility. This proposed location affords the best sky view cone so that the OCTL instruments can ‘see’ various deep and near space objects.

Further, Alternative C would allow the pad spaces identified for placement of the new OCTL facility in Alternatives A and B to be used for other projects. At the same time, by grading the larger site for the OCTL facility as shown on Alternative C, there may also be additional space created immediately north of TM-2 that could be used for another future project.

Alternative C accommodates the future development pattern and becomes the Proposed Action in this EA and is described in Section 2.2.2. In conjunction with the NEPA and NHPA processes of assessing potential impacts of the Proposed Action and No-Action alternatives, the alternatives will also be evaluated for funding and implementation feasibility.

2.1.3 Goldstone Deep Space Communications Complex

2.1.3.1 Planning Objectives

GDSCC was analyzed for implementation of specific projects identified by NASA JPL and/or for the development of potential projects of the types likely to be considered for GDSCC in the future. The DSN is at a critical juncture. Though it has operated reliably for 45 years, its ability to maintain a traditionally high state of readiness has been called into question. Humans may venture into deep space for the first time during the next 25 years. At the same time many DSN Earth-based assets, particularly antenna systems, will be reaching or exceeding their design lifetimes. New technologies, including optical communications, arrays of radio frequency antennas, and advanced coding, modulation, and data compression, are maturing and would be options to help create a revitalized DSN as funding becomes available.

The DSN Master Plan Update identifies seven strategic goals to support the NASA mission and maintain the current DSN:

- Develop the NASA-wide space communications and navigation architecture within DSN so that it provides unified mission support;
- Define candidate pathways towards enhanced deep space communications capability and implement selected new capabilities as appropriate;
- Define candidate pathways that would enhance deep space tracking and navigation capability and implement these new capabilities as appropriate;
- Leverage the migration towards a unified space communications and navigation architecture to improve reliability and operability for missions and cost-effectiveness for program elements;
- Create an efficient and affordable network of earth communications stations to support robotic and man-crewed missions in medium earth orbit (MEO) and deep space;
- Capitalize on the role of deep space communications for NASA missions to inspire and mentor the new generations of scientists, technologists, engineers and mathematicians. Engage the public at large, and enhance general technical and scientific literacy; and
- Enable new capabilities by conducting advanced development of deep space communications, tracking, navigation, and information and science systems when funding becomes available.

These strategic goals and other facility-related goals were translated into the following planning objectives for the DSN at GDSCC:

DSN Robustness Project. Provide backup to the existing 70-m (230-ft) antenna by using an array of 4- 34-m (111.5-ft) Beam Wave Guide (BWG) antennas and increase the transmitting capability by installing an 80 KW transmitter on a 34-m (111.5-ft) antenna. The new antenna would be placed at the Apollo Site.

Antenna and Facility Subsystem/Assembly Replacement/Modernization. Sustain existing DSN capability by replacing and modernizing/upgrading subsystems/ assemblies.

Asset Management/Maintenance. Implement a reliability-based asset management/maintenance program using a computerized system. Standardize maintenance practices DSN-wide by initiating shared job plans.

Operational Efficiency. Examine DSN complex operational work flows and determine areas where efficiencies can be gained by consolidation of effort and implementation of new technology.

Enhanced Environmental Planning. Environmental considerations are an integral part of facility development and modernization. Enhanced environmental analysis/planning should be part of the DSN Master Plan process.

Scientific Research. In addition to its role of supporting the retrieval of scientific data from all NASA spacecraft operating in deep space, DSN antennas would continue to support various forms of direct near space and deep space radio telescopic observations such as those conducted by the Goldstone Solar System Radar (GSSR).

DSN FMP Steering Committee meetings were conducted in May, June, and July of 2010 to review the long term development of the DSN in general and GDSCC in particular. Questionnaires were used as a tool to explore and verify the needs and plans visualized for DSN facilities. Because GDSCC is extensive in area, encompassing 114 sq km (44 sq mi); is interconnected with telecommunications, power, and water infrastructure; and has a major proportion of its facilities built in the 1960s, the DSN will focus on infrastructure at GDSCC.

2.1.3.2 Conceptual Alternatives

Based on the goals and objectives described above, GDSCC identified the following conceptual project activities:

- Add one 34-m (111.5-ft) BWG Antenna (as part of the DSN Robustness Project);
- Replacement of entire steel pipe water distribution system 135,000 LF (25+ mi);
- Communications fiber optic and copper wire extensions and replacements 77,000 LF (14+ mi);
- Ground Water Protection/Environment Compliance Projects; and
- Sustainability projects under preliminary study include radiant cooling/thermal storage and joint credit for a proposed US Army Ft. Irwin solar-electric facility (1,000 MW).

2.2 Proposed Action

Each development activity within the Proposed Actions for NASA JPL, TMF, and GDSCC were developed to help meet the purpose and need for the respective Master Plans, and these proposed activities are described below.

2.2.1 NASA JPL

The implementation of the Proposed Action would fulfill the objectives of the NASA JPL Master Plan, and has been identified as the “Preferred Alternative.” The development plan under the Proposed Action includes all major projects anticipated for the NASA JPL facility. Six of the projects would be funded over a twenty year period through the NASA recapitalization program. These major mission-critical recapitalization projects and their associated and phased 5-year plan development/construction periods are summarized in **Table 2-3.**

Table 2-3. Recapitalization Project Phasing and Construction under NASA JPL Master Plan

Phase	Target Development Period	Proposed Construction Projects		Associated Building Demolition Activities	
		Project	Area, sq m (sq ft)	Building Number and Name	Area, sq m (sq ft)
Recapitalization Building Projects					
2	2013-2017	Flight Electronics Facility	7,897 (85,000)	103, Electronic Fabrication Shop 277, Isotope Thermoelectric System Laboratory 189, Electronic Laboratory Annex T1722, Mars Exploration I Trailer T1723, Mars Exploration II Trailer	2,217 (23,861) 2,209 (23,782) 300 (3,232) 669 (7,200) 870 (9,360)
2	2013-2017	Advanced Robotics Research & Development Facility	4,645 (50,000)	18, Structural Test Laboratory 84, Chemical Materials Laboratory 280, Static Test Facility 288, Project Equipment Storage 107, Laser Research Laboratory 316, Hazardous Materials Storage Facility T1701-T1712, Trailers	1,432 (15,416) 131 (1,415) 134 (1,440) 320 (3,444) 507 (5,461) 356 (3,835) 1,839 (19,800)
3	2018-2022	Mechanical Development Facility	9,290 (100,000)	82, High Vacuum Laboratory 83, Quality Assurance 122, Energy Conversion Systems 125, Combined Engineering Support 90, Pyrotechnics Laboratory 117, Liquid & Solid Propellant Laboratory 129, Combustion Research Laboratory 158, Materials Research Processing Laboratory 170, Fabrication Shop 239, Propellant Conditioning Laboratory 246, Soils Test Laboratory 296, Central Cooling Tower	1,060 (11,407) 10,302 7,373 66,114 797 4,148 2,499 29,707 35,533 860 750
4	2023-2027	Research &Technology Development Facility	9,290 (100,000)	199, Celestial Simulator 229, Shielded Room Building 11, Space Sciences Laboratory 79, Low-Temp Laboratory 86, Solid Oxidizer Laboratory 87, Propellant Conditioning Laboratory 88, Bio-Chemical Cold Room 89, Laser Laboratory 121, Analytical Instruments Laboratory 149, Energy Conversion Development 183, Physical Sciences Laboratory	3,366 371 9,043 21,527 534 182 624 2,011 3,543 5,494 96,483 1,440 12,240

Table 2-3. Recapitalization Project Phasing and Construction under NASA JPL Master Plan

Phase	Target Development Period	Proposed Construction Projects		Associated Building Demolition Activities	
		Project	Area, sq m (sq ft)	Building Number and Name	Area, sq m (sq ft)
				T1719, Trailer T1720, Trailer	
5	2028-2032	Systems Assembly & Test Facility	4,645 (50,000)	144, Environmental Laboratory 148, Energy Conversion Laboratory 248, Ten-Foot Space Simulator 313, Environmental Testing 150, Space Simulator Facility	35,019 6,611 13,469 3,988
All	2013-2032	Underground Utility Infrastructure Replacement			

Sources: Information obtained from JPL Preliminary 5-Year Recapitalization Plan, Implementation Plan, dated August 16, 2010; JPL Oak Grove *Master Plan Update 2011-2032 dated March 2011;* and Table entitled "Building Demolition Associated with Major Projects, provided by JPL on February 14, 2011.

Notes: sq m=square meters; sq ft=square feet; TBD=to be determined; NA=not available

These projects would consolidate existing functions, located in scattered substandard buildings, into five major modern buildings. This process also creates other 'open' areas that would be developed into needed surface parking, landscaped open space, and future development sites.

Other major capital projects, projects that are needed to address a series of long-term building deficiencies and enhance JPL employee and visitor aspects of the Lab are listed in **Table 2-4.** Most of these other major capital projects do not have a target development period (listed as TBD) and funding for these projects would be identified as time proceeds. Some of these projects may become eligible for NASA funding in future years beyond 2032 but are shown here because they are part of the long term NASA vision at JPL. Proposed development under the Proposed Action is depicted in **Figure 2-2**.

The Proposed Action for NASA JPL incorporates the following features:

- Consolidation of Programs and Facilities - New buildings are grouped in a central area, with individual buildings achieving functional adjacencies, and enhanced service, work flow, and infrastructure efficiencies;

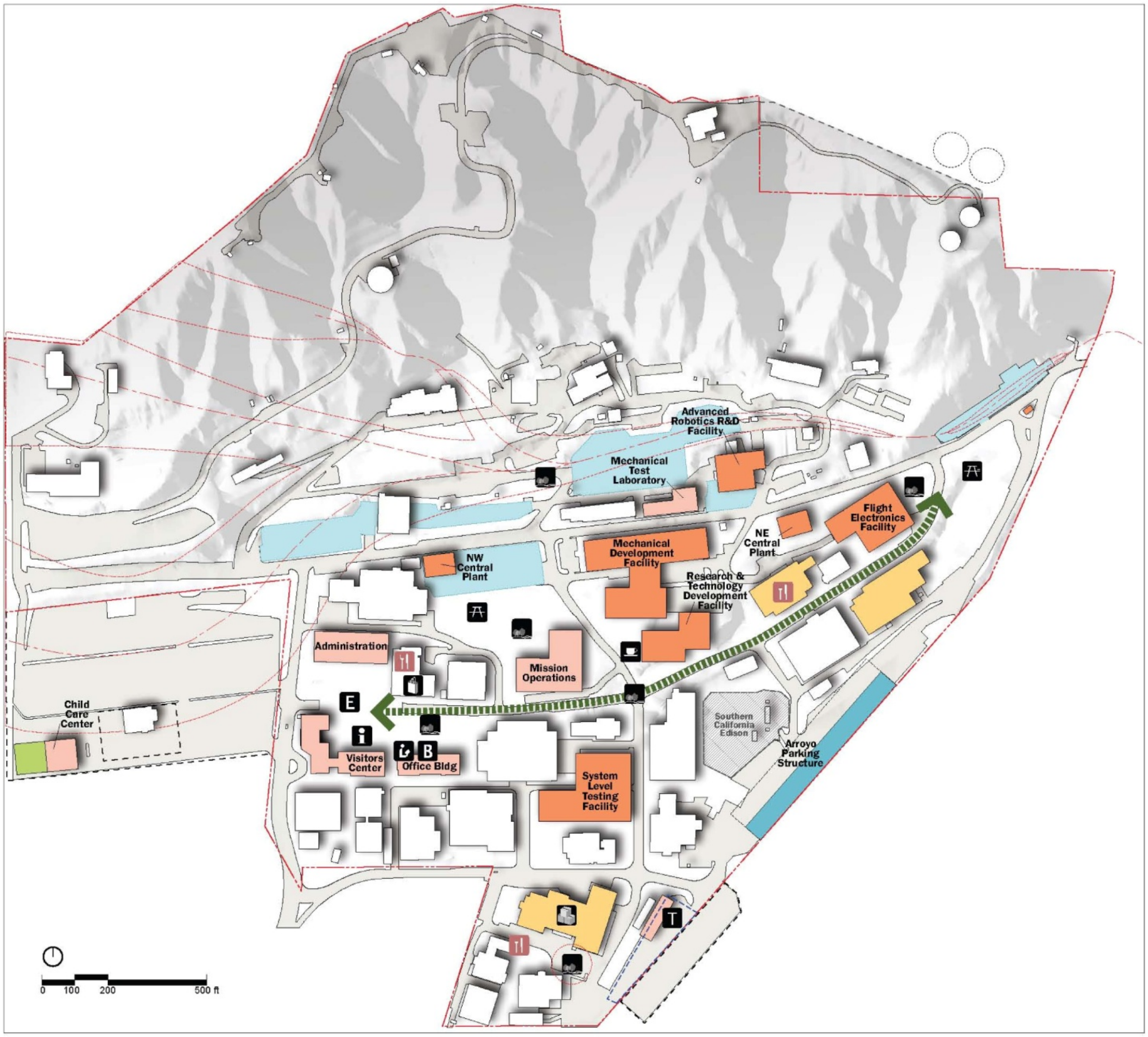
- Vehicular Circulation and Parking – New parking structures would meet acute near-term demands; and the completion of a perimeter loop road would achieve vehicular, service, and operational efficiency; and

- Open Space Network – An enhanced Mariner Mall lined with community support facilities and pedestrian corridors, would contribute to an overall improvement in facility character, encouraging outdoor meetings and collaboration.

Table 2-4. Other Capital Project Phasing and Construction under NASA JPL Master Plan

Target Development Period	Proposed Construction Projects		Associated Building Demolition Activities	
	Project	Area, sq m (sq ft)	Building Number and Name	Area, sq m (sq ft)
Other Capital Projects				
Parking				
2011-2012	Arroyo Parking Structure	1,500 Spaces	322, General Storage Facility T1714, Trailer	404(4,354) 483 (5,200)
TBD	Surface Parking Lot 1	470 spaces		
TBD	Surface Parking Lot 2	80 spaces		
TBD	Surface Parking Lot 3	400 spaces	111	44,390
TBD	Surface Parking Lot 4	230 spaces		
Other Major Capital Administrative Projects				
2013-2017	Mechanical Test Laboratory	464 (5,000)		
TBD	Mission Operations Support Center	4,645 (50,000)	114, Administration 156, Computer Program Offices 185, Programming Office	9,317 23,995 1,978
TBD	Replace Administration Building	4,645 (50,000)	180, Administration	105,568
TBD	Office Building	9,290 (100,000)		
TBD	Relocation of Transportation Services	139 (1,500)		
TBD	Contractor's Center	(15,000)		
TBD	Northeast Central Plant	650 (7,000)	177, Transportation Garage 284, Transportation Office	472 (5,081) 114 (1,225)
TBD	Northwest Central Plant	650 (7,000)		
TBD	Underground Utility Upgrades	TBD		
Employee/ Enhancement Projects				
TBD	Child Care Center	16,000		
TBD	Retail Store	139 (1,500)		
TBD	Visitor Center/Museum	5,574 (60,000)	249, Visitor Reception	4,873
Renovation & Reconstruction Projects				
TBD	Enhanced Receiving/Distribution Facility	10,963 (118,000)		
TBD	B303 Retrofit	3,849 (41,428)		
Open Space and Landscape Projects				

Figure 2-2. Proposed Development under NASA JPL Master Plan



Existing Buildings to Remain

Capital Projects

- Major Recapitalization Projects 2013-2032
- Other Major Capital Projects (Funding Period and Source TBD)
- Major Renovation Projects

Other Projects

- Parking Structure
- Surface Parking Lot
- Mariner Mall Pedestrian Improvements
- Leased Parking Facilities
- NASA/JPL Site Boundary
- Child Day Care Play Yard
- Sierra Madre/Bridge Fault Setback Zones

- Major Food Service
- Outdoor Amenity/ Gathering Area
- JPL Retail Store
- Snack Bar
- Exterior Illumination Screen /Display
- Transportation Service
- Event Plaza
- Library
- Business Center
- Recreation Area
- Receiving Enhancement
- Security Gate
- Existing Food Service to Remain

Figure 2-2
Proposed Development under NASA JPL Master Plan

Programmatic EA for NASA JPL Facility Master Plan Updates
NASA Jet Propulsion Laboratory
California Institute of Technology
Pasadena, CA

Source: JPL Oak Grove Master Plan Update 2011-2032, March 2011

The activities associated with implementing the Proposed Action include demolition, construction, and/or rehabilitation activities. As identified in **Table 2-3**, NASA JPL is proposing to demolish 66 sub-standard buildings (including trailers), or 73,509 sq m (791,246 sq ft) of existing building space, over a 20-year period. Factors influencing demolition activities include age, condition, functional mismatch, systems inefficiencies, and location within the San Andreas Fault zone. Most projects would require some combination of employee relocation to temporary quarters during demolition activities, then relocation into the newly constructed buildings.

As identified in **Table 2-3** and depicted in **Figure 2-2,** NASA JPL is proposing construction of approximately 78,914 sq m (849,428 sq ft) of new or rehabilitated building space (AC Martin 2011), plus parking areas. The consolidation envisioned anticipates an associated reduction in building area of about 9,569 sq m (103,000 sf). Constructing the facilities and projects that make up the 20-year focus period of the Master Plan would involve a continual and progressive process of more detailed project planning, project definition, project phasing, and project funding categorization. The following sections describe the proposed major recapitalization building projects and other capital projects; transportation, circulation, and parking; open space and landscaping; sustainability plan; and underground infrastructure.

2.2.1.1 Proposed Recapitalization Buildings/Projects

Flight Electronics Facility

The 85,000 sq ft Flight Electronics Facility would be located west of the intersection of Mariner Road and Explorer Road, on the former site of buildings 1722, 1723, and 277. It would be a 4-story facility with predominately Class 100K clean rooms for the fabrication, assembly, and functional testing of flight hardware. The fabrication and assembly areas would be a mix of low and high bays. A small portion of the building would be allocated to general offices for fabrication and Q&A. There would also be a small, box level, Thermal Vacuum and Dynamics test area on site to eliminate the current practice of the transporting of components back and forth from test facilities.

A key feature of this facility would be direct vehicular service access to Explorer road. This would reduce the need for service vehicles to use Mariner road. The facility would also be linked to the future Mechanical, Research & Development, and Advanced Robotics Facilities through the new service corridor. This would help facilitate more interaction between research facilities and manufacturing facilities.

The Flight Electronics Facility would consolidate many of the laboratories working with flight science which currently are spread throughout NASA JPL. This would allow a better discourse between affiliated programs currently located in buildings such as 300 and 302. Furthermore, the Flight Electronics Facility should allow pedestrians who require assistance to use the circulation systems to ascend from Mariner Road to Explorer Road. This building would be connected to the proposed Northeast Central Plant.

Advanced Robotics Research and Development Facility

The 50,000 sq ft Advanced Robotics Research & Development Facility would be linked to the Mars/Lunar Yard and would allow researchers to easily fabricate and field test components. Located just north of Explorer road and the entry of the service corridor, the Advanced Robotics Facility's close proximity to other laboratories would encourage collaboration between all facets of robotic exploration. The facility would house a prototype robotic vehicle assembly/functional testing laboratory, prototype development laboratories, and general offices for research personnel. The prototype development laboratories would be specific to non-flight research and would be comprised of an integrated controls and structure lab, a sensors and actuators lab, an advanced operations/ test productivity lab, a tele-robotics/human factor lab, and an artificial intelligence lab.

The main fabrication bay would be located on the top floor of the facility. This would allow direct access for field testing of equipment in the Mars/Lunar Yard. A large freight elevator would have direct access to Explorer Road and the service corridor to the south east. This would end the current practice of navigating Pioneer Road with sensitive equipment. This building is anticipated to be connected to the proposed northeast Central Plant.

Mechanical Development Facility

The 100,000 sq ft Mechanical Development Facility would be located on the southeast corner of Explorer and Surveyor Roads. The facility would be the primary location for the fabrication and storage of ground support equipment. All truck access would be through the service corridor exiting onto Explorer Road, which would alleviate vehicular traffic on Mariner Road. The service corridor would also provide an outdoor staging area for fabrication overflow.

The facility would be comprised of two wings. The "North Wing" would be a large high-bay fabrication area for general machining and precision machining. The "South Wing" would be a 3-floor structure. On the ground floor there would be a large high-bay fabrication area in addition to a Material R&D Laboratory and Mechanical Research Laboratory. Above would be two floors of general offices over-looking the central square. The Mechanical Development Facility's would be large enough to handle all future manufacturing in a single location. The large bays can also be subdivided based on project needs. The neck connecting the North and South wings would have multiple functions. Primarily, it would provide a protected area for pass through/ascension and staging between the wings. It would also contain a corridor and amenities for pedestrians traveling east and west.

Research & Technology Development Facility

The 100,000 sq ft Research & Technology Development Facility would be 5-story structure that would be located on the northwest corner of Mariner and Surveyor Roads. The structure would step up the topography to eliminate the need for large amounts of grading. It would also help facilitate assisted pedestrian access to Explorer Road through the use of its internal circulation. Access would be from Explorer Road through the service corridor and would not have vehicular access along Mariner Road or Survey Road, eliminating the need for these roads to be used by vehicles. Between the Mechanical Development Facility and the Research & Technology Development Facility, the new large population of staff would help build the central square as one of the major nodes on the NASA JPL facility. This building is anticipated to be connected to the proposed Northeast Central Plant.

System Level Testing Facility

The 100,000 sq ft System Level Testing Facility would drastically improve NASA JPL's ability to accurately and efficiently test components at all stages of development. Navigating Pioneer Road's slope while moving components currently requires a large number of staff, road closures, as well as damage risk. The facility would be centrally located with easy access to all fabrication facilities. The proximity to these facilities would improve NASA JPL's ability to quickly transfer components back and forth from the testing facility to the fabrication facilities. This would not only allow NASA JPL to test components more frequently thereby creating more accurate equipment, it would also reduce manufacturing costs created by component transfers.

The 3-floor facility would be comprised of a Class 100K high-bay clean room with seismic isolation pads to house a majority of the test equipment; a 10 meter Thermal Vacuum Chamber which would be located at the north-east to isolate it from other testing equipment and to create an architectural feature on the south end of the central square; a high-bay large shaker and acoustic test area; and general offices. One key element would be a large air-lock and staging area. This would prevent any contamination, thereby reducing cleaning costs.

Underground Utility Infrastructure Project

This major project addresses the need to replace major underground utility systems that experience periodic failures, threaten Lab safety (e.g. aging fire water protection), or are needed to accommodate and support the proposed new recapitalization laboratory buildings. This proposed project is described in Section 2.2.1.7.

2.2.1.2 Other Capital Projects

Besides the six major recapitalization projects described above, other capital projects described below comprise a diverse set of projects needed to create a complete NASA JPL facility that supports NASA mission projects, employees and visitors to NASA JPL. Many of these other capital projects do not currently have an identified funding source. Some of these projects may be supported by NASA funding for years beyond the end of the fourth 5-year program delineated in the Master Plan Update. Others may be submitted for various types of NASA JPL funding as projects are further defined and placed into a future budgetary framework. Other capital projects include employee and visitor projects that support employees on a practical, social and aesthetic basis. They also support public outreach and science education, an increasingly important component of the NASA mission.

Arroyo Parking Structure

This proposed parking structure would be located in the southeast edge of NASA JPL, adjacent to the Arroyo Seco. The parking structure would have at least 1,500 stalls, which represents a 1,230-stall net increase after demolition of the existing underlying surface lots. This proposed project is further discussed in Section 2.2.1.3.

Surface Parking Lots

The consolidation of similar activities into 5 proposed new buildings would create opportunities for open spaces, some of which would be developed into surface parking lots which would be dispersed throughout the facility. A detailed discussion of these proposed surface parking lots is provided in Section 2.2.1.3.

Mechanical Test Laboratory

This proposed building would be approximately 5,000 sq ft and would support spacecraft development and testing activities carried out by JPL for NASA astronomic body landing missions. NASA JPL's entry, descent, and landing (EDL) development and testing capabilities are dependent upon this type of facility. The laboratory would be located north of Explorer Road in close proximity to the proposed Mechanical Development Facility and Advanced Robotics R&D Facility to achieve efficiencies between fabrication, testing, and assembly steps in the spacecraft development process.

Mission Operations Support Center

This proposed building would be approximately 465 sq m (50,000 sq ft) and would be located on the northwest corner of Mariner and Surveyor Roads. It would consolidate the activities of the Interplanetary Network Directorate into one central modern facility including the NOCC, which monitors and controls most of NASA's unmanned exploration spacecraft.

Replace Administration Building

This proposed building would be approximately 4645 sq m (50,000 sq ft) and would be located on the site of the current administration building 180. Built in 1964, NASA JPL's Administration Building 180 would be approaching an age of over seventy years towards the end of the Master Plan Update horizon of 2032. Even by today's standards, the building has inefficient building systems and floor layout configuration.

Office Building

This proposed building would be approximately 9290 sq m (100,000 sq ft) and located on the south eastern portion of the Mariner Mall on the site now occupied by Building 183. The facility would consolidate administrative functions scattered throughout NASA JPL and would be the location where employees now working out of leased facilities at the Woodbury Complex could be relocated back to NASA JPL.

Relocation of Transportation Services

This proposed building would be approximately 139 sq m (1,500 sq ft) and would be required to make way for the proposed Northeast Central Plant. Once the relocation of Transportation Services has been completed, the existing transportation Buildings 177 and 284 would be demolished and the proposed Northeast Central Plant would be built on the site. The proposed new site of Transportation Services would be in the southeast parking area, east of Building 315, Cooling Tower South. Moreover, this would be the preferred relocation site due to its proximity to Central Receiving/Distribution, Loop Road, and the South Gate. There is also a parking area adjacent to the proposed building that could help consolidate fleet vehicle parking.

Contractor's Center

This proposed project would be approximately 1394 sq m (15,000 sq ft) and would not be a stand-alone building. It would be located in existing space inside building 168, near the Main Gate. The proposed project would expand the limited on-Lab contractor meeting venues and consolidate them into one. These meeting venues are currently scattered throughout the facility with limited access to outside contractors making meetings more cumbersome than desired for frequent project-related meetings and conferences.

Northeast Central Plant

This would be the first of two proposed central plants and would be located in the northeast quadrant of the NASA JPL facility. This project is proposed for scheduling in Phase 1 (2013-2017). The purpose of this Plant is to provide chilled water capacity for the replacement of Cooling Tower 237, the replacement of dedicated chillers currently serving Buildings 303 and 317, and four new buildings in the northeast quadrant of NASA JPL.

Northwest Central Plant

This second central plant would be located in the northwest quadrant of the NASA JPL facility and is proposed for scheduling in Phase 2 (2018-2022). The purpose of the plant is to provide chilled water capacity for the replacement of Cooling Towers 228 and 166, the long-term displacement of Cooling Tower 296, and the construction of new buildings in the northwest quadrant. The plant would also provide heated water and back-up power generation for the new and existing buildings in the northwest quadrant.

Child Care Center

Currently under the leadership of Caltech, a child care program is operated by Child Educational Center, Inc. as a non-profit organization on the grounds of the La Cañada High School campus. As part of the Master Plan Update process, Child Educational Center confirmed their interest in being located on or near the NASA JPL facility and, due to the demand for their program, they estimated that planning for a future child care facility should anticipate a capacity of approximately 160 children. This translates into a facility requirement of approximately 16,000 sq ft of indoor space and another 16,000 sq ft of outdoor play area. The proposed location for the Child Care Center would be located in the southwest portion of the West Parking Area.

Retail Store

The proposed retail store would be approximately 1,500 sq ft and would not be a new stand-alone new building, but would be located inside the proposed Visitor Center, with access for off-Lab visitors. The proposed location for the Visitor Center would be in the northwest portion of the proposed Mariner Mall

Visitor's Center/Museum

This proposed building would be approximately 5574 sq m (60,000 sq ft) and would include an auditorium. This facility would directly support NASA's public outreach with a particular orientation to supporting Science, Technology, Engineering, and Mathematics or 'STEM' activities. Visits by the general public are currently limited to pre-arranged scheduled tours which debark from the existing Visitor Center and are conducted by escorts to selected Lab locations, including the museum in Von Kármán Hall (Building 186). While these tours are useful in presenting the work of the Laboratory to an interested public, they fall short of making NASA JPL's mission and accomplishments more generally known. The proposed building would consolidate the functions of the existing Visitor Center and Von Kármán Hall so that public access would be before the security check-in. It is envisioned that lectures, conferences and employee educational programs would be conducted in this facility.

Enhanced Receiving/Distribution Facility

This proposed project would not be a new stand-alone building, but would require renovation of the existing Shipping and Receiving Facility, Building 241, and Material Services Building 171 to better align these facilities for enhanced workflow. Proposed modifications would improve security, increase floor space, and would include the construction of conditioned space to accept flight hardware.

Building 303 Retrofit

The existing laboratories inside Building 303 would be relocated to the proposed Flight Electronics Building when construction is complete. The empty space inside Building 303 would then be converted to office space for engineering staff who would work in the adjacent Flight Electronics Facility and the Research and Technology Development Facility.

2.2.1.3 Transportation, Circulation, and Parking

Vehicular circulation would be enhanced through the completion of a facility perimeter loop road along the edge of NASA JPL's central core. Most of the loop road is in place, with primary vehicular routes on Explorer Road, Ranger Road, and Forestry Camp Road. However, on the southeastern edge of NASA JPL, the loop road is not well defined and is narrow and somewhat circuitous. To support the access needs of the proposed Parking Structure discussed below, Arroyo Road would be widened to a minimum of 7.9 m (26 ft), consistent with the other stretches of the perimeter loop road. It would also be straightened to avoid jogs in the road that provide truck maneuverability challenges. Selected stop signs on Arroyo Road would be removed so that traffic could flow unimpeded, and intersecting driveways would be controlled by stop signs.

As part of the enhanced perimeter loop road, service drives would be constructed to access loading and service areas of core facilities from the loop road, minimizing or eliminating traffic in the pedestrian-oriented core. Efficiency would be enhanced by consolidating service access, reducing the distance and number of stops needed for delivery and service truck trips.

Future parking supply would be reduced by the non-renewal of the East Arroyo Parking Lot Lease after the current lease expires in 2013, resulting in the loss of approximately 1,100 spaces; and removal of 412 spaces parking spaces associated with the construction of the proposed projects. Proposed parking includes a parking structure and surface parking lots as described below.

Arroyo Parking Structure

In the short term, NASA JPL would need to address the loss of the 1,100 parking spaces currently provided in the East Arroyo Lot. To address this, NASA would fund the Arroyo Parking Structure. This parking structure would be a composite parking structure located on the southeast edge of the site. The parking structure would have 1,500 stalls which is a 1,230 stall net increase after demolition of the existing surface lots. The adjacent campus loop road would be accommodated by building various upper floors over the loop road, permitting free vehicular travel under those areas of the parking structure. Also, a pedestrian bridge leading from the structure to a new pedestrian walk adjacent to Building 303 and connecting with Mariner Mall would potentially be constructed.

Several other site related constraints and features to be addressed during the design process for this parking structure include (1) relocation of a 66 kV overhead power line by Southern California Edison (SCE), either by re-routing the overhead lines around the new parking structure; or installing underground lines from the NASA JPL fence line into the proposed site; (2) construction of berms or other flood control devices to divert potential flood waters associated with the Arroyo Seco; and (3) maintaining a minimum overhead height clearance of 6.1 m (20 ft) at the south end of the proposed structure for roll-off bins that are part of the Building 324 Recycling Center operations.

Surface Parking Lots

Projected further out in the 20-year master planning horizon is the construction of new surface parking. New surface parking facilities could be constructed on potential development sites, adjacent to future buildings, or in fault zones in the northern portion of the Lab. Potential development sites for surface parking include several lots north of Explorer Road (440 spaces/385 space net gain), on the current site of Buildings 111, 114, 156, 185 (200 spaces/180 space net gain), on a new site south of the east entry formed after the removal of Buildings 103 and 11 (230 spaces/170 space net gain), and on a new site north of the east entry formed after the removal of Buildings 316 and 107 (80 spaces/60 net spaces).

As a long term goal, the Master Plan projects and accommodates the relocation of employees currently operating out of the remote and leased Woodbury facilities back to the main NASA JPL facility. Based upon the current parking need at Woodbury, this future scenario would increase parking demand by 320 spaces.

2.2.1.4 Open Space and Landscaping

The proposed design for NASA JPL emphasizes the pedestrian core (Mariner Mall) with a design that includes paving, lawn, and planting areas. A continuous “flowing” walk interspersed with pedestrian nodes would provide opportunities for organizing community activities, informal gathering and interaction, and relaxation. Shaded seating areas would be provided at strategic locations expected to receive large pedestrian usage. While proposed largely for pedestrian use, Mariner Mall would allow vehicular movement through select locations as well.

Mariner Plaza would be located at the west end of Mariner Mall, and is envisioned as a pedestrian zone that offers a first glimpse of the facility to visitors. Paving areas are organized to encourage easy pedestrian movement between buildings. Landscape amenities such as benches, umbrella seating, water features, accent pots, etc. would be located to complement the nature and needs of specific areas. Mariner Plaza would include anOutdoor Digital

Screen that would be located in front of the proposed Visitor Center/Museum and would feature educational updates, images, videos and slide shows changed periodically to reflect current topics of interest.

Surveyor Square is another pedestrian node located in the activity crossroads of the NASA JPL facility. It would allow controlled vehicular movement through in the north-south direction up to the main circulation loop and the new parking garages in the south. This area would integrate ample seating opportunities and can accommodate vending machines as well as small refreshment/magazine kiosks in an area adjacent to the proposed Research and Technology Development Facility on the northeast corner of the square. The transition zone between and beyond the pedestrian nodes provides a pleasant walk through the facility, gives access to adjacent buildings and occasionally incorporates shaded seating areas for resting. Mariner Walk would terminate in an informal recreation area in the western portion of the site that can be developed as the needs of the residents evolve.

Mariner Mall comprises of formal landscape planting that transitions to a more naturalized style beyond the central core. The plant list builds upon Pasadena's landscape heritage and incorporates drought tolerant, native and California friendly plant material. The plantings would constitute a mix of hedges, low shrubs, and ground cover planting. The proposed plant list divides the site into two planting zones. The first occurs along the perimeter (site boundary, roads, parking lots) as well as within informal meadows and recreation areas and would include native plants requiring minimal maintenance and irrigation. The second list is prescribed for the pedestrian core and would supplement the native plants with more ornamental and maintained planting, requiring some maintenance but generally low water use.

2.2.1.5 Pedestrian Circulation Network

The conversion of Mariner Road to a pedestrian corridor at NASA JPL is a major Master Plan concept to improve facility pedestrian circulation. The Mariner Walk would be improved with shade trees and pedestrian-scaled landscaping, lighting, benches, special paving materials, and other amenities. By converting the road to a walk, pedestrians would have a pathway to traverse the Lab, in contrast to existing conditions, where sidewalks are narrow, typically not shaded, and often not contiguous. North-south corridors would be improved to provide enhanced pedestrian connections between the rest of the Lab and Mariner Walk. Improvements would include shade trees, wider sidewalks and/or conversions to pedestrian-only rights of way. These enhancements would increase the ease and comfort of walking through NASA JPL, which would induce more pedestrian activity.

2.2.1.6 Sustainability Plan

NASA has adopted federal sustainability goals and has further defined sustainability goals and frameworks for the NASA Centers like JPL. As a way of further addressing EO 13514 (Federal Leadership in Environmental, Energy and Economic Performance), NASA developed its vision for a sustainable future as contained in its Strategic Sustainability Performance Plan (SSPP). The 2010 SSPP establishes reduction goals for energy use, water use, greenhouse gas emissions, waste, and pollution.

Prior to issuance of the SSPP, JPL had begun achieving basic sustainability goals set by NASA. JPL's sustainability plan focuses on the critical NASA SSPP goals for which the center has already made progress and for which it has the greatest ability to implement. Of the ten SSPP goals, these include Goals 1, 4, and 6 and encompass facility energy intensity reduction; potable water intensity reduction; renewable energy production, and greenhouse gas emissions reduction. To address these goals, the NASA JPL sustainability plan identifies a series of strategies for achieving targeted SSPP goals. These strategies and Master Plan goals are listed in **Table 2-4** by sustainability category.

Table 2-5. Sustainability Goals at NASA JPL

Sustainability Category	NASA Goal	Master Plan Goal
Energy Intensity	Reduce Facility Energy Intensity 3% annually from FY 2003 baseline for FY 2006 – FY 2015 (30% Total)	Construct highly energy efficient new buildings: - Maximize passive cooling, lighting - Achieve economies of scale; minimize building skin to volume ratio, central cooling plant - High performance materials—building skin, thermal storage - Consolidated more efficient data centers and clean rooms - Continue efficiency retrofit of existing buildings - Minimum LEED Silver Certification - Reduce Facility Heat Island
Water Intensity	Reduce potable water use intensity by at least 26% by FY 2020	Reduced landscaping water needs by 50% by 2030
Renewable energy use	Renewable electricity installation and use. Increase percentage of electricity from renewable sources from 3% FY 2007 to 7.5% in FY 2013)	Produce 2.3 MW through on-site PV Arrays (approx. 25% of Electric base load)
Greenhouse gas reduction	Reduce Greenhouse Gas Emissions Intensity 1% annually or 9% by FY 2015 from FY 2003 baseline	Focus on buildings efficiency, commuting and data centers: electricity consumption, daily commuting travel, and business travel

Source: JPL Oak Grove Master Plan Update 2011-2032, March 2011

The operational missions carried out at NASA JPL, along with its geographic location, present unique sustainability opportunities and constraints. The site's south facing hillside aspect is well positioned to optimize solar energy production. At the same time, NASA JPL's data intensive activities inherent in its mission have seen a continual increase in the use of energy. This rising demand creates difficulties for the Lab in meeting the NASA facility energy intensity reduction goals. Meeting sustainability goals would require leadership, commitment, meaningful action and rigorous tracking. NASA JPL has already met some short-term sustainability goals as set by NASA and is actively working towards achieving the others.

2.2.1.7 Underground Infrastructure

The multi-phased Underground Utility Infrastructure project would address the need to replace major underground utility systems that experience periodic failures, threaten Lab safety (e.g. aging fire water protection), or are needed to accommodate and support the new recapitalization laboratory buildings. Given the concentrated/congested underground utility pathways and to minimize disruptions to Lab buildings, circulation, and access, this recapitalization project needs to be constructed over a series of project phases. Proposed Phases 1 and 2 would replace and construct utilities in geographically contained areas, thereby minimizing access impacts to other areas of the Lab. Phases 3 and 4 would address the replacements, relocations, and extensions of major utility systems that can be isolated and worked on in a segment by segment basis until the entire project is complete. **Table 2-5** presents the proposed underground utility infrastructure phasing plan.

Table 2-6. Underground Utility Infrastructure Phasing Plan at NASA JPL

Phase	ID	Sub-project	Description	Justification
Phase 1	A	Relocate B177 & B284 vehicles, fuel tanks, storage & personnel	New site to be southeast parking east of B315.	New location adjacent to central receiving and Facilities Division activities.
	B	Deconstruct B177 & B284 and clear site	Deconstruct B177 & B284 and clear site.	Clear site for NE Central Plant.
	C	Construct NE Central Plant	Construct chilled and heated water plants with distribution systems; and emergency power and distribution systems to support buildings in northeast quadrant.	Replacement of obsolete equipment, replacement of lost capacity due to displacement of existing utilities, required to support new buildings.
	D	Replace water mains in and north of Explorer Road	Replace and abandon in place for later rehabilitation existing 10-inch and 12-inch water mains in and north of Explorer Road.	Age puts these pipelines at risk.
	E	Upgrade Lift Station 224	Install appropriately-sized pumps at existing lift station.	Increase redundant capacity.
	F	Complete natural gas loops in Explorer Road and Mariner Road	Install new 6-inch medium-pressure gas mains, forming a backbone throughout the laboratory.	Increase redundancy for fuel cell regeneration and emergency power generation.
	G	Cooling Tower 296 pipeline conversion	Construct bypass piping around existing chiller units serving buildings currently supported by Cooling Tower 296 in anticipation of conversion to chilled water from NE Central Plant.	Conversion to chilled water must be completed prior to deconstruction of Cooling Tower 296.
	H	Manhole #92 Replacement	Build new high voltage vault to replace existing deteriorated facility.	Potential failure could jeopardize NASA JPL operations.
Phase 2	A	Potential relocation or other actions TBD	NA	NA
	B	Potential other actions TBD	NA	NA
	C	Construct NW Central Plant	Construct chilled water, heated water and emergency power generation and distribution to support buildings in northwest quadrant.	Replacement of obsolete equipment and lost capacity due to displacement of existing utilities required to support new buildings.
	D	Reroute water and gas mains in Arroyo Road	To accommodate construction of parking structures along Arroyo Road, relocate water mains and gas mains away from proposed sites	Site conflict
Phase 3	A	Construction new wastewater equalization and metering facility, and lift station	Proposed site is south of Cooling Tower 315. New facility would consist of an equalization basin, a metering station, a lift station and a force main.	Efficiencies by consolidating pumping facilities. Six pumps at three facilities will be replaced by three pumps at one facility. Improve aesthetics by relocating wastewater equalization basin away from main gate.
	B	Install sewer pipelines	Install new wastewater collection pipelines in Mariner Road, Surveyor Road and Arroyo Road and crossing Mariner Road as necessary to reroute sewage to new facility	Site conflict

Table 2-6. Underground Utility Infrastructure Phasing Plan at NASA JPL

Phase	ID	Sub-project	Description	Justification
	C	Deconstruct obsolete wastewater facilities	Deconstruct Lift Stations 224 and 308, Equalization Basin 289 and Metering Station 270	Facilities not needed or integrated with proposed reconfigured wastewater collection system.
	D	Replace water main	Replace water main in Mariner Road between Ranger Road and Surveyor Road	Main undersized to support new buildings in NW Quadrant
	E	Reconfigure natural gas source	Relocate natural gas PRVs in Ranger Road as necessary to accommodate construction of the Visitor Center	Site conflict
Phase 4	A	Reconfigure water storage	Connect water system to Pasadena Water and Power tanks	Develop recycled water use
	B	Repurpose obsolete water infrastructure	Transfer ownership of main pump station and Tanks 175 and 258 to Pasadena Water and Power for recycled water distribution	Develop recycled water use
	C	Install recycled water distribution system	Reline abandoned water mains in and north of Explorer Road and in Mariner Road west of Surveyor Road as shown. Install new pipelines in Ranger Road, Surveyor Road, Mariner Road, Mesa Road and Explorer Road as shown. Construct hydropneumatic facility adjacent to Pump House 268. Connect new system to existing irrigation stations	Develop recycled water use

Source: JPL Oak Grove Master Plan Update 2011-2032, March 2011

2.2.2 Table Mountain Facility

As depicted in **Figure 2-3**, the Proposed Action for TMF accommodates up to 465 sq m (5,010 sq ft) for OCTL-2, and a Remote Sensing Facility of approximately 279 gross sq m (3,000 gross sq ft) within a 20-year planning horizon. The Proposed Action also accommodates the major planned infrastructure improvement projects identified by NASA JPL such as the safer move efficient Roof Replacement project (**Table 2-6**). These projects are described below.

The Proposed Action also includes an estimated 186 sq m (2,000 sq ft) of “future use” building space that could be accommodated in the TM-15 area which is identified as ‘NASA JPL Reserve’. This area could accommodate a to-be-determined user potentially having greater independence from the use of the core TMF activity area. Various site upgrades and support infrastructure such as a new perimeter fence, pavement, power, water, and sewer improvements would be needed to render the TM-15/NASA JPL Reserve site usable.

2.2.2.1 Optical Communications Telescope Laboratory-2

The proposed OCTL-2 facility would be a major new project for which TMF provides the optimal location for its development. In addition to the primary instrument space and related roof dome, the facility would include an integral mirror construction shop facility and office spaces. A conceptual layout of the facility is illustrated on **Figure 2-4**.

The site would be located northwest of TM-2. To accommodate the project, related parking and site expansion potential, the proposed OCTL site would be created assuming grading of the knoll to maximize the building area south of the existing TM- access road. This would roughly correspond to a site created upon the level of the 2,259-m (7,410-ft) contour. As an alternative site specific development concept, the knoll northwest of TM-2 would be graded over time as two to three separate development site pads constructed as terraces. Because of its superior view cone, and slightly higher elevation, the central pad would be the site for the OCTL-2 facility. The TM-2 fence line would also be expanded to encompass the knoll area. The OCTL-2 project would support, the exploration of mars and beyond programs designed to provide high volume data communications capabilities into deep space.

2.2.2.2 Remote Sensing Facility

The proposed Remote Sensing Facility, would house additional roof mounted remote sensing instruments and provide additional research/laboratory space for atmospheric analysis. The Remote Sensing Facility would also be configured to accommodate a high-bay balloon launching facility needed to support NASA’s atmospheric monitoring and experiment missions. The floor area needed for the facility is estimated at about 3,000 gross square feet which would provide space for up to 10 researchers. To provide service access and potentially limited surface parking for the proposed facility, a small paved area would probably be created west of the TMF LIDAR Facility, Building TM-21.

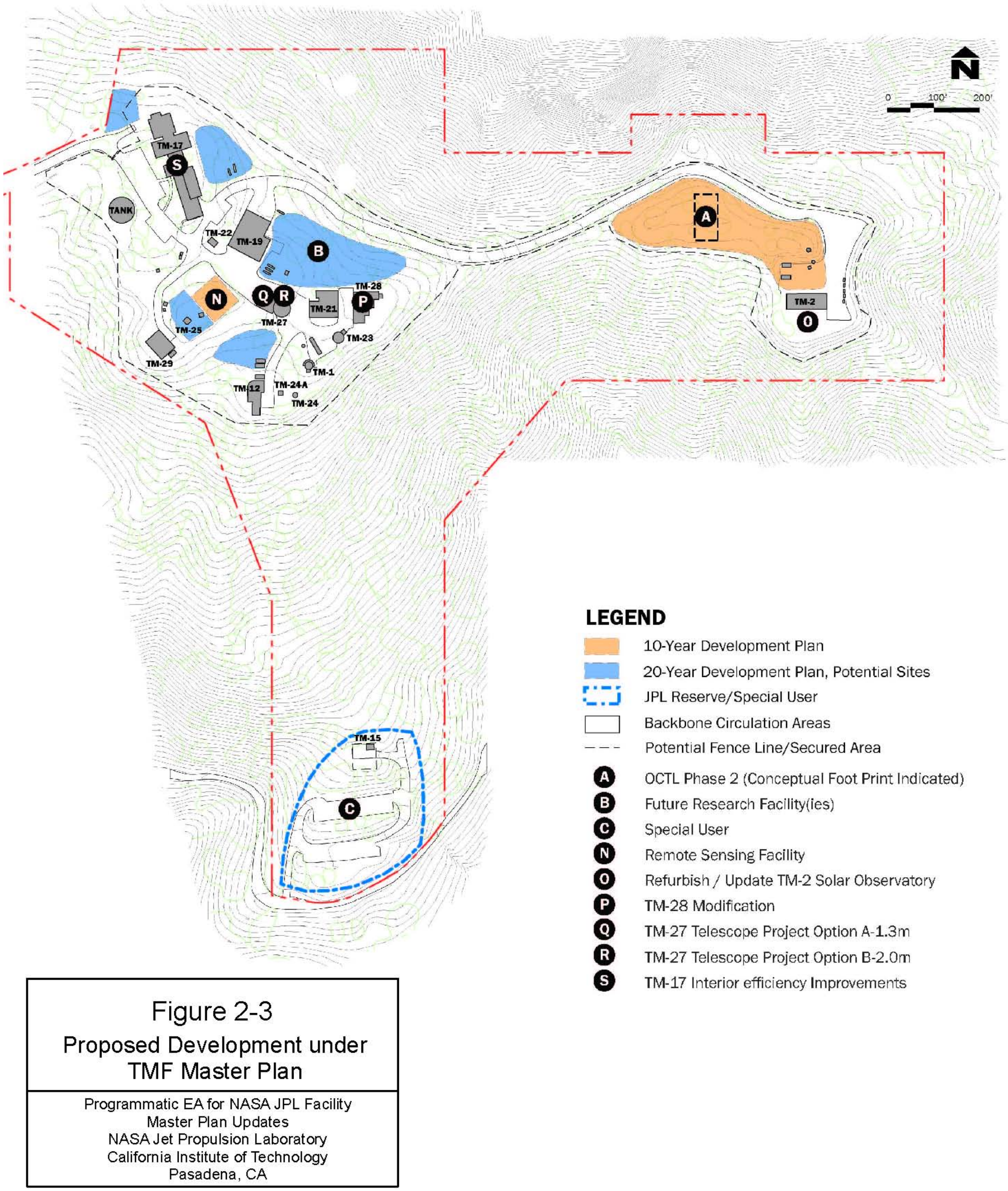
2.2.2.3 Infrastructure Plans and Improvements

Various infrastructure concepts were developed in response to the needs of the Proposed Action (**Figure 2-3**). Implementation would require upgrades to existing utility systems and expanded and/or new systems needed to service anticipated growth for TMF. These projected utility infrastructure improvements for power, telecommunications, storm drain, water, sanitary sewer, gas systems, and pavement and parking improvements, are described below.

Planned Electrical Power System

As the TMF is served by two separate SCE electric power feeds—one serving the main site and the other serving the existing TM- 2 area (including the proposed OCTL-2 facility), each of these areas is discussed separately below.

Figure 2-3. Proposed Development under TMF Master Plan



Source: Table Mountain Facility Master Plan Update 2011-2032, March 2011

Table 2-7. TMF Development Plan Summary

ID	Project Name	Metric	Plan Period	Notes
A	Optical Communications Telescope Laboratory Phase 2 (OCTL-2)	465.4 GSM (5,010 GSF)	10 Year	
B	Future Research Facility (ies)	650 GSM (7,000 GSF)	20 Year	To accommodate future research to be determined. Facility floor area projection based on past growth of TMF.
C	Future User	185.8 GSM (2,000 GSF)	20 Year – NASA Reserve	Accommodation of future user in the NASA JPL Reserve area
D	Fire Suppression Systems	4 Buildings	10 Year	TM-1, TM-2, TM-12, TM-27
E	Safer/Efficient Roof Replacements	9 Buildings	10 Year	TM-1, TM-2, TM-12, TM-17, TM-19, TM-21, TM-22, TM-27, TM-28
F	Perimeter Security Fence	1,615 LM (5,300 LF)	10 Year	Includes various associated improvements to gates, lights, and card reader.
G	Additional Parking Areas	24 Parking Spaces	10 Year	
H	Additional Parking Areas	15 Parking Spaces	20 Year	
I	Roadway and Utility Upgrades/ Improvements	Various	10 Year	Install underground water, power and communications utilities to connect TM-2 area to main TMF area. Resurface roadway and guardrail upgrades.
J	Utility Upgrades	Various	10 Year	Install new 250 KW/313 KVA emergency generator in TM-19 to address growth of base load associated with Remote Sensing Facility
K	Utility Upgrades	Various	10 Year	Install new 800 amp service (Transformers/pad, switch, 175 KW/219 KVA back-up generator, utility building) to the SCE 12KV feed servicing TM-2 to address growth of power loads associated with new OCTL-2.
L	Utility Upgrades	Various	20 Year	Install new 800 amp TMF main area service to address growth of base load associated with new future Research Facility.
M	Utility Upgrades	Various	20 Year	Install on site 12KV interconnection line between TMF main and TM-2 site areas (currently served by two separate SCE 12 KV high voltage feed lines) to provide system reliability
N	Remote Sensing Facility	279 GSM (3,000 GSF)	10 Year	Lab/office configuration to accommodate multiple roof mounted instruments. Approx. 5 to 10 occupants. High Bay balloon launching facility.
O	Refurbish/Update TM-2 Solar Observatory	243 GSM (2,614 GSF)	10 Year	Equipment updates; new coelostat
P	TM-28 Modification	46.5 GSM (500 GSF)	10 Year	Roof and floor modifications to accommodate a FTUVS Heliostat and dome
Q	TM-27 Telescope Project Option A-1.3m	281 GSM (3,025 GSF)	10 Year	Possible NASA support for NEO research and as part of OCTL-2 Program

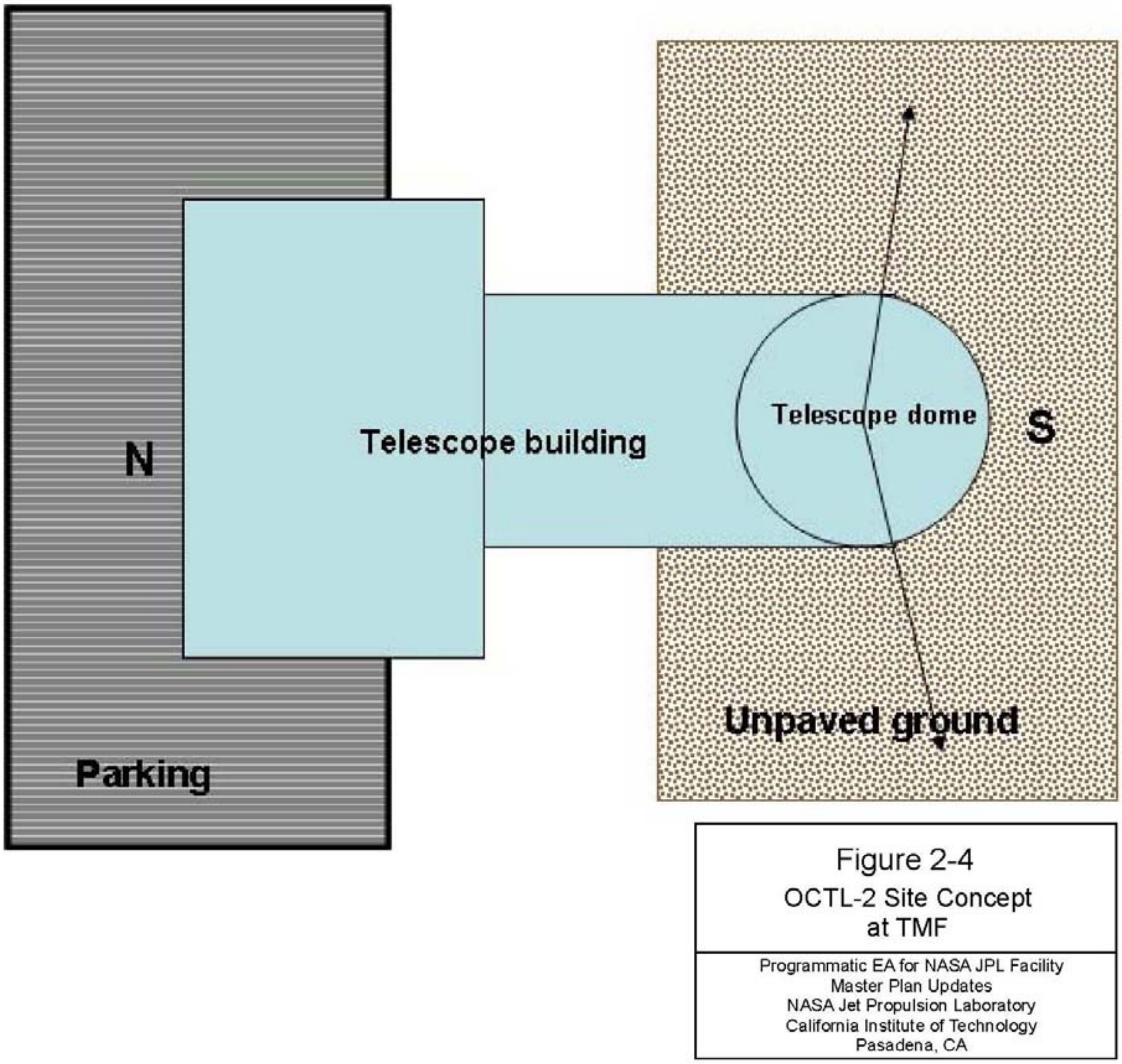
Table 2-7. TMF Development Plan Summary

ID	Project Name	Metric	Plan Period	Notes
R	TM-27 Telescope Project Option A-2.0m	281 GSM (3,025 GSF)	10 Year	
S	TM-17 Interior Efficiency Improvements	37 GSM (400 GSF)	10 Year	Reconfiguration of Library into teleconference and meeting facility; Upgrades to bathroom facilities to address ADA and staffing requirements
T	Replacement of Fire Alarm Notification system	11 buildings	10 Year	Replace fire alarm notification system destroyed by lightning strikes in 2010 to assure proper protection of NASA assets. New system to be totally code compliant.

Source: Table Mountain Facility Master Plan Update 2011-2032, March 2011

General Notes:
1. Projects A to M were proposed as part of the 2006 TMF Master Plan; Projects N to S were identified and/or refined as part of the 2010 TMF Master Plan Update Exploration process.
2. 10 and 20 year plan periods identified in the table are estimates based upon current thinking of the TMF Master Plan Steering Committee. Project implementation schedules are all dependent upon to-be-determined NASA and JPL funding priorities.
Notes: GSM=gross square meters; GSF=gross square feet; LF=linear feet

Figure 2-4. OCTL-2 Site Concept at TMF



Source: Table Mountain Facility Master Plan Update 2011-2032, March 2011

Main Area Electrical Power - The main site electrical service is approximately 50 percent loaded. The Proposed Action for this area includes a 279-sq m (3,000 sq ft) Remote Sensing Facility. TMF would connect the facility to the existing service as part of the Proposed Action. The main site emergency generator is undersized to serve a full 400-amp load of the main service. If the Remote Sensing Facility was added to the TMF main area, then a new emergency generator would be needed to accommodate larger connected and projected average loads. TMF would install a 757-l (200-gal) diesel-fueled generator with an industry standard generator capacity of 250 kW/313 kVA TMF would complete all the necessary Antelope Valley Air Quality Management District (AVAQMD) permitting requirements.

The generator would be installed in the existing generator room located in Building TM-19 and would replace the existing propane fueled generator. The room would need minor modification to support proper intake air, exhaust port and proper clearances.

TM-2 Area Electrical Power - To accommodate the new projected load associated with the OCTL-2, a new 800 amp-480V 3Phase-4W service and meter would be added to feed the new facility and to back feed the existing TM-2 building. To accommodate this new service, a 1.8-m (6-ft) x 2.4-m (8-ft) transformer pad type installation and 12 kilovolts (kV) underground cable feed from the existing SCE overhead pole location would be required. The new service would also require a 400 amp transfer switch for emergency backup. This switch, main panel, the emergency generator, as well as a central distribution frame for telecommunications, would require a small stand alone utility building measuring approximately 3.7 m (12 ft) wide and 12.8 m (42-ft) long. A separate 76.2-m (250-ft) 400 amp underground feeder would be provided to connect the OCTL-2 site.

TMF would interconnect the two independent existing high voltage lines that serve the main area and the TM-2 area, to yield a more reliable power system for both areas. The configuration of this interconnection would include two high voltage switches at the point of connection to each site which would allow disconnection of either site from a downed power circuit. Approximately 518 m (1,700 ft) of interconnection lines would be provided in an underground duct bank installed along the access road to TM-2. They would run from the existing transformer pad at Building TM-22 on the main site to the new transformer pad at TM-2.

A diesel-fueled 757-l (200-gal) fuel tank (dual lined) generator would be installed in a new generator room located adjacent to the new transformer pad and main electrical room. The room would be a minimum size of 3.7 m (12 ft) by 5.5 m (18 ft) and share a common wall with the new main electrical equipment room. The size would be approximately 1.2 m (4 ft) wide, 2.7 m (9 ft) long, and 3 m (10 ft) in height. TMF would obtain all required South Coast Air Quality Management District (SCAQMD) pre-approved permits.

Planned Telecommunications System

The Proposed Action would require new communications infrastructure for OCTL-2 and the Remote Sensing Facility, including new underground distribution conduits and communications cabling. Additional conduits and routing with the quantity of copper and fiber optic cable to support anticipated usage in the three areas would be required to upgrade current infrastructure.

OCTL-2 Facility - One new 10-cm (4-in) or two 5-cm (2-in) underground conduit would originate at TM-17 and proceed east across the service road north of TM-19. The communications conduit (50 pairs of Unshielded Twisted Pair (UTP) Outside Plant rated) would continue down to TM-2. A pull box would be placed at the OCTL site for future conduit to extend into the minimum point of entry (MPOE) of the new facility. Four 5-cm (2-in) underground conduits would be placed from the pull box northeast of TM-28 (by the side of the service road) up to the vault southeast of TM-21 to provide a pathway for new fiber optic cable (12-strand multimode fiber, 62.5/125u, Outside Plant rated) to be installed from the Server Room in TM-21 to the OCTL MPOE.

TM-2 Existing Facility - A new pull box would be installed at the North West corner of TM-2 to provide a new underground cable pathway for communications cable that continues from the new conduit installed to the OCTL Facility. This site is currently served through a combination of overhead and direct burial cable from the telephone pole just north of TM-27. The new pathway would be installed with 25 pairs of new Outside Plant cable with the option of 12 strands of fiber optic cable to replace the existing telephone modems.

Remote Sensing Facility - This facility would be serviced through a new conduit system consisting of two 5-cm (2-in) underground conduits extending from the MPOE of the future building to utility building TM-22. From TM-22, two new 5-cm (2-in) underground conduits would be installed along the north side of the road extending to TM-27. There would be a pull box installed across from TM-27 with the two new 5-cm (2-in) underground conduits continuing to the MPOE of TM-21. This new conduit would provide fiber optic cable pathway to the new facility directly from TM- 21. The UTP copper cable for the new building would originate in TM-17 and extend through the existing conduit system to TMF-22 and then through two 5-cm (2-in) conduits to the MPOE.

Planned Storm Drain System

The TMF is located on a hilltop, which in general allows the surface storm water runoff to be conveyed to the surrounding slopes through natural relief or graded swales. Uncontrolled overland drainage from paved to natural areas is a main reason for the erosion easily noticeable in several locations around the road to TM-2. To prevent further erosion of the surrounding slopes, the road between the main site and the TM-2 area would be equipped with curb and gutter, and sloped to drain away from the slopes where possible. The runoff would be intercepted by drain inlets in the gutter then discharged at several locations via down drains.

Reconstruction of existing parking areas would not cause changes to the existing drainage patterns. The proposed future facilities would be designed to prevent erosion of the adjacent natural areas. Future buildings would have roof drains, either individual or collected in an underground storm drain manifold. The runoff from the roof would be conveyed to and discharged onto nearby slopes using outlet structures, and rip/rap dispersal pads.

Planned Water System

Site domestic and fire water needs (including the two remote sites TM-2 and TM-15) would continue to be served by a 1.19 million-l (315,000-gal) steel tank owned by the USFS and located on the west side of the site next to the main entrance. The tank is supplied with water by single 7.6 cm (3-in) line fed from supply wells and pumps located in the Swarthout Valley. This tank also supplies water to the USFS and several local users in the general area. Domestic and fire suppression water would be provided from a common potable water main. The whole water system for the site would continue to be pressurized by a booster pump located in building TM-19.

The fire hydrant configuration would be optimized to reflect future needs. While most of the hydrants would remain in place, several would be relocated or replaced by new ones, to better serve the reconfigured main site. Most of the existing site water lines are steel pipes, the most recent of which were installed approximately 25 to 30 years ago. Steel pipes would be replaced with new polyvinyl chloride (PVC) pipes as a part of the Proposed Action. A new 20.3-cm (8-in) PVC water pipe would be installed along the access road to TM-2, to replace the existing pair of 5-cm (2-in) and 15-cm (6-in) water lines supplying that site.

Individual water service lines would be provided for each new building to serve domestic and fire suppression water needs. The proposed buildings would be equipped with fire suppression sprinkler systems. Due to the subfreezing winter temperatures experienced at TMF, those buildings would be equipped with “dry-type” automatic protection systems. TMF would install fire suppression sprinkler systems in the existing buildings TM-1, TM-2, TM-12 and TM- 27.

Planned Sanitary Sewer System

The remote character of TMF dictates the use of septic tanks equipped with leach fields or percolation pits for disposal of grey water and sewage. Under the Proposed Action, sanitary sewer needs would be met through the construction of new septic tanks connected to percolation pits or perforated leach pipes. Although a soils analysis indicates the general suitability of site soils to properly percolate, the use of percolation pits is subject to standard site specific geotechnical and soil percolation tests needed to verify the suitability of specific installation locations (AC Martin 2011).

Planned Gas System

The liquid propane gas (LPG) demands would be met by adding a new 3,785.4-l (1,000-gal) LPG tank in proximity to a new building facility. LPG service can be provided by adding new tanks to the existing tank groups or by the installation of individual tanks. The LPG demands of the proposed OCTL-2 building would be met by a new tank located in the vicinity of the proposed 600-sq ft OCTL support building.

Planned Pavement Improvements

The access road to TM-2 and the new OCTL-2 facility, as well as most of the parking areas and driveways on the main site, would be brought up to standards with regard to width, turning radii, pavement thickness/ condition, drainage, signage, striping and safety. At present, parking areas and internal access roads are mostly paved with asphalt- concrete. The wide range in temperature fluctuation during the year: below freezing in the winter and reaching 27 degrees Celsius (◦C) [80 degrees Fahrenheit (◦F)] in the summer, compounded by the use of heavy snow removal equipment, has an adverse effect on the longevity of the pavement service life. The pavement of the access road to TM-2, which would also serve the new OCTL facility, is cracked and eroded.

Excessive cracking would be prevented by adding geofabric, bonded to the road surface and saturated with bitumen to seal the existing pavement and at the same time to increasing its tensile strength. A waterproof asphalt-concrete overlay would be added over the sealed pavement. To improve roadway stability, certain portions of the access road showing evidence of weakening sub-base, may also have to be over-excavated up to 0.9 m (3 ft) below the base course and geofabric installed, overlain by crushed rock as a geofabric reinforcement.

Further, various portions of the road would be improved with curb, gutter and drain inlets to collect the road surface runoff and convey it to properly designed surface run-off areas. Toe of slope drain ditches to intercept slope runoff would also improve the longevity of roadway service life. The access road would have a minimum roadway width of 6.1 m (20 ft) for its entire length and minimum of 7.9 m (26 ft) where adjacent to surface parking. A 7.6-m (25-ft) minimum turning radii would be constructed, where possible. Proper truck turnaround areas would be constructed to facilitate the proper traffic circulation through the site. To improve safety along the access road to TM-2, TMF would install metal guardrail sections, and 6-m (20-ft) wide gaps would be left for every 30.5 m (100 ft) of guardrail to allow snow removing equipment to push snow to the side. Guide marker poles would be installed along the road to facilitate road navigation in deep snow.

Surface parking is provided in front of buildings TM-2, TM-17 and TM-19. New parking lots would be added next to the future buildings. Some of the existing surface parking areas would be reworked to comply with the standard parking design requirements.

Employee and Administrative Improvements

TMF is a unique research facility that as an observatory often requires overnight and/or extended periods of stay. This extended work time element necessitates having the on-site dormitory facility located in TM-17. It also necessitates provisions for food service and recreation. Although there is lodging and food services located nearby in the community of Wrightwood, recreational demands and occasional heavy snowfall can limit access to local facilities from TMF so that having the capability for overnight stay at TMF is essential to maintaining the ability for extended scientific observation.

Because TM-17 contains the dormitory facility for TMF, several offices available to researchers, and TMF administration, it is the center of activity for TMF. A small outdoor patio and ‘picnic-type’ area adjacent to the dormitory wing section of TM-17 is popular in non-winter months. Often, this TM-17 activity is manifested in considerable foot traffic within and around the TM-17 building. Further, with this activity there is a potential for noise that may distract some researchers engaged in office research or daytime sleep while others are arriving, engaged in discussions, having meals, or occupied in passive recreational activities. These potential conflicts are a natural outgrowth of the demands placed upon TMF—given the diverse set of instruments located at TMF, the multiple institutions that may use TMF at any time, and the periodic conferences and special meetings held there.

Under the Proposed Action, TMF would improve and modify TM-17, including a reconfiguration of the Library into a teleconference and meeting facility. This project would accommodate regular researcher meetings as well as special periodic conferences and meetings that take place at TMF. Enhanced sound attenuation construction techniques would be employed to reduce sound transmission to adjacent building areas. The project would also include upgrades to bathroom facilities to address ADA and staffing requirements. An additional small picnic area would be created approximately 35 m (120 ft) to the east of TM-17 and slightly down slope. This distance would reduce the noise impacts upon the adjacent dormitory wing of TM-17 located in the north end of the building. A low earth tone block wall enclosure would be used to help shelter the area from winds as well as providing further noise buffering between the area and the TM-17 dorms.

In conclusion, the Proposed Action fulfills the objectives of the Master Plan. The Proposed Action affords the best location for the proposed OCTL-2 project and as such, has been identified as the Preferred Alternative.

2.2.3 Goldstone Deep Space Communications Complex

Operational functions are concentrated in five Sites—Echo Site, Mars Site, Apollo Site, Venus Site, Gemini Site—each having its own individual and specialized role within the GDSCC complex. The future plan for GDSCC maintains the basic functional characteristics of the complex. Beyond this broad planned approach to the long term development of GDSCC, specific projects have been identified for NASA funding. As described below, the Master Plan divides the Proposed Action into two construction projects, with each project representing one of the objectives:

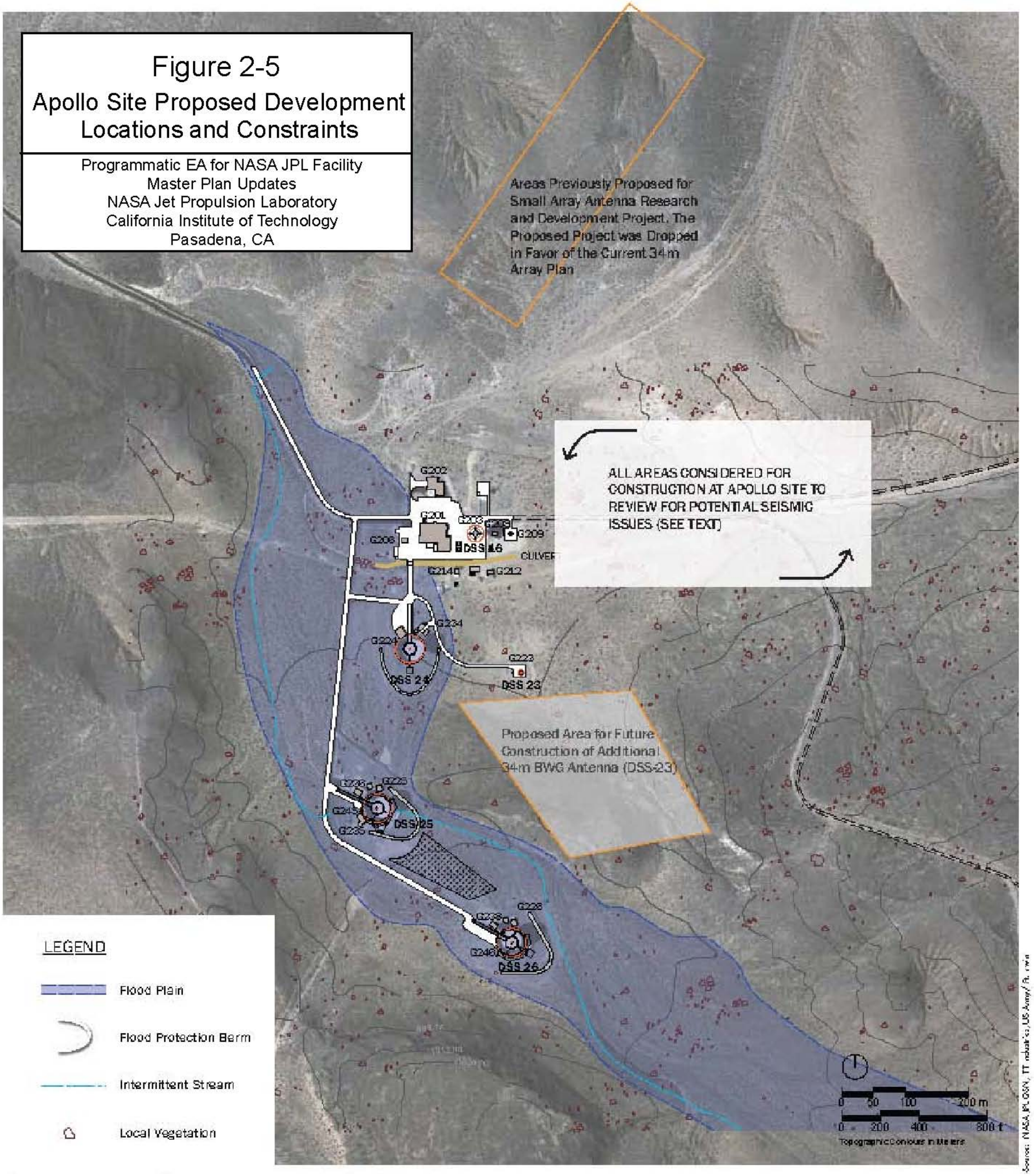
- Construct a 34-m (111.5 ft) BWG antenna at Apollo Site; and
- Provide infrastructure improvements as necessary to maintain reliability and comply with Federal and state regulations, including water, power, communications, and sewer.

2.2.3.1 Apollo Site Antenna

The 34-m (111.5 ft) BWG antenna project is part of the DSN's strategy to address the need for increased data volumes and replace the dependence on the older 70 m (230 ft) antennas found at the three worldwide communications complexes at GDSCC; Madrid, Spain; and Canberra, Australia. NASA's long-term strategy includes the potential development and use of optical communications technologies which can achieve higher data volumes. The future of optical communications at GDSCC is discussed later.

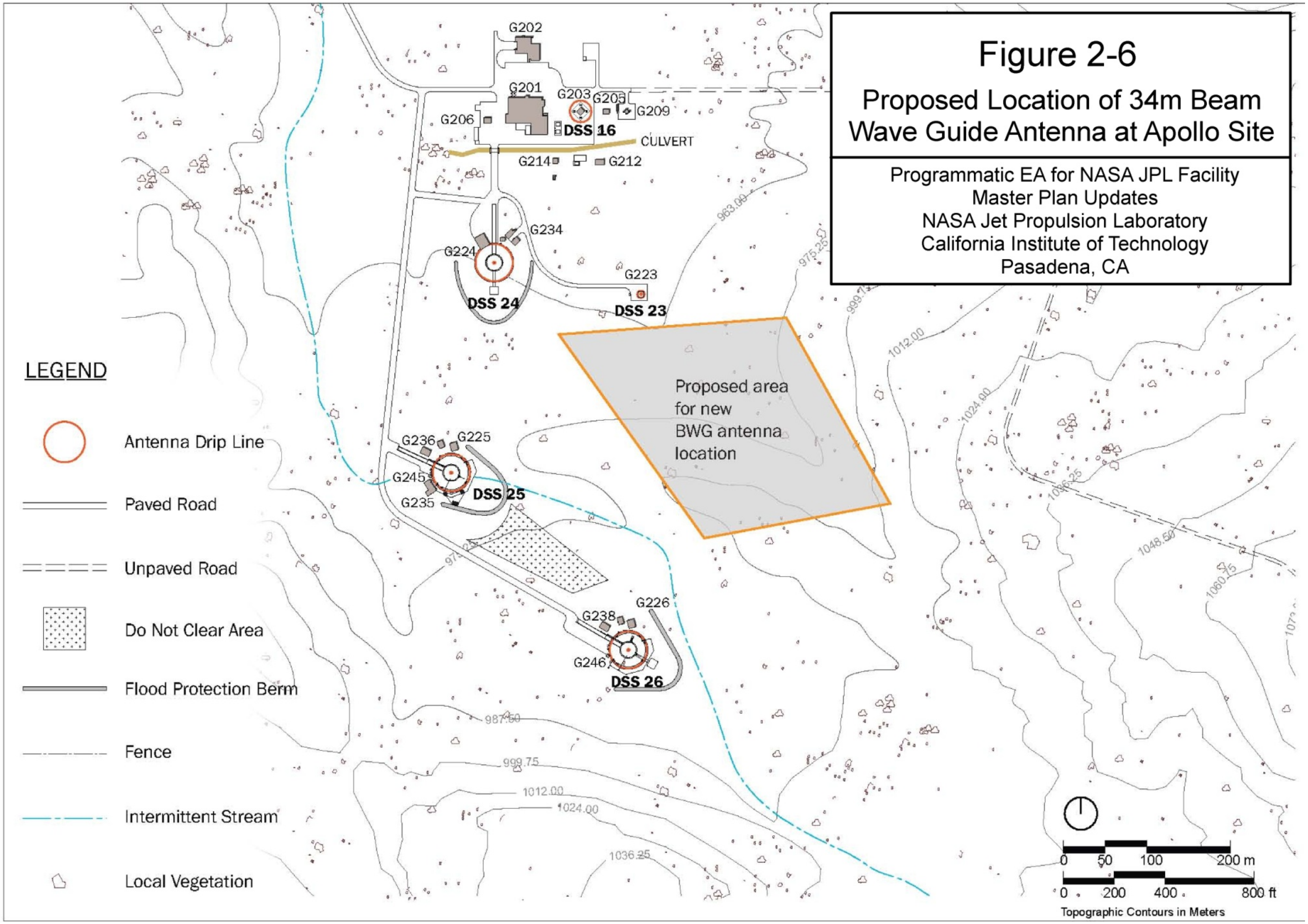
To meet the goals of the DSN Robustness Project, the Apollo Site has been identified by NASA JPL as the appropriate location for an additional 34m BWG antenna and a specific area at Apollo has been tentatively selected as a location that meets the antenna technical array criteria. The proposed development area is illustrated on **Figures 2-5 and 2-6**.

Figure 2-5. Apollo Site Proposed Development Locations and Constraints



Source: Deep Space Network Facilities Master Plan Update 2011-2032, March 2011

Figure 2-6. Proposed Location of 34m Beam Wave Guide Antenna at Apollo Site



Source: Deep Space Network Facilities Master Plan Update 2011-2032, March 2011

The Apollo Site has one known environmental constraint and one potential environmental constraint which need to be addressed when considering any major future development. A flood plain associated with a desert intermittent stream crosses the Apollo Site; and a potential second constraint is the potential presence of an earthquake fault (**Figure 2-5**).

GIS files obtained from Fort Irwin show a fault crossing the Apollo Site in a generally north-south direction identified as the 'Goldstone Lake Fault.' Although this information came from a USGS data base, subsequent updated geologic mapping of the Mojave desert undertaken by the USGS in 1999 and 2000 has not confirmed the location of a fault at the Apollo Site (AC Martin 2011). Because of this uncertainty, it can be concluded that any area on the Apollo Site identified for a large antenna such as the proposed 34 m (111.5 ft) BWG antenna should be subjected to a geologic study to determine whether there are any active faults impacting the proposed development area.

The flood plain depiction contained on **Figure 2-5** was characterized based upon: 1) the lateral limits of a braided stream channel pattern typ**i**cally expressing intermittent stream courses; 2) an analysis of the site contours to identify the landform 'trough' that would be the natural flow path of water; and 3) the presence of flood protection berm/deflection structures constructed by NASA JPL to divert any known or potential flood waters around the existing Apollo antennas DSS-24, DSS-25, and DSS-26 (A.C. Martin 2011).

The general aridity of the Goldstone site desert environment and associated sparse and slow growing vegetative cover tend to reflect imprints such as floods for long periods of time so that a visible flood plain may reflect a long period of storm activity and therefore be a decent indicator of the extent of large flood events. Still, large flood events may extend into areas outside of the boundaries indicated. The extent of such a large flood could be modeled. The main axial length of the drainage area appears to be approximately 2.5 km (1.6 mi) in length which when linked with an estimated maximum storm would help constrain the size of any potential flood (**Figure 2-5**).

As depicted in **Figure 2-5,** the proposed 34 m (111.5 ft) BWG Antenna site lies outside the direct influences of the flood plain constraint. Another potential development site at the Apollo Site was identified in 2006 as part of a prototype array antenna facility then under consideration as part of a system-wide DSN plan. This area lies to the north of the main Apollo Site facilities and likewise lies outside of the mapped flood plain constraint.

2.2.3.2 Infrastructure Upgrade and Replacement

Proposed major infrastructure replacement and upgrade projects to be implemented over the next 20-year planning period are listed in **Table 2-7**. Initiated as part of the 2006 DSN Facilities Master Plan effort, all basic facility infrastructure at GDSCC was evaluated and a number of site-wide infrastructure system components in need of replacement and/ or upgrade were identified. This evaluation was in response to known infrastructure deficiencies that had accumulated over the course of 40 years of DSN operations at GDSCC. Further analysis since has further defined infrastructure needs.

2.2.3.3 Future Optical Communications

GDSCC has been identified as a potential location for research optical telescopes and operational telescopes of the future. Although development of these types of facilities is currently under study at NASA JPL, NASA JPL acknowledges that development of a prototype at GDSCC has the advantages of being relatively close to NASA JPL and accessible for use throughout the year.

Table 2-8. Summary of GDSCC Utility Infrastructure Projects

System	Location/Pathway	Metric	Proposed 20-Year Plan
Communications			
Fiber Optic (96 Strand SM)	Mars-Apollo	17,000 LF	Replacement
Copper (50 PR)	Mars-B box mid complex	10,000 LF	Replacement
Fiber Optic (144 Strand SM)	Apollo-Echo	10,000 LF	Replacement
Copper (50 PR)-1	Apollo-B box mid complex	4,500 LF	Replace and expand capacity to 50 PR
Copper (50 PR)-2	Apollo-B box	4,500 LF	Replace and expand capacity to 50 PR
Copper (50 PR)-3	Apollo-Col Tower-204	2,000 LF	Replace and expand capacity to 50 PR
Copper (50 PR)-4	Apollo-Col Tower-208	3,500 LF	Replace and expand capacity to 50 PR
Copper (50 PR)-3	Echo-Guard Gate G-93	4,000 LF	Replacement
Copper (25 PR)-3	Echo-Guard Gate G-93	4,000 LF	Replacement
Copper (50 PR)-1	Apollo-B box mid complex	4,500 LF	Replacement
Fiber Optic (48 Strand SM)	Venus-Gemini	3,500 LF	Replace and expand capacity to 48 strand
Copper (50 PR)	Venus-Gemini	3,500 LF	Replace and expand capacity to 50 PR
Copper (100 PR)	B box mid complex- Pioneer	4,000 LF	Replacement
Copper (25 PR)	B box mid complex- Airfield	2,000 LF	Replacement
Redundant Communications Path		TBD	
Power			
12.5 Kilovolts Feed	Apollo Site	TBD	Add additional feed to increase system redundancy/diverse path
UPS system increase	Mars Site	TBD	Add 2.0 Megawatts of additional UPS capacity for ultimate 6.0 Megawatts total
Time of Use Metering	Ft. Irwin sub station		Negotiate time-of-use metering with Fort Irwin for sustainable energy projects
Various Power Facility upgrades	Misc.		See DSN/ITT Table A for Various Facility Upgrades
Water Supply			
6-inch steel pipe	Fort Irwin-Venus	30,000 LF	Replacement-abandon existing in place
6-inch steel pipe	Venus-Echo	28,000 LF	Replacement-abandon existing in place
6-inch steel pipe	Echo-Apollo	26,000 LF	Replacement-abandon existing in place
6-inch steel pipe	Apollo-Uranus	41,000 LF	Replacement-abandon existing in place
8-inch steel pipe	Uranus-Mars	3,000 LF	Replacement-abandon existing in place
8-inch steel pipe	Apollo-Mojave	7,000 LF	Replacement-abandon existing in place
Meter on Tank Discharge Lines	All Tanks	6 meters	Install low flow water meters to monitor and trend usage
Ion Exchange Filtration System	Echo	1 plant	Construct filtration plant to meet purity requirements
Fire Pumps	All Sites	8 pumps	Routine maintenance, rehabilitation, upgrade as necessary
Wastewater			

Table 2-8. Summary of GDSCC Utility Infrastructure Projects

System	Location/Pathway	Metric	Proposed 20-Year Plan
Sewage Settlement Ponds	Echo	50,000 SF	Reline with geo-textile to prevent groundwater contamination
Sewage Settlement Ponds	Mars	60,000 SF	Reline with geo-textile to prevent groundwater contamination
Propane Gas Distribution			
LPG pipes and cathodic protection	Echo	1,500 LF	Replacement to meet current state regulations
HVAC			
General	All Sites		Most HVAC equipment >20 yrs old/must replace per maintenance history
HVAC Controls	All Sites		Modernize HVAC control to support efficiency/operability
HVAC Equipment	Mars		Chiller #1 and #3, Air Handler #2 and #3, MCC-1
Chiller	Mars/DSS-14		Install chiller/upgrade HVAC controls to reduce cooling tower load
Cooling Water Loop	Mars & Echo		Water Treatment Program-testing, analysis and remediation of cooling loops
HVAC Equipment	Throughout		Replace aging equipment as needed at Apollo, Echo, Gemini, Mars, Venus
Chillers	Throughout		Replace chillers using R-22 refrigerant (i.e. R-22 is being phased out)
HVAC Equipment	Mars/DSS-13		Modify HVAC equipment as test bed for new cooling design
Thermal Storage	Mars		Feasibility Study
Radiant Cooling	Mars, Echo		Feasibility Study

Source: Source: Deep Space Network Facilities Master Plan Update 2011-2032, March 2011

NOTES: SM= ; LF=linear feet; SF=square feet; PR=pair; TBD=to be determined; UPS=Uninterruptible Power Supply; HVAC=Heating, Ventilation, Air Conditioning; MCC= ; LPG=liquid propane gas

Based upon current NASA JPL thinking, the prototype system would most likely consist of two closely collocated optical telescopes: a telescope of approximately 12 m (39 ft) in diameter with an accompanying domed support building comparable in size to those used on the 34 m (111.5 ft) BWG antenna; and an uplink beacon facility with a 2.2 m (7.2 ft) telescope.

2.2.3.4 Sustainability Plan

Various sustainability initiatives could be developed under the Proposed Action at GDSCC. The potential development of a Radiant Cooling-Thermal Storage System would need further study to establish its feasibility either as an independent system or in relation to the proposed thermal electric arrays under consideration for deployment by the US Army within the confines of GDSCC. The DSN Master Plan Update (A.C. Martin 2011) recommends a focused study to investigate this potential. Such a system has been described by XDOBS LLC (See: http://renewablecooling.com/ renewable-cooling-basic-intro-presentation.pdf).

EnLink Geoenergy indicated the potential of using ground source thermal mass and energy as part of an overall cooling solution for facilities such as GDSCC. Ground source thermal energy can typically be tapped through vertically or horizontally buried piping. Therefore, a study of developing a system to utilize the natural environment to address cooling loads should be broadened to analyze geothermal alternatives. Similarly, later discussions with DSN revealed that a geothermal system used to cool antennas had proven effective at the Canberra Deep Space Communication Complex and therefore should be studied for use at GDSCC.

To save energy over the short term, a Heating, Ventilation, and Air Conditioning (HVAC) Utility Energy Savings Contract with SCE has been initiated which entails replacement of selected cooling units and assemblies throughout the Goldstone site. Antenna equipment cooling would be a major component of the work.

2.3 No Action Alternative

The No-Action Alternative is the same for NASA JPL, TMF, and GDSCC: current programs and projects would continue to develop as planned and the actions proposed in this EA as part of Master Plan implementation would not be taken. No new construction would occur under this alternative.

The No-Action Alternative does not provide a framework for renewing NASA JPL infrastructure that would help meet future planning goals. NASA JPL facilities would be planned on a site-by-site basis, and research, operational and administrative space would continue to be inadequate. NASA JPL, TMF, and GDSCC would not have a plan to reach sustainability goals, and conservation efforts would continue to be unconsolidated. The No-Action Alternative would not fulfill any of the master planning objectives.

Although this alternative does not satisfy the purpose and need for long-range expansion at NASA JPL, TMF, and GDSCC, it is included in the environmental analysis to provide a baseline for comparison with the Proposed Action and is analyzed in accordance with CEQ regulations for implementing NEPA. Although this alternative would eliminate unavoidable adverse, short-term impacts associated with the Proposed Actions for NASA JPL, TMF, and GDSCC, the No Action Alternative would not satisfy the purpose and need for this project

2.4 Comparison of Impacts

Table 2-9 summarizes the alternatives effects on each resource based on the impact analysis described in Section 3, Affected Environment and Environmental Consequences, of this EA.

Table 2-9. Summary of Potential Impacts for NASA JPL, TMF, and GDSCC

Issue	Proposed Action			No Action Alternative
	NASA JPL	TMF	GDSCC	
Land Use	Short-term: No off-site impacts because no changes to land use would occur outside NASA JPL. Minor on-site impacts because of interim relocation of existing facilities, demolition, construction, and infrastructure redevelopment. Long-term: Minor beneficial impacts to on-site land use would result from a more cohesive setting at NASA JPL.	Short-term: No off-site impacts because no changes to land use would occur outside TMF. Minor on-site impacts because of demolition, construction, and infrastructure redevelopment. Long-term: No adverse impacts	Short-term: No off-site impacts because no changes to land use would occur outside GDSCC. Negligible on-site impacts because of demolition, construction, and infrastructure redevelopment. Long-term: No adverse impacts	Short-Term: No impact. Long-Term: No impact.
Socioeconomics	Short-term: Negligible beneficial off-site impacts from temporary employment during construction. Also negligible on-site beneficial impact from demolition of older buildings, eliminating deferred maintenance costs for outdated and vacant buildings. Long-term: No adverse impacts to population, housing, or employment in surrounding areas, or on-site are anticipated. There would be long-term beneficial effects for facility operations	Short-term: Negligible beneficial off-site impacts from temporary employment during construction. Long-term: No adverse impacts to population, housing, or employment in surrounding areas, or on-site are anticipated	Short-term: Negligible beneficial off-site impacts from temporary employment during construction. Long-term: No adverse impacts to population, housing, or employment in surrounding areas, or on-site are anticipated	Short-Term: No impact. Long-Term: No impact.
Environmental Justice	Short-Term: No impact. Long-Term: No impact.	Short-Term: No impact. Long-Term: No impact.	Short-Term: No impact. Long-Term: No impact.	Short-Term: No impact. Long-Term: No impact.
Traffic and Transportation	Short-Term: Minor adverse impacts from construction activities on traffic generation, traffic congestion, traffic volume, street use, and parking availability on-site and in surrounding areas.	Short-Term: Minor adverse impacts from construction activities on traffic generation, traffic volume, and parking availability on-site.	Short-Term: Negligible adverse impacts from construction activities on traffic generation and traffic volume on-site.	Short-Term: No impact.

Table 2-9. Summary of Potential Impacts for NASA JPL, TMF, and GDSCC

Issue	Proposed Action			No Action Alternative
	NASA JPL	TMF	GDSCC	
	Long-Term: Beneficial impacts as current facility-wide parking issues would be addressed with increases in available parking spaces.	Long-Term: Minor beneficial impacts as current facility-wide parking issues would be addressed with increases in available parking spaces.	Long-Term: No impact	Long-Term: No impact.
Public Services and Utilities	Short-Term: Negligible adverse impacts from construction due to temporary disruptions/outages in electrical power, natural gas supplies, and water, sanitary, and storm sewer lines. Long-Term: Minor beneficial impacts because of more reliable grid connections, and updated technologies for greater efficiency and increases in safety. New infrastructure would result in reduced on-site risks for emergency response and safety management.	Short-Term: Negligible adverse impacts from construction due to temporary disruptions/outages in electrical power, natural gas supplies, and water, sanitary, and storm sewer lines. Long-Term: Minor beneficial impacts because of more reliable grid connections, and updated technologies for greater efficiency and increases in safety. New infrastructure would result in reduced on-site risks for emergency response and safety management.	Short-Term: Negligible adverse impacts from construction due to temporary disruptions/outages in electrical power, natural gas supplies, and water, sanitary, and storm sewer lines. Long-Term: Minor beneficial impacts because of more reliable grid connections, and updated technologies for greater efficiency and increases in safety. New infrastructure would result in reduced on-site risks for emergency response and safety management.	Short-Term: No impact. Long-Term: No impact.
Air Quality	Short-Term: Minor and intermittent impacts at regional and local scale from particulate matter and engine exhaust emissions generated during construction activities. Long-Term: No adverse impacts	Short-Term: Minor and intermittent impacts at regional and local scale from particulate matter and engine exhaust emissions generated during construction activities. Long-Term: No adverse impacts	Short-Term: Minor and intermittent impacts at regional and local scale from particulate matter and engine exhaust emissions generated during construction activities. Long-Term: No adverse impacts	Short-Term: No impact. Long-Term: No impact.
Noise	Short-Term: Minor on-site impacts on ambient noise from construction activities. Impacts would be minor because these activities would be carried out during normal working hours.	Short-Term: Minor on-site impacts on ambient noise from construction activities. Impacts would be minor because these activities would be carried out during normal working hours.	Short-Term: Minor on-site impacts on ambient noise from construction activities. Impacts would be minor because these activities would be carried out during normal working hours.	Short-Term: No impact.

Table 2-9. Summary of Potential Impacts for NASA JPL, TMF, and GDSCC

Issue	Proposed Action			No Action Alternative
	NASA JPL	TMF	GDSCC	
	Long-Term: No adverse impacts.	Long-Term: No adverse impacts.	Long-Term: No adverse impacts.	Long-Term: No impact.
Geology and Soils	Short-term: Negligible adverse impacts on soils during construction. Long-term: Negligible adverse impacts on local geology and soils at the site, but no affects on regional geology. No adverse impacts to natural hazards or effects on site's pre-existing seismic conditions.	Short-term: Negligible adverse impacts on soils during construction. Long-term: Negligible adverse impacts on local geology and soils at the site, but no affects on regional geology. No adverse impacts to natural hazards or effects on site's pre-existing seismic conditions.	Short-term: Negligible adverse impacts on soils during construction. Long-term: Negligible adverse impacts on local geology and soils at the site, but no affects on regional geology. No adverse impacts to natural hazards or effects on site's pre-existing seismic conditions.	Short-Term: No impact. Long-Term: No impact.
Water Resources	Short-Term: Minor adverse impact on surface water and groundwater, and negligible effect on floodplains during construction. Erosion and sedimentation controls would be implemented as a BMP. Long-Term: No adverse impacts.	Short-Term: Minor adverse impact on surface water and groundwater, and no effect on floodplains during construction. Erosion and sedimentation controls would be implemented as a BMP. Long-Term: No adverse impacts.	Short-Term: Minor adverse impact on surface water and groundwater, and negligible effect on floodplains during construction. Erosion and sedimentation controls would be implemented as a BMP. Long-Term: No adverse impacts.	Short-Term: No impact. Long-Term: No impact.
Biological Resources	Short-term: Negligible impact on vegetation as the proposed activities would take place on previously disturbed areas with no naturally occurring vegetation. Negligible impact on wildlife as NASA JPL does not provide suitable habitat, the current land use would not change, and proposed activities are not in close enough proximity to any T&E species to generate noise-related effects. Long-term: No adverse impacts.	Short-term: Minor adverse effects on vegetation and wildlife habitat during construction activities. Long-term: No adverse impacts.	Short-term: Minor adverse effects on vegetation and wildlife habitat during construction activities. Long-term: No adverse impacts.	Short-Term: No impact. Long-Term: No impact.

Table 2-9. Summary of Potential Impacts for NASA JPL, TMF, and GDSCC

Issue	Proposed Action			No Action Alternative
	NASA JPL	TMF	GDSCC	
Threatened, Endangered, and Sensitive Species	Short-Term: Negligible adverse impacts Long-Term: No adverse impact.	Short-Term: Negligible adverse impacts from loss of foraging habitat during construction and from construction-related noise that could disturb transient bird species. Localized effects on sensitive plant species due to proximity to construction sites. Long-Term: No adverse impact.	Short-Term: Negligible adverse impacts Long-Term: No adverse impact.	Short-Term: No impact. Long-Term: No impact.
Cultural Resources	Short-Term: Minor adverse impacts from the potential removal of, or alteration to, a National Register of Historic Places-eligible structure. Proposed mitigation will be addressed in a Programmatic Agreement and Cultural Resources Management Plan approved by the CA State Historic Preservation Office. Long-Term: No adverse impact.	Short-Term: No adverse impacts. Proposed mitigation will be addressed in a Programmatic Agreement and Cultural Resources Management Plan approved by the CA State Historic Preservation Office. Long-Term: No adverse impact.	Short-Term: No adverse impacts. Proposed mitigation will be addressed in a Programmatic Agreement and Cultural Resources Management Plan approved by the CA State Historic Preservation Office. Long-Term: No adverse impact	Short-Term: No impact. Long-Term: No impact.
Hazardous Materials and Waste Hazardous Materials	Short-Term: Negligible impact. Hazardous materials used during construction would not be expected to increase. Long-Term: Negligible adverse impact, as hazardous materials used would not be	Short-Term: Negligible impact. Hazardous materials used during construction would not be expected to increase. Long-Term: Negligible adverse impact, as hazardous materials used would not be expected to increase. Procurement of	Short-Term: Negligible impact. Hazardous materials used during construction would not be expected to increase. Long-Term: Negligible adverse impact, as hazardous materials used would not be expected to increase.	Short-Term: No impact. Long-Term: No impact.

Table 2-9. Summary of Potential Impacts for NASA JPL, TMF, and GDSCC

Issue	Proposed Action			No Action Alternative
	NASA JPL	TMF	GDSCC	
Hazardous Waste	expected to increase. Procurement of products containing hazardous materials would be comparable to those currently used. Short-Term: Minor adverse impacts from hazardous and chemical wastes generated from facility demobilization and demolition. Long-Term: Negligible adverse impact, as volume, type, classifications, and sources of hazardous wastes would be similar in nature with the baseline condition waste streams.	products containing hazardous materials would be comparable to those currently used. Short-Term: Minor adverse impacts from hazardous and chemical wastes generated from facility demobilization and demolition. Long-Term: Negligible adverse impact, as volume, type, classifications, and sources of hazardous wastes would be similar in nature with the baseline condition waste streams.	Procurement of products containing hazardous materials would be comparable to those currently used. Short-Term: Minor adverse impacts from hazardous and chemical wastes generated from facility demobilization and demolition. Long-Term: Negligible adverse impact, as volume, type, classifications, and sources of hazardous wastes would be similar in nature with the baseline condition waste streams.	Short-Term: No impact. Long-Term: No impact.

3.0 AFFECTED ENVIRONMENT

This section describes the existing conditions at NASA JPL, TMF, and GDSCC. Much of the information used to develop this section has been obtained from either the NASA JPL Environmental Resource Documents (ERDs) or the NASA JPL Master Plan Updates for the individual facilities.

3.1 NASA JPL

3.1.1 Land Use

This section describes regional land use and facility land use in and around NASA JPL. Future expansion at NASA JPL is limited by local topography and surrounding regional land use.

3.1.1.1 Regional Land Use

The primary land use near NASA JPL is residential along with undeveloped areas of the ANF to the north. The communities of La Cañada Flintridge, Pasadena, and Altadena surrounding NASA JPL to the west, south, and east, respectively, are predominantly low density, single family residences. The ANF is largely undeveloped and improved with hiking/equestrian trails and service roads. No state forests or parks exist in the surrounding area.

There are no industrial land uses near NASA JPL. The Arroyo Seco adjacent to NASA JPL, which serves as a flood control reservoir, is currently used for spreading basins and recreational facilities. Other specialized land uses adjacent to NASA JPL include equestrian riding clubs, a USFS facility ranger station, and a LACFD facility. The southernmost 121.4 ha (300 ac) of the Upper Arroyo Seco are operated as the HWP. The lower eastern portion of the HWP area is comprised of a sediment plain located upstream of the Devil’s Gate Dam. It also contains Johnson Field, which is used for softball games, group picnics, and related activities. The western portion of the HWP area contains HWP (formerly Oak Grove Park). This area is dominated by passive recreation uses, water conservation, and flood control activities. The entire basin is designated as Open Space in the Land Use Element of the City of Pasadena Comprehensive General Plan.

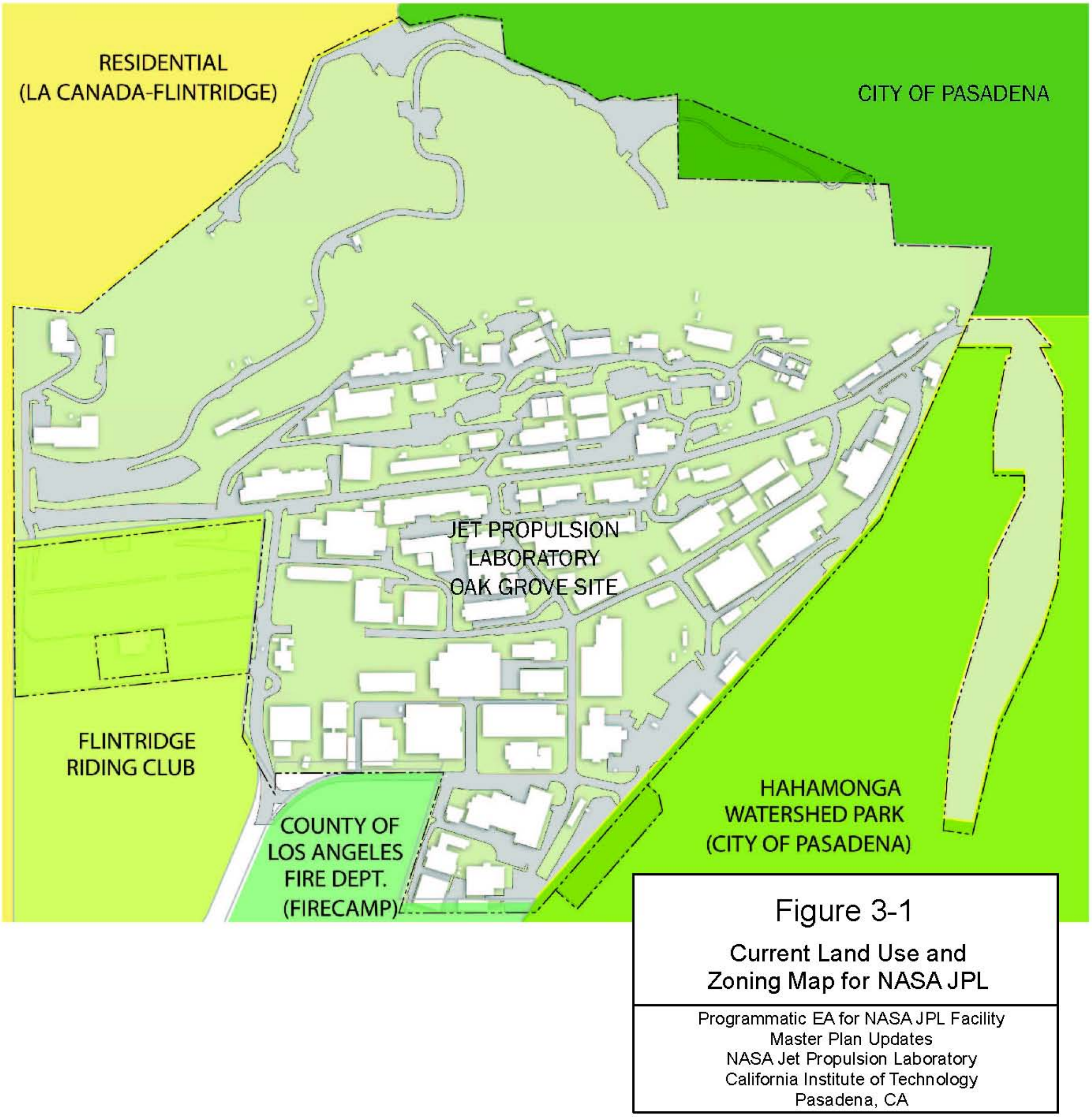
The closest commercial land use to NASA JPL lies several miles away in the Foothill Boulevard corridor between Crown Avenue and Oak Grove Drive. Development in this area caters to local residents with commercial establishments including gas stations, grocery stores, dry cleaners, etc. Stores fronting on sidewalks have limited setbacks, off-street parking, and limited landscaping. The prominent educational facility in the region is Caltech, which manages JPL for NASA. The Art Center College of Design and Occidental College are two other fairly well known schools in the area. Cultural and entertainment resources include the Rose Bowl, the Norton Simon Museum, the Huntington Library, Descanso Gardens, and the Los Angeles Arboretum.

3.1.1.2 Facility Land Use

Buildings and Structures

NASA JPL consists of 138 buildings and other minor ancillary structures, totaling over 233,000 gross sq m (2.5 million gross sq ft) in area (See **Appendix B**). An analysis of space type distribution shows that the large majority of component types is office and laboratory space. Laboratory space includes some areas of ‘computational laboratory space that resembles office work space except for its needs for particular kinds of utilities and services. The balance of space is comprised of technical facilities and shops, which typically have lower occupancies than office space. Approximately eighty-five percent of NASA JPL personnel are housed in office-type space.

Figure 3-1. Current Land Use and Zoning Map for NASA JPL



Source: JPL Oak Grove Master Plan Update 2011-2032, March 2011

That ratio is expected to grow in the coming years as computational analysis and simulation supplants other work modes, and as increasing amounts of NASA JPL work is performed off-Lab by contractors, affecting a shift in JPL personnel responsibilities more in the direction of project management.

Facility Amenities and Recreation

JPL offers employees services and amenities at locations throughout the facility. These include three major food service facilities (in Buildings 167, 190, and 303) a coffee kiosk in Mariner Mall, and a variety of vending machine clusters across the facility. There is also an outlet of the Caltech Employees' Credit Union (Building

218) and at least one ATM, several small gyms and fitness facilities, shared video-conferencing and teleconferencing facilities, training facilities, a library, and one outdoor basketball court (currently at Building 317). “Child care is available at a private facility near La Cañada High School. These services are comparable to those provided at other NASA Centers, as well as with comparable industries in California and the U.S. Although not directly tied to the NASA mission at JPL, they help employee morale, recruitment and retention.

The condition, scale, and location of these services are not to the highest standard. Many of the services, such as fitness facilities, are located in basements and rears of buildings. Food facilities are not strategically placed to capture employees. The off-site location of child care is inconvenient for employees to use. Conference facilities are short in supply, distributed inconveniently, and are inadequately sized.

The surrounding communities of Pasadena, La Cañada, and Altadena have ample recreation and cultural facilities for residents and visitors alike. Recreational opportunities are such that a tourist-based economy in the area has continued to increase steadily. No recreation opportunities exist within the project area.

3.1.2 Socioeconomics

3.1.2.1 Population and Demographics

Current population data for the project area was gathered from the 2000 Census and the 2006–2008 American Community Survey. Census numbers do not reflect NASA JPL population, as there is no residing human population. NASA JPL lies within the boundaries of La Cañada Flintridge and Pasadena, in Los Angeles County. According to the U.S. Census Bureau, the County had a population of 9,519,338 at the time of the 2000 census. The estimated population for 2006 was 9,948,081, which represents a 4.5 percent increase since 2000. According to the California Department of Finance, Los Angeles County had a population of 10,393,185 in January, 2010 which represents a 9.7 percent increase since 2000 (State of California Department of Finance, May 2010).

In the 2000 Census, 95.1 percent of respondents reported themselves as being one race, while 4.9 percent reported being of two or more races. Of the respondents who reported as one race, 48.7 percent were listed as White, 9.8 percent as Black or African American, 0.8 percent as American Indian and Alaska Native, 11.9 percent as Asian, 0.3 percent as Native Hawaiian and Other Pacific Islander, and 23.5 percent as Some Other Race. The study area for the socioeconomic analysis represents an 8-km (5-mi) radius around the proposed project and includes:

- Altadena – Census Tracts 4603.01. 4603.02, and 4610
- Pasadena – Census Tract 4604
- La Cañada Flintridge – Census Tracts 4605.01, 4605.02, and 4607

Census tracts are defined by the U.S. Census Bureau as small, relatively permanent statistical subdivisions of a county. The primary purpose of census tracts is to provide a stable set of geographic units for the presentation of decennial census data, in this case the 2000 U.S. Census. The spatial size of census tracts varies widely depending on the density of the settlement.

Population expansion is an enduring characteristic in Los Angeles County and California as a whole. With a projected rate of increase of 5.2 percent per year, the county is expected to reach 10,983,900 people during 2015. The largest demographic in the County is of White or Non-Hispanic origin. However, per the California

Department of Finance Demographic Research Unit, it is expected that the Hispanic or Latino population will be the largest demographic by 2050 (State of California Department of Finance Demographic Research Unit, 2007).

According to the U.S. Census Bureau, the population of Pasadena, California, during 2000 was 133,936 people, which per the California Department of Finance, increased 13.8 percent to 151,576 people in 2005. This makes it the seventh largest city in Los Angeles County. Pasadena is ethnically diverse and well educated with 41.3 percent of people age 25+ having a Bachelor's degree or higher, compared to 26.6 percent of persons in the State of California. The largest demographic is White persons (53.4 percent), followed by persons of Hispanic or Latino origin (33.4 percent), Black or African American persons (14.4 percent), Asian persons (10.0 percent), persons with two or more races (5.4 percent), American Indians or Alaska Native persons (0.7 percent), and Native Hawaiian and other Pacific Islander (0.1 percent).

The unincorporated area of Altadena had a population of 42,610 people in 2000, which increased 2.5 percent to 43,667 people on 2008. The majority of the population demographic consists of Non-Latino/White persons which constitute 47.3 percent of the population.

The City of La Cañada Flintridge had an estimate population of 20,318 people in 2000 which increased only slightly to 20,773 people in 2008. The largest demographic is Non-Latino/White, which is 71.4 percent of the total population. The second largest demographic is Asian, which is 25.4 percent of the population. The residents of La Cañada Flintridge are well educated with 63.5 percent of persons processing a Bachelor's degree or higher. **Table 3-1** presents the racial and ethnic characteristics for the study area, including Los Angeles County, Altadena, Pasadena, and La Cañada-Flintridge.

Table 3-1. Social Characteristics of NASA JPL Study Area and County - Race & Ethnicity (2000)

Area	Total Population	Percentage of Population by Race & Ethnicity						
		Non-Latino White Alone	Black or African American Alone	American Indian or Alaska Native Alone	Asian Alone	Native Hawaiian or Other Pacific Islander Alone	Two or More Races	Hispanic or Latino (regardless of race)
Altadena (Census Tracts 4603.01, 4603.02, and 4610)	42,610	47.3%	31.4%	0.6%	4.2%	0.1%	6.1%	20.4%
Pasadena (Census Tract 4604)	133,936	53.4%	14.4%	0.7%	10.0%	0.1%	5.4%	33.4%
La Cañada Flintridge (Census Tracts 4605.01, 4605.02, and 4607)	20,318	74.5%	0.4%	0.2%	20.6%	0.0%	3.3%	4.8%
Los Angeles County	9,519,331	48.7%	9.8%	0.8%	11.9%	0.3%	4.9%	44.6%

Source: U.S. Census Bureau, Race and Ethnicity 2000 data.
Note: Data may not add up to 100 percent because persons may report more than one racial category.

EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks,* requires Federal agencies, to the extent permitted by law and mission, to identify and assess environmental health and safety risks that might disproportionately affect children. The EO further requires Federal agencies to ensure that their policies, programs, activities, and standards address these disproportionate risks. The order defines environmental health and safety risks as "risks to health or to safety that are attributable to products or substances that the child is likely to come in contact with or ingest (such as the air we breathe, the food we eat, the water we drink and use for recreation, the soil we live on, and the products we use or are exposed to)." Such information aids in evaluating whether a proposed action would render vulnerable children targeted for protection in the EO.

3.1.2.2 Economy/Employment

There are 5,544 full time JPL employees (Caltech) at JPL (Chirino, 2010a). In addition, 4,752 non- JPL, service and contract personnel are assigned to JPL. Approximately 65 percent of employees live within a 10-mile radius of NASA JPL. Most employees reside in Los Angeles County, with some residing in Orange, San Bernardino, and Riverside Counties. The composition of the staff is diverse, as minorities represent 33 percent of the labor force, while female employment makes up 30 percent of the population. Professional and technical staff account for 69 percent of the staff. Almost 27 percent of California's population lives in Los Angeles County. The median household income in Los Angeles County was $46,452 in 1999 which increased to $55,452 in 2008 (U.S. Census Bureau, 2000 and American Community Survey, 2008). See Section 3.1.3.2 for median household incomes in Pasadena, La Cañada Flintridge, and the unincorporated area of Altadena.

The 1999 median household income in Pasadena was $46,012, which increased 39.5 percent to $64,184 in 2008 (U.S. Census Bureau, 2000). NASA JPL is Pasadena's top employer with 4.9 percent of the total city employment. The Pasadena City College and the Huntington Memorial Hospital follow at 3.3 percent of the total city employment (City of Pasadena, 2008). In 1999, 11.6 percent of families and 15.9 percent of individuals were living below the poverty line. In 2008, these percentages decreased slightly with 10.5 percent of families and 13.6 percent of individuals living in poverty (U.S. Census Bureau, 2008).

La Cañada Flintridge ranks 18th in a list published by www.forbes.com of the most affluent cities in the U.S. The median household income increased from $109,989 in 2000 to $140,474 in 2008. There are very few people living below the poverty level that reside in La Cañada Flintridge with only 2.1 percent of families and 2.9 percent of individuals falling below the poverty line (U.S. Census Bureau, 2000 and 2008). See Section 3.3.1 for low income and poverty levels in 2000 for Altadena, Pasadena, and La Cañada Flintridge. The median household income in Altadena in 2000 was $60,549, which increased 42.7 percent to $86,384 in 2008. In 2000, 7.4 percent of families and 10.6 percent of individuals lived below the poverty line. These percentages decreased in 2008 to 5.5 percent of families and 8.1 percent of households (U.S. Census Bureau, 2000 and 2008).

3.1.2.3 Housing

Private residential areas surround NASA JPL, and the area is predominately zoned Single Family Residential, although the land to the east is mostly ANF land. Although the cost of living index in L.A. County is very high (153.6) compared to the U.S. average (100), the median price of houses has drastically decreased since 2007. According to the Los Angeles Almanac, the median home sale price in 2008 was approximately $360,000 (Los Angeles Almanac, 2008). In 2000, there were 54,114 housing units in Pasadena, with an average of 2.5 persons per household. The median value of a home in Pasadena in 2000 was $286,400 and about 45.8 percent of residents were homeowners. Of the housing units, 28,111 were rental properties with monthly rent charges between $500.00 -$749.00 (U.S. Census Bureau, 2000). The median home value in Pasadena increased in 2008 to $685,200 (U.S. Census Bureau, 2008).

There were 15,250 housing units in the unincorporated area of Altadena in 2000, which increased to 15,340 housing units in 2008. The median home value in 2000 was $261,000 which increased to $674,100 in 2008 (U.S.

Census Bureau, 2000 and 2008). The median home value in La Cañada Flintridge in 2000 was $587,800, which increased 70.1 percent to $1,000,000 in 2008. There were 7,133 housing units and only 8.52 percent of the units were classified as rental properties in 2008. This is substantially lower than the U.S. renter occupied unit percentage of 32.9 percent.

3.1.3 Environmental Justice

This section describes existing conditions for environmental justice in the NASA JPL area. EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* [Federal Highway Administration (FHWA) 1998], requires that all Federal agencies address the effects of policies on minorities and low-income populations and communities, and to ensure that there would be no disproportionately high and adverse human health or environmental effects to minority or low-income populations or communities in the area. A "minority" is defined as a person who is Black, Hispanic (regardless of race), Asian American, American Indian, and/or Alaskan Native. "Low-income" is defined as a household income at or below the U.S. Census Bureau Poverty Threshold (FHWA, 1998).

A screening analysis using U.S. Census Bureau racial and economic information catalogued by Census Tract and Block Group for 2000 was used to identify low income and minority populations in the communities of Altadena, Pasadena, and La Cañada Flintridge. The following census tracts, within an 8 km (5-mi) radius of NASA JPL, were used to determine the minority or low-income households that could be affected by the proposed action:

- Altadena – Census Tracts 4603.01. 4603.02, and 4610
- Pasadena – Census Tract 4604
- La Cañada Flintridge – Census Tracts 4605.01, 4605.02, and 4607

3.1.3.1 Minority Populations

A minority population is defined as an identifiable group of minority persons who live in geographic proximity, or are geographically dispersed or transient persons who will be similarly affected by a proposed program, policy, or action (FHWA 1998). Minority populations residing in the study area were compared to population characteristics of the city and state. The CEQ guidance states that "minority populations should be identified where either (a) the minority population of the affected area exceeds 50% or (b) the population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographical analysis."

As depicted in **Table 3-2**, only census tracts in Altadena and Pasadena meet the definition of a minority population; none were found in the community of La Cañada Flintridge. Census Tracts 4603.01, 4603.02, 4610, and 4604 would be areas of potential Environmental Justice concern due to minority populations.

3.1.3.2 Low-Income Populations

Low-income status was based upon comparing the income of the project site and larger study area residential population to the U.S. Census Bureau Poverty Threshold (U.S. Census Bureau, Housing and Household Economic Statistics Division, 2000). CEQ guidelines do not specifically state the percentage considered meaningful in the case of low-income populations. "Low-income populations" is defined by the U.S. Department of Housing and Urban Development (HUD) as populations where "50% or greater are low-income individuals."

Table 3-2. NASA JPL Study Area Minority Populations (2000)

Census Tract	Population Total	American Indian	Black	Hispanic	Asian	Total Minority
Altadena						
4603.01	4,515	12 (0.3%)	2,196 (48.6%)	697 (15.4%)	163 (3.6%)	3,068 (68%)
4603.02	4,303	7 (0.2%)	2,251 (52.3%)	1,322 (30.7%)	91 (2.1%)	3,671 (85.3%)
4610	6,000	27 (0.5%)	2,636 (43.9%)	2,512 (41.9%)	191 (3.2%)	5,366 (89.4%)
Pasadena						
4604	886	2 (0.2%)	439 (49.5%)	223 (25.2%)	64 (7.2%)	728 (82.2%)
La Cañada Flintridge						
4605.01	5,560	7 (0.1%)	22 (0.4%)	217 (3.9%)	1,355 (24.4%)	1,601 (28.8%)
4605.02	4,430	5 (0.1%)	0	187 (4.2%)	1,010 (22.8%)	1,202 (27.1%)
4607	5,202	1 (0.01%)	28 (0.5%)	325 (6.2%)	867 (16.7%)	1,221 (25.5%)

Source: U.S. Census Bureau 2000 data.

Census data (2000) were reviewed to determine the number of persons from each census tract within a 8 km (5-mi) radius that are low-income individuals, living below the poverty level. **Table 3-3** provides low-income and poverty level data for Altadena, Pasadena, and La Cañada Flintridge, respectively.

Table 3-3. NASA JPL Study Area Low Income and Poverty Levels (2000)

Census Tract	Population Total	Median Household Income	% of Median Household Income	Persons Below Poverty Level
Altadena				
4603.01	4,515	$63,681	105.1%	195 (4.3%)
4603.02	4,303	$42,090	69.5%	256 (5.9%)
4610	6,000	$40,517	66.9%	641 (10.7%)
Pasadena				
4604	886	$48,977	106.4%	68 (7.7%)
La Cañada Flintridge				
4605.01	5,560	$112,286	102.1%	117 (2.1%)
4605.02	4,430	$100,213	91.1%	103 (2.3%)
4607	5,202	$133,246	121.4%	167 (3.2%)

The number of people over the age of 18 living below the poverty level was divided by the number of people in the census tract to obtain the percent of people living in poverty. The data shown in **Table 3-3** demonstrates that low income individuals do reside within the surrounding community. However, the percentages in the potentially affected census tracts are well below the 50 percent required to be considered a "low-income population" as defined by HUD guidelines.

3.1.4 Traffic and Transportation

The environmental analysis includes consideration of the existing roadway and circulation system in the NASA JPL area, and whether the Proposed Action would increase the traffic generated on the facility. Transit and parking considerations are also included in the analysis.

3.1.4.1 Regulatory Framework

This regulatory framework describes the state and local statutes and regulations that establish the standards of transportation and circulation. It must be considered by NASA JPL when rendering decisions on projects that include construction, operation, or maintenance activities that have the potential to affect traffic and circulation.

State

State statute requires that a Congestion Management Program (CMP) be developed, adopted, and updated biennially for every county that includes an urbanized area and shall include every city and the county government within that county. Since the CMP became effective in 1990, it has forged new ground in linking transportation, land use, and air quality decisions for one of the most complex urban areas in the country. The program is intended to address local growth impacts on the regional transportation system and is addressed as part of the traffic analysis. On August 18, 2010, the Los Angeles County Draft CMP was released for public comment. The Draft CMP summarizes the results of 18 years of CMP highway and transit monitoring and 15 years of monitoring local growth.

Regional

The Government Code also recognizes the need for transportation and mobility planning to consider regional transportation issues. Therefore, various provisions of the Mobility Element address efforts to coordinate NASA JPL transportation improvements with improvements to the regional transportation network. In addition, the Mobility Element discusses the need for coordination between the various regional transportation agencies, including the State of California Department of Transportation (Caltrans), Los Angeles Department of Transportation (LADOT), Foothill Transit, County of Los Angeles Metropolitan Transit Authority (LACMTA), and adjoining municipal jurisdictions within the County of Los Angeles.

3.1.4.2 Street System

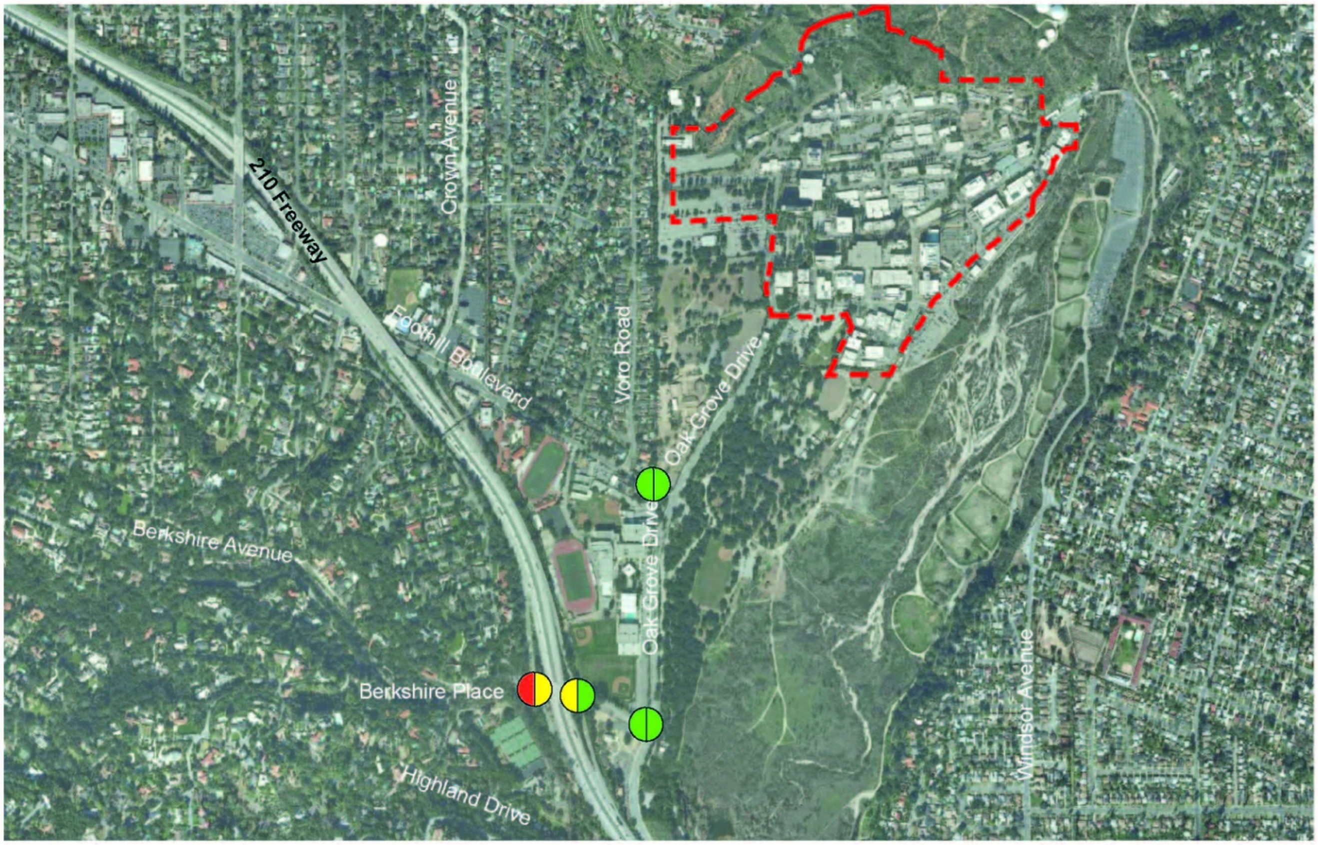
NASA JPL is served by a transportation system that connects it to regional freeways and a local roadway system (**Figure 3-2**).

Regional

The US Interstate 210 Foothill Freeway is a limited access east-west freeway facility, which provides regional access to NASA JPL from the San Fernando Valley to the northwest, and the San Gabriel Valley and Inland Empire to the east. In the vicinity of NASA JPL, the I-210 freeway has four mixed-flow travel lanes in each direction. The Berkshire Avenue/Oak Grove Drive exit provides the most direct access to the Center from both the eastbound and westbound traffic routes (AC Martin 2011).

State Route (SR) 134 (Ventura Freeway) is an east-west freeway that connects Pasadena with the San Fernando Valley to the west. The Ventura Freeway is located to the south of NASA JPL. Additional regional access is provided via SR 2 (Glendale Freeway) located west of NASA JPL. In the project vicinity, four mixed-flow travel lanes and one high occupancy vehicle lane are provided in each direction on the Ventura Freeway. An interchange with the Foothill Freeway is located southeast of the Center.

Figure 3-2. Major Traffic Routes to NASA JPL



OFF-LAB ROADWAY LEVEL OF SERVICE				
INTERSECTION	EXISTING LEVELS OF SERVICE (LOS)			
	AM PEAK HOUR		PM PEAK HOUR	
	ICU OR DELAY	LOS	ICU OR DELAY	LOS
Oak Grove Drive & Foothill Boulevard	0.687	B	0.704	C
Oak Grove Drive & Berkshire Place	0.790	C	0.644	B
I-210 Westbound Ramps & Berkshire Place	28.5	D	12.5	B
I-210 Eastbound Ramps & Berkshire Place	72.2	F	28.6	D

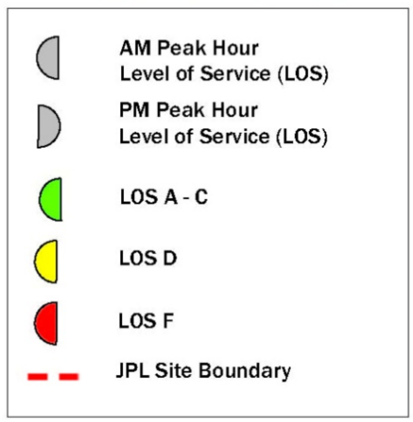


Figure 3-2

Major Traffic Routes to NASA JPL

Programmatic EA for NASA JPL Facility Master Plan Updates
NASA Jet Propulsion Laboratory
California Institute of Technology
Pasadena, CA

Source: JPL Oak Grove Master Plan Update 2011-2032, 2011

Notes: ICU=Intersection Capacity Utilization; LOS=Level of Service

Local

The principal arterial road providing access to the main entrance of NASA JPL is Oak Grove Drive along the western limits of the facility. Oak Grove Drive has a total average weekday traffic count of approximately 9,308 vehicles per day (vpd) near the Main Gate. It is a four-lane road with no parking and limited sidewalks. The primary arterial feeders to Oak Grove Drive are Foothill Boulevard, the Foothill Freeway eastbound and westbound ramps, and Berkshire Place. Oak Grove Drive provides access to the primary parking facilities used by employees, visitors, and service vehicles. Foothill Boulevard is designated as a primary arterial west of Crown Avenue, and a major arterial east of Crown Avenue (AC Martin 2011). There is one westbound lane and two eastbound lanes on Foothill Boulevard near the NASA JPL Main Gate. Berkshire Place is a major arterial with two travel lanes in each direction (AC Martin 2011). There are no parking facilities along Berkshire Place.

Access to the East Gate and the south end of the Arroyo Parking Lot is provided via Windsor Avenue. Windsor Avenue provides one travel lane in each direction, plus a separate left turning lane at intersections (JPL Master Plan, 2003). In 2008, the total average weekday traffic count south of the Arroyo parking lot was 5,963 vpd. The total average weekday traffic count north of the Arroyo Parking Lot at the East Gate was approximately 2,583 vpd (KOA Corporation, 2008). Windsor Avenue is primarily residential in nature in the vicinity of NASA JPL.

Bicycle Facilities

The "Mobility Element" of the City of Pasadena General Plan emphasizes the increased use of bicycling and walking within the City. The City has adopted a policy to make Pasadena a place where bicycling and walking are encouraged, where all streets are bikeways, and where safety, education, and facilities are provided as a part of transportation and recreational planning and programs. A bikeway runs from South Pasadena to Oak Grove Park and connects to bicycle lanes on Oak Grove Drive. On-street bicycle lanes are provided north of Foothill Boulevard and south of Berkshire Place (AC Martin 2011).

3.1.4.3 Traffic Generation and Circulation

Morning traffic and afternoon congestion is common on Foothill Boulevard between Crown Avenue and Oak Grove Drive. Much of the congestion is a result of two private high schools, a public high school, an elementary school, and NASA JPL being in the same vicinity. A study of on-site and off-site transportation existing conditions at NASA JPL in 2010 (AC Martin 2011) calculated the intersection level of service (LOS) for major intersections near NASA JPL (**Figure 3-2**). LOS classifications rate traffic as follows:

Level of Service	General Description
A	• Little to no congestion or delays
B	• Limited congestion. Short delays
C	• Some congestion with average delays
D	• Significant congestion and delays
E	• Severe congestion and delays
F	• Total breakdown with extreme delays

The traffic study found that the intersection of I-210 eastbound ramp/Berkshire Place was operating at a LOS F during morning rush hour. I-210 westbound ramp/Berkshire Place was operating at a LOS D during morning rush hour. For the evening rush hour, the I-210 eastbound ramp/Berkshire Place was operating at a LOS D. All other intersections in the NASA JPL area were operating at LOS B to C under both the morning and afternoon peaks.

Some traffic congestion occurs at the gates, especially when visitors and deliveries mix with personnel entering the facility (Boyle, 1988), during high security, and during high-profile media events. On-site traffic is limited at

NASA JPL because of security checkpoints with no public thoroughfare. On-site vehicle circulation is provided by two-lane roads through the central core areas of NASA JPL. On-site traffic volumes are depicted in **Table 3-4**. Traffic is limited at NASA JPL because of the limited parking and facility access, and the physical size of the roads. Roads serving the northern portion of the Lab are steep and winding, making transportation of large or sensitive equipment challenging and time sensitive.

A variety of delivery and haul truck trips serve NASA JPL daily, and circulation is managed to avoid peak traffic and full parking associated with daily Lab operations. For example, liquid nitrogen (LN) is delivered daily by an approximately 20-m (65-ft) truck and trailer. There are multiple LN tanks at NASA JPL that require the truck to navigate through the Lab, making between one and seven stops. Delivery is scheduled between 6 and 10pm to minimize disruption to on-site traffic circulation (AC Martin 2011).

Table 3-4. NASA JPL Existing Traffic Volumes

Segment	Peak Volume		
	Weekday	AM Peak Hour	PM Peak Hour
East Parking Lot	6,137	966	961
Explorer Road (near northern gate)	2,941	445	338
Oak Grove Drive (near main gate)	9,967	1,094	1,083
Forestry Camp Road	3,227	421	353
Ranger Road (south of West Lot)	8,063	932	941
Ranger Road (adjacent to West Lot)	3,455	312	340
Mesa Road (adjacent to telecom facility)	500	130	48

Source: JPL Oak Grove Master Plan Update 2011-2032, 2011

3.1.4.4 Mass Transit

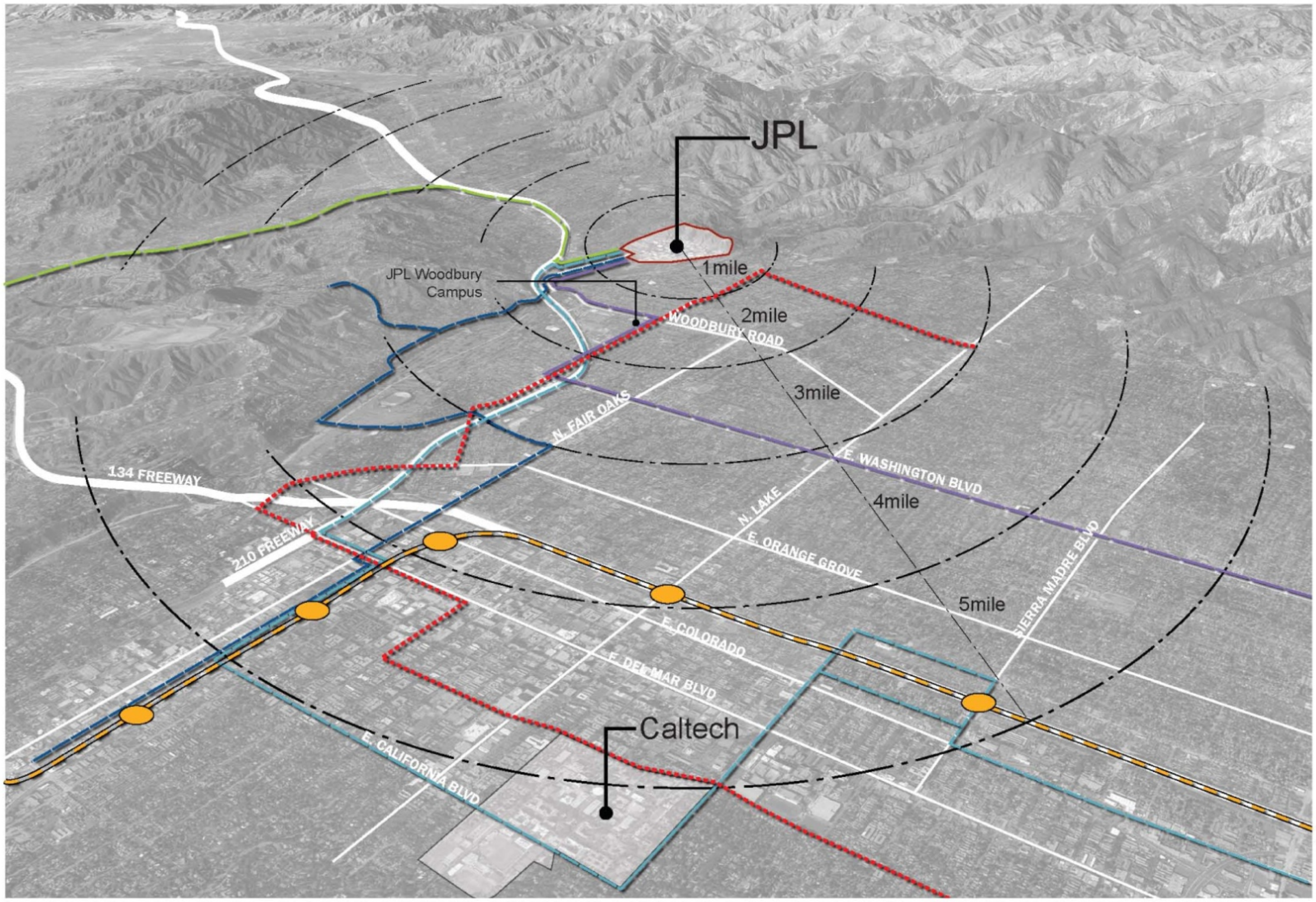
Public Transportation

The following public transit lines serve NASA JPL, and are operated by LACMTA, Pasadena Area Rapid Transit (ARTS) and the City of Glendale (Beeline): Metro 177; Metro 268; Pasadena ARTS Bus Line 51/52; Glendale Beeline 3; JPL-Woodbury Shuttle; and JPL Shuttle. Lines servicing the Center pick up and drop off passengers at the bus stop located at the Oak Grove Drive entrance. The transit lines are depicted in **Figure 3-3** and described in more detail in **Table 3-5.**

JPL Shuttle - The JPL shuttle bus system is a direct interface between regional public transportation, publicly used facilities, and on-site transit. The service transports employees between the East Parking Lot and employee workstations along a perimeter route (i.e., Support Bus). The buses run every 20 minutes from 7:00 AM to 9:00 AM and 3:00 PM to 5:00 PM (JPL 2008). Two buses remain in use throughout the day, one for on-lab transport and one for off-lab transport. Passengers board at stops located in the parking areas and along internal streets.

Buses take 10 to 15 minutes to circulate around the core of NASA JPL. Travel time from the East parking area to bus stops along the route takes approximately 5 to 10 minutes depending on the distance traveled on the bus. The time an employee spends in transit from when they leave their vehicle in the East parking area may be lengthy as buses may be full and pass by waiting passengers and/or a recent departure of a bus. Parking bus service stops at, but does not circulate through, the West parking area. Few stops have shelters and/or benches.

Figure 3-3. Transit and Transportation Lines in the Area Surrounding NASA JPL



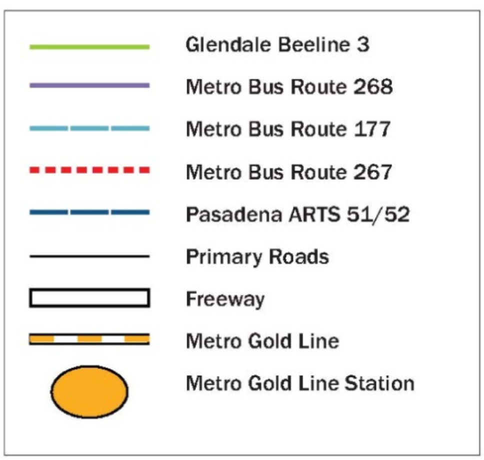


Figure 3-3

Transit and Transportation Lines in the Area Surrounding NASA JPL

Programmatic EA for NASA JPL Facility Master Plan Updates
NASA Jet Propulsion Laboratory
California Institute of Technology
Pasadena, CA

Source: JPL Oak Grove Master Plan Update 2011-2032, 2011

Table 3-5. Transit Access to NASA JPL

Route	Service Type	Destinations Served	Operating Hours	Approximate Headways (min.)
Metro 177	Local	JPL, Old Town Pasadena, Caltech, City College, Metro Gold Line	5:30 AM – 6:35 PM	AM: 20 MD: 60 PM: 20
Metro 268	Local	JPL, El Monte Transit Center, Santa Anita, Metro Gold Line	5:10 AM – 9:50 PM	AM: 30 MD –N/A PM: 30
Pasadena Arts 51/52	Circulator	JPL, Old Town Pasadena, Art Center College of Design, Metro Gold Line	6:20 AM – 7:30 PM	AM: 20 MD: 60 PM: 20
Glendale Beeline 3	Circulator	JPL, Glendale Community College, Glendale Galleria	6:00 AM – 6:30 PM	15-20
JPLWoodbury Shuttle	JPL Shuttle	JPL, Woodbury Building 601	7:10 AM – 5:30 PM	20
JPL Shuttle	JPL Shuttle	NASA JPL,	7:45 AM – 4:00 PM	50

Source: JPL Oak Grove Master Plan Update 2011-2032, 2011

3.1.4.5 Parking

There are 4,425 on- and off-site parking spaces available for employee vehicles at NASA JPL. Parking is limited due to the high density of buildings in the main development area and lack of adequate planning in early stages of the facility's history. The ability to meet parking needs is one of the most serious problems facing NASA JPL.

On-Lab Parking

Approximately 2,075 parking spaces are currently provided on-Lab in a variety of facilities, including surface lots, lots adjacent to buildings, underground parking below some buildings, as well as parking on streets inside the Lab boundaries. Parking facilities are interspersed throughout the Lab, and are served by the on-Lab shuttles.

Priority Parking

On-Lab priority parking is provided for car and van pools. Carpools with three or more persons may park in any "green" hang tag locations. Two person carpools may park in any of the cross-hatched "unassigned parking" areas. Vanpools are given individually reserved parking spaces. Approximately 875 on-Lab parking spaces are priority reserved spaces. Preferential parking is also provided for electric vehicles and CNG and hybrid vehicles.

Off-Lab Parking

The following three off-Lab surface parking lots are leased for NASA JPL use, totaling 2,350 spaces:

- **East Arroyo Lot -** 1,100 surface parking spaces are contained in the East Arroyo Lot, which is currently leased from the City of Pasadena. NASA JPL's lease of the lot extends through 2013. The City of Pasadena has informed NASA JPL that it will not be renewing the lease, as the lot is slated for restoration to its natural environment as part of the HWP master plan. Therefore, this supply will no longer be available for NASA JPL use.

- **West Lot -** 1,030 surface parking spaces are contained in the West Lot, which is currently leased from the Flintridge Riding Club. Because this parking facility is leased, parking supply may not always be available, jeopardizing NASA JPL's ability to provide sufficient parking in the future.

- **East Lot -** The East lot, accessed from Forestry Camp Road, leased from the City of Pasadena, comprises 220 surface parking spaces.

3.1.5 Utilities and Services

The analysis of utilities and services includes a description of the regulatory framework that guides the decision-making process, existing conditions of the proposed project area, thresholds for determining if the proposed project would result in significant impacts, anticipated impacts, and proposed mitigation measures. The current utility infrastructure at NASA JPL includes electrical power, natural gas, fuel oil, water, sanitary sewer, nitrogen and compressed air, telecommunications, and storm sewers.

The utility systems at NASA JPL have been installed incrementally throughout the development of the facility. The current utility infrastructure includes elements spanning its entire history. Some original pipes and equipment date back to the World War II era. The majority of the newer utility systems are buried below grade in a relatively protected environment and their condition is not expected to have changed since construction. NASA JPL has evaluated Federal energy reduction goals and has programs to address these goals. NASA JPL has shown good progress towards these energy reduction goals. **Table 3-6** provides a summary of resource usage through 2007.

Table 3-6. Resource Consumption at NASA JPL

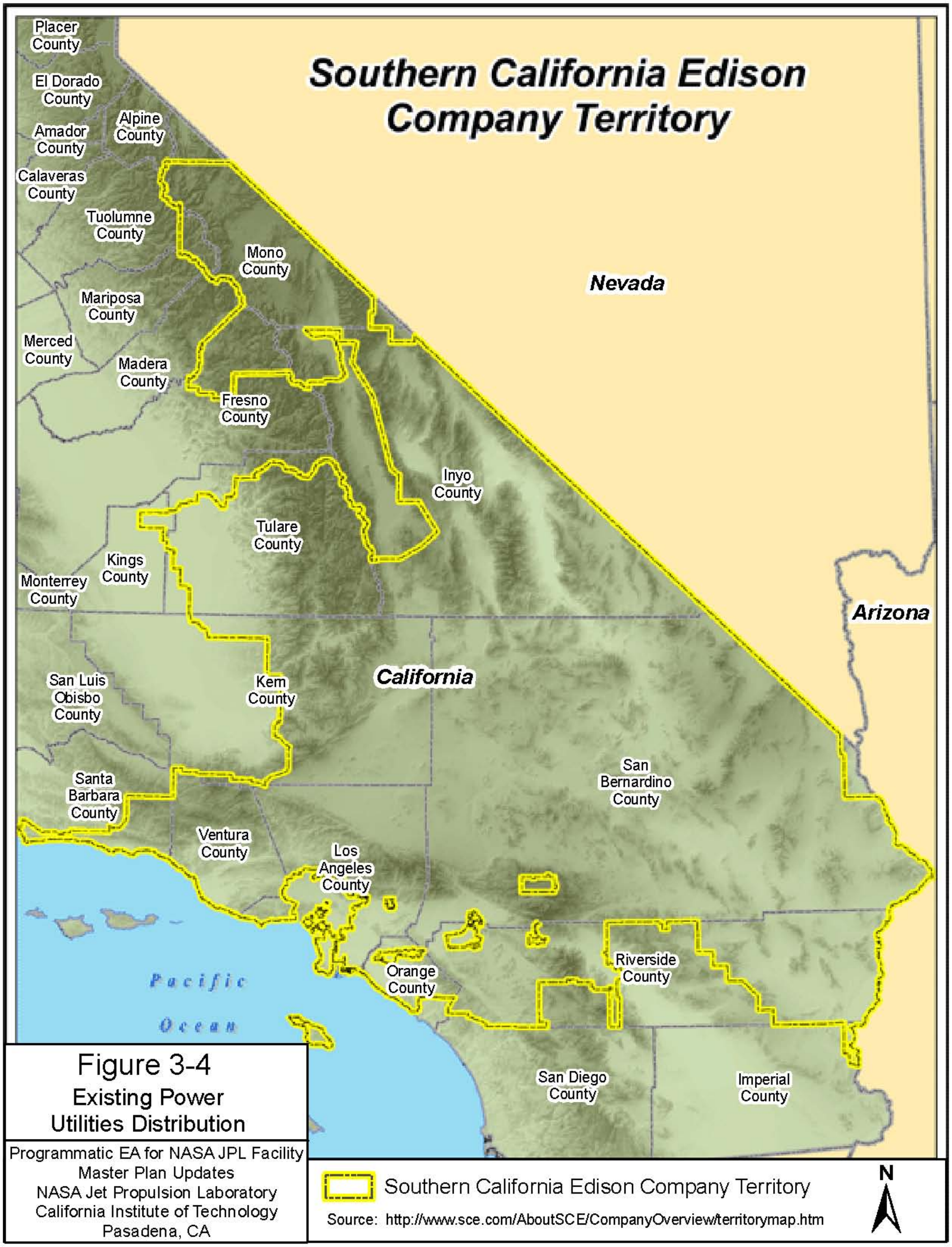
Year	Electricity	Gas (Therms)	Fuel Oil (Gal)	Water (Gal)	Sewage (Gal)
2007	110,914,211	1,015,266	NA	118,800,000	33,057,000
2006	107,985,027	995,493	NA	118,540,000	35,061,000
2005	104,085,059	1,069,857	NA	111,210,000	38,582,100
2004	102,437,859	1,072,678	NA	125,720,000	47,311,700
2003	101,299,246	1,133,333	NA	122,340,000	43,000,000
2002	98,883,746	1,163,836	NA	111,490,000	67,523,000

Source: Information provided by JPL Facilities Engineering & Construction, November 2010.

3.1.5.1 Electrical Power

The main power lines for transmission in the basin area belong to SCE. SCE is one of the nation's largest electric utilities, servicing more than 14 million people in a 129,499 sq km (50,000 sq-mi) area of central, coastal, and Southern California (**Figure 3-4**) (SCE, 2010). SCE derives its energy from its own generating facilities and other sources, including efficient low-cost hydroelectric and nuclear facilities. SCE is the nation's largest purchaser of renewable energy, buying and delivering approximately 13.6 billion kilowatt hours (kWh) from wind, solar, biomass, geothermal, and small hydro supplies to energy customers in 2009 (SCE, 2010).

Figure 3-4. Existing Power Utilities Distribution



The SCE main power lines follow the toe of the western slope, run the length of the basin from south to north and feed into the JPL Arroyo Seco Substation. Power transmission voltages of 220 kilovolts (kv) to 500 kv are reduced to a sub-transmission voltage of 66 kv at the Arroyo Seco Substation. The 66 kv is further reduced to 16 kv for distribution throughout NASA JPL. A 16.5 kv single line for Substation "H" feeds all of the power requirements for the Center. It is comprised of two 2,000-amp, 16.5-kv switchboards that are fed by two SCE transformers. The SCE transformers are capable of providing up to 22.4 MW of power to the site. Two separate 66 kv high voltage lines feed Substation "H" adding further reliability to the distribution system.

The NASA JPL underground distribution system provides two separate 16 kv feeds to each transformer bank with a means of selecting which feeder of the two is active, while one remains in stand-by mode. There are currently ten 16 kv feeders that provide service to approximately 50 individual transformer banks at NASA JPL. Two Mission Operation buildings, Building 240 and Building 264, are provided electricity via isolated 16 kv feeders. No other transformer banks are connected to the feeders supplying electricity to these mission critical buildings. The 16 kv feeder lines run between "Substation H" and the two buildings to provide greater system reliability.

Electrical system upgrades over the past 15 years have included the replacement of the 2.4 kv and 4.16 kv medium voltage cables and transformer banks. The 480 volt low voltage cables that feed into most NASA JPL buildings have not been replaced, nor have low voltage switchboards, panels, or motor control centers that make up the balance of the aging distribution system equipment. The JPL Facilities Department estimates that the present baseline load for the Center is approximately 10.5 MW with a peak demand of 18 MW. Each feeder has a capacity of 8.9 MW, with an average load per feeder of 1.8 MW. The ten feeders currently operate at approximately 20 percent of maximum load. Monitoring of individual feeders determines when a feeder approaches overloading and when balancing of the system becomes necessary. The current system has significant capacity to support future building expansion programs at NASA JPL.

3.1.5.2 Natural Gas

Natural gas is supplied to NASA JPL by the Southern California Gas Company (SoCalGas Natural gas is supplied to the laboratory via a 30 pounds per square inch (psi), 8-in high-pressure gas main located on the east side of Oak Grove Drive. A system of medium pressure gas lateral lines connect to the high-pressure gas line via pressure reducing valves, reducing the pressure provided to most on-site buildings from 30 psi to 5 psi. Inlet pressure of natural gas received at on-site buildings is 2 psi or higher.

Natural gas service is provided to standby generator engines in the Frequency Standard Laboratory (Building 298) and to three gas distribution lateral mains. Two gas lateral lines located along Explorer Road and Mariner Road feed into the main gas line. The natural gas is used in boilers, water heaters, and in some research facilities. With the exception of pipes installed during the Modernization of South Utility System (MOSUS) project (1993), the distribution system was installed in the 1960s. The pipes installed during the MOSUS Project in 1993 would be retained and integrated into planned future redevelopment of the natural gas system. The average annual natural gas consumption for NASA JPL in 2009 was 3.3 million m^3 (116.8 million ft^3) (Uyeki, 2010a).

3.1.5.3 Petroleum, Oil, and Lubricants

NASA JPL operates two underground storage tanks (USTs), 17 stationary aboveground storage tanks (ASTs), and three portable ASTs with capacities greater than 208 l (55 gal). NASA JPL manages lubricating oil, waste oil, dielectric fluid, hydraulic fluid, diesel fuel, and gasoline. Lubricating oil and waste lubricating oil are managed at the Space Flight Operations Facility (Building 230) and at various locations throughout the facility that have smaller generators and turbine pumps. Waste oil is managed as a hazardous waste and is accumulated in 208-l (55-gal) drums. Lubrication oil is managed in 208-l (55-gal) drums or 0.95-l (one-quart) containers.

Diesel fuel is used for vehicle refueling and emergency power generation. Bulk quantities of diesel fuel are stored at the Transportation Garage (Building 177) and the Building 230. Building 177 has a 7,571-l (2,000-gal) diesel AST and a 7,571-l (2,000-gal) biodiesel-20 AST for vehicle fueling. Building 230 has one 56,781-l (15,000-gal) diesel UST and one 37,854-l (10,000-gal) diesel AST to store fuel for emergency power generators. Diesel for the other generators is stored in ASTs ranging in capacities of 227 to 7,571 l 60 to 2,000 gal).

Gasoline is only used for vehicle and equipment refueling and is stored in one 37,854-l (10,000-gal) UST at Building 177 where a fuel dispenser is used to distribute it to vehicles. A 378.5-l (100-gal) AST, located in the back of a pickup truck, distributes gasoline to small gasoline-powered carts throughout the installation. Contractor tanker trucks deliver the gasoline and diesel to the ASTs and USTs at Building 177.

3.1.5.4 Water Distribution

NASA JPL purchases its water from the City of Pasadena. Potable water is received from the City via a 15-cm (6 in) water main connection located on Upper Arroyo Road near the East Gate. Water is pumped to three water storage tanks identified as Tank 175, Tank 258, and Tank 267 located on the mesa above JPL. Tanks 175 and 258 have a water storage capacity of 2.27 million l (600,000-gal) each. Tanks 175 and 258 are interconnected with a 20-cm (8-in) pipeline and a 30-cm (12-in) bypass line. Tank 267 has a water storage capacity of approximately 3.8 million l (1 million gal) and is gravity fed from Tank 175 through a 30-cm (12-in) pipeline.

Water is distributed at NASA JPL via several gravity loops that tie into 25- and 30-cm (10- and 12-in) primary lateral lines located along Explorer Road. These water mains date back to the 1940's, and the capacity and redundancy of the water system in this area is suspect especially with respect to fire flow. Numerous isolation valves in this area are not functional, which contributes to operational and maintenance difficulties with respect to temporary shutdown of a water main for inspection or repair. In the event of a pipe failure, restoration of service to buildings north of Explorer Road would be delayed and there is a high potential for system contamination.

There are several secondary loops comprised of 15- and 20-cm (6- and 8-in) pipelines connected to the 25- and 30-cm (10- and 12-in) loops. The system operates at relatively high pressures in certain areas due to topographical variations. The lowest pressure in the system is near Building 251 at 60 psi and the highest pressure in the system is 160 psi on the discharge side of the pump. The water system has five pressure-reducing valves located throughout the water distribution network to lower the system pressure from approximately 130 psi to 90-100 psi. All service connections between the water system and buildings are equipped with pressure regulators to reduce the pressure to between 70 and 80 psi. When demand is at its lowest, the maximum allowable pressure is 150 psi.

There are two groundwater wells equipped with pumps located behind Building 150. These are used to lower high groundwater levels so that flooding does not occur in some of the buildings in the area. The water rights to this groundwater are owned by the city of Pasadena and, although it is of high quality, it is not used but rather discharged directly into a nearby storm sewer. The pump is controlled by a water level sensor in the wells to ensure groundwater elevations do not exceed the height at which problems occur.

While NASA JPL had an average water use of 117 million gals per year (gpy) through 2007 (JPL 2008), 2009 water usage was 90.7 million gpy (Uyeki, 2010b). The public water system serves approximately 10,250 persons. Approximately 55 percent of the water used by JPL is for consumptive purposes (i.e., the water is used and does not generate wastewater that discharges to the sanitary sewer collection system). The highest consumptive use is for cooling towers, which averaged 33.4 million gpy from 2004-2007. The second highest consumptive water use is for irrigation, which averaged 30.6 million gpy from 2004-2007. The remainder of the use, 53 million gpy, or 45 percent, is for domestic purposes (i.e., offices and laboratory operations) (JPL 2008).

There are 83 fire hydrants placed throughout NASA JPL. All hydrants satisfy 2011 JPL Design Standards which adopts the 2010 California Fire Code as the JPL Fire Code. Fire department connections and fire boxes are distributed around the laboratory to supply regional fire protection access. Fire flow tests are conducted on a 5-year basis and there are no records of insufficient fire flow in JPL fire fighting history.

3.1.5.5 Wastewater Collection and Treatment

The City of Pasadena wastewater collection system, which is a part of the Los Angeles County Sanitation District (LACSD), receives effluent generated at the laboratory. The average monthly wastewater discharge for JPL in 2009 was approximately 227,125 l per day (60,000 gpd) (Chirino, 2010b). The wastewater collection system at JPL contains gravity and pressurized pipes (Herda, 2010).

The majority of the wastewater flows by gravity to a wastewater retention basin (i.e. large wet well) located at Building 289. The wet well is serviced by two 1,514-l (400-gal) per minute (gpm) pumps and one 1,136-l per minute (300-gpm) pump. The wet well has 378,541 l (100,000 gal) of capacity, which is sufficient for approximately 18 hours of detention under future average day conditions (JPL 2008). Additional wastewater flows by gravity to two wastewater lift stations at Building 224 and Building 308. The effluent from these lift stations is conveyed to the retention tank. The effluent is discharged to Building 270, the sewage metering station, before leaving the laboratory. All wastewater lift stations are equipped with emergency backup power generators, audio/visual alarms, and gas monitoring equipment (JPL 2008).

Wastewater discharge to sewers in the Los Angeles basin is regulated by the wastewater ordinance of the LACSD. This ordinance regulates sewer construction, sewer use, and both direct and indirect industrial wastewater discharges. The U.S. Environmental Protection Agency (USEPA) has enacted specific requirements for implementing the intentions of the CWA. LACSD regulates industrial wastewater discharges at NASA JPL through an Industrial Waste Discharge Permit (Permit No. 7024).

An addendum to the permit was issued in 1990 to include wastewater discharge from the Microdevices Laboratory, Building 302. Another addendum to the permit was obtained in 2005 to add discharge from the CERCLA Groundwater Treatment System. The primary sources of industrial wastewater at NASA JPL include laboratories, metal fabrication shops, scrubber discharge, boiler and cooling tower blowdown, and discharge from the groundwater treatment system. The principal sources of industrial wastewater are summarized in **Table 3-7**.

The two components of maximum wastewater generation at NASA JPL are peak flow from buildings and inflow and infiltration (I/I) (AC Martin 2011). In 2009, six month average for wastewater discharge was 60,000 gpd. Although the wastewater infrastructure has aged, the existing sewer system is adequate for current and near term use (AC Martin 2011).

Table 3-7. Industrial Wastewater Sources at NASA JPL

Location		Discharge
Building Name and No.	Area	
Planetary Protection Lab (98)	Room 101	Rinse from dishwasher
Fabrication Shop (103)	Room 108C	Rinse from circuit board cleaning
Materials Research Processing Lab (158)	Room 106	Rinse from sample preparation (cutting and grinding)
Instrument Systems Lab (168)	Machine Shop	Rinse from parts cleaning
Fabrication Shop (170)	Machine Shop	Rinse from parts cleaning, water-jet machine tool
Transportation Garage (177)	Outside	Carwash overflow
Procurement & Communications Support (202)	Room 112	Rinse from Dishwater
Paint Shop (231)	Paint Shop	Rinse from brush cleaning
System Development (233)	Room 129	Rinse from parts cleaning
Chemical Engineering	---	Rinse from dishwasher
Earth & Space Science Lab (300)	Room 108C	Rinse from Polaroid positive/negative processing
Earth & Space Science Lab (300)	Room 108D	Rinse from sample preparation (cutting and grinding)
Microdevices Lab (302)	Outside	Reverse osmosis reject – deionized water system
Cooling Towers		Cooling Tower blowdown
Boilers		Boiler blowdown

3.1.5.6 Nitrogen and Compressed Air Systems

NASA JPL has a central, 105,992-l (28,000-gal) liquid nitrogen (LN) storage tank (Tank 10). LN is delivered daily to NASA JPL by tanker truck. Currently, there is no LN distribution system located at NASA JPL. **Table 3-8** provides LN2 tank capacities and locations. Current facilities designs are being done following a lab-wide compressed air system audit in fiscal year (FY) 07. The plans are to install redundant, smaller horsepower compressors in key facilities, and ultimately removing the need for the centralized system. This effort will greatly reduce the amount of energy required to meet the compressed air demand at NASA JPL.

3.1.5.7 Communications

The Communication system at NASA JPL is comprised of several different types of communication cable systems. Fiber optic cable is used for high speed, high bandwidth applications; multi-pair copper cables for telephone, security, fire alarm, timing circuits, and facilities control systems; coaxial cable for radio frequency (RF) broadband serving NASA site Closed Circuit Television (CCTV), and Von Karman television channels (G&W Consulting, 2010). All communication system cables are installed in an underground conduit and manhole system dispersed through the Center. Conduit running between manholes generally consists of six to eight 10-cm (4-in) conduits in a duct bank.

Table 3-8. NASA JPL Liquid Nitrogen Tanks Nominal Capacities and Locations

National Bd #	JPL #	Location	Map Grid	Volume liters (gallons)	SCF	Tons
4886	4	11 East	F-3	4,921 (1,300)	121,043	4.38
3327	5	83 South	D-4	4,921 (1,300)	121,043	4.38
3698	6	144 North	C-3	19,684 (5,200)	484,172	17.54
3397	8	233 North	C-6	4,921 (1,300)	121,043	4.38
3261	9	129 North	D-4	4,921 (1,300)	121,043	4.38
372	10	150 North	C-2	105,992 (28,000)	2,607,080	94.43
7377	15	** 149 West	D-2	9,464 (2,500)	232,775	8.43
1877	20	157 S/W	D-5	4,921 (1,300)	121,043	4.38
3737	23	302 East	E-4	4,921 (1,300)	121,043	4.38
169	24	300 East	E-4	6,057 (1,600)	148,976	5.40
4815	25	300 East	E-4	4,921 (1,300)	121,043	4.38
774	26	302 East	E-4	3,407 (900)	83,799	3.04
8942	27	302 East	E-4	11,356 (3,000)	279,330	10.12
2224	28	103 N/E	F-3	1,893 (500)	46,555	1.69
2516	30	79 East	D-3	9,464 (2,500)	232,775	8.43
5641	31	306 South	D-6	19,684 (5,200)	484,172	17.54
60133	32	248 East	C-2	41,640 (11,000)	1,024,210	37.10
62811	33	306 South	D-6	41,640 (11,000)	1,024,210	37.10
65539	34	148 South	D-3	41,640 (11,000)	1,024,210	37.10
65818	35	233 North	C-6	22,712 (6,000)	558,660	20.24
67658	36	144 N/E	C-3	41,640 (11,000)	1,024,210	37.10
67531	37	183 S/E	C-5	22,712 (6,000)	558,660	20.24
67660	38	168 N/E	C-5	22,712 (6,000)	558,660	20.24
68856	39	212 North (Oak Grove Mesa)	E-1	5,678 (1,500)	139,665	5.06
68868	40	338 North	D-3	22,712 (6,000)	558,660	20.24
LN2 Tank	41	318 East	D-6	22,712 (6,000)	558,660	20.24

Multi-pair copper wiring was the original method used for communication wiring and is still used today for less active systems on Center. Fiber optic cables are replacing the copper wiring systems throughout the Center. The fiber optic networks, both single and multi-mode, offer greater speeds, larger bandwidth or carrying capacity, and the ability to go longer distances. Almost all buildings have fiber optic feeds (AC Martin 2011).

Copper cables are distributed in multiple sizes from 15-pair through 100-pair cables from several hub locations located at NASA JPL. The majority of the communication backbone duct bank system of six 10-cm (4-in) conduits is overloaded by a number of old, 27-pair obsolete instrumentation copper cables that have few active circuits (AC Martin 2011). The conduit system could be reused for new communication wiring if these cables were eliminated.

The main entry communications path to the Center is located near Building 107. This commercial telephone system connection terminates in Building 171. A high speed communication circuit via T1 public telephone lines on the AT&T copper trunk cabling system supports Buildings 230 and 264.

3.1.5.8 Storm Water Collection

The storm water generated on NASA JPL property discharges to the Arroyo Seco and is permitted by a National Pollutant Discharge Elimination System (NPDES) Storm Water General Permit (CAS0000001 and WDID 4B19S001524). The permit requires the Center to develop and maintain a Storm Water Pollution Prevention Plan (SWPPP) to prevent storm water pollution from occurring at the Center. The SWPPP identifies best management practices (BMPs) for the variety of industrial activities on Center that are exposed to precipitation.

The existing storm drain system was designed to intercept flows from steep slopes on the northern portion of the Center by the use of several debris catch basins, which carry the storm water runoff in underground pipes through the developed portion of NASA JPL, and discharge into the Arroyo Seco (Hahamongna Watershed Park Master Plan, 2003). The four major storm water drains that pass through the Center are constructed of vitrified clay, reinforced concrete pipe (RCP) and corrugated metal pipe (CMP), and range in size from 61 to 122 cm (24 to 48 in). Various storm water trunk lines collect surface runoff from NASA JPL, and residential properties to the west, and transport the runoff directly to the Arroyo basin. Branch lines collect the storm runoff from the developed areas and carry it to the major drains. Storm water from La Cañada Flintridge also flows into the drains that cross NASA JPL and emerge in the Arroyo basin.

With the present ongoing maintenance program, the storm drain system is functioning adequately. When new construction is necessary, the storm drain system must be modified to include drainage protection for new construction.

3.1.5.9 Solid Waste

JPL retains a waste services contractor, Athens Services, to dispose of its municipal solid waste streams, comprised largely of construction debris and general office or operational wastes. Athens Services provides dumpsters and recycling services, and empties approximately 96 dumpsters each work day (i.e., 5 days per week). In 2009, Athens Services disposed of approximately 500,000 pounds of trash at the Chiquita Canyon Landfill, which is owned and operated by Republic Services.

In previous years, JPL was unable to find waste contractors to perform nightly waste stream sorting services, and trash was unable to be sorted as few companies were willing to spend the money to hire the labor to do it. 2009-2010 is the first year that JPL has been able to have nightly trash sorted and recyclables removed. Waste volumes and disposal costs are minimized by recycling cardboard, non-ferrous metal, ferrous metal, toner cartridges, wooden pallets, high-grade white paper, newspaper, aluminum cans, and plastics. The recycling program is managed at Building 261, Recycling Center. In 2009, Athens Services recycled about 1,500,000 pounds of trash and 500,000 pounds of construction and demolition material from JPL. This reduced the JPL annual landfill use by approximately 1,600,000 pounds. Additionally, Green Waste is disposed of via composting at the Scholl Canyon Sanitary Landfill. Scholl Canyon only accepts limited items, such as clean dirt, green waste, and clean asphalt.

3.1.5.10 Emergency Response and Safety Management

NASA JPL has an on-site Medical Clinic and Emergency Services Facility located in Building 310 on Explorer Road. The facility includes fire, security and hazardous materials emergency response units as well, as a medical emergency response unit and an emergency care center. NASA JPL's on-site medical services facility is also located here. The building may be considered an 'essential facility,' and is located within 30 m (100 ft) of a known trace of the JPL Bridge Fault, a branch of the Sierra Madre Fault System.

Police Protection

The Los Angeles County Sheriff Department (LASD) provides police protection services and traffic enforcement services to NASA JPL. The closest patrol station to NASA JPL is located in LASD Region 1 at 780 East Altadena Drive, Altadena, CA 91001. The Altadena station maintains an average emergency response time of 3 to 5 minutes (http://www.lasdhq.org)

Fire Protection

Fire suppression equipment at NASA JPL consists of hand-held fire extinguishers. These extinguishers consist of carbon dioxide (CO_2) and dry chemical types (A-B-C). The Los Angeles County Fire Department (LACoFD) provides fire prevention, fire suppression, and life safety services to NASA JPL. The LACoFD consists of almost 4,000 personnel organized into three regions and 21 battalions. The LACoFD North Region, Battalion #4 is comprised of seven fire stations. Fire Station No. 82, located nearby on Foothill Boulevard, will continue to be the primary emergency responder for NASA JPL. The fire stations operated by the LACoFD currently maintain an average emergency response time of less than four minutes (http://www.fire.lacounty.gov).

Medical Facilities

NASA JPL has an on-site medical clinic located in Building 310. The Medical Clinic supplies medical services to JPL personnel for non-life threatening and non-emergency injuries and illnesses. The closest hospital to the Center is the Verdugo Hills Hospital in Glendale, which is 5.8 km (3.6 mi) west of NASA JPL. Huntington Memorial Hospital in Pasadena is located 8 km (5 mi) southeast of NASA JPL. Glendale Memorial Hospital in Glendale is located approximately 12.9 km (8 mi) southwest of NASA JPL.

3.1.5.11 Security Management

Security is managed by an in-house private security company that monitors access to and from NASA JPL. The Center is fenced and gated with limited points of entry. There are three manned security gates. Security personnel at the checkpoints pre-screen all arriving vehicles, drivers, and pedestrians, perform vehicle inspections, and direct persons and vehicles to the three security gates The primary gate is located at the west end of NASA JPL (West Gate), adjacent to the Visitor Center, where most arriving visitors are screened, badged, and admitted by prior arrangement. This checkpoint is located off-Lab on the public street under agreement with the City of La Cañada Flintridge. Employees entering at the West Gate are admitted upon presentation of staff identification badges.

The second gate is located at the south end of NASA JPL (South Gate), and is used primarily for deliveries and by contract service providers. Such visitors are admitted at the South Gate where they temporarily park their vehicles and are signed-in and admitted at an outdoor security booth. The third gate is located at the east end of the facility, at the Oak Grove Bridge entrance to the Lab (East Gate). The East Gate is used almost exclusively by JPL staff entering through the East Arroyo Parking Lot.

An unmanned gate is located on the Upper Mesa north of NASA JPL (North Gate). The North Gate is accessed by card key and is only utilized by authorized JPL staff. In addition, there are several personnel gates located along the NASA JPL perimeter. These are pedestrian turnstile-type gates used by JPL staff mainly to access the surrounding park and National Forest areas during work hours for recreation purposes. Access to most buildings is open to those who have been admitted to NASA JPL through the primary security gates. Access to buildings with special or sensitive uses, or to areas with higher security needs, is limited to those with appropriate access codes on their magnetic card keys.

3.1.5.12 Schools

The project area serves as an extended recreational, educational, and cultural venue for area residents, thus having a positive impact on students in both the existing private and public school systems. NASA JPL has nine schools located within approximately 0.8 km (0.5 mi).The closest schools are primarily northwest of NASA JPL in the City of La Cañada Flintridge, or east and southeast of NASA JPL in Altadena. These schools are listed in **Table 3-9**. The nearest school is La Cañada High School, located adjacent to NASA JPL's western boundary. Flintridge Prep School, Edison Elementary, St. Francis High School, Franklin Elementary, Mount Saint Joseph Elementary School, Flintridge Sacred Heart Academy, Jackson Elementary, and John Muir High School are located at least 0.4 km (0.25 mi) from NASA JPL (JPL 2008).

Table 3-9. Schools in the Vicinity of NASA JPL

School	Address
La Cañada Flintridge	
La Cañada High School	4463 Oak Grove Drive
Hillside School and Learning Center	4331 Oak Grove Drive
Crestview Preparatory School	140 Foothill Boulevard
St. Francis High School	200 Foothill Boulevard
St. Bede the Venerable School	4524 Crown Avenue
Flintridge Preparatory School	4543 Crown Avenue
Foothill Progressive Montessori School	1526 Indianola Way
Altadena	
Odyssey Charter School	725 West Altadena Drive
Nia Education Charter School	3126 Glenrose Avenue
Franklin Elementary School	527 Ventura Street
Jackson Elementary School	593 West Woodbury Road
John Muir High School	1905 Lincoln Avenue
Harriet Tubman Pre-School	36 West Montana Street

3.1.5.13 Parks

NASA JPL serves as an extended educational and cultural venue for area residents, thus having a positive impact on residents in Pasadena and other nearby and regional communities. There are two public parks located 1.6 km (1 mi) from NASA JPL. Loma Alta Park (3330 Lincoln Avenue) is located 1.6 km (1 mi) east of the Center. Oak Grove Park is located approximately 1.6 km (1 mi) south of NASA JPL. NASA JPL is located to the west of the HWP. Recreational facilities on the eastside of HWP are limited to Johnson Field (City of Pasadena 2003).

3.1.6 Air Quality

The following sections describe the local air resources in terms of climate, air quality standards, air quality conditions, and the NASA JPL air pollution sources, controls, and reporting requirements. Air emission sources at NASA JPL, and the controls employed to minimize emissions, are also discussed.

NASA JPL and the surrounding communities of Pasadena, Altadena, and La Cañada-Flintridge, are located in the eastern portion of the Los Angeles metropolitan area, within the South Coast Air Basin (SOCAB). The SOCAB is bounded on the west by the Pacific Ocean and on the north and east by the San Gabriel, San Bernardino, and San Jacinto Mountains. The southern limit of the SOCAB is the San Diego County line. The SOCAB consists of Orange County, all of Los Angeles County except for the Antelope Valley, the non-desert portion of western San Bernardino County, and the western and Coachella Valley portions of Riverside County.

3.1.6.1 Climate

The SOCAB has a distinctive climate determined by its geographical location. Regional meteorology is dominated by a persistent high-pressure area, which resides over the eastern Pacific Ocean. Seasonal variations in this pressure system cause changes in regional weather patterns. The SOCAB has a subtropical climate characterized by warm, dry summers and mild winters, infrequent rainfall and moderate humidity, with moderate daytime onshore breezes. This mild climatic condition is occasionally interrupted by periods of hot easterly winds associated with Santa Ana winds, winter storms, and infrequent summer thunderstorms. The Santa Ana winds can be strong near the mouths of canyons oriented along the direction of airflow, such as the Arroyo Seco.

Air quality is correlated to the dominant transport direction of local winds. The SOCAB is located in an area of high pollution potential because of the proximity of the air basin’s topography and general weather influences with the Los Angeles metropolitan area. Even though the SOCAB has a semi-arid climate, air near the surface is generally moist because of the presence of a shallow marine air layer.

During spring and summer, pollution produced during any one day is blown out of the SOCAB through the inland mountain passes or limited by warm, vertical currents adjacent to mountain slopes. Air pollutants can be transported 96.6 km (60 mi) or more inland by ocean air during the afternoons. From early fall to winter, the transport is less pronounced because of slower average winds speeds and the appearance of land breeze winds may begin by late afternoon. Pollutants remaining in the air basin could be trapped and begin to accumulate during the night and the following morning. A low wind speed in pollutant source areas is an important indicator of air stagnation and represents the potential buildup for the primary (criteria) air pollutants.

The hot, dry Santa Ana winds form in the desert during the fall and winter months due to a Canadian high-pressure system over the Great Basin. They travel through Utah, New Mexico, Nevada, Southern California, and pick up desert dust and heat while over the Mojave Desert. They then make their way through the San Gabriel and San Bernardino Mountain Ranges through the Cajon Pass and Banning Pass, eventually making their way into the SOCAB. If the Santa Ana winds are strong, they can surpass the strength of the onshore sea breeze, thus transporting additional suspended dust and pollutants into the air basin, or out over the ocean. If the Santa Ana winds are weaker, they simply oppose the sea breeze and cause stagnation, resulting in high pollution events.

Temperature inversions limit the vertical depth through which pollution can be mixed, and these patterns of seasonal winds lead to two further conditions conducive to pollution concentration within the SOCAB. The first set of conditions occurs during the summer when coastal areas are characterized by a sharp discontinuity between the cool, marine air at the surface and the warm, sinking air aloft within the high pressure cell over the ocean to the west. This marine/subsidence inversion allows for good local mixing, but acts like a giant lid over the air basin. The air in the basin remains stagnant, as the average wind speed in downtown Los Angeles settles at less than 8 kilometers per hour (kph) (5 miles per hour [mph]).

The second set of conditions are related to cool, clear winter nights, which form an inversion layer when the cold air off the mountains to the south sinks to the basin floor while the air aloft over the basin remains warm. This forms radiation inversions, which in conjunction with calm winds, traps pollutants near their source producing localized pollution ‘hot spots’ associated with the more heavily developed areas of the air basin. These conditions typically remain until the onshore breezes are strong enough to either push the pollutants laterally up the mountain ranges and along the canyons into the inland valleys, or to lift the inversion and create mixing. As a result of these conditions, summers are often periods of hazy visibility and occasionally unhealthy air, while winter air quality impacts tend to be highly localized.

3.1.6.2 Air Quality Standards

The air quality in a given region or area is measured by the concentrations of various pollutants in the atmosphere. The measurements of pollutants in ambient air are expressed in units of parts per million (ppm), milligrams per cubic meter (mg/m^3), or micro grams per cubic meter ($\mu g/m^3$). The air quality in a region is a result of not only the types and quantities in an area, but also surface topography, the size of the topographical ‘air basin’, and the prevailing meteorological conditions.

Air pollutants are regulated at the Federal, state, and local regulatory agency levels with each agency having different levels of responsibility. The USEPA regulates at the Federal level, while the California Air Resources Board (CARB) regulates at the state level. The CARB has delegated the responsibility for implementation of the Federal Clean Air Act (CAA) and California CAA to local air pollution control agencies. Regional ‘Air Quality Management Districts’ (AQMD) or ‘Air Pollution Control Districts’ (APCD) serve as the regulatory authority for each of the air basins within California. NASA JPL and the City of Pasadena are located within the SOCAB, which is in turn regulated by the South Coast Air Quality Management District (SCAQMD).

The CAA directed the USEPA to establish national standards for air, resulting in the development of the National Ambient Air Quality Standards (NAAQS); the New Source Performance Standards (NSPS); and the National Emission Standards for Hazardous Air Pollutants (NESHAP). NAAQS were established for a set of six main air pollutants, referred to as ‘criteria pollutants’. The six criteria pollutants are ozone (O_3); carbon monoxide (CO); nitrogen dioxide (NO_2); sulfur dioxide (SO_2); lead (Pb); and respirable particulate matter, for, particulates equal to or less than 10 microns in diameter (PM_{10}), and particulates equal to or less than 2.5 microns in diameter ($PM_{2.5}$).

Additionally, the NAAQS ambient air quality standards were developed with a set of ‘primary’ thresholds to protect the public health, and a set of ‘secondary’ air quality levels to protect public welfare such as effects on vegetation, crops, wildlife, economic values, and visibility. The EPA is the regulatory agency charged with enforcing the NAAQS. The EPA classifies the air quality in an Air Quality Control Region (AQCR), or in sub-areas of an AQCR, according to whether the concentrations of criteria pollutants in ambient air exceed the primary or secondary NAAQS. Areas within each AQCR are designated as either ‘attainment’, ‘non-attainment’, ‘maintenance’, or ‘unclassified’ for each of the six criteria pollutants.

Attainment means that the air quality within an AQCR is better than the NAAQS; nonattainment indicates that the criteria pollutant levels exceed NAAQS; maintenance indicates that an area was previously designated in nonattainment, but is now in attainment; and unclassified means that there is not enough information to appropriately classify an AQCR, therefore, the area is considered in attainment. Additionally, non-attainment may be designated levels. For example, with ozone, each designated non-attainment area is then classified as either 'marginal'; 'moderate'; 'serious'; 'severe'; or 'extreme' based on the level of ambient ozone concentrations.

California adopted the NAAQS and promulgates additional California Ambient Air Quality Standards (CAAQS), under the CCAA. The CCAA identifies ten criteria pollutants and the California standards are generally more stringent that the Federal primary standards. For many of the pollutants, the CAAQS is identical to the NAAQS; however, in some cases, such as particulate matter, the CAAQS is more stringent than the NAAQS. **Table 3-10** presents the primary and secondary NAAQS and AAQS, and compares the CCAA with the Federal standards.

Additionally, the CAA Amendments of 1990 require Federal agencies to ensure their proposed actions conform to the applicable State Implementation Plan (SIP). Section 176 (c) (1) of the CAA Amendments of 1990 prohibits a Federal agency from engaging in, supporting, or approving an activity that:

- Causes or contributes to any new violation of a NAAQS, which establishes primary and secondary standards for the six criteria pollutants;
- Increases the frequency or severity of existing violations of any NAAQS; or
- Delays the timely attainment of any NAAQS or required interim emission reductions or milestones.

Referred to as the General Conformity requirement, the intent is to promote long-range planning for the attainment and maintenance of air quality standards by evaluating air quality impacts of Federal actions before they are undertaken. An Applicability Analysis is the initial screening evaluation of the action. The action's emissions must be calculated, and assumptions noted, unless the action is exempt or clearly *de minimis*. If calculated emission levels are above thresholds found in 40 CFR 93.153, or if they are "regionally significant", a conformity determination must be made. If project emissions are below threshold levels, the Federal action is presumed to conform, the project may proceed as planned and the General Conformity Rule has been met.

3.1.6.3 Air Quality Conditions

The SCAQMD is the air pollution control agency for Orange County and the urban portions of Los Angeles, Riverside, and San Bernardino counties. This area of 27,824 sq km (10,743 sq mi) contains over 16.7 million people (about half the population of California). It is the second most populated urban area in the U.S. and one of the smoggiest. Currently, SO_2 and Pb are the only two NAAQS parameters for which the SOCAB is in compliance. The SOCAB is designated non-attainment for $PM_{2.5}$, NO_2, and sulfates; with non-attainment considered 'serious' for PM_{10} and CO; and 'extreme' for [8-hour] O_3. The SCAQMD develops and adopts an Air Quality Management Plan, the blueprint to bring this area into compliance by achieving attainment status with Federal and state clean air standards. Rules are adopted to reduce emissions from various sources, including specific types of equipment, industrial processes, paints and solvents, and consumer products. The SCAQMD issues permits to businesses and industries to ensure compliance with air quality rules.

Pollutant transport in the SOCAB generally follows the on-shore and offshore air flow characteristic of coastal areas. Daytime transport is inland toward the San Gabriel Mountains, where the flow divides westward through the San Fernando Valley, and eastward toward the San Bernardino area. On some days, the flow is predominantly southward into Orange County and eastward toward Riverside County.

Table 3-10. State of California and Federal Air Quality Standards

Pollutant	Averaging Time	California Standard Concentration	National Standard	
			Primary	Secondary
O3	1-Hour [c]	0.009 ppm (180 µg/m³)	--	Same as primary standard
	8-Hour [b]	0.070 ppm (137 µg/m³)	0.08 ppm (157 µg/m³)	
PM_{10}	24-Hour [a]	50 µg/m³	150 µg/m³	Same as primary standard
	Annual Arithmetic mean [d]	20 µg/m³	--	
$PM_{2.5}$	24-Hour [f]	No separate State standard	35 µg/m³	Same as primary standard
	Annual Arithmetic mean [e]	12 µg/m³	15 µg/m³	
CO	8-Hour [a]	9.0 ppm (10 mg/m³)	9.0 ppm (10 mg/m³)	None
	1-Hour [a]	20 ppm (23 mg/m³)	35 ppm (40 mg/m³)	
NO_2	Annual Arithmetic mean	0.030 ppm (56 µg/m³)	0.053 ppm (100 µg/m3)	Same as primary standard
	1-Hour	0.18 ppm (338 µg/m³)	--	
SO_2	Annual Arithmetic mean	--	0.030 ppm (80 µg/m³)	--
	24-Hour [a]	0.04 ppm (105 µg/m³)	0.14 ppm (365 µg/m³)	--
	3-Hour [a]	--	--	0.5 ppm (1300 µg/m³)
	1-Hour	0.25 ppm (655 µg/m³)	--	--
	1-Hour	0.25 ppm (655 µg/m³)	--	--
Pb	30-Day Average	1.5 µg/m³	--	--
	Calendar year	--	1.5 µg/m³	Same as primary standard
Visibility reducing Particles	8-Hour	Extinction coefficient of 0.23 per kilometer visibility of 10 miles or more due to particles when relative humidity is less than 70 percent	No Federal Standards	
Sulfates	24-Hour	25 µg/m³		
Hydrogen Sulfide	1-Hour	0.03 ppm (42 µg/m³)		
Vinyl Chloride	24-Hour	0.001 ppm (42 µg/m³)		

Sources: USEPA, 2007 and CARB, 2007

Notes: ppm= parts per million; µg/m³= micrograms per cubic meter; mg/m³ = milligrams per cubic meter. Parenthetical values are approximate equivalent concentrations.

a. Not to be exceeded more than once per year.
b. To attain this standard, the 3-year average of the fourth highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.
c. Standard is attained when expected number of days per year with maximum hourly average concentrations above 0.12 ppm is ≤ 1. EPA revoked the 1-hour ozone standard in all areas except the 14 8-hour ozone nonattainment Early Action Compact Areas.
d. To attain standard, the expected PM10 concentration at each monitor within an area must not exceed 50 µg/m3.
e. To attain this standard, the 3-year average of the fourth highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.
f. To obtain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 3542 µg/m3.

Nighttime transport is offshore. The actual blend of these flow patterns is complex, and different pollutant concentrations are observed at various inland locations on any given day. Therefore, the SCAQMD has divided the air basin into 38 Source Receptor Areas (SRA), each containing one or more monitoring stations. These SRAs are designated to provide a general representation of the local meteorological conditions within the particular area. As shown in **Figure 3-5**, the stations are distributed throughout the basin to provide comprehensive coverage.

NASA JPL is located within SRA 88, and the nearest monitoring station is the West San Gabriel Valley station, located 8 km (5 mi) to the southeast of NASA JPL at 752 Wilson Avenue, Pasadena (station number 088). Pollutants monitored at the station include O_3, CO, total suspended particulates (TSP), sulfates (SO_4), and NO_2. The station is not equipped to monitor ambient PM_{10} or $PM_{2.5}$ levels or Pb.

O_3 is an end product of reactions between reactive organic gases (ROG) and nitrous oxides (NO_X) in the presence of ultraviolet radiation. In the SOCAB, emissions of NO_X are heavily distributed in the western portion of the basin. Daytime wind flow, mountain barriers, a persistent temperature inversion, and intense sunlight all contribute to high O_3 concentrations in the downwind, inland valleys and coastal areas. Maximum O_3 concentrations usually are recorded during the summer.

Ozone is associated with eye irritation, reduced visibility, and adverse health effects at high concentrations. In 2006, ozone levels at the West San Gabriel Valley station in Pasadena exceeded the Federal one hour standard of 0.12 parts ppm for 5 out of 365 days and exceeded the state standard of 0.09 ppm for 25 days (SCAQMD, 2006). The maximum 1-hour ozone concentration reported at the station was 0.15 ppm. Basin-wide, the highest concentration of ozone was reported to be 0.18 ppm at the East San Gabriel Valley 2 station.

CO concentrations are highest near heavily congested roadways. The monitoring station reported 0 days of violation of the Federal and state 8-hour CO standards of 9.0 ppm. The maximum 8-hour CO concentration recorded at the station during 2006 was 2.8 ppm, while the highest concentration recorded in Los Angeles County was 6.4 ppm at the South Central Los Angeles County station.

The Federal annual standard for NO_2 is 0.053 ppm, while the state 1-hour standard is 0.25 ppm. There were 0 days of violation of the state standard, with 0.14 ppm recorded as the highest 1-hour NO_2 concentration at the South Central Los Angeles County Station. The annual average ambient NO_2 concentration at the station for 2006 was 0.0310 ppm, which indicates compliance with the standard. A summary of annual maximum pollutant concentrations reported across SCAQMD monitoring stations for 2009 is presented in **Table 3-11**, together with a comparison of the number of days the standards were exceeded for either the State of California or the Federal standards. This table presents data for CO, O_3, NO_2, SO_2, suspended particulates (PM10), fine particulates (PM2.5), TSP, Pb, and SO_4.

3.1.6.4 Air Pollution Sources, Controls, and Reporting Requirements

NASA JPL submits annual emissions inventory reports to the SCAQMD, which includes emissions analysis from permitted and unpermitted sources. All sources of air pollutants and permit status are evaluated under a comprehensive air pollutant source identification and evaluation program, which includes an extensive equipment listing maintained by JPL's Environmental Affairs Program Office (EAPO) as part of their emissions and waste management database. **Table 3-12** lists the volumes of criteria pollutants reported to the SCAQMD in 2009. **Table 3-13** lists the volumes of toxic pollutants reported to the SCAQMD for 2009.

Figure 3-5. SCAQMD Air Monitoring Network

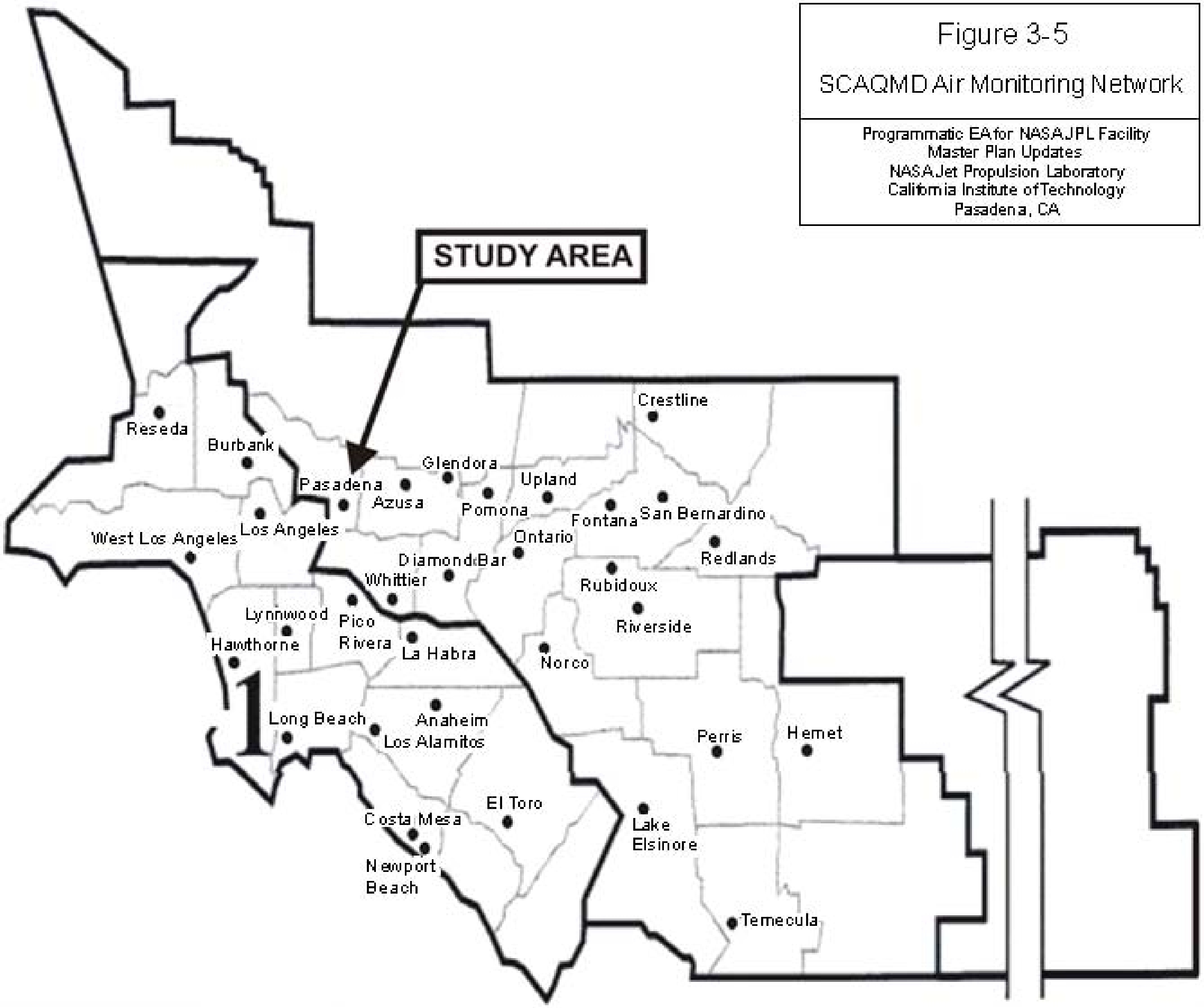


Table 3-11. 2006 Air Quality SCAQMD

2009 AIR QUALITY
SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

2009

Source/Receptor Area No.	Location	Station No.	Carbon Monoxide a) No. Days of Data	Carbon Monoxide a) Max. Conc. in ppm 1-hour	Carbon Monoxide a) Max Conc. in ppm 8-hour	Ozone No. Days of Data	Ozone Max. Conc. in ppm 1-hour	Ozone Max. Conc. in ppm 8-hour	Ozone Fourth High Conc. ppm 8-hour	No. Days Standard Exceeded: Health Advisory ≥ 0.15 ppm 1-hour	No. Days Standard Exceeded: Federal b) Old > 0.12 ppm 1-hour	No. Days Standard Exceeded: Federal b) Current > 0.075 ppm 8-hour	No. Days Standard Exceeded: State c) Current > 0.09 ppm 1-hour	No. Days Standard Exceeded: State c) Current > 0.070 ppm 8-hour	Nitrogen Dioxide d) No. Days of Data	Nitrogen Dioxide d) Max Conc. in ppm 1-hour	Nitrogen Dioxide d) 98th Percentile Conc. ppm 1-hour	Nitrogen Dioxide d) Annual Average AAM Conc. ppm	Sulfur Dioxide e) No. Days of Data	Sulfur Dioxide e) Max. Conc. in ppm 1-hour	Sulfur Dioxide e) Max. Conc. in ppm 24-hour
LOS ANGELES COUNTY																					
1	Central LA	087	357	3	2.2	365	0.139	0.100	0.073	0	1	2	3	5	365	0.12	0.07	0.0281	365	0.01	0.002
2	Northwest Coastal LA County	091	365	2	1.5	365	0.131	0.094	0.075	0	1	3	6	5	355	0.17	0.06	0.0170	--	--	--
3	Southwest Coastal LA County	820	349	2	1.9	352	0.077	0.070	0.061	0	0	0	0	0	362	0.08	0.07	0.0159	362	0.02	0.006
4	South Coastal LA County 1	072	362	3	2.2	363	0.089	0.068	0.064	0	0	0	0	0	362	0.11	0.07	0.0212	361	0.02	0.005
4	South Coastal LA County 2	077	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6	West San Fernando Valley	074	365	4	2.8	365	0.135	0.100	0.093	0	1	19	15	31	365	0.07	0.06	0.0171	--	--	--
7	East San Fernando Valley	069	365	3	2.9	365	0.145	0.096	0.086	1	1	14	16	28	353	0.09	0.07	0.0274	362	0.01	0.003
8	West San Gabriel Valley	088	365	4	2.1	365	0.176	0.114	0.095	1	3	12	12	19	365	0.08	0.06	0.0221	--	--	--
9	East San Gabriel Valley 1	060	357	3	1.7	365	0.150	0.107	0.091	1	4	17	23	32	365	0.10	0.07	0.0194	--	--	--
9	East San Gabriel Valley 2	591	351	3	2.1	352	0.150	0.118	0.108	3	7	42	45	64	350	0.09	0.06	0.0170	--	--	--
10	Pomona/Walnut Valley	075	365	3	1.8	365	0.138	0.099	0.095	0	1	23	25	37	365	0.10	0.08	0.0274	--	--	--
11	South San Gabriel Valley	085	365	3	2.1	365	0.131	0.101	0.072	0	1	3	8	6	361	0.10	0.07	0.0259	--	--	--
12	South Central LA County	112+	354	7	4.6	354	0.104	0.086	0.064	0	0	1	2	1	354	0.09	0.07	0.0214	--	--	--
13	Santa Clarita Valley	090	361	2	1.4	357	0.140	0.122	0.103	0	5	64	57	77	357	0.13	0.05	0.0151	--	--	--
ORANGE COUNTY																					
16	North Orange County	3177	365	4	2.3	365	0.115	0.082	0.075	0	0	3	4	9	365	0.10	0.06	0.0206	--	--	--
17	Central Orange County	3176	365	3	2.7	365	0.093	0.077	0.068	0	0	1	0	2	365	0.07	0.06	0.0179	--	--	--
18	North Coastal Orange County	3195	362	3	2.2	365	0.087	0.075	0.066	0	0	0	0	3	365	0.07	0.06	0.0130	364	0.01	0.004
19	Saddleback Valley	3812	362	2	1.0	362	0.121	0.095	0.084	0	0	10	7	14	--	--	--	--	--	--	--
RIVERSIDE COUNTY																					
22	Norco/Corona	4155	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
23	Metropolitan Riverside County 1	4144	364	2	1.9	346	0.116	0.100	0.089	0	0	35	25	57	357	0.08	0.06	0.0171	364	0.01	0.003
23	Metropolitan Riverside County 2	4146	365	3	1.8	--	--	--	--	--	--	--	--	--	365	0.08	0.06	0.0200	--	--	--
23	Mira Loma	4165	364	3	2.4	364	0.118	0.090	0.086	0	0	22	15	37	364	0.08	0.05	0.0158	--	--	--
24	Perris Valley	4149	--	--	--	354	0.125	0.108	0.101	0	1	67	53	88	--	--	--	--	--	--	--
25	Lake Elsinore	4158	365	1	0.7	365	0.128	0.105	0.096	0	1	37	24	65	365	0.06	0.04	0.0129	--	--	--
29	Banning Airport	4164	--	--	--	359	0.133	0.104	0.100	0	1	70	55	93	359	0.06	0.05	0.0109	--	--	--
30	Coachella Valley 1**	4137	365	2	0.7	365	0.120	0.098	0.096	0	0	53	0	73	349	0.05	0.04	0.0081	--	--	--
30	Coachella Valley 2**	4157	--	--	--	365	0.097	0.090	0.085	0	0	24	0	41	--	--	--	--	--	--	--
SAN BERNARDINO COUNTY																					
32	Northwest San Bernardino Valley	5175	365	2	1.5	365	0.146	0.121	0.102	1	3	49	51	71	363	0.11	0.07	0.0239	--	--	--
33	Southwest San Bernardino Valley	5817	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
34	Central San Bernardino Valley 1	5197	365	2	1.5	365	0.142	0.128	0.100	0	3	48	45	65	365	0.11	0.07	0.0235	365	0.01	0.002
34	Central San Bernardino Valley 2	5203	363	3	1.9	363	0.150	0.126	0.101	1	2	62	53	79	363	0.08	0.06	0.0196	--	--	--
35	East San Bernardino Valley	5204	--	--	--	365	0.145	0.122	0.100	1	1	73	62	91	--	--	--	--	--	--	--
37	Central San Bernardino Mountains	5181	--	--	--	364	0.149	0.121	0.110	2	7	92	70	107	--	--	--	--	--	--	--
38	East San Bernardino Mountains	5818	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DISTRICT MAXIMUM				7	4.6		0.176	0.128	0.110	3	7	92	70	107		0.17	0.08	0.0281		0.02	0.006
SOUTH COAST AIR BASIN				7	4.6		0.176	0.128	0.110	6	15	113	102	133		0.17	0.08	0.0281		0.02	0.006

ppm - Parts Per Million parts of air, by volume. AAM = Annual Arithmetic Mean --- Pollutant not monitored.

** Salton Sea Air Basin.

+ Site was relocated.

a) - The federal 8-hour standard (8-hour average CO > 9 ppm) and state 8-hour standard (8-hour average CO > 9.0 ppm) were not exceeded. The federal and state 1-hour standards (35 ppm and 20 ppm) were not exceeded, either.

b) - The federal 1-hour ozone standard was revoked and replaced by the 8-hour average ozone standard effective June 15, 2005. U.S. EPA has revised the federal 8-hour ozone standard from 0.084 ppm to 0.075 ppm, effective May 27, 2008.

c) - The 8-hour average California ozone standard of 0.070 ppm was established effective May 17, 2006.

d) - The federal standard is annual arithmetic mean NO_2 > 0.0534 ppm. California Air Resources Board has revised the NO_2 1-hour state standard from 0.25 ppm to 0.18 ppm and has established a new annual standard of 0.030 ppm, effective March 20, 2008. U.S. EPA has established a new NO2 1-hour standard of 100 ppb (0.100 ppm), effective April 7, 2010.

e) - The state standards are 1-hour average SO_2 > 0.25 ppm and 24-hour average SO_2 > 0.04 ppm. U.S. EPA has revised the federal standard by establishing a new SO2 1-hour standard of 75 ppb (0.075 ppm) and revoking the existing annual (0.03 ppm) and 24-hour (0.14 ppm) SO2 standards, effective August 2, 2010. The federal and state SO_2 standards were not exceeded.

South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, CA 91765-4182
www.aqmd.gov

DRAFT

2009

2009 AIR QUALITY
SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Source/Receptor Area No.	Location	Station No.	Suspended Particulates PM10[f]: No. Days of Data	PM10: Max. Conc. in $\mu g/m^3$ 24-hour	PM10: No. (%) Samples Exceeding Standards, Federal > 150 $\mu g/m^3$ 24-hour	PM10: No. (%) Samples Exceeding Standards, State > 50 $\mu g/m^3$ 24-hour	PM10: Annual Average Conc.[h] (AAM) $\mu g/m^3$	Fine Particulates PM2.5[g]: No. Days of Data	PM2.5: Max. Conc. in $\mu g/m^3$ 24-hour	PM2.5: 98th Percentile Conc. in $\mu g/m^3$ 24-hour	PM2.5: No. (%) Samples Exceeding Federal Std > 35 $\mu g/m^3$ 24-hour	PM2.5: Annual Average Conc.[i] (AAM) $\mu g/m^3$	Particulates TSP: No. Days of Data	TSP: Max. Conc. in $\mu g/m^3$ 24-hour	TSP: Annual Average Conc. (AAM) $\mu g/m^3$	Lead: Max. Monthly Average Conc.[j] $\mu g/m^3$	Lead: Max. Quarterly Average Conc.[j] $\mu g/m^3$	Sulfate: Max. Conc. in $\mu g/m^3$ 24-hour	Sulfate: No. Days Exceeding State Std ≥ 25 $\mu g/m^3$ 24-hour
LOS ANGELES COUNTY																			
1	Central LA	087	60	72	0	4(6.7)	33.1	365	61.7	34.0	7(1.9)	14.3	61	148	66.8	0.00	0.00	9.8	0
2	Northwest Coastal LA County	091	--	--	--	--	--	--	--	--	--	--	59	99	50.8	--	--	9.1	0
3	Southwest Coastal LA County	820	60	52	0	1(1.7)	25.4	--	--	--	--	--	48	87	42.4	0.00	0.00	8.6	0
4	South Coastal LA County 1	072	57	62	0	3(5.3)	30.5	365	63.4	34.2	6(1.6)	13.0	60	128	55.4	0.00	0.00	13.6	0
4	South Coastal LA County 2	077	56	83	0	5(8.9)	33.2	365	55.8	30.5	4(1.1)	12.5	59	159	65.2	0.00	0.00	12.1	0
6	West San Fernando Valley	074	--	--	--	--	--	122	39.9	27.2	1(0.8)	11.4	--	--	--	--	--	--	--
7	East San Fernando Valley	069	60	80	0	11(18.3)	39.2	295	67.5	34.4	4(1.4)	14.4	--	--	--	--	--	--	--
8	West San Gabriel Valley	088	--	--	--	--	--	122	52.0	35.7	3(2.5)	12.3	59	153	48.5	--	--	8.8	0
9	East San Gabriel Valley 1	060	52	74	0	7(13.5)	32.0	189	72.1	42.9	6(3.2)	12.8	58	208	74.9	--	--	7.9	0
9	East San Gabriel Valley 2	591	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
10	Pomona/Walnut Valley	075	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
11	South San Gabriel Valley	085	--	--	--	--	--	124	71.1	35.4	3(2.4)	14.8	59	194	69.7	0.01	0.01	9.9	0
12	South Central LA County+	112+	--	--	--	--	--	122	69.2	37.7	3(2.5)	14.7	57	118	59.6	0.01	0.01	9.9	0
13	Santa Clarita Valley	090	53	56	0	1(1.9)	23.4	--	--	--	--	--	--	--	--	--	--	--	--
ORANGE COUNTY																			
16	North Orange County	3177	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
17	Central Orange County	3176	56	63	0	1(1.8)	30.9	365	64.6	32.1	4(1.1)	11.8	--	--	--	--	--	--	--
18	North Coastal Orange County	3195	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
19	Saddleback Valley	3812	59	41	0	0	23.0	122	39.2	23.8	1(0.8)	9.5	--	--	--	--	--	--	--
RIVERSIDE COUNTY																			
22	Norco/Corona	4155	59	79	0	7(11.9)	35.6	--	--	--	--	--	--	--	--	--	--	--	--
23	Metropolitan Riverside County 1	4144	118	77	0	34(28.8)	42.5	359	47.2	39.6	12(3.4)	15.3	60	161	87.6	0.00	0.00	7.3	0
23	Metropolitan Riverside County 2	4146	--	--	--	--	--	122	42.2	34.0	2(1.6)	13.4	61	162	66.0	0.00	0.00	6.8	0
23	Mira Loma	4165	59	108	0	33(55.9)	53.4	295	49.3	40.6	16(5.4)	16.9	--	--	--	--	--	--	--
24	Perris Valley	4149	58	80	0	9(15.5)	34.8	--	--	--	--	--	--	--	--	--	--	--	--
25	Lake Elsinore	4158	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
29	Banning Airport	4164	59	99	0	1(1.7)	25.9	--	--	--	--	--	--	--	--	--	--	--	--
30	Coachella Valley 1**	4137	54	140	0	1(1.9)	22.6	122	21.8	14.6	0	6.7	--	--	--	--	--	--	--
30	Coachella Valley 2**	4157	120	132	0	9(7.5)	32.5	122	27.6	17.0	0	7.9	--	--	--	--	--	--	--
SAN BERNARDINO COUNTY																			
32	Northwest San Bernardino Valley	5175	--	--	--	--	--	--	--	--	--	--	59	123	58.5	0.00	0.00	6.8	0
33	Southwest San Bernardino Valley	5817	61	70	0	8(13.1)	35.3	122	46.9	35.9	3(2.5)	14.7	--	--	--	--	--	--	--
34	Central San Bernardino Valley 1	5197	60	75	0	13(21.7)	40.2	122	46.4	32.7	2(1.6)	14.3	58	185	84.3	--	--	6.7	0
34	Central San Bernardino Valley 2	5203	52	66	0	11(21.2)	41.5	122	37.9	35.2	3(2.4)	13.0	61	125	74.3	0.01	0.00	7.1	0
35	East San Bernardino Valley	5204	60	52	0	2(3.3)	30.2	--	--	--	--	--	--	--	--	--	--	--	--
37	Central San Bernardino Mountains	5181	50	57	0	1(2.0)	24.1	--	--	--	--	--	--	--	--	--	--	--	--
38	East San Bernardino Mountains	5818	--	--	--	--	--	61	40.8	29.4	1(1.6)	9.9	--	--	--	--	--	--	--
DISTRICT MAXIMUM				140	0	34	53.4		72.1	42.9	16	16.9		208	87.6	0.01	0.01	13.6	0
SOUTH COAST AIR BASIN				108	0	59	53.4		72.1	42.9	27	16.9		208	87.6	0.01	0.01	13.6	0

$\mu g/m^3$ - Micrograms per cubic meter of air. AAM = Annual Arithmetic Mean -- - Pollutant not monitored.

** Salton Sea Air Basin.

+ Site was relocated.

f) - PM10 samples were collected every 6 days at all sites except for Station Numbers 4144 and 4157 where samples were collected every 3 days.

g) - PM2.5 samples were collected every 3 days at all sites except for the following sites: Station Numbers 069, 072, 077, 087, 3176, 4144 and 4165 where samples were taken every day, and Station Number 5818 where samples were taken every 6 days.

h) - Federal annual PM10 standard (AAM > 50 $\mu g/m^3$) was revoked effective December 17, 2006. State standard is annual average (AAM) > 20 $\mu g/m^3$.

i) - Federal PM2.5 standard is annual average (AAM) > 15.0 $\mu g/m^3$. State standard is annual average (AAM) > 12.0 $\mu g/m^3$.

j) - Federal lead standards are rolling 3-month average > 0.15 $\mu g/m3$, and quarterly average > 1.5 $\mu g/m^3$. State standard is monthly average ≥ 1.5 $\mu g/m^3$.

Maps showing the source/receptor area boundaries can be accessed via the Internet by entering your address in the AQMD Current Hourly Air Quality Map, accessed from http://www2.aqmd.gov/webappl/gisaqi2/VEMap3D.aspx or at http://www.aqmd.gov/map/MapAQMD2.pdf. A map is also available free of charge from the AQMD Public Information Center at 1-800-CUT-SMOG.

Table 3-12. 2009 Criteria Pollutants Reported by NASA JPL to SCAQMD

Pollutant ID	Pollutant Description	Annual Emissions (Tons per Year)
CO	Carbon Monoxide	5.669
NOX	Nitrogen Oxides	8.767
ROG	Reactive Organic Gases	2.206
SOX	Sulfur Oxides	0.056
TSP	Total Suspended Particulates	0.835

Table 3-13. 2009 Toxic Pollutants Reported by NASA JPL to SCAQMD

Pollutant ID	Pollutant Description	Annual Emissions (lbs/yr)
79345	1,1,2,2-Tetrachloroethane	0.001
79005	1,1,2TRICLETHAN	0.000
95636	1,2,4TRIMEBENZE	0.195
78875	1,2-Dichloropropane {Propylene dichloride}	0.000
106990	1,3-Butadiene	1.318
542756	1,3-Dichloropropene	0.000
91576	2-Methyl naphthalene [PAH, POM]	0.000
83329	ACENAPHTHENE	0.000
208968	ACENAPHTHYLENE	0.000
75070	Acetaldehyde	5.140
107028	Acrolein	0.688
7664417	Ammonia	2206.881
7440382	Arsenic	0.008
1332214	Asbestos	0.024
191242	B[GHI] PERYLENE	0.000
71432	Benzene	7.693
205992	Benzo[b]fluoranthene	0.000
192972	Benzo[e]pyrene [PAH, POM]	0.000
7440439	Cadmium	0.008
56235	Carbon tetrachloride	0.001
76131	Chlorinated fluorocarbon 113	355.000
7782505	Chlorine	0.063
67663	Chloroform	0.000

Table 3-13. 2009 Toxic Pollutants Reported by NASA JPL to SCAQMD

Pollutant ID	Pollutant Description	Annual Emissions (lbs/yr)
18540299	Chromium (VI)	0.001
218019	Chrysene	0.000
7440508	Copper	0.022
9901	Diesel engine exhaust, particulate matter	182.240
100414	ETHYL BENZENE	1.448
106934	Ethylene dibromide	0.001
107062	Ethylene dichloride	0.000
206440	FLUORANTHENE	0.000
86737	FLUORENE	0.000
50000	Formaldehyde	13.456
1115	Glycol ethers (and their acetates)	137.288
110543	HEXANE	10.579
7647010	Hydrochloric acid	1.013
7439921	Lead (inorganic)	0.045
108383	M-XYLENE	0.689
1634044	ME T-BUTYLETHER	0.288
7439965	Manganese	0.017
7439976	Mercury	0.010
67561	Methanol	405.180
78933	Methyl ethyl ketone	12.888
108101	Methyl isobutyl ketone {Hexone}	27.772
75092	Methylene chloride	7.769
91203	Naphthalene	0.165
7440020	Nickel	0.021
1151	PAHs, total, with components not reported	0.209
85018	PHENANTHRENE	0.000
129000	PYRENE	0.000
7782492	Selenium	0.011
100425	Styrene	0.020
108883	Toluene	41.091
79016	Trichloroethylene	2.300

Table 3-13. 2009 Toxic Pollutants Reported by NASA JPL to SCAQMD

Pollutant ID	Pollutant Description	Annual Emissions (lbs/yr)
75014	Vinyl chloride	0.000
1330207	Xylenes	3.546
95476	o-Xylene	0.240

NASA JPL is currently permitted by the SCAQMD as a Regional Clean Air Incentives Market (RECLAIM) facility, and as a Title V facility under the Federal Operating Permit Program because the volumes of criteria pollutants and toxic (non-criteria) pollutants exceed regulatory thresholds, respectively. The Title V permit is the air pollution control permit system required by Title V of the Federal CAA, as amended in 1990, and is also administered by the SCAQMD. NASA JPL received its initial Title V Facility Permit in September 2001 due primarily to annual emissions of NOx exceeding the threshold amount shown in Table 1 of SCAQMD Rule 3001. The Title V facility permit was last renewed in March 2006, and is due for renewal in 2011.

The type of air emission sources that usually require SCAQMD permits to operate (Rule 201 and Rule 203) include boilers, internal combustion engines, emergency generators, painting operations, degreasers, fuel storage tanks, dispensers, and various research and development processes. Various types of these individual emissions units currently operate under SCAQMD permits at NASA JPL. **Table 3-14** is adapted from the EAPO database and lists equipment with permits in place.

Although JPL has a substantial amount of research and development activities, only one facility requires that air pollution control equipment be installed: the Microdevices Laboratory (Building 302) requires a wet scrubber to control emissions for clean room laboratory operations. NASA JPL is currently in compliance with air quality permitting regulations. **Table 3-15** summarizes a review of SCAQMD compliance history for NASA JPL, and shows three violations have occurred in the past seven years, and all were corrected within a 45-day window.

3.1.6.5 Toxic Release Inventory

NASA JPL complies with other reporting requirements, such as the Section 313 Reporting Requirements under the Emergency Planning and Community Right to Know Act (EPCRA) and toxic emission inventory reporting under Air Toxics “Hot Spots” Information and Assessment Act AB 2588. NASA JPL has submitted required inventory data; however, due to the low facility priority ranking, which is based on both toxicity and quantity of emissions, NASA JPL has not been required to submit a follow-up risk assessment of reported emissions.

3.1.7 Noise and Vibration

The following section describes noise and vibrations as environmental considerations, and describes the existing conditions that pertain to the noise and vibration environments in the NASA JPL area.

3.1.7.1 Noise

Noise is defined as sound that is unwanted or undesirable because it interferes with speech and hearing, or is otherwise annoying. Sounds are described as noise if they interfere with an activity or disturb the person hearing them. Under certain conditions, noise may cause hearing loss, interfere with human activities, and affect the health and well-being of a community.

Table 3-14. Permitted Equipment List for NASA JPL

Appl No.	Permit_Status	Eq_Type	Equip_Description	Permit No.	JPL Bldg No.	JPL Equip I.D.
510207	ACTIVE - 5/12/10	Basic	I C E (>500 HP) EM ELEC GEN DIESEL	510207	277	8159R
509746	ACTIVE - 4/22/10	Basic	I C E (50-500 HP) EM ELEC GEN-DIESEL	509746	150	8232R
497713	ACTIVE - 4/15/09	Basic	I C E (50-500 HP) EM ELEC GEN-DIESEL	497713	224	8247
471739	ACTIVE - 7/27/07	Basic	SERV STAT STORAGE & DISPENSING GASOLINE	471739	177	JPL-A65RM
468704	ACTIVE - 5/24/07	Basic	I C E (50-500 HP) EM ELEC GEN-DIESEL	468704	179	A179
458446	ACTIVE - 6/30/06	Basic	I C E (50-500 HP) EM ELEC GEN-DIESEL	458446	286	G0461
458448	ACTIVE - 6/30/06	Basic	I C E (50-500 HP) EM ELEC GEN-DIESEL	458488	Sub-H	8226
458449	ACTIVE - 6/30/06	Basic	I C E (50-500 HP) EM ELEC GEN-DIESEL	458449	159	8225
458450	ACTIVE - 6/30/06	Basic	I C E (50-500 HP) EM ELEC GEN-DIESEL	458450	150	8242
458453	ACTIVE - 6/30/06	Basic	I C E (50-500 HP) EM ELEC GEN-DIESEL	458453	249	A179
458443	ACTIVE - 6/30/06	Basic	I C E (>500 HP) EM ELEC GEN DIESEL	458443	230	S2210
458444	ACTIVE - 6/30/06	Basic	I C E (>500 HP) EM ELEC GEN DIESEL	458444	230	S2209
458445	ACTIVE - 6/30/06	Basic	I C E (>500 HP) EM ELEC GEN DIESEL	458445	230	S2208
458447	ACTIVE - 6/30/06	Basic	I C E (>500 HP) EM ELEC GEN DIESEL	458447	150	8150
458451	ACTIVE - 6/30/06	Basic	I C E (>500 HP) EM ELEC GEN DIESEL	458451	310	8145
458452	ACTIVE - 6/30/06	Basic	I C E (>500 HP) EM ELEC GEN DIESEL	458452	302	8229
454660	ACTIVE - 3/21/06	Basic	SEMICONDUCTOR, INTEGRATED CIRCUIT >=5 PC	454660	302	JPL-A79
436668	ACTIVE - 11/24/04	Basic	I C E (50-500 HP) EM ELEC GEN-NAT GAS	436668	244	G2395
417563	ACTIVE - 8/10/03	Basic	CHARBROILER - NATURAL GAS	417563	167	A167-6
415437	ACTIVE - 5/23/03	Basic	Degreaser (<=1 lb/day VOC w/ Toxics)	415437	302	A302-7
415436	ACTIVE - 5/23/03	Control	SCRUBBER, OTHER VENTING S.S.	415436	302	JPL-A76
401919	ACTIVE - 5/30/02	Basic	SOLDERING MACHINE	401919	103	2062714
375751	ACTIVE - 11/3/00	Basic	DEGREASER OTHER SOLVENTS <=1 lb/d VOC	375751	103	A103-4
366520	ACTIVE - 4/7/00	Basic	I C E (50-500 HP) EM ELEC GEN-NG & LPG	366520	308	8238
354582	ACTIVE - 4/16/99	Control	SPRAY BOOTH PAINT AND SOLVENT	F20748	18	JPL-A2
346766	ACTIVE - 10/9/98	Basic	SEMICONDUCTOR, INTEGRATED CIRCUIT	F19446	302	JPL-A78R
322821	ACTIVE - 12/5/96	Basic	BOILER (<5 MMBTU/HR, NG ONLY)	F5280	171	M0072
322825	ACTIVE - 12/5/96	Basic	BOILER (<5 MMBTU/HR, NG ONLY)	F5281	171	M0098
297842	ACTIVE - 2/27/95	Basic	BOILER (<5 MMBTU/HR, NG ONLY, LOW NOX BURNER)	D88716	180	M1942
297842	ACTIVE - 2/27/95	Control	BOILER (<5 MMBTU/HR, NG ONLY, LOW NOX BURNER)			

Table 3-14. Permitted Equipment List for NASA JPL

Appl No.	Permit_Status	Eq_Type	Equip_Description	Permit No.	JPL Bldg No.	JPL Equip I.D.
297843	ACTIVE - 2/27/95	Basic	BOILER (<5 MMBTU/HR, NG ONLY, LOW NOX BURNER)	D88717	180	M1943
297843	ACTIVE - 2/27/95	Control	BOILER (<5 MMBTU/HR, NG ONLY, LOW NOX BURNER)			
295383	ACTIVE	Basic	BOILER (<5 MMBTU/HR, NG ONLY, LOW NOX BURNER)	D86359	161	M3050
295383	ACTIVE - 10/31/94	Control	BOILER (<5 MMBTU/HR, NG ONLY, LOW NOX BURNER)			
295375	ACTIVE - 10/31/94	Basic	BOILER (<5 MMBTU/HR, NG ONLY, LOW NOX BURNER)	D86539	161	M3051
295375	ACTIVE - 10/31/94	Control	BOILER (<5 MMBTU/HR, NG ONLY, LOW NOX BURNER)			
291526	ACTIVE - 6/13/94	Basic	BOILER (<5 MMBTU/HR, NG ONLY)	D94750	238	M6631R
289485	ACTIVE - 3/17/95	Basic	I C E (50-500 HP) EM PORT N-RNT GASOLINE	D89575	212	8984
288576	ACTIVE - 3/13/95	Basic	I C E (50-500 HP) EM ELEC GEN-DIESEL	D89308	150	8232
285226	ACTIVE - 5/26/94	Basic	I C E (50-500 HP) EM ELEC GEN-DIESEL	D83262	202	8216
285227	ACTIVE - 5/31/94	Basic	I C E (50-500 HP) EM ELEC GEN-DIESEL	D83305	268	8886
285413	ACTIVE - 5/26/94	Basic	I C E (50-500 HP) EM ELEC GEN-NAT GAS	D83263	298	8217

ICE - Internal Combustion Engine
HP - Horsepower
EM - Emergency
GEN - Generator
ELEC - Electric
NG/NAT GAS - Natural Gas
MMBTU - Million British Thermal Units

Table 3-15. SCAQMD Notices to Comply for NASA JPL

Notice Number	Violation Date	Re-Inspection Date	Status
C85692	1/7/2003	2/20/2003	In Compliance
D10825	7/15/2007	8/23/2007	In Compliance
D23916	7/1/2007	7/10/2009	In Compliance

Sound pressure levels are commonly measured in a logarithmic unit called a decibel (dB). The human ear is not equally sensitive to all sound frequencies, being less sensitive to very low and very high frequency sounds. Therefore, sound levels in standard frequency bands are weighted differentially to correspond more closely to the frequency response of the human ear and the human perception of loudness. Such weighted sound levels are designated as A-weighted and measured in units of A-weighted decibel (dBA).

For the average person, a 10-dBA increase in the measured sound level is subjectively perceived as being twice as loud, and a 10-dBA decrease is perceived as half as loud. The dB change at which the average human would indicate that the sound is just perceptibly louder, or perceptibly quieter, is 3 dBA. There is generally a 10-dBA reduction in sound level for each doubling of distance from a noise source due to spherical spreading loss (e.g., if the sound level at 7.6 m (25 ft) from a piece of construction equipment was 86 dB, the sound level at 15.2 m (50 ft) would be expected to be 76 dB, at 100 ft 66 dB, etc.). Typical sound levels experienced by people range from about 40 dBA in a quiet living room to 85 dBA on a sidewalk adjacent to heavy traffic.

Table 3-16 provides a list of typical noise levels. The general principle on which most noise acceptability criteria are based is that a perceptible change in noise is likely to cause annoyance wherever it intrudes upon the existing ambient sound; that is, annoyance depends upon the sound that exists before the introduction of the new sound.

Varying noise levels are often described in terms of the equivalent constant dB level. Equivalent noise levels (Leq) are used to develop single-value descriptions of average noise exposure over various time periods. Such average noise exposure ratings often include additional weighting factors for potential annoyance due to time of day or other considerations. Leq data used for these average noise exposure descriptors are based on A-weighted sound level measurements, although other weighting systems are used for special conditions (e.g., blast noise).

Average noise exposure over a 24-hour period is often presented as a day-night average sound level (Ldn) or a community noise equivalent level (CNEL). Ldn values are calculated from hourly Leq values, with the Leq values for the nighttime period (10 p.m. – 7 a.m.) increased by 10 dB to reflect the greater disturbance potential from nighttime noises. CNEL values are very similar to Ldn values, but include a 5 dB annoyance adjustment for evening (7 p.m. – 10 p.m.) Leq values, in addition to the 10 dB adjustment for nighttime Leq values. Unless specifically noted otherwise, Ldn and CNEL values are assumed to be based on dBA measurements. For any given noise condition, the CNEL value will be slightly higher than the corresponding Ldn value. But in the context of land use compatibility standards, Ldn and CNEL levels are considered equivalent to each other.

Table 3-16. Typical Noise Levels

Noise Level (dBA)	Noise Source
140	Jet engine
130	Threshold of pain
115-120	Amplified rock band
105-115	Commercial jet takeoff at 200 feet
95-105	Community warning siren at 100 feet
85-95	Busy urban street
75-85	Construction equipment at 50 feet
65-75	Freeway traffic at 50 feet
55-65	Normal conversation at 6 feet
45-55	Typical office interior
35-45	Soft radio music
25-35	Typical residential interior
15-25	Typical whisper at 6 feet
5-15	Human breathing
0-5	Threshold of hearing

The nature of dB scales is such that individual dB ratings for different noise sources cannot be added directly to give the dB rating of the combination of these sources. Two noise sources producing equal dB ratings at a given location will produce a composite noise level 3 dB greater than either sound alone. When two noise sources differ by 10 dB, the composite noise level will be only 0.4 dB greater than the louder source alone. Most people have difficulty distinguishing the louder of two noise sources that differ by less than 1.5 to 2 dB. A 10 dB increase in noise level is perceived as a doubling in loudness. A 2 dB increase represents a 15 percent increase in loudness, a 3 dB increase is a 23 percent increase in loudness, and a 5 dB increase is a 41 percent increase in loudness.

When distance is the only factor considered, sound levels from an isolated noise source will typically decrease by 6 dB for every doubling of distance away from the noise source. When the noise source is a continuous line (e.g. relatively continuous vehicle traffic on a highway), noise levels decrease by 3 dB for every doubling of distance.

Surrounding Land Uses

Surrounding land uses for NASA JPL are described in Section 3.1.1. The closest schools are primarily southwest of NASA JPL in the City of La Cañada Flintridge, or east and southeast of NASA JPL in Altadena. All of the school sites are at least 0.4 km (0.25 mi) from the boundary of NASA JPL. In general, noise conditions at these school sites are dominated by noise from highway traffic.

Community Noise Standards

In California, local general plans are required to include a noise element, which identify predominant noise sources and problems, establish land use compatibility standards for various land use categories, and establish policies and implementation programs for addressing noise issues in the local community. The City of La Cañada Flintridge and the City of Pasadena have adopted similar land use compatibility standards as part of their general plan noise elements, but use different terminology to describe the same acceptability standards.

The noise element of the La Cañada Flintridge general plan specifies a CNEL of less than 70 dBA as normally acceptable and a CNEL of 67.5 to 77.5 dBA as conditionally acceptable for the office buildings, businesses, and commercial and professional land use category. The noise element uses the term “normally acceptable” to mean that noise conditions are acceptable for a land use assuming conventional construction without any specific noise attenuation designs, while “conditionally acceptable” means that noise conditions are acceptable for a land use assuming conventional construction with windows closed and provision of a fresh air supply and air conditioning.

Chapter 5.36 of the La Cañada Flintridge Municipal Code allows construction equipment to produce noise levels exceeding 65 dBA at the property line only if the equipment is operated during specified hours of the day. Construction equipment use is prohibited on Sundays and holidays. When standard time is in effect, construction equipment use is limited to the hours of 7 a.m. to 6 p.m., Mondays through Fridays, and 9 a.m. to 5 p.m. on Saturdays. When daylight savings time is in effect, the Monday through Friday hours are extended to 7 p.m. This Chapter also contains procedures for allowing construction equipment use outside these designated hours.

The noise element of the Pasadena general plan specifies a CNEL of less than 70 dBA as clearly acceptable and a CNEL of 67.5 to 77.5 dBA as normally acceptable for the office buildings, businesses, and commercial and professional land use category. The “clearly acceptable” category in the Pasadena noise element is equivalent to the “normally acceptable” category in the La Cañada Flintridge noise element. Similarly, the “normally acceptable” category in the Pasadena noise element is equivalent to the “conditionally acceptable” category in the La Cañada Flintridge noise element.

The noise element of the Pasadena general plan sets the clearly acceptable CNEL limit for schools, libraries, churches, hospitals, and nursing homes at 65 dBA; the noise element of the La Cañada Flintridge general plan sets the comparable limit at 70 dBA. Except for that difference, the noise elements of the Pasadena and La Cañada Flintridge general plans set the same land use compatibility standards.

Title 9 of the Municipal Code of Pasadena includes two relevant noise ordinance sections. Chapter 9.36 establishes general noise limits and restrictions for a range of noise sources. The noise restrictions most relevant to actions associated with implementation of the Master Plan at NASA JPL include:

- Limits the use of pile drivers, power shovels, pneumatic hammers, derrick power hoists, forklifts, cement mixers, and similar construction equipment within 152 m (500 ft) of a residential district at any time other than 7 a.m. to 7 p.m., Mondays through Fridays and 8 a.m. to 5 p.m. on Saturdays. These restrictions prohibit the use of such construction equipment on Sundays and holidays.

- Prohibits the operation of powered construction equipment that generates a noise level in excess of 85 dBA at a distance of 30.5 m (100 ft).

The City of Pasadena general plan also includes long-term planning policies at NASA JPL that encourage:

- Site planning and traffic control measures that minimize the effect of traffic noise in residential zones.

- Automobile and truck access to industrial and commercial properties abutting residential zones to be located at the maximum practical distance from residential zones.

- Limitations on the use of motorized landscaping equipment, parking lot sweepers, and other high-noise equipment on commercial properties if activity will result in noise that adversely affects residential zones.

- Limitations on the hours of truck deliveries to industrial and commercial properties abutting residential zones unless there is no feasible alternative or there are substantial transportation benefits for scheduling deliveries at another hour.

- Limitations on construction activities adjacent to noise-sensitive receptors.

- Construction and landscaping activities that employ techniques for minimizing noise.

The community plan for the unincorporated community of Altadena does not include a formal noise element. The Altadena community plan does, however, identify a CNEL of 65 dBA as the land use compatibility standard for noise-sensitive land uses (residential, schools, and health care facilities). As a Federal facility, NASA JPL would be cognizant of noise restrictions for surrounding communities and integrate these restrictions into noise control parameters established as part of the planning process.

Noise sources at NASA JPL

Noise sources at NASA JPL include vehicle traffic and parking, cooling towers, pumping stations, compressors, backup generators, building ventilation and air conditioning equipment, various blowers and exhaust fans, LN system venting equipment, equipment fabrication and maintenance shops, laboratory and testing facilities, and grounds maintenance activities. Many mechanical equipment noise sources are housed inside buildings, a factor that reduces the equipment contribution to outdoor ambient noise levels.

Ambient Noise Levels at NASA JPL

A survey of ambient noise conditions was conducted at NASA JPL by Tetra Tech, Inc., from May 22-27, 2007. The noise survey included long-term noise monitoring at eight stations and short-term monitoring at 37 locations. Type 1 (precision) integrating sound level meters were utilized at six of the long-term monitoring stations. Type 2 (general purpose) data logging sound level meters were used at two of the long-term monitoring stations and at all 37 short-term monitoring locations. Noise monitoring was conducted on weekdays at seven of the long-term monitoring stations and all of the short-term monitoring locations. Additional monitoring was conducted at five of the long-term monitoring stations on a weekend using three Type 1 and two Type 2 sound level meters. Monitoring durations were approximately 24 hours at most of the long-term monitoring stations and 10 to 18 minutes at most of the short-term monitoring locations.

The long-term monitoring stations were located around the periphery of NASA JPL. These locations provide conservative estimates of noise contributions from NASA JPL to adjacent land uses. Noise levels measured at these stations are not exclusively produced by noise sources at NASA JPL. Off-site vehicle traffic and recreational activities contribute to noise levels measured at stations along the southern and western boundaries of NASA JPL. **Figure 3-6** illustrates locations used for long-term noise monitoring. Noise levels measured at the long-term monitoring stations are summarized in **Table 3-17**.

Long-term station 1 (LT-1) through LT-6 were monitored using Type 1 sound level meters. Stations LT-7 and LT-8 were supplemental stations monitored with Type 2 sound level meters. Battery problems caused early termination of data logging at station LT-7 during the weekday monitoring episode. In general, the highest noise levels around the periphery of NASA JPL were on the east side of the property. The lowest noise levels around the periphery of NASA JPL were on the north side of the property. LT-1, located along the eastern boundary, had the highest noise levels of all the LT stations and was the only location where minimum noise levels did not drop below 50 dBA. Long-term station 6 (LT-6) located along the northern boundary above the Mesa, had the lowest noise levels of all of the long-term stations.

Stations LT-1, LT-3, LT-5 and LT-7 were monitored for 24 hours or more on a weekday and a weekend. Station LT-1 exhibited higher noise levels on the weekend than on the weekday. Station LT-3 showed lower noise levels on the weekend compared to the weekday monitoring. Station LT-5 had slightly lower overall average noise levels on the weekend compared to the weekday, but slight differences in evening and nighttime noise levels produced a higher CNEL level for the weekend compared to the weekday.

The CNEL levels measured near NASA JPL boundaries were within normally/clearly acceptable land use compatibility standards for office-type land uses identified in the noise elements of the La Cañada Flintridge and Pasadena general plans. The measured CNEL levels at stations LT-4 through LT-8 were also within normally/clearly acceptable land use compatibility standards for low density residential land uses identified in the noise elements of the La Cañada Flintridge and Pasadena general plans. Measured CNEL levels at stations LT-1 through LT-3 were within the conditionally/normally acceptable land use compatibility standards for low density residential land uses as identified in the noise elements of the La Cañada Flintridge and Pasadena general plans.

Given the buffer provided by the Arroyo Seco open space area (approximately 0.3 km [0.2 mi] near station LT-2 and approximately 0.2 km [0.13 mi] near station LT-1), the highest CNEL level measured at station LT-1 (68.9 dBA) would be reduced to less than 65 dBA in the residential portions of Altadena. Thus, the long-term noise monitoring data collected in May 2007 indicate that NASA JPL is not causing noise levels in adjacent residential areas to exceed applicable land use compatibility standards.

Table 3-17. Summary of Noise Levels at Long-Term Monitoring Stations Near NASA JPL

Monitoring Station	Weekday/ Weekend	Monitoring Duration	CNEL dBA	Leq dBA	Lmax dBA	L10 dBA	L90 dBA	Lmin dBA
LT-1	Weekday	24.8 hrs	65.0	61.2	99.7	58.9	55.4	53.5
LT-1	Weekend	25.8 hrs	68.9	62.7	89.6	63.8	60.8	58.3
LT-2	Weekday	24 hrs	62.4	58.2	99.8	57.7	50.2	46.6
LT-3	Weekday	24 hrs	62.7	58.9	87.4	61.6	47.2	41.6
LT-3	Weekend	24.9 hrs	61.7	57.2	88.9	58.3	47.9	42.2
LT-4	Weekday	24 hrs	57.9	54.7	102.1	54.5	43.1	36.0
LT-5	Weekday	24 hrs	54.4	50.0	85.7	51.0	42.2	38.9
LT-5	Weekend	25 hrs	56.3	48.9	96.9	46.9	39.1	33.4
LT-6	Weekday	24 hrs	51.7	45.4	75.6	45.9	41.0	36.6
LT-7	Weekday	10.6 hrs	n.a.	51.4	73.6	52.7	48.0	45.9
LT-7	Weekend	20.7 hrs	57.3	53.6	91.8	52.3	48.3	46.4
LT-8	Weekend	24.4 hrs	55.3	53.1	89.7	50.7	44.3	41.9

Source: Tetra Tech 2007.

Notes:

Monitoring at stations LT-1 through LT-6 was conducted using Type 1 integrating sound level meters set to A-weighting, fast response (1/8-second data integration period).

Monitoring at stations LT-7 and LT-8 was conducted using Type 2 data logging sound level meters set to A-weighting, fast response, and a 3-second data logging interval.

Battery problems caused early termination of data logging at station LT-7 during the weekday monitoring episode.

dBA = "A-weighted" decibel scale

CNEL = a 24-hour average with annoyance penalties of 5 dBA for evening noise and 10 dBA for nighttime noise

Leq = equivalent continuous noise level (energy-averaged without annoyance penalties)

Lmax = maximum sound level

L10 = noise level exceeded 10% of the time

L90 = noise level exceeded 90% of the time

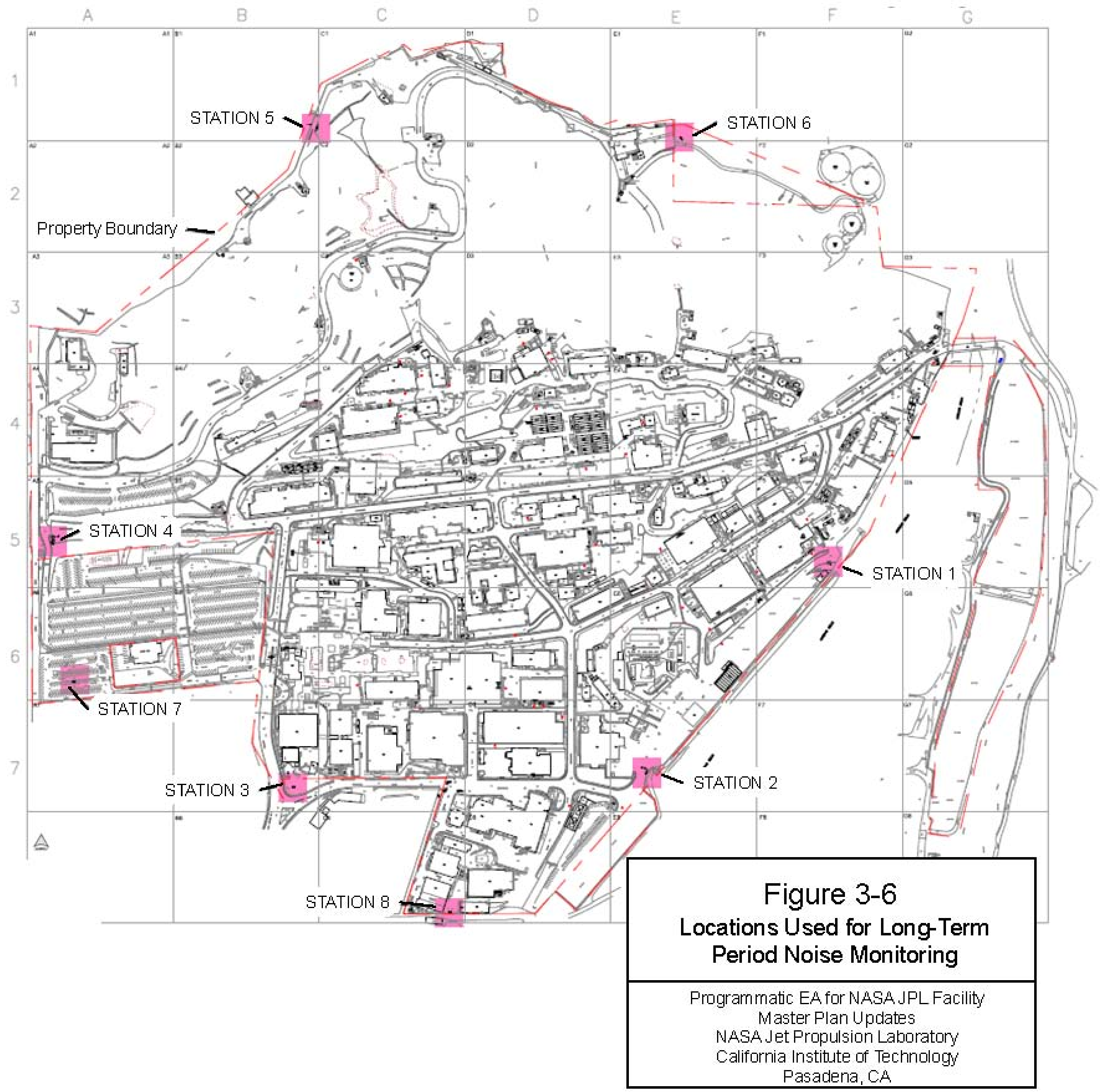
Lmin = minimum sound level

n.a. = not applicable; too few hours of data to calculate CNEL

The long-term noise monitoring was supplemented by short-term monitoring conducted at 37 locations between May 22, 2007 and May 25, 2007. All of the short-term noise monitoring was conducted on weekdays between 6:45 a.m. and 5:20 p.m. The primary purpose of the short-term monitoring was to collect noise level data for various types of equipment noise sources.

Many equipment noise sources at NASA JPL operate intermittently. Consequently, equipment was not in operation during all of the short-term monitoring episodes. When equipment at a particular building was not in operation, the resulting noise monitoring data represented general ambient noise level conditions. **Table 3-18** summarizes short-term noise monitoring data from 11 locations representing on-site general ambient noise conditions. Ambient noise levels at the locations in **Table 3-18** included traffic noise and equipment noise associated with other buildings in the vicinity, but no recognizable equipment noise from the referenced building.

Figure 3-6. Locations Used for Long-Term Period Noise Monitoring at NASA JPL



Mechanical equipment associated with particular buildings dominated the outdoor noise levels measured at 26 of the short-term monitoring locations. In a few monitoring events, local vehicle traffic also contributed to the measured noise levels.

Table 3-19 summarizes the noise level data from locations with identifiable mechanical equipment noise sources. It should be noted that monitoring durations at the locations listed in **Table 3-19** generally lasted for 10 to 16 minutes, but identified equipment sometimes operated for only a portion of the monitoring episode. Noise levels in this table reflect the period when the equipment was operating.

Table 3-18. Short-Term Measurements of Daytime Ambient Noise Levels, NASA JPL

Location Number	Monitoring Location	Monitoring Duration	Leq dBA	Lmax dBA	Lmin dBA
ST-01	40 feet west of Building 280	17.48 minutes	62.1	77.6	55.3
ST-02	30 feet west of Building 18	16.38 minutes	60.9	77.6	55.3
ST-03	25 feet west of Building 286	16.63 minutes	58.9	77.6	50.2
ST-04	25 feet east of Building 310	16.82 minutes	58.6	79.8	48.7
ST-05	26 feet east of Building 308	18.68 minutes	62.6	82.3	52.2
ST-08	30 feet SE of Building 271	14.85 minutes	66.6	73.8	64.7
ST-10	25 feet east of Building 149	14.95 minutes	54.4	72.5	49.1
ST-25	North side of Mariner Road facing Building 157	12.27 minutes	63.8	83.9	49.7
ST-30	50 feet west of Building 230	13.98 minutes	56.0	67.5	48.6
ST-34	30 feet west of Building 268	9.97 minutes	48.8	60.8	46.7
ST-37	30 feet NE of Building 144	12.95 minutes	62.0	66.0	51.6

Source: Tetra Tech 2007.

Notes: Type 2 data logging sound level meters were used and set to A-weighting, fast response, and a 1-second data logging interval. Leq = equivalent continuous noise level; Lmax = maximum sound level; Lmin = minimum sound level; dBA=A-weighted decibel scale.

Table 3-19. Short-Term Measurements of Outdoor Equipment Noise Levels, NASA JPL

Station No.	Monitoring Location	Dominant Noise Sources	L_{eq} (dBA)	L_{max} (dBA)	L_{min} (dBA)
ST-06	40 feet west of Building 315	Cooling towers and traffic	67.8	87.4	58.4
ST-07	28 feet east of Building 158.A1	Compressor	75.0	77.5	73.5
ST-09	27 feet north of Building 11	Filling liquid nitrogen tank	82.4	90.3	73.5
ST-11	30 feet north of Building 149	Outdoor condenser and motor	63.6	69.1	60.5
ST-12	28 feet north of Building 150	Outdoor chiller system	70.4	83.2	68.3
ST-13	30 feet NE of building 150	Liquid nitrogen venting	82.0	88.2	76.7
ST-14	32 feet south of Building 150	Pump room	81.3	85.8	37.8
ST-15	25 feet north of Building 144	Fan and vibration table room	66.6	84.0	53.6
ST-16	28 feet east of Building 144	Fan and liquid nitrogen venting	60.1	67.7	58.4
ST-17	25 feet south of Building 296	Cooling towers	64.3	71.6	62.9
ST-18	40 feet north of equipment pad southeast of Building 300	Outdoor chiller system	71.5	73.1	68.0
ST-19	50 feet west of Building 300	Air handler room	63.0	70.1	59.1
ST-20	30 feet east of Building 302	Air handler room	67.4	69.0	66.4
ST-21	25 feet SW of Building 170	Outdoor compressor and pump	67.0	72.0	63.8

Source: Tetra Tech 2007.

Notes: Type 2 data logging sound level meters were used and set to A-weighting, fast response, and a 1-second data logging interval. Building 158.A1 (station ST-07) is an accessory building at the southwest corner of building 158. Stations ST-18 and ST-35 represent two separate monitoring episodes at the same location; Leq = equivalent continuous noise level; Lmax = maximum sound level; Lmin = minimum sound level

The data in **Table 3-19** illustrate that there can be intermittently high noise levels near some types of mechanical equipment on NASA JPL. However, noise levels due to these localized sources would decrease rapidly at increasing distances from the equipment. The noise levels measured at the long-term monitoring stations demonstrate that high levels of equipment noise are limited to localized areas within NASA JPL, and do not adversely affect noise levels at the property fence line.

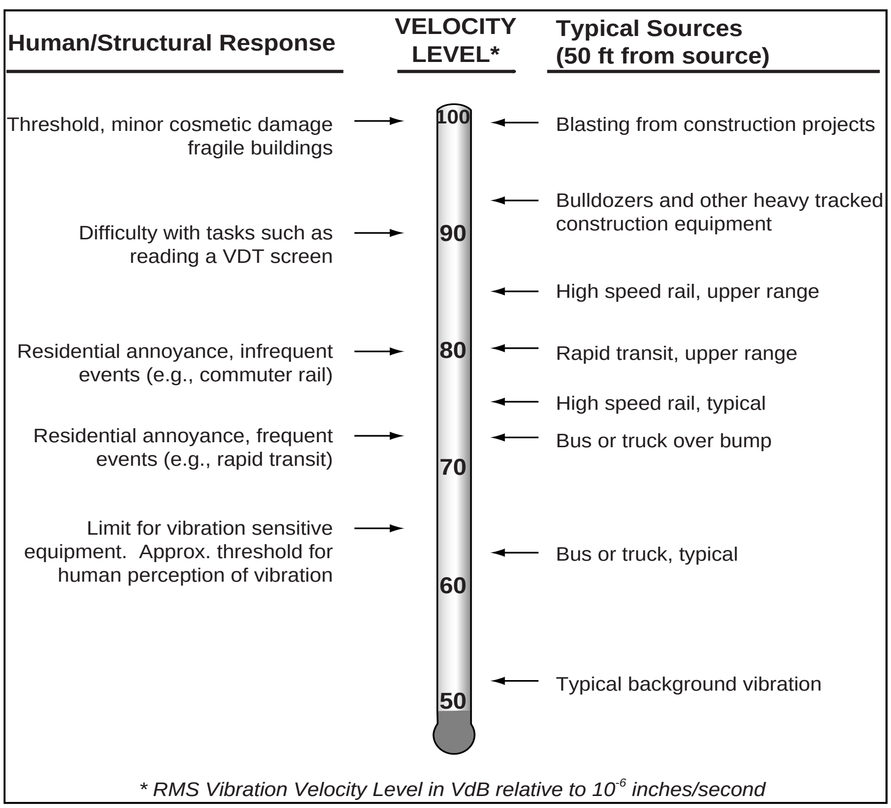
CNEL levels measured near NASA JPL boundaries were within normally/clearly acceptable land use compatibility standards for office-type land uses and residential developments, as identified in the noise elements of the La Cañada Flintridge and Pasadena general plans. Thus, the 2007 noise monitoring data indicated that NASA JPL was not causing noise levels in adjacent residential areas to exceed land use compatibility standards.

3.1.7.2 Vibration

Ground borne vibration is the oscillatory motion of the ground about some equilibrium position, and is described in terms of velocity for evaluating impact. Vibration above certain levels can damage buildings, disrupt sensitive operations, and cause discomfort to humans within buildings. **Figure 3-7** illustrates typical ground borne vibration levels for common sources, and criteria for human and structural response to ground borne vibration. As shown, the range of interest is from 50 vibration decibels (VdB) to 100 VdB, from imperceptible background vibration to the threshold of damage. Although the threshold of human perception to vibration is 65 VdB, annoyance is minor unless the vibration exceeds 70 VdB.

Airborne sound waves can also cause vibrations to structures. Studies have shown sound levels reaching a home or other structure must be greater than 137 dB to cause any damage (JPL 2008).

Figure 3-7. Typical Ground-Borne Vibration Levels and Criteria



Source: U.S. Federal Transit Administration, 1995.

3.1.8 Geology and Soils

Land resources are described in terms of topography, geology, and seismology.

3.1.8.1 Regulatory Framework

This regulatory framework identifies the Federal, state, and local statutes and policies that relate to geology and soils, and must be considered by JPL during the decision making process for projects that involve earth moving or soil disturbance, such as grading, excavation, backfilling, or the modification of existing structures or construction of new structures.

Federal

There are no specific Federal regulations addressing geology and soils issues that are not addressed by the more stringent state or local requirements.

State

The California Geological Survey (CGS) has delineated special study zones along known active and potentially active faults in California pursuant to the Alquist-Priolo Earthquake Fault Zones (APEFZ) Act of 1972. The State designates the authority to local government to regulate development within APEFZ. Construction of habitable structures is not permitted over potential rupture zones.

The CGS has also identified Seismic Hazard Zones that are delineated in accordance with the Seismic Hazard Mapping Program (SHMP) of the Seismic Hazards Act of 1990. The Act is "to provide for a statewide seismic hazard mapping and technical advisory program to assist cities and counties in fulfilling their responsibilities for protecting the public health and safety from the effects of strong ground shaking, liquefaction, landslides, or other ground failure and other seismic hazards caused by earthquakes."

The CGS identifies several earth resource issues that should be taken into consideration in evaluating whether proposed projects are likely to be subject to geologic hazards, particularly related to earthquake damage. These considerations include the potential for existing conditions to pose a risk to the project, and the potential for the project to result in an impact on the existing conditions for geology or soils. The State of California (Uniform) Building Code sets standards for investigation and mitigation of facility conditions related to fault movement, liquefaction, landslides, differential compactions/seismic settlement, ground rupture, ground shaking, tsunami, seiche, and seismically induced flooding. Mitigation of geological (including earthquake) and soil (geotechnical) issues must be undertaken in compliance with the California Building Code.

The State CGS establishes regulations related to geologic hazards (e.g., faulting, liquefaction, subsidence, ground shaking) as they affect persons and structures. Projects located within special studies (active or potentially active faults) or designated hazards (liquefaction or seismically induced landslide) zones as delineated by the APEFZ and SHMP may be subject to regulatory control. The State designates this control to local governments to regulate development within special studies and hazards zones. The CGS also issues guidelines for the evaluation of geologic and seismic factors that may impact a project, or that a project may affect. Applicable guidelines include: California Division of Mines and Geology (CDMG) Note 42, Guidelines to Geologic/Seismic Reports; CDMG Note 46, Guidelines for Geologic/Seismic Considerations in Environmental Impact Reports; and CDMG Note 49, Guidelines for Evaluating the Hazard of Surface Fault Rupture

Each guideline provides checklists and outlines to help insure a comprehensive report of geologic/seismic conditions. Although not mandatory in all their detail, these guidelines provide assistance in assuring completeness of geologic/seismic studies conducted for a project.

3.1.8.2 Topography

NASA JPL is located near the southwestern base of the San Gabriel Mountains. The northern portion of the facility is mountainous and steep and topped by a narrow ridge. The remainder of the facility slopes moderately and has been graded extensively throughout its development. The site terrain varies in elevation from 328 m (1,075 ft) to 140 m (458 ft) above mean sea level (amsl). Periodic tectonic uplift of the mountains has occurred during the past 1 to 2 million years producing the present area topography. Most of this uplift occurred along north to northeast dipping reverse and thrust faults located along the southwestern edges of the mountains.

3.1.8.3 Geology

NASA JPL is situated on an alluvial plain of the San Gabriel Mountains. These mountains north of NASA JPL are of the Quaternary Pacoima Formation. This formation is composed of conglomeratic arkosic sandstones of stream channel and fanglomeratic origin (Ebasco, 1990). **Figure 3-8** illustrates the general geology of the Los Angeles basin and the NASA JPL area. The soil consists primarily of 50.8 cm (20 in) to 76.2 cm (30 in) of fine sandy loam (Hanford Series). Similar subsoil extends to a depth of 1.8 m (6 ft) and is underlain by a granitic basement. This crystalline basement is composed of rocks ranging from Precambrian to Tertiary, and includes various types of diorites, granites, monzonites, and granodorites with a history of intrusion and metamorphism.

The northern portions of NASA JPL include relatively steep ascending terrain underlain by crystalline granitic rock at shallow depths. The southern portions of the site slope gently to the south on the surface of an alluvial fan, which includes relatively deep sequences of sands, gravel, cobbles, and boulders.

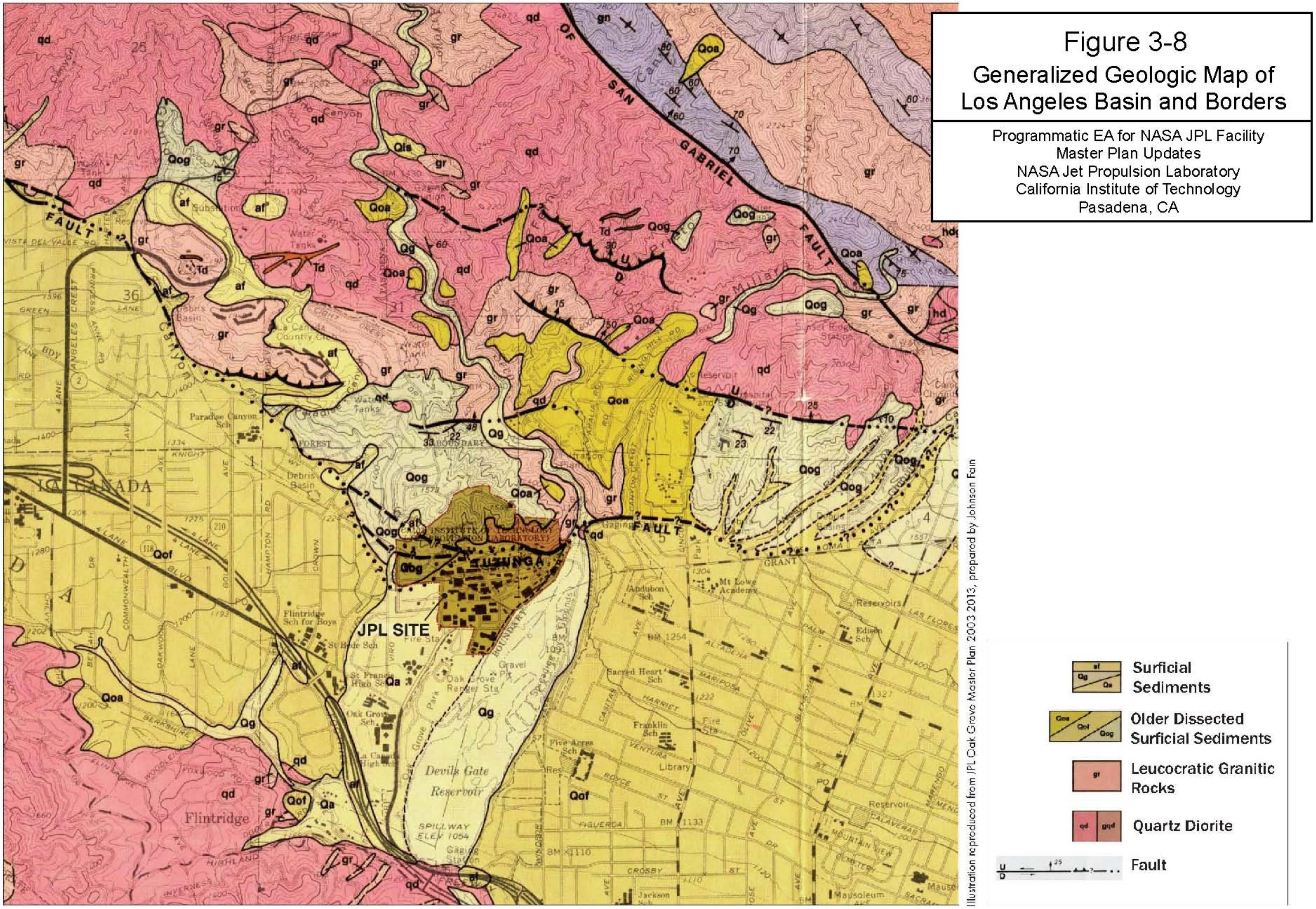
The Arroyo Seco, a drainage course emanating from the San Gabriel Mountains, has incised through the alluvium on the southeast side of NASA JPL. The near surface soils reflect the underlying parent material, are granular, and include a fine to coarse sandy loam, underlain by sands and silty to clayey sands with gravel and cobbles (Johnson Fain, 2003).

Soils –NASA JPL soils consist of 51 to 76 cm (20 to 30 in) of fine sandy loam (Hanford Series). Soils are mapped as Balder family-Xerorthents complex, 5 to 60 percent slopes (USDA 2010). The Balder family soils are well drained gravelly sandy loam derived from residuum weathered from granodiorite. Xerorthents soils are somewhat excessively drained gravelly sandy loam derived from residuum weathered from granodiorite and/or residuum weathered from metamorphic rock (NASA JPL 2006). Similar subsoil extends to a depth of 1.8 m (6 ft) and is underlain by a grantic basement. This crystalline basement is composed of rocks ranging from Precambrian to Tertiary, and includes various types of diorites, granites, monzonites, and granodorites with a complex history of intrusion and metamorphism (JPL 2008).

3.1.8.4 Seismology

NASA JPL is located at the southwestern base of the San Gabriel Mountains. These mountains are part of the Transverse Ranges Physiographic province, which is characterized by east-west trending mountain ranges and active thrust faulting. The site terrain varies in elevation from approximately 328 m (1,075 ft) to 472 m (1,550 ft) amsl. The northern portions of the site include relatively steep ascending terrain underlain by crystalline granitic rock at shallow depths. The southern portions of the site slope to the south on the surface of an alluvial fan, which includes relatively deep sequences of sands, gravel, cobbles and boulders (**Figure 3-8**).

Figure 3-8. Generalized Geologic Map of Los Angeles Basin and Borders



The Arroyo Seco, a drainage course emanating from the San Gabriel Mountains, has incised through the alluvium on the southeast side of NASA JPL. The near surface soils reflect the underlying parent material, are generally granular, and include a near surface fine to coarse sandy loam, underlain by sands and silty to clayey sands with gravel and cobbles. The on-site soils have moderate to high foundation-bearing capacity and low to moderate expansion potential. Excavation of the alluvial fan deposits is generally feasible; cobbles and boulders may impact the re-use of excavated material for structural fill. Excavation in the granitic rock areas may encounter difficult to severe digging conditions. The corrosion potential of the onsite soils ranges from slight to moderate.

NASA JPL is located in a seismically active area as is most of southern California. Active faults in the vicinity of NASA JPL include the San Andreas fault located 39 km (24 mi) to the northeast, the Newport-Inglewood fault zone located 28 km (17.5 mi) to the southwest, the Whittier-Elsinore fault located 27 km (17 mi) to the south/southeast, and the Raymond fault located 5.6 km (3.5 mi) to the south (**Figure 3-9**). The active Sierra Madre fault zone trends east-west along the base of the San Gabriel Mountains, crossing through NASA JPL.

The Sierra Madre fault zone includes multiple segments of reverse thrust faults that dip steeply to the north. It is considered to be more active along the western end of the fault zone with decreasing activity in the central and eastern portions. NASA JPL is located within the central portion of the Sierra Madre fault zone. The fault zone is considered active and capable of producing moderate to large earthquakes and ground rupture. Historic earthquakes along related fault zones include the 1971 M6.5 San Fernando Earthquake and the 1991 M5.8 Sierra Madre Earthquake. Current U.S. USGS data indicate that the Sierra Madre fault zone is capable of producing a Magnitude 7.0 earthquake. Although recent geologic studies of the Sierra Madre fault system near NASA JPL indicate Holocene fault movement, the Sierra Madre fault zone on site is not currently zoned as an APEFZ by the CGS.

The on-site trace of the Sierra Madre fault is referred to as the JPL Bridge fault. The location of the fault on site is based on relatively extensive exploration of the fault zone in 1977 by the joint efforts of LeRoy Crandall and Associates and the Caltech Sierra Madre Fault Investigation Team (**Figure 3-10**). The mapped fault trace trends east/west just north of Explorer Road. The eastern half of the fault trace is relatively well defined and mapped as a narrow solid fault trace. The western half of the fault trace is more complex and less well defined. Three diverging fault traces are projected across the western half of the site. These faults are mapped as queried, dashed, fault traces shadowed by relatively wide potential rupture zones. The western fault traces are based on interpretation of geomorphic features and exploratory drilling results, rather than direct observation of faulting. The relatively wide potential rupture zones are based on the degree of fault trace uncertainty and possible variation in rupture paths through relatively deep alluvium in these areas.

Seismic hazards on site include fault related ground rupture and ground shaking hazards. A significant earthquake along the Sierra Madre fault zone could result in surface ground rupture at NASA JPL. Vertical displacements on the order of 2-3 m (7-10 ft) or more may occur. A similar magnitude of horizontal displacement is considered possible. Mitigation of ground rupture hazard is generally achieved by appropriate setbacks from known fault traces. The appropriate setback from on-site faults and potential rupture zones should be based on evaluation of risk and performance objectives. A minimum setback of 30 m and 15 m (100 and 50 ft), should be maintained from the nearest fault trace or fault rupture zone for essential (e.g., first aid station, fire and security stations, disaster operation and communication areas, etc.) and nonessential structures, respectively.

Figure 3-9. Major Earthquake Faults of Southern California

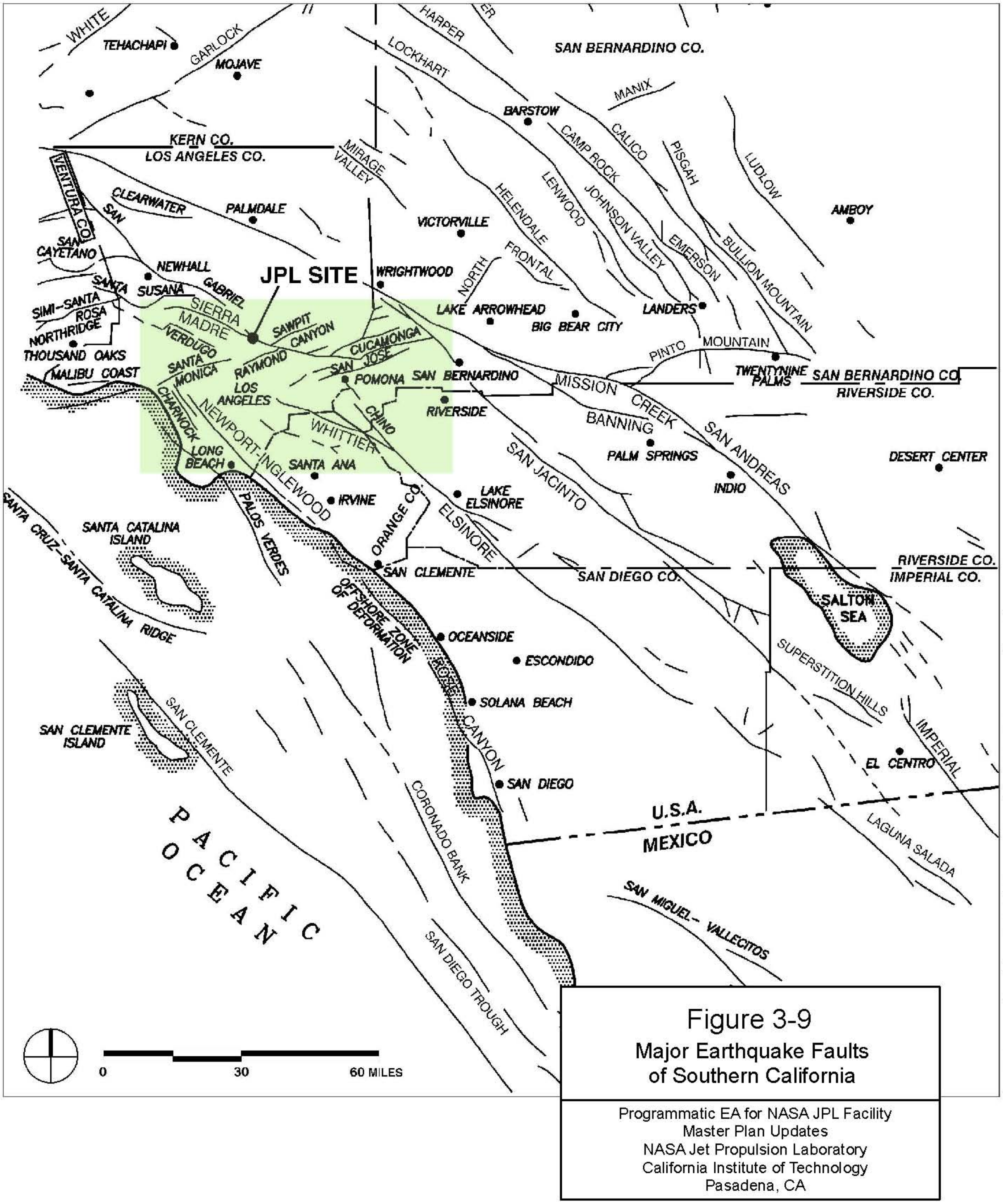
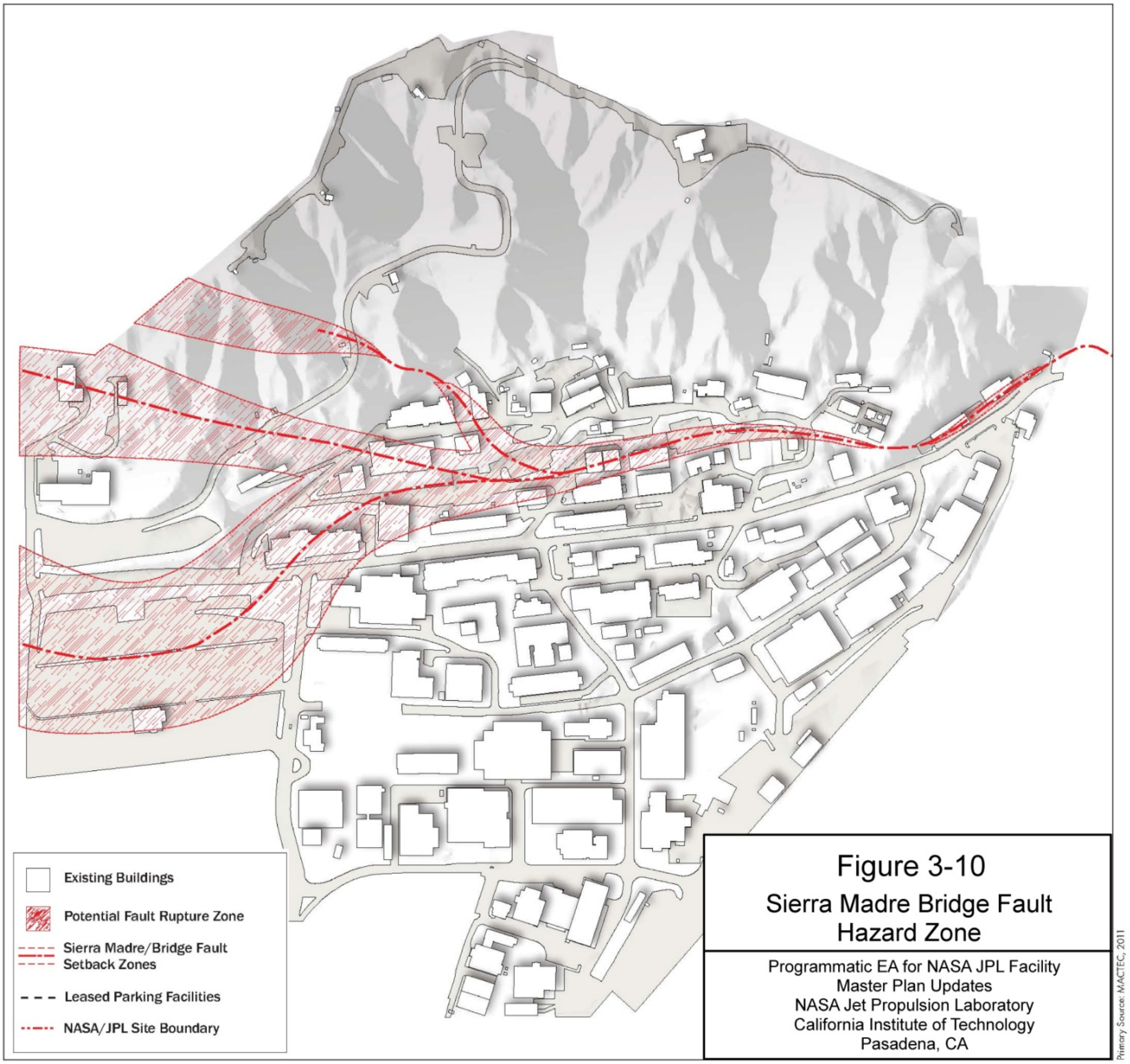


Illustration reproduced from JPL Oak Grove Master Plan 2003-2013, prepared by Johnson Fain

Figure 3-10. Sierra Madre Bridge Fault Hazard Zone



Source: JPL Oak Grove Master Plan Update 2011-2032, 2011

Planning considerations should include routing of lifelines around potential rupture zones or other mitigation measures to reduce the potential for damage due to fault rupture. In 2010, in support of the Master Plan Update effort, MACTEC Engineering and Consulting, Inc. revisited earlier seismic studies undertaken for NASA JPL. Planning questions affecting the future development potential of the Lab were addressed (AC Martin 2011).

MACTEC confirmed that, based on the definition contained in the APFZ Act, structures occupied by humans for more than 2,000 hours per year, including parking structures, cannot be constructed in fault setback zones. Several existing structures lie within approximately 15 m (50 ft) of mapped fault and fault rupture zones. These include important structures such as Telecommunications (Building 238), Environmental Laboratory (Building 144), the Gyro Laboratory (Building 251), the Magnetic Laboratory (Building 253), and Information Systems Development (Building 126), all of which sit within fault rupture zones. Buildings such as Administration (Building 180), the Space Flight Operations Facility (Building 230), Structural Test Laboratory (Building 18), and the Laser Research Laboratory (Building 107) are within 15 m (50 ft) of rupture zones. The Emergency Services Facility (Building 310) could be considered an ‘essential facility’ owing to its important role in handling fire, health, and other hazard emergencies; it sits less than 30 m (100 ft) from the known fault rupture zone.

Seismic ground-shaking hazards include potential damage to structures due to seismic ground motion and secondary effects of shaking such as landslides and soil liquefaction. Mitigation of shaking hazards to structures should be performed by assessing the anticipated ground motion characteristics and incorporating appropriate structural design. Site specific evaluations for new structures and seismic retrofits are required.

The State of California Seismic Hazard Zones map for this area indicates that the steep slopes in the northern portions of JPL may be subject to seismically induced landslides. The map indicates that portions of the site near the Arroyo Seco may be subject to seismically induced liquefaction. Seismically induced landslides in the steep granitic rock terrain within the northern portions of the site would likely be comprised of shallow rock falls or debris slides, where loose material is present on steep slopes. Soil liquefaction may occur where loose sandy soils and shallow groundwater exist, and can result in soil settlement and lateral earth spreading.

New development (or evaluation of existing structures) would be subject to site-specific geotechnical evaluations. Such evaluations should address soil and geologic conditions and provide recommendations pertaining to foundation design and planned earthwork. Seismic hazards, including fault rupture and ground shaking, should be evaluated with respect to the planned construction. Sites located within areas of potential seismic landslide or liquefaction hazards should be evaluated in accordance with the guidelines of the State Seismic Hazards Mapping Act (1990) and appropriate mitigation measures provided, as warranted.

3.1.9 Water Resources

The following sections describe water resources in the vicinity of JPL in terms of surface water, floodplains, groundwater, water quality standards, and water quality impacts.

3.1.9.1 Surface Water

The primary surface water feature near JPL is the Arroyo Seco, an intermittent stream in a deeply cut canyon that drains a portion of the northeastern section of the Los Angeles River Basin and links the San Gabriel Mountains to the Los Angeles River. The Arroyo Seco meanders south through the canyon and past various cities, joins the Los Angeles River, and continues on to the Pacific Ocean. The Arroyo Seco Watershed can be divided into three segments: the upper basin from JPL area to the headwaters, the HWP and Devil’s Gate Dam, and the Central and Lower Arroyo Seco (City of Pasadena, 2009).

Natural flow in the Arroyo Seco is dependent on rainfall and is nonexistent during dry months. The average monthly discharge for the Arroyo Seco from 1914 to 2009 at the USGS Stream Gauging Station, located 3.2 km (2 mi) upstream of NASA JPL, is 10.11 cubic ft per second (USGS, 2010). Direct drainage to the Arroyo Seco is mostly through storm drains from local municipalities. Storm water runoff from 54.4 sq km (21 sq mi) in the ANF drains into the Arroyo Seco (City of Pasadena 2009). There are 20 main tributaries upstream of NASA JPL that discharge surface water into the Arroyo.

On-site drainage from NASA JPL is north to south. Runoff in the steep northern areas of the site is intercepted with debris basins to control the velocity of runoff and to capture debris from the mountains. Surface runoff from the northern areas is transmitted by an underground storm drain system, located throughout the developed lower portion of NASA JPL to one of nine outlet points in the Arroyo Seco. With an average rainfall of 51 cm (20 in) per year, this amounts to 1.5 million l (400,000 gal) per year.

Devil's Gate Dam and Reservoir is a flood control detention feature located in the Arroyo Seco Canyon, 1.6 km (1 mi) downstream from NASA JPL. The dam is owned and operated by the Los Angeles County Department of Public Works (LACDPW) for flood safety and sediment management. Under flow and sediment transport situations, the lowest elevation outlet gate is kept open until water levels behind the dam rise to either the outlet tunnel or the spillway floor (City of Pasadena, 2009). This helps minimize sediment build-up behind the dam, while maximizing storage capacity for use during major storm events.

The City of Pasadena Department of Parks and Recreation initiated a multi-use project in the Arroyo Seco, known as the Hahamongna Watershed Park Master Plan in September 2003 (City of Pasadena 2003). The project was designed to enhance water resources, improve flood control, restore native habitat, and improve recreation and infrastructure for use by the local community. It included development of hiking trails into the Arroyo, construction of an interpretive nature center, restoration of native vegetation, and the revitalization of HWP. The City of Pasadena Water and Power Department plans to increase spreading basis operations for the project. Some of the land proposed to be used as spreading basins is currently leased by NASA JPL for parking (the East lot).

3.1.9.2 Floodplains

A floodplain is a portion of a river valley, adjacent to the channel built of sediments deposited during the present regimen of the stream, and is covered with water when the river overflows its banks at flood stages. Floodplain ecosystem functions include natural moderation of floods, flood storage and conveyance, groundwater recharge, nutrient recycling, water quality maintenance, and a diversity of plants and animals. Floodplains provide a broad area to spread out and temporarily store floodwaters. This reduces flood peaks and velocities and erosion potential. In their natural vegetated state, floodplains slow the rate at which the incoming overland flow reaches the main water body (FEMA, 1986).

Floodplains are subject to periodic or infrequent inundation because of precipitation and melting snow collecting within a catchment basin or watershed. The risk of flooding typically hinges on local topography, the frequency and intensity of precipitation events, and the size of the watershed above the floodplain. The 100-year floodplain is the area that has a 1 percent chance of inundation by a flood event in a given year. Certain facilities inherently pose too great a risk to be in either the 100- or 500-year floodplain, such as hospitals, schools, or storage buildings for irreplaceable records. Federal, state and local regulations often limit floodplain development to passive uses (recreational and preservation activities) to reduce risks to human health and safety.

The Federal Emergency Management Agency (FEMA) has not produced adjoining quadrangles mapping floodplains in the vicinity of NASA JPL and has not performed a detailed study within the boundaries. **Figure 3-11** summarizes the area floodplain designations, and shows NASA JPL is characterized by FEMA as either 'Zone X', which indicates moderate to low risk areas, or 'Zone D,' which indicates that flood hazards have not been determined, but are possible (www.fema.gov), accessed on July 27, 2010). Although FEMA has not mapped floodplains at NASA JPL, extrapolation of aerial photography indicates 1.1 ha (2.6 ac) of floodplain associated with the Arroyo Seco adjoins the eastern boundary of NASA JPL and the adjacent parking area on the eastern banks of the Arroyo Seco.

The floodplain of the Arroyo Seco is a dynamic ecosystem, and supports a classic assemblage of Southern California plant and animal communities. The 100-year flood plain reaches 328 m (1,075 ft) amsl, which includes portions of the west Arroyo parking lot. The rest of NASA JPL is located at higher elevations. There are no known wetlands on the facility. The LACDPW owns and operates Devil's Gate Dam and the dam facilities, including a flood control easement to the top of the dam parapet wall at elevation 328 m (1,075 ft) amsl. The County operates the flood control channel from the outlet of Devil's Gate Dam, south through the Arroyo Seco, to its point of confluence with the Los Angeles River (Pasadena, 2003).

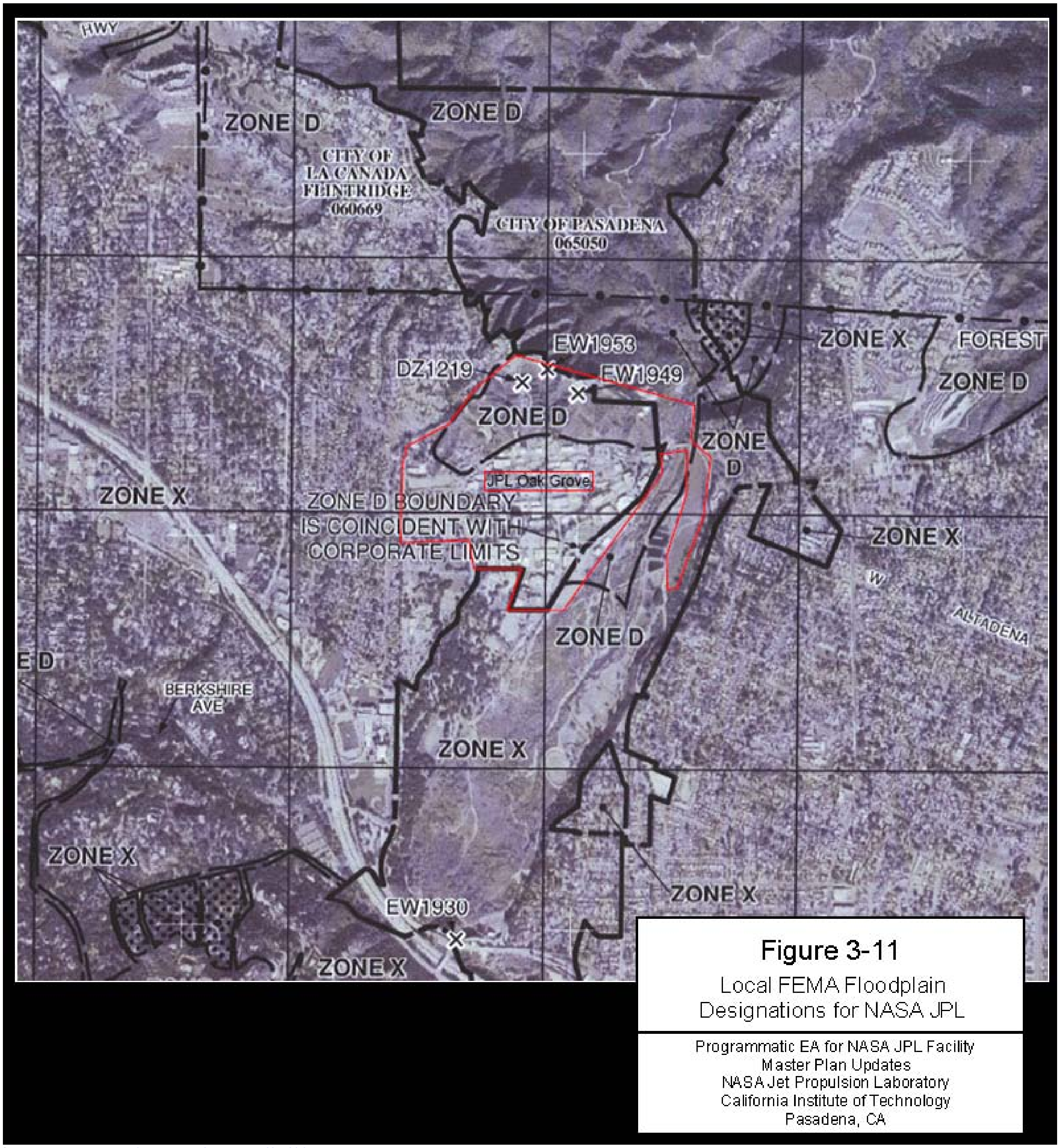
3.1.9.3 Groundwater

NASA JPL is situated over part of an unconfined groundwater aquifer called the Monk Hill Basin. The Pasadena Subarea, the Santa Anita Subarea, and the Monk Hill Basin make up the unconfined aquifer called the Raymond Basin (Pasadena, 2000). The Raymond Basin is bounded to the north by the San Gabriel Mountains, to the south and east by the San Gabriel Valley, and the west by the San Rafael Hills. The Basin provides part of the potable water supply for Pasadena, La Cañada -Flintridge, San Marino, Sierra Madre, Altadena, Alhambra, and Arcadia.

The Monk Hill and greater Raymond Basin aquifers are composed largely of unconsolidated alluvial sediments, ranging to a maximum thickness of approximately 335 m (1,100 ft) (City of Pasadena, 2000). The greater Raymond Basin is replenished by both natural rainfall and artificial recharge from several spreading basins on the eastern side of the Arroyo Seco, downstream of NASA JPL. These spreading basins are operated by the City of Pasadena. The alluvial aquifer below the Arroyo Seco is predominantly characterized by relatively coarse sediment, which makes the Arroyo extremely permeable. Surface water percolates into the groundwater fairly quickly, and groundwater flow rates are relatively high. The City of Pasadena obtains approximately 40 to 50 percent of its municipal water supply from groundwater wells.

The groundwater table below the facility is located at 61 m (200 ft) (NASA, 2006). The groundwater table and groundwater flow patterns are significantly influenced by Pasadena production wells located to the southeast. Groundwater moves from La Cañada-Flintridge to the southeast towards NASA JPL, then towards these water supply wells. The groundwater contains various chemicals, including some historically used at NASA JPL. In 1992, NASA JPL was placed on the National Priority List (NPL) of sites subject to regulation under CERCLA. The local water purveyors constantly monitor the water served to the public and take the necessary actions, including blending and treatment, to assure this water meets all applicable drinking water quality standards. See Section 3.12 for further information on CERCLA-related issues.

Figure 3-11. Local FEMA Floodplain Designations for NASA JPL



Source: www.msc.fema.gov/idms - 7/27/10

3.1.9.4 Water Quality Standards

The EPA, in accordance with its authority under the CWA, has delegated to California the responsibility for administering a water pollution program consistent with the requirements of the CWA. The California Porter-Cologne Water Quality Act establishes the State Water Resources Control Board (SWRCB) and the nine California Regional Water Quality Control Boards (CRWQCBs). These Boards are responsible for implementing the water pollution control program including the NPDES program and the implementation of publicly owned treatment works (POTW) and pretreatment standards.

The Los Angeles CRWQCB developed the Los Angeles Basin Plan to protect beneficial uses of all water bodies in the basin. The Plan designates beneficial uses for surface and ground waters, sets objectives to be attained or maintained to protect the designated beneficial uses and conform to the state's anti-degradation policy, and describes implementation programs to protect waters in the region. Objectives are present and will be used to set effluent limits, policies, and other conditions that become part of individual permits issued by the Board.

3.1.9.5 Storm Water Management

Storm water generated on NASA JPL discharges to the Arroyo Seco and is permitted by a NPDES Storm Water General Permit. The permit requires NASA JPL to develop and maintain a SWPPP to prevent storm water pollution. The SWPPP identifies BMPs for industrial activities that are exposed to precipitation. NASA JPL holds a Stormwater Discharge Permit for the discharge of groundwater from an artesian well behind Building 150. Construction Stormwater Permits are required for onsite construction activities.

The existing storm drain system was designed to intercept flows from the steep slopes on the north portion of the Site by the use of several debris catch basins, which carry the storm water runoff in underground pipes through the developed portion of the Center, and discharge into the Arroyo Seco (City of Pasadena 2003). The major storm water drains that pass through NASA JPL are constructed of vitrified clay, RCP, and CMP, and range in size from 61 to 122 cm (24 to 48 in). The various storm water trunk lines collect surface runoff from the Center and residential properties to the west and transport the runoff directly to the Arroyo basin. Branch lines sized from 30.5 to 61 cm (12 to 24 in) collect the stormwater runoff from the developed areas and carry it to the major drains.

Storm water from La Cañada Flintridge also flows into the drains that cross NASA JPL and emerge in the Arroyo. The stormwater runoff from all impervious surfaces flows directly into the flood control channel without treatment. According to the Arroyo Seco Master Plan Master Environmental Investigation Report (EIR) prepared by the City of Pasadena in 2006, the water quality in the Arroyo is in good condition; however, control of trash will be a future focus for water quality improvement since the watershed is part of the Los Angeles River, which is listed in 303(d) by EPA for trash total maximum daily load (TMDL).

3.1.10 Biological Resources

This section includes a discussion of NASA JPL's local vegetation, wetlands, and wildlife.

3.1.10.1 Inventory and Survey

The 2007 Biological Resources Inventory for NASA JPL lists plants and animals observed at NASA JPL during 2001 and 2007 surveys (Tetra Tech, Inc. 2007). A literature search was conducted to identify special-status species and plant communities with potential to occur in the NASA JPL area. Records for Pasadena and the surrounding eight quadrangles in the California Natural Diversity Data Base (CNDDB) were consulted. The 2001 Biological Resources Inventory for NASA JPL (CMBC, 2001) included a literature search for the U.S. Fish and Wildlife Service (USFWS) Federal status species and the City of Pasadena Database.

A biological survey of the 26.3 ha (65-ac) undeveloped area at NASA JPL was conducted to identify plant and animal species and their habitats present at the facility in 2001 (CMBC 2001). The accuracy of this survey was confirmed in 2007 by a team of two biologists who resurveyed the undeveloped areas from vantage points above and below those areas on two separate occasions. In addition, a focused survey for the coastal California Gnatcatcher was conducted on six separate days during April and May, 2007, which coincides with the breeding season for the gnatcatcher. These surveys were conducted by an independent biological consultant who holds the necessary Federal Endangered Species Act survey permit.

A 2010 search of the CNDDB found two wildlife species and four species of vegetation not observed during previous surveys that have the potential to inhabit NASA JPL based on local landscape. Vegetation species include Parish's rupertia (*Rupertia rigida),* San Gabriel oak (*Quercus durata var.gabrielensis),* Fragrant pitcher sage (*Lepechinia fragrans*), and Western spleenwort (*Asplenium vespertinum).* Wildlife species include the burrowing owl (*Athene cunicularia*) and the silver-haired bat (*Lasionycteris noctivagans)* (**Table 3-20**).

While, none of these six species have Federal or state special status, Parish's rupertia is on the California Native Plant Society's watch list due to its limited distribution. San Gabriel oak, Fragrant pitcher sage, and Western spleenwort are listed as endangered under California Native Plant Society's (CNPS) watch list. A literature search for the USFWS lists of threatened or endangered species revealed no such species listing or critical habitat on the site.

Table 3-20. California Natural Diversity Database Vegetation Species List for NASA JPL (2010)

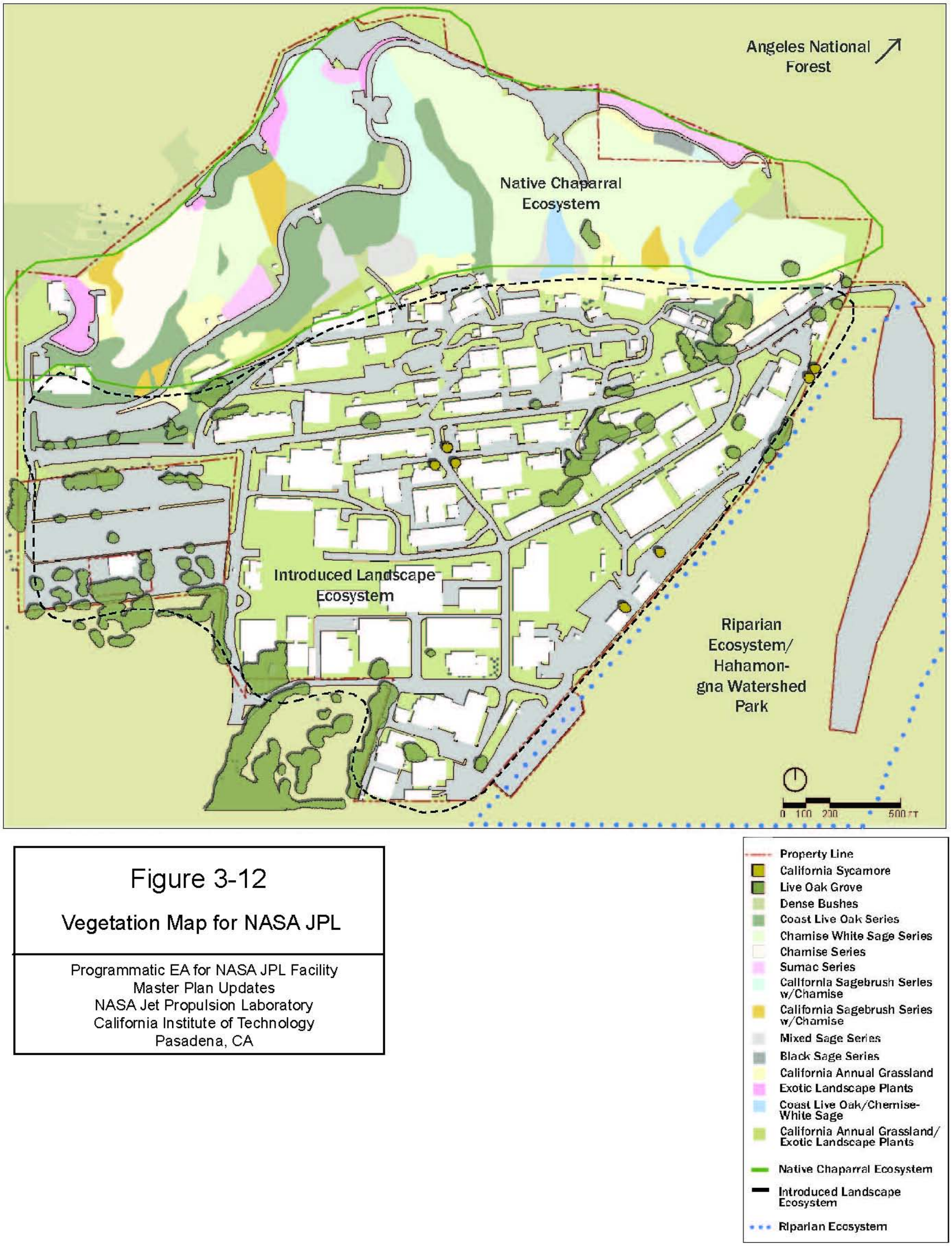
Common Name	Scientific Name	Description
Parish's rupertia	*Rupertia rigida*	Parish's rupertia is a dicot native to California. It is a perennial herb with a habit in chaparral, foothill woodland, and yellow pine communities.
San Gabriel oak	*Quercus durata var.gabrielensis*	San Gabriel oak is a dicot shrub endemic to California. Its preferred habitat is chaparral and foothill woodland. This species is threatened mostly by urbanization.
Fragrant pitcher sage	*Lepechinia fragrans*	Fragrant pitcher sage is a flowering shrub endemic to California. Its preferred habitat is chaparral, dry ravines, rocky slopes, and ridge tops.
Western spleenwort	*Asplenium vespertinum*	Western spleenwort is a pteridophyte fern endemic to California. Its preferred habitat is chaparral, coastal sage scrub, and southern oak woodland.
Burrowing owl	*Athene cunicularia*	The burrowing owl, formerly known as the *Speotyo cunicularia*, is a small, terrestrial bird which is both nocturnal and diurnal. Food preferences are large arthropods, and small mammals and reptiles. They nest underground in abandoned burrows in late March to April.
Silver-haired bat	*Lasionycteris noctivagans*	The silver-haired bat resides in all North American states with the exception of Florida. During daylight hours, the bats reside behind loose tree bark of hardwoods such as willows, maples, and ashes. They are insectivorous with a diet consisting of flies, beetles, and moths.

Source: California Department of Fish and Game (CDFG), 2010

3.1.10.2 Vegetation

NASA JPL encompasses 73 ha (181 ac) of land, of which 26.3 ha (65-ac) (37 percent) remain relatively undeveloped. These undeveloped areas are located primarily on the south-facing hillsides and canyons below the mesa on NASA JPL's northern boundary. Within the undeveloped area, approximately 13.8 ha (34 ac) (52 percent) is vegetated by chaparrals, 5 ha (12 ac) (18 percent) by coastal scrubs, and 4.5 ha (11 ac) (17 percent) by oak woodland. The remaining 3.2 ha (8 ac) (13 percent) consist of mowed firebreaks, disturbance-adapted native and exotic grasses and forbs, and areas with primarily non-native naturalized or landscape plants. The primary locations of these plant types at NASA JPL are shown on **Figure 3-12.**

Figure 3-12. Vegetation Map for NASA JPL



Source: JPL Oak Grove Master Plan Update 2011-2032, 2011

The vegetation of the adjacent Arroyo Seco HWP area is dominated by a mixture of California terrestrial natural plant communities or vegetation series that have been subject to varying levels of disturbance from sand and gravel mining, water conservation, flood control, and recreation activities. Throughout the majority of the HWP area drainage, riparian scrub habitats and weedy non-native grasslands dominate the floor of the central portion of the drainage. Oak woodland and other types of scrub habitats occupy variable areas along the perimeter and/or side walls of the drainage. Landscaped areas are populated with introduced, ornamental shrubs and trees and exotic, ruderal (associated with disturbed ground) weedy species of grasses and forbs.

Hillsides

The hillsides and canyons support a mix of chaparral and coastal scrub communities; however, exotic plant species are also present. These communities blend and integrate with one another so that delineation of boundaries between vegetation types is only an approximation.

Chaparral plant communities present include three series: chamise-white sage, chamise (*Adenostoma fasciculatum*), and sumac. The chamise-white sage series occupies the largest area, extending over approximately 11.5 ha (28.4 ac) on several large slopes and hillsides from the northwestern edge of the mesa to the eastern portion. The chamise series covers approximately 1.3 ha (3.2 ac) on a southwest facing hillside on the northwestern edge of the facility, located above and east-northeast of Buildings 251 and 253. The sumac series is present on approximately 0.8 ha (2.1 ac) of sheltered, more northerly-facing hillsides and canyon bottoms. Small, unmapped patches of this series may also occur within larger areas occupied by other chaparral types.

The coastal scrubs found on the facility also occur as intergrading series. These include the California sagebrush, mixed sage, and black sage series. Because the California gnatcatcher, a federally threatened species and a California species of special concern, utilizes several types of coastal scrub but appears to avoid scrubs where chamise is present, the California sagebrush series on-site has been mapped according to whether or not chamise is present. The California sagebrush series with chamise occupies approximately 2.4 ha (6.0 ac) on the slopes in the central part of the hillsides. The California sagebrush series without chamise occupies approximately 1.4 ha (3.5 ac) on the middle and lower slopes of the hillsides.

The mixed sage series occurs on approximately 1 ha (2.4 ac) at the mouths of two canyons in the center of the hillsides. A small 0.08-ha (0.2-ac) patch of black sage plant community was identified in the eastern ridgeline of the hillsides. Woodland, comprised of the coast live oak series, occupies approximately 4.5 ha (11.1 ac) at the bottom of the hillsides, along the top of the central section of the mesa and in the water canyon bottoms. A mix of chamise/white sage and coast live oak series occupies an additional area of approximately 0.3 ha (0.8 ac) south of the large water tanks and in a small canyon north of Building 238.

Many exotic landscaping plants have become naturalized in the understory area of the oak woodland. Therefore, this plant community is considered severely degraded. Within the mesa and hillsides area, especially along the ridgeline and at the west end of the mesa around Buildings 251 and 253, 0.5 ha (1.1 ac) are classified as landscape and exotic plants.

Lower Facilty

Fire prevention efforts, essential for the protection of buildings and other structures on the facility, consist of strips of mowed vegetation approximately 9 m (30 ft) wide, established as a fuel-break between the brushy hillsides and the buildings at the bottom of the slope. These areas, which occupy approximately 2.7 ha (6.7 ac), are characterized as California annual grassland series. Approximately 0.2 ha (0.6 ac) within the mowed areas is dominated by exotic plants and is, therefore, characterized as California annual grassland/exotic.

On the more developed portions of NASA JPL, a mix of landscaping and native plants is found throughout. Approximately 70 mature coast live oak trees are present, sometimes isolated in planters as specimen trees (e.g., near Buildings 183 and 302), or retained within a landscaped area (along Explorer Boulevard). Some areas have over a dozen trees retained in groups (near Building 177) and as shade trees in the parking lots on the east side of the facility. While these trees have value to wildlife and contribute genetic material to the regional population of coast live oaks, they are not considered a part of a functioning native plant community.

Los Angeles County and the cities of Pasadena and La Cañada Flintridge legally protect mature oaks and other heritage trees to the extent possible. NASA JPL consults the LACFD-Forestry Division regarding on-site actions that have the potential to affect oak trees. The LACFD enforces oak tree regulations in the County.

3.1.10.3 Wetlands

EO 11990, "Protection of Wetlands," requires Federal agencies to avoid, where possible, adversely impacting wetlands. Proposed actions that have the potential to adversely impact wetlands must be addressed in a statement of findings. The CWA sets the basic structure for regulating discharges of pollutants into U.S. waters. Section 404 of the CWA establishes a Federal program to regulate the discharge of dredge and fill material into waters of the U.S., including wetlands. The National Wetlands Inventory (a department within the USFWS), USEPA, and the NRCS help in identifying wetlands.

NASA JPL is near the base of the San Gabriel Mountains at elevations between 328 m (1,075 ft) and 472 m (1,550 ft). The water table beneath the facility averages 67 m (220 ft) below ground surface. Therefore, NASA JPL does not meet the definition of a wetland. No wetlands are located in the vicinity of the proposed project area. The closest wetland is Seal Beach in Orange County.

3.1.10.4 Wildlife

NASA JPL supports a variety of wildlife, including reptiles, birds, and mammals. Four common reptile species typically associated with chaparral, oak, and coastal scrub habitats were observed during field studies: side-blotched lizard (*Uta stansburiana)*, western fence lizard (*Sceloporus occidentalis*), granite spiny lizard (*Sceloporus orcutti*), and California whipsnake (*Masticophis lateralis*). Western rattlesnakes have also been observed at NASA JPL. Other reptile species, such as alligator lizard (*Elgaria multicarinata*), western skink (*Eumeces skiltonianus*), and gopher snake (*Pituophis catenifer*), are likely present.

Diverse assemblages of birds use habitats on NASA JPL as year-round, summer, or some winter residents or migrants. More than 89 bird species were noted during field surveys conducted in 2001 and 2007. Typical species observed in native habitats include western scrub jay (*Aphelocoma californica*), California towhee (*Pipilo crissalis*), spotted towhee (*P. maculatus*), wren-tit (*Chamaea fasciata*), red-tailed hawk (*Buteo jamaicensis*), oak titmouse (*Baeolophus inornatus*), acorn woodpecker (*Melanerpes formicivorus*), band-tailed pigeon (*Patagioenas fasciata*), Bewick's wren (*Thryomanes bewickii*), and others.

A number of native and exotic species closely associated with human habitation were also observed, such as northern mockingbird (*Mimus polyglottos*), common raven (*Corvus corax*), American crow (*C. brachyrhynchos*), rock dove (*Columba livia*), and European starling *(Sturnus vulgaris)*. Several nutmeg manikins (*Lonchura punctulata*), an exotic finch that has recently established wild populations in southern California, presumably from escaped cage birds, were observed. Two red-crowned parrots (*Amazona viridigenalis*), native to Mexico, were observed during a May 2007 survey. These birds were most likely escaped pets or their offspring and are not protected in California.

Six mammal species were observed during field surveys in 2001 and 2007: Audubon cottontail rabbits (*Sylvilagus audubonii*), California ground squirrels (*Otospermophilus beecheyi*), wood rats (*Neotoma* spp.), coyote (*Canis latrans*), striped skunks (*Mephitis mephitis*), and mule deer (*Odocoileus hemionus*). Raccoons (*Procyon lotor*), bobcats (*Lynx rufus*), gray foxes (*Urocyon cinereoargenteus*), deer mice (*Peromyscus* spp.), pocket gophers (*Geomys* spp.), western gray squirrels (*Sciurus griseus*), and other mammals of the southern California foothills are all likely present at times on the site.

The mule deer are abundant and acclimated to human presence. These animals often bed and forage in areas immediately adjacent to roads and buildings. Mountain lions (*Puma concolor*) have been observed occasionally on the facility. A young black bear (*Ursus americanus*) was discovered on the site in May 2007 and was relocated to a more remote part of the San Gabriel Mountains by the California Department of Fish and Game (CDFG).

3.1.11 Threatened, Endangered, and Other Sensitive Species

The Endangered Species Act (ESA) requires the analysis of impacts to all federally listed threatened or endangered species that could be affected by the proposed project. Section 7 of the ESA requires Federal agencies to consult with the USFWS, or designated representative, to ensure that any action authorized, funded, or carried out by the agency does not jeopardize the continued existence of listed species or critical habitats. Surveys of NASA JPL in 2001 (CMBC, 2001) and in 2007 (Tetra Tech and Circle Mountain, 2007) did not find evidence of species listed as threatened or endangered by either the state of California or Federal government. No special-status plants were detected during surveys of the facility. No critical habitat has been identified on the site. Historically, portions of the site were designated as critical habitat for the Southwestern Arroyo Toad; that designation was repealed by the USFWS in late 2002.

Further protection under the Migratory Bird Treaty Act makes it unlawful to pursue, hunt, kill, capture, possess, buy, sell, purchase, or barter any migratory bird, including the feathers or other parts, nests, eggs, or migratory bird products. In addition, this act serves to protect environmental conditions for migratory birds from pollution or other ecosystem degradations. Some migratory birds may be potential transients of the general area, but the immediate project area contains little to no suitable habitat for migratory birds. There are no known nesting sites in this area, and these lands are not vital for foraging or roosting.

3.1.12 Cultural Resources

This section includes a discussion of NASA JPL and local cultural resources, which include: historic buildings and structures; archaeological and historical objects, sites, and districts; cultural landscapes; and sites and resources important to Native American and other ethnic groups.

The NHPA, as amended (16 U.S. Code [USC] 470 *et seq*.), NEPA, and NPR 8580.1 require the consideration of impacts on historic properties, urban quality, and cultural resources. The term “historic property” is defined in the NHPA (16 USC §470(w)(5)) as “any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on the National Register [of Historic Places].” Section 101(b)(4) of NEPA stresses the importance of preserving “important historic, cultural, and natural aspects of our national heritage…” . Section 106 of the NHPA stipulates in part that:

> *"The head of any federal agency having direct or indirect jurisdiction over a proposed federal or federally assisted undertaking in any state and the head of any federal department or independent agency having authority to license any undertaking shall, prior to the approval of the expenditure of any federal funds on the undertaking or prior to the issuance of any licenses, as the case may be, take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register."*

The regulations implementing the NHPA (36 CFR Part 800) direct Federal agencies to consider their Section 106 responsibilities as early as possible in the NEPA process, and to plan their public participation, analysis, and review in such a way that they can meet the purposes and requirements of both statutes in a timely and efficient manner. Thus, NASA is obliged to consider the effects of construction for the proposed new activities on any historic properties. In doing so, NASA must first define the Area of Potential Effects (APE). According to 36 CFR § 800.16(d), the APE is defined as:

> *The geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of the undertaking and may be different for different kinds of effects caused by the undertaking.*

NASA, in consultation with the California State Historic Preservation Office (SHPO), has determined that the APE for this project consists of the NASA JPL property.

3.1.12.1 Archeological Resources

The Gabrieleño Indians (so referenced by their association with the San Gabriel Valley and Mission San Gabriel) inhabited the Pasadena region until the early twentieth century. The Tongva (the Gabrieleño name for their people) displaced the prehistoric Hokan-speakers of Southern California. The area around NASA JPL was occupied by pre-Gabrieleño populations as early as 2000 B.C.

No known or recorded archaeological resources are located within the boundaries of NASA JPL (McKenna et al., 1993). However, several sites are located in the vicinity: CA-LAN-26 (California-Los Angeles) situated along the Arroyo Seco (about 2.4 km [1.5 mi] south of NASA JPL) is described as a prehistoric village and cemetery complex of undetermined age. This site was reportedly destroyed by bulldozing prior to 1962. CA-LAN-342 is situated in Millard Canyon, approximately 1.6 km (1 mi) northeast of NASA JPL. This site was a Middle Horizon Village site (circa 1500 B.C. to A.D. 500) characterized by numerous grinding implements and other prehistoric stone artifacts.

Several large habitation sites, possibly of the Hahamongna peoples have been identified in the vicinity (Singer, Atwood, and Gomes, 1992). Historical documents identify this Hahamongna prehistoric community as occupying the upper reaches of Arroyo Seco, Verdugo Wash, and the San Rafael Hills (Johnston, 1962). Mission register data indicate that the Hahamongna were a large community that undoubtedly helped construct the mission at San Gabriel where 70 Hahamongna baptisms were recorded between 1707 and 1805 (McKenna et al., 1993). Semi-autonomous communities like and including the Hahamongna occupied sites in the vicinity but disappeared soon after the arrival of the Spanish.

NASA JPL is well developed with few undisturbed areas available for archaeological inspection. The only undisturbed area, the hillside to the north, is considered too steep to be inhabitable or archaeologically sensitive. The area adjacent to the Arroyo Seco, however, can be considered potentially sensitive because of the occurrence of archaeological sites to the north and south of NASA JPL.

A Cultural Resources Survey of alternative locations for a proposed parking structure at NASA JPL near the Arroyo Seco was completed in 1993 (McKenna et al., 1993) that characterized the archaeological and historical background of the site. Based on the survey, the proposed site was considered to be clear of any known cultural resources, but the study emphasized that there is potential for buried deposits indicative of either prehistoric or historic activities within NASA JPL.

In November 2005, in accordance with Section 10.4 of 43 CFR Part 10 *Native American Graves Protection and Repatriation Act Regulations* (dated December 4, 1995), the JPL EAPO developed the Protocol for the Inadvertent Discovery of Cultural Artifacts (JPL Rule Doc ID 72132). This JPL Rule describes the protocols/process that the JPL Facilities Department and the EAPO must follow should an inadvertent discovery of a cultural artifact occur at NASA JPL.

3.1.12.2 Historic Resources

JPL prepared a *Historic Resources Study Gate to Gate, NASA Jet Propulsion Laboratory, Pasadena, CA* in 2010 (Page & Turnbull, 2010). The study was completed to assist NASA JPL in meeting its obligations under Sections 106 and 110 of the NHPA. The study resulted in an assessment of historic structures and a selective reconnaissance level survey of structures on the NASA JPL property.

Of the 139 resources inventoried in the study, 73 resources are over fifty years of age (as of 2009). Fifty years is generally recognized by the National Park Service as the minimum age necessary for a property to become historically significant. Nine facilities less than fifty years old were also evaluated based upon their apparent level of significance. The remaining resources are less than fifty years old, and were not evaluated for listing in the National Register due to their apparent lack of significance. After evaluation, the study concluded that 7 buildings are eligible for listing on the National Register of Historic Places (NRHP). These buildings, with their date of construction, include:

- Building 11, Space Sciences Laboratory, 1942
- Building 18, Structural Test Laboratory, 1945
- Building 82, High Vacuum Laboratory, 1948
- Building, 90, Pyrotechnics Laboratory, 1948
- Building 103, Electronic Fabrication Shop, 1947
- Building 125, Combined Engineering Support, 1954; and
- Building 179. Spacecraft Assembly Facility, 1961

NASA JPL has initiated consultation through the Section 106 process with the California SHPO. As a result of this consultation, a programmatic agreement is being developed that will identify any mitigation measures to be implemented as well as preservation design guidelines for the defined character areas in NASA JPL.

Two structures, Building 230 – Space Flight Operations, and Building 150 – 25-ft Space Simulator, are currently listed as NHLs as a result of the *Man in Space Theme* Study performed by the National Park Service in 1984. These properties were formally designated by the Secretary of the Interior on October 3, 1985.

Many historic places and landmarks exist in the area surrounding NASA JPL. One of the more famous landmarks is Christmas Tree Lane (Santa Rosa Avenue) located in Altadena. This road was planted with 150 Deodar trees over 100 years ago to line the entrance to the Woodbury Ranch. Near the Woodbury Ranch was the Rubio Canyon Terminal of the Mount Lowe Railway. This station was located near the current intersection of Lake and Calaveras Avenues.

3.1.13 Hazardous Materials and Waste

Management of hazardous materials and wastes at NASA JPL focuses on evaluation of the storage, handling and transportation capabilities for a site. Evaluation extends to the generation and disposal of hazardous wastes, and includes fuels, solvents; acids and bases; and petroleum oil, and lubricants (POL). In addition to being a threat to humans, the improper release of hazardous materials and wastes can threaten the health and well-being of wildlife species, botanical habitats, soil systems, and water resources. In the event of a release of hazardous materials or wastes, the extent of contamination varies based on the type of soil, topography, and water resources.

In general, hazardous materials, hazardous substances, and hazardous wastes include elements, compounds, mixtures, solutions, and substances that, when released into the environment or otherwise improperly managed, could present substantial danger to the public health, welfare, or the environment.

Regulatory Framework

The principal Federal regulatory agency responsible for setting laws and guidelines for hazardous materials and wastes is the USEPA. The key Federal laws and regulations pertaining to hazardous materials associated with implementation of the Master Plan at JPL are the CERCLA; the Superfund Amendments and Reauthorization Act (SARA); the Toxic Substances Controls Act (TSCA); and the Resource and Conservation Recovery Act (RCRA).

CERCLA, which was amended by SARA and TSCA, establishes prohibitions and requirements concerning closed and abandoned hazardous waste sites; provides for liability of persons responsible for releases of hazardous wastes at such sites; and establishes a trust fund for cleanup when no party can be found responsible.

SARA establishes a nationwide emergency planning and response program, as well as reporting requirements for facilities that store, handle, or produce significant quantities of hazardous materials; and identifies requirements for planning, reporting, and notification concerning hazardous materials.

Under RCRA the USEPA has the authority to designate and control hazardous waste from “cradle-to-grave”. The controls include the transportation, treatment, storage and disposal of hazardous waste. The Act also establishes a framework for the management of non-hazardous solid wastes and environmental problems associated with underground petroleum storage tanks and other hazardous substances.

Solid and hazardous waste streams in California are also regulated at both the state and local levels. Historically, the California Integrated Waste Management Board (CIWMB) was the regulatory agency responsible for regulating solid waste in the State of California. However in January 2010, the CIWMB, along with the Division of Recycling, in the Department of Conservation was abolished by legislation. All associated duties and responsibilities were transferred to the California Department of Resources Recycling and Recovery (CalRecycle), a new entity within the California Natural Resources Agency.

While the California Department of Toxic Substance Controls (CalDTSC) is the regulatory body for hazardous and universal waste streams, CalRecycle has enforcement authority over waste disposal programs under California Code of Regulations (CCR) Title 27, and nonhazardous waste management under CCR Title 14.

The State of California also has a state specific regulation, the Hazardous Waste Control Law (1972) which is similar to RCRA and pertains to the management of hazardous waste streams. Additionally, the Southern California Association of Governments (SCAG) is responsible for preparing the *Southern California Hazardous Waste Management Plan* pursuant to the California Health and Safety Code. SCAG's decision makers adopt regional policies for both solid waste and hazardous wastes that will enable the region to support state waste goals while growing in accordance with SCAG's adopted plans, such as the Regional Transportation Plan, Compass Growth Vision, and Regional Comprehensive Plan and Guide.

The following sections discuss hazardous materials, hazardous wastes, pollution prevention and waste minimization, non-hazardous wastes, toxic substances, and the NASA CERCLA cleanup at NASA JPL.

3.1.13.1 Hazardous Materials

The USEPA definition of hazardous material includes any item or chemical that may cause harm to people, plants, or animals when released by spills, leaks, pumping, pouring, emitting, discharging, injecting, escaping, leaching, dumping, or disposing into the environment. Hazardous materials include any substance or chemical that is a “health hazard” or “physical hazard”, including: chemicals which are carcinogens; toxic agents; irritants; corrosives; sensitizers; agents that act on the hematopoletic (blood-related) system; agents that damage the lungs, skin, eyes, or mucous membranes; chemicals that are combustible, explosive, or flammable; oxidizers or pyrophorics; unstable-reactive or water-reactive substances; and chemicals that during normal handling, use or storage may produce or release dusts, gases, fumes, vapors, mists or smoke that may have any of the previously mentioned characteristics.

The U.S. Occupational Health and Safety Administration (OSHA) is responsible for enforcement and implementation of Federal laws and regulations pertaining to worker health and safety under 29 CFR Part 1910. OSHA includes the regulation of hazardous materials in the workplace and ensures appropriate training in their handling.

3.1.13.2 Hazardous Wastes

Hazardous waste is defined as any solid, liquid, contained gaseous, or semi-solid waste; or any combination of wastes that pose a substantial present or potential hazard to human health or the environment. JPL uses various chemicals in research and development activities and for overall laboratory maintenance. As a result, JPL generates a variety of chemical wastes in small quantities. Typical wastes include mixed solvents, contaminated laboratory glassware, reaction products, and out-of-date or excess chemical reagents. Large amounts of non-hazardous waste are also generated (e.g., paper and plastic).

Certain types of hazardous wastes are subject to special management provisions intended to ease the management burden and facilitate the recycling of such materials. These are called ‘Universal Wastes’, and their associated regulatory requirements are specified in 40 CFR 273. Types of waste currently covered under the universal waste regulations include hazardous waste batteries, hazardous waste thermostats, and hazardous waste lamps.

JPL Hazardous Waste Generation and Handling

JPL generates 1,000 kg (2,204 pounds) or more hazardous wastes per month and is therefore classified as a large quantity generator. Research and development activities generate different types of laboratory chemical wastes, which are generated in small quantities and are commonly chemicals that have either exceeded their shelf life, are excess after project completion, or are spent after being used in a given project. An inventory of hazardous chemical wastes in storage for disposal may include over 150 different substances. In most cases, the quantity of a laboratory waste is less than 3.78 l (1 gal) of liquid or 0.9 kilograms (kg) (2 pounds) of solid material. These are transported offsite for disposal. **Appendix C** lists the 2006 total of hazardous wastes from JPL that were shipped off-site. Hazardous wastes are moved from the point of generation to the Hazardous Waste Accumulation Facility (Building 305) for consolidation prior to transport for recycling/disposal off-site.

The facility includes four separate areas for accumulation of compatible materials and a fenced outside area with sloped, epoxy-coated floors for packing laboratory wastes. The facility is designed to contain spills. Inspections of the hazardous waste accumulation facility are conducted weekly per state and Federal regulations.

Materials are removed from Building 305 by a licensed hazardous waste hauler and transported to permitted hazardous waste disposal or recycling facilities. The actual type and quantity can vary daily, and from week to week. Before any waste is accepted at the 90th day for disposal, it must be appropriately containerized, and labeled with a Hazardous Waste Disposal Form. Decisions about whether a particular material is hazardous or non-hazardous are made by JPL in accordance with applicable state and Federal hazardous waste regulations. This system is designed to maintain a complete and precise waste inventory.

3.1.13.3 Pollution Prevention and Waste Minimization

JPL has an established strategy to provide a systematic approach to pollution prevention as presented in its Pollution Prevention Plan. Plan objectives are to develop a program for preventing, reducing, reusing, and recycling waste and emissions. The plan builds on existing programs and activities that currently meet compliance requirements, as well as identifying additional activities while trying to reduce costs associated with pollution prevention programs. The plan also encourages pollution prevention concepts to be implemented in daily business processes to aid employees in understanding pollution prevention and environmentally related activities.

An objective of the plan is to measure performance of facility-wide activities in reducing chemical use, increasing efficiency of raw materials, energy, water, waste and other resources and conserving natural resources. NASA set a goal of 50 percent reduction of targeted releases by CY 2000, and NASA JPL met this goal. NASA JPL has attained a 98 percent reduction from the baseline year. Included in the targeted releases are ozone depleting substances and SARA 313 toxic releases inventory chemicals (SARA 313 TRI). NASA JPL identifies all routinely generated waste streams that result from ongoing processes and has achieved a 95 percent reduction in hazardous waste generation since CY 1992. Waste minimization measures that have been implemented include:

- Waste stream characterization;
- Source reduction;
- Materials Management through computerized tracking systems;
- Centralized purchase of chemicals;

- Use of *iProcurement* style purchasing, enabling rapid procurement of materials needed in quantities that do not exceed what is needed for the task, thus reducing waste generation of excess chemicals and the need to stockpile extra chemicals; and,

- Hazardous Waste Generator Training classes including instruction on hazardous waste source reduction principals.

Since 1992, NASA JPL has reduced hazardous waste by 94 percent, toxic chemicals_by 98 percent, and ozone depleting chemicals by 97 percent. As a result, NASA JPL has recognized cost savings for the period 1992-2009 of $1,312,731 (measured as reduced toxic chemical purchase cost and reduced Hazardous Waste Disposal Fees) (**Figure 3-13**).

3.1.13.4 Non-Hazardous Wastes

Non-hazardous waste (garbage and recycling) generated at NASA JPL is collected in containers/barrels and disposed of daily by a contractor. A large construction materials container is also provided and removed as needed. Non-hazardous waste materials such as scrap metal, metal drums, scrap paper, pallets, and toners are periodically recovered and recycled. NASA JPL has an aggressive recycling program with recycling bins distributed throughout the facility for white paper, toner cartridges, and cardboard. Newspaper recycling bins are in all cafeterias. Bound materials, scrap metal and wooden pallets are recycled. Recycling has resulted in a 73 percent landfill diversion. In 2006, over 1,200 tons of non-hazardous materials were recycled.

3.1.13.5 Toxic Substances

Excluding laboratory chemicals, other toxic or hazardous substances that are or were present at NASA JPL include polychlorinated biphenyls (PCBs), asbestos, pesticides, and radiation sources. The status of these, as well as information regarding chemical safety and reporting requirements, is discussed below.

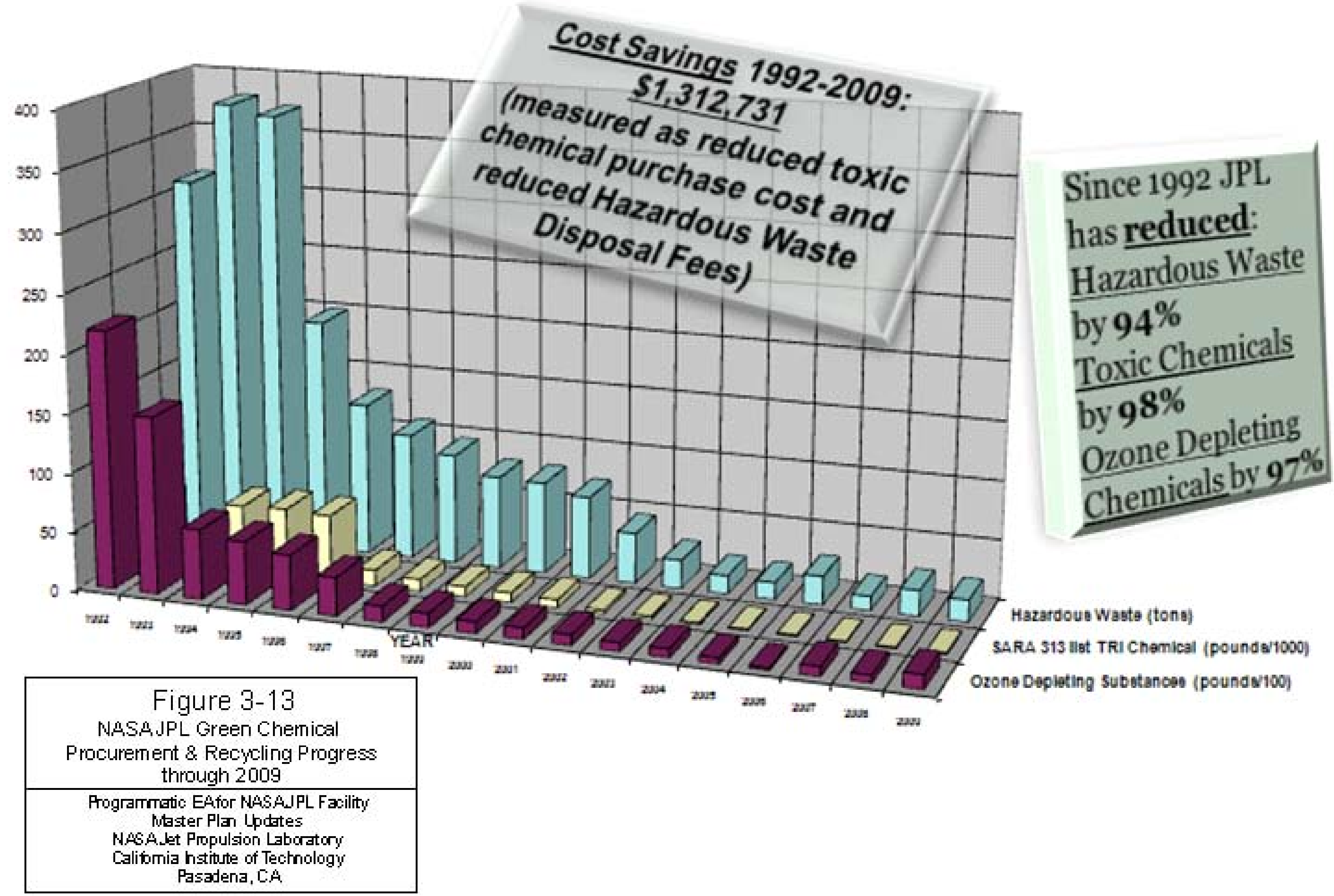
PCBs

Through the 1980s up to 1993, NASA JPL conducted a lab-wide program to identify and remove all PCB transformers and capacitors from the facility. A PCB transformer or capacitor is defined as an item containing more than 500 ppm PCBs. A PCB-contaminated item contains 50 to 500 ppm PCBs. Items may contain up to 500 ppm PCB per Federal definition and be classified as a non-PCB item. As part of the program, PCB transformers were either removed from the facility and disposed of or reclassified as non-PCB transformers. In both cases, the PCB oil removed from the transformers and sent off-site for disposal was incinerated.

Asbestos

Asbestos is the only substance currently in use at NASA JPL that is regulated by the Federal government under the Toxic Substances Control Act (TSCA). Asbestos removal or abatement is dictated by the renovation or remodeling needs of JPL. Asbestos is found in spray-applied fireproofing and piping insulation. Non-friable asbestos may be contained in flooring tile and adhesive. Asbestos is removed by a licensed contractor in accordance with the asbestos standard of OSHA, 29 C.F.R., 1926-58. Asbestos containing materials (ACM) are handled and disposed of off-site consistent with TSCA.

Figure 3-13. NASA JPL Green Chemical Procurement & Recycling Progress through 2009



Pesticides

Use of insecticides, fungicides, herbicides, and rodenticides is regulated by the California Department of Food and Agriculture (CDFA) and the Federal Insecticide, Fungicide, and Rodenticide Act, (FIFRA). A range of pesticides are used at JPL for rodent control and grounds maintenance, and are applied by licensed contractors and occasionally by grounds maintenance workers (ant bait stations), both overseen by certified advisors and applicators. JPL reduces potential environmental impacts of pesticides in use by controlled applications, inventory inspection, and monitoring. All insecticides, fungicides, herbicides, and rodenticides are handled, applied, and disposed of consistent with the CDFA requirements and FIFRA.

Radiation

The possession and use of radioactive materials is governed by a broad-scope radioactive materials license issued by the State of California. A radiation safety committee, composed of staff members experienced in handling and safeguarding radiation sources and radioactive materials, administers JPL's responsibilities under this license. The committee authorizes use, prepares hazard analyses, establishes safety practices, approves facilities in which radiation sources will be used, and monitors activities in which radiation hazards may be a factor. A radiation safety officer appointed by the Director of the Office of Safety and Mission Success supervises and directs personnel in performing radiation safety duties. Ionizing radiation sources are licensed/registered as required.

JPL radiation sources include ionizing (e.g., x-rays, gamma rays, alpha and beta particles, neutrons, protons, high-speed electrons) and non-ionizing emitters (e.g., lasers and radio frequency radiation). Large ionizing radiation sources are few and fixed in location, but small sources are used in varying locations throughout the site. There are fewer than 300 sources of ionizing radiation, most used in equipment calibration. **Table 3-21** lists the common types and sources of radiation present at NASA JPL.

Non-ionizing radiation sources include visible and near-visible infrared lasers, electromagnetic radiation (microwave and radio frequency transmitters) and ultraviolet radiation from ultraviolet lamps. Source controls include occupational safety evaluations of new sources and checks for correct operation and adherence to safety procedures. Radioactive waste is disposed of by licensed contractors who remove the waste to an authorized off-site disposal facility. Storage and disposal is consistent with JPL's radioactive material license conditions.

Chemical Safety and Reporting Requirements

Use of insecticides, fungicides, herbicides, and rodenticides is regulated by the California Department of Food and Agriculture (CDFA) and the Federal Insecticide, Fungicide, and Rodenticide Act, (FIFRA). A range of pesticides are used at JPL for rodent control and grounds maintenance, and are applied by licensed contractors and occasionally by grounds maintenance workers (ant bait stations), both overseen by certified advisors and applicators.

JPL complies with EPCRA and the more strict State of California community right-to-know requirements. JPL is in compliance with Title 19 of the CCR and California Business Plan requirements, and provides a California Business Plan annually to the LACFD. As part of the plan, JPL submits a facility inventory of hazardous materials that contains reportable quantities of materials. Acutely hazardous materials (AHM) listed in the plan are presented in **Table 3-22**. All AHM stored at JPL are below threshold quantities for Accidental Release Prevention (November 2007). Accidental releases are unanticipated emissions of a regulated substance or other extremely hazardous substance into the ambient air from a stationary source.

Table 3-21. Types and Sources of Radiation at NASA JPL

Type	Potential Population Exposed	Source	Nature of Control Techniques
Ionizing			
Radioactive Materials	60	Approximately 280 Sources. Major radionuclides include Cobalt-60, Strontium-90, Cesium-137, Nickel-63, Carbon-14	Ionizing radiation source controls include: • radiation safety committee review of proposed uses of ionizing radiation sources, • general and use-specific training, • area assessments, operational oversight, • annual review of all users and use, and • personal dosimetry and area monitoring.
Radiation Machines*	20	14 Machines	
Non-Ionizing			
Microwaves	200	Microwave Transmitters	Operational Safety Review of new operations
Ultraviolet Waves	200	Ultraviolet Lamps	Exposure Limits Safety Manual
	100	Lasers	Eye Exam and UV Skin Exam
Infrared Light Waves	200	Lasers	Annual Eye Exam
Electromagnetic	General Lab Population	Radio Transmitters; Antennas	Periodic Inspections and Monitoring

Source: JPL Occupational Safety Office, 2007; *Following the California Department of Health Services definition of "registered radiation machine."

Table 3-22. Acutely Hazardous Materials Stored at NASA JPL

Name of Material	
Ammonia, NH3 (100%)	Hydrogen Fluoride, HF (100%)
Arsine, AsH3 (100%)	Hydrogen Sulfide, H2S (100%)
Boron Trichloride, BCl3 (100%)	Methylamine, CH3N2 (100%)
Boron Trifluoride, BF3 (100%)	Methyl Chloride, CH3Cl (100%)
Carbonyl Fluoride, COF2 (100%)	Mixed Oxides of Nitrogen (MON3, MON25)
Chlorine, Cl2 (100%)	Nitric Oxide, NO (100%)
Chlorine, Cl2 (10% in Helium)	Nitric Oxide, NO (10% in Helium)
Chlorine, Cl2 (5% in Helium)	Nitrogen Dioxide, NO2 (100%)
Chlorine, Cl2 (1% in Helium)	Nitrogen Dioxide, NO2 (5% in Air)
Dichlorosilane, H2Cl2Si (100%)	Nitrogen Tetroxide, N2O4 (100%)
Ethylene Oxide, C2H4O (100%)	Nitrogen Trioxide, N2O3 (100%)
Fluorine, F2 (100%)	Phosgene, CCl2O (100%)
Fluorine, F2 (20% in Nitrogen)	Phosphine, PH3 (100%)
Fluorine, F2 (5% in Helium)	Phosphine, PH3 (15% in Silane)
Hydrogen Bromide, HBr (100%)	Phosphine, PH3 (4% in Hydrogen)
Hydrogen Chloride, HCl (100%)	Sulfur Dioxide, SO2 (100%)
Hydrogen Chloride, HCl (5% in Helium)	Tetrafluoroethylene, C2F4 (100%)
Hydrogen Chloride, HCl (1% in Carbon Monoxide)	

Source: JPL EAPO/OSPO, Nov 2007

3.1.13.6 NASA CERCLA Cleanup

During historical operations at the JPL site, various chemicals and other materials were used. In the 1940s and 1950s, liquid wastes from materials used and produced at JPL, such as solvents, solid and liquid rocket propellants, cooling tower chemicals, and analytical laboratory chemicals, were disposed of into seepage pits, a disposal practice common at that time. By 1958**,** a sanitary sewage system was installed to handle sewage and wastewater, and the use of seepage pits for sanitary and chemical waste was discontinued. Some of these chemicals, including perchlorate and chlorinated solvents containing VOCs, eventually reached groundwater hundreds of feet beneath JPL and beneath areas adjacent to the lab.

In 1980, VOCs were reported in wells owned by the City of Pasadena and by Lincoln Avenue Water Company (LAWC), which serves parts of the adjacent community of Altadena. In 1992, NASA JPL was placed on the NPL by the USEPA. This is a USEPA listing of the top-priority sites for investigation and remediation under the CERCLA program. As the responsible agency, NASA has conducted a number of detailed investigations and studies on the facility and adjacent areas since the early 1990s:

- Conducted a Remedial Investigation (RI) from 1994 to 1998. The RI report, which characterized the nature and extent of the chemicals in the groundwater, was completed in 1999. The RI for Operable Unit (OU)-1 and OU-3 contained human health and ecological risk assessments which look at the possible effects to human health and the environment in the absence of any cleanup action.

- Initiated a groundwater monitoring program in 1996 analyzing for VOCs and other chemicals, including perchlorate, metals, anions, cations, and other field parameters. Analytical results are summarized in quarterly reports and technical memoranda that are available in the Information Repositories and on the project website.

- Conducted modeling and aquifer testing at and adjacent to NASA JPL to characterize the complex groundwater conditions and groundwater flow.

- Completed a draft Feasibility Study in 2000 that identified and evaluated various groundwater cleanup alternatives for the source area and in areas adjacent to NASA JPL.

In addition to these studies, NASA funded treatment facilities for LAWC in Altadena and for Pasadena in the early 1990s to remove VOCs from drinking water wells that were affected by chemicals from NASA JPL. In 2004, NASA implemented a Removal Action directed at the off-facility groundwater to achieve quick, protective results. For that Removal Action, NASA funded additional treatment facilities at LAWC to remove perchlorate in addition to VOCs. This removal action is part of the Preferred Alternative for OU-3.

NASA has also conducted studies to determine the best technologies to use to treat groundwater. In the late 1990s and early 2000s, NASA conducted pilot testing of several technologies to address dissolved perchlorate in source area groundwater, including a study that evaluated the effectiveness of a biological reactor technology called a fluidized bed reactor (FBR). Based on these studies, NASA installed a demonstration treatment plant on NASA JPL in the source area in 2005. This system, which consists of liquid-phase granular activated carbon treatment to remove VOCs and a fluidized bed reactor to remove perchlorate, was successful in the demonstration phase. All CERCLA documentation associated with NASA JPL can be found in the Information Repository section of the NASA CERCLA website http://jplwater.nasa.gov. As part of the CERCLA cleanup, NASA divided the facility into three separate areas referred to as OUs. These OUs are described below.

OU 1 On-Facility Groundwater

The goal for on-facility groundwater is treatment and containment of the groundwater "source area" – the area that contains the highest concentration of chemicals located in an eight-ac by 30.5-m (100-ft)-thick portion of the aquifer beneath the north-central part of NASA JPL. Treating the groundwater source area reduces the highest concentration of chemical mass in groundwater and decreases the time needed to treat groundwater in areas beyond the NASA JPL boundaries.

The on-site treatment plant, located at the "source area" at NASA JPL, originally was designed to extract groundwater from two multilevel extraction wells at 568 l per minute (150 gpm) and treat that water using liquid-phase granular activated carbon to reduce VOC concentrations. Perchlorate in the groundwater is biologically broken down into chloride and water using an FBR. Operation of this treatment system began in early 2005 and is successfully removing the chemicals from the source area groundwater.

The 2005 study was successful and demonstrated the effectiveness of the FBR system. Therefore, NASA proposed an interim remedy and issued a Proposed Plan to expand the existing groundwater treatment system to more than double the amount of water being treated – to a rate of up to 1,325 l per minute (350 gpm)**.** NASA issued a notice of its Proposed Plan and held a public meeting in November 2005 to facilitate public comment on the Proposed Plan. In December 2006, the final Interim Record of Decision was approved by the Federal Facilities Agreement (FFA) parties (EPA, the California Department of Toxic Substances Control, the CRWQCB, and NASA). The system expansion was completed in 2008.

OU 2 On-Facility Soil

The goal for cleaning on-facility soil is to minimize the amount of VOCs migrating from the soil into the underlying groundwater. This is done by removing those chemicals from the soil and soil vapor in the unsaturated soil zone (referred to as the vadose zone) beneath NASA JPL. NASA began investigating sources of VOCs during the early 1990s. These studies focused on former seepage pits previously used for sanitary and laboratory waste disposal. NASA collected deep soil borings and subsurface gas samples to determine which seepage pits were sources of VOCs, and the extent of the chemicals in the soil. In near surface soil (0 to 9 m [30 ft] below ground surface), no elevated levels of VOCs were found, so no further action was necessary. The deeper soils at 61 m (200 ft) contained concentrations of VOCs at high enough levels to pose a continued threat to the underlying groundwater aquifer, and these soils were addressed further.

NASA initiated a plan to clean up chemicals in deeper soils. Removing the source of chemicals was an important step to keep the chemicals from spreading to groundwater. In 1998, NASA ran a pilot test to evaluate the feasibility of using Soil Vapor Extraction (SVE) to reduce the concentration of VOCs in soil beneath NASA JPL. This test was successful, removing more than 91 kg (200 pounds) of the chemicals.

The 2002 Record of Decision (ROD) identified SVE as the remedial action for on-facility soil. Three additional SVE wells were installed in 2002 and operation of the SVE further reduced VOC concentrations to protect groundwater. The soil vapor extraction system successfully removed approximately 300 pounds of chemicals that were contained in on-facility soils. Based on diminished volatile chemicals in extracted soil vapor, operation was stopped in September 2005. Rebound monitoring was initiated immediately following shutdown of the SVE system in order to check for any increase in levels, with the final rebound sampling occurring in May 2006. The operation was deemed complete in March 2007 after a Remedial Action Report was accepted by the FFA parties.

OU 3 Off-Facility Groundwater

In the late 1980s, two LAWC wells and four City of Pasadena wells were shut down for having VOCs concentrations above drinking water standards. Treatment systems were installed to treat the groundwater extracted from the LAWC and City wells. A carbon filtration system was installed at LAWC, and an air stripping system was installed in the Arroyo Seco for four of the City of Pasadena wells, which are collectively referred to as the Windsor Reservoir wells.

In April 2006, NASA published a Proposed Plan, and in August 2007 the FFA parties approved an interim ROD for OU-3. The selected remedy is to remove target chemicals from the aquifer at the existing LAWC plant and at four City drinking water wells by adding a treatment facility to remove perchlorate and VOCs. The approach is called centralized treatment because groundwater pumped from the wells is treated after the water is drawn from the wells and prior to use by the City and for LAWC customers. NASA would fund the City to lease treatment equipment and operate the system.

Groundwater from four City drinking water wells – Arroyo Well, Well 52, Windsor Well, and Ventura Well – would be cleaned in this new treatment facility using a liquid phase granular activated carbon (LGAC) system to remove VOCs, and an ion exchange system to remove perchlorate. The system would be located adjacent to the Windsor Reservoir. The ROD also provides that NASA continues to fund the existing treatment system at the LAWC that was constructed in 2004 as a Removal Action. This system uses LGAC with ion exchange and has been operating successfully since July 2004, treating over one billion gallons of water since initiating operation.

3.2 Table Mountain Facility

3.2.1 Land Use

The following section describes regional land use and facility land use in and around TMF.

3.2.1.1 Regional Land Use

The TMF is surrounded by the ANF (**Figure 3-14**). Future expansion is therefore limited by surrounding regional land use, and the topography of the San Gabriel Mountains (**Figure 1-4)**.

Figure 3-14. Aerial Photo of TMF

Source: http://tmoa.jpl.nasa.gov/Gallery

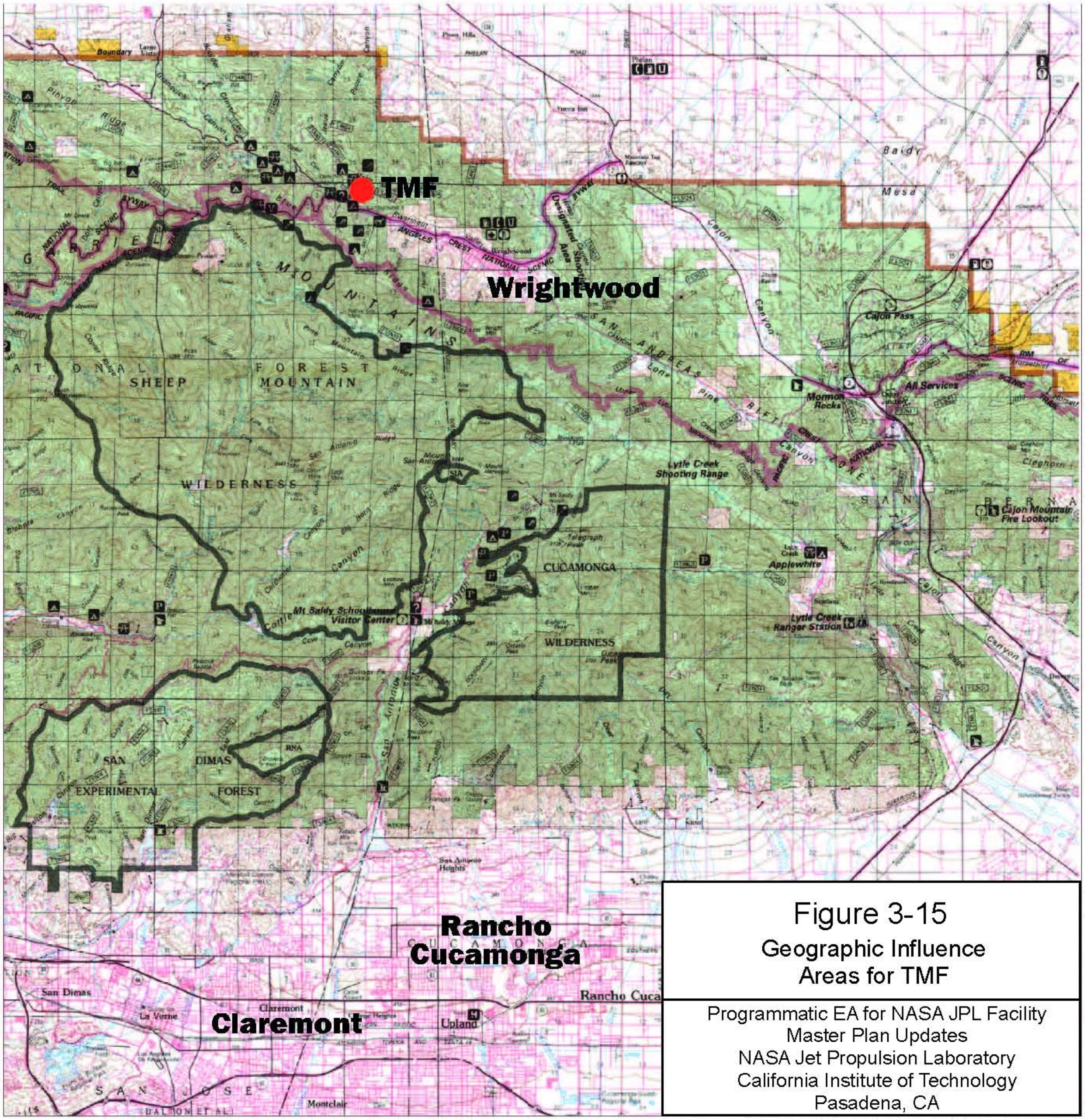
Geographic Setting

Given the mission of the TMF, it is useful to consider the facility within the context of several geographic influence areas:

- The ANF is administered by the USFS;
- The closest population is the town of Wrightwood, an unincorporated community of approximately 4,000 people located approximately 4 km (2.5 mi) away;
- Wrightwood straddles San Bernardino and Los Angeles Counties, and is therefore partially located within the two separate regulatory jurisdictions; and
- The larger metropolitan growth area consists of the expansive Los Angeles and Orange County- urban areas to the south and the rapidly urbanizing desert areas to the north (**Figures 1-1 and Figure 3-15**).

These geographic areas, briefly described below, place a significant role and influence upon the current operations of the TMF and will continue to influence TMF operations into the future.

Figure 3-15. Geographic Influence Areas for TMF



Source: United State Department of the Interior, Bureau of Land Management

Angeles National Forest - The ANF is considered a major urban forest, lying adjacent and contiguous to the nation's second largest urban region. The ANF represents a major recreation destination to the residents of and visitors to the Los Angeles urban region, with 3.5 million annual visits. These visits represent about 12 percent of all visits to national forests located in CA. The most popular activities listed by visitors to the ANF include; general activities such as escaping the noise, heat, etc., driving for pleasure, downhill skiing/ snowboarding, viewing wildlife, birds, fish, etc., hiking/walking, picnicking/family gathering, and camping.

The Wrightwood area offers a range of these activities, including dedicated areas for downhill skiing/ snowboarding, camping, picnicking and horseback riding. The downhill skiing/ snowboarding category is important to TMF in that Mountain High Resort (MHR) operates three winter sports facilities in the Wrightwood area: Mountain High West, Mountain High East, and North Pole Tubing Park, located directly northwest of and adjacent to, TMF. The combined capacity of MHR East and West is 6,900 simultaneous on-the-mountain guests per day. This translates into 2,300 destination auto trips per day assuming 3 persons per vehicle.

Many visitors enter the ANF or avail themselves of its scenic beauty by driving the Angeles Crest Highway, a National Scenic Byway/State Scenic Highway (SR 2) which connects Pasadena/Altadena on the west with SR 138 on the east passing through Wrightwood. This two-lane facility is administered by Caltrans.

San Bernardino National Forest - Located 2.4 km (1.5 mi) east of TMF, the County Line boundary separating Los Angeles and San Bernardino Counties also separates the ANF from the San Bernardino National Forest (SBNF). The SBNF registers 1.9 million visitors per year (2003)—most assumed to visit areas to the east such as the Big Bear and Arrowhead recreational areas or to a lesser extent the Mount Baldy/Mount San Antonio area located some 16 km (10 mi) south of TMF. Mount Baldy is not directly accessible by road from Wrightwood.

Community of Wrightwood - The community of Wrightwood is a small island of privately held properties surrounded by ANF lands. Primarily located in San Bernardino County, Wrightwood also includes unincorporated areas of Los Angeles County to the west, due to a north-south County Line boundary passing through the area. The community lies at an elevation of 1,829 m (6,000 ft) within the 6.4-km (4-mi) long Swarthout Valley, a geographical feature formed by the San Andreas Fault. State Highway 2 passes through the Swarthout Valley with major portions of the Wrightwood community lying south of the highway (**Figure 3-16**).

Figure 3-16. Building TM-23 atop Table Mountain Ridgeline

Source: AC Martin Master Plan Update Nov, 2010

3.2.1.2 Facility Land Use and Zoning

The TMF operates within, and is completely surrounded by the ANF, which is administered by the USFS. All users of Forest lands are required to secure special use permits, or SUPs, from the USFS. **Figure 1-4** depicts the facility site plan (existing land use) for TMF. The core TMF activity area and facilities occupy the ridge and hill top areas of the east end of the Table Mountain Ridge (**Figure 3-17**).

A main compound area contains most of the scientific and research facilities, a community area contained within Building TM-17 composed of dormitories, administrative and research offices, meeting areas and a modest food facility; and a maintenance support area centered in Building TM-19. All facilities within this area are interconnected by asphalt drives which widen in areas to create the majority of the TMF parking places and a few asphalt aprons. A temporary program-related trailer currently occupies the area east of TM-1. The TMF compound is surrounded by a 2.4-m (8-ft) high chain link security fence which contains the main gate. An asphalt road leaves the main compound on the northeast and proceeds east along the Table Mountain ridge to a level pad that contains TM-2/14 and two adjacent staging areas. The TM-2/14 compound is surrounded by a second chain link fence and gate.

A third and unused TMF activity area is located in the extreme southern and downhill part of the TMF site. This former site was dedicated to the testing of solar panels from 1965 to the mid-1980s. The site usually identified as TM-15 or the Industrial User's site, has a separate access road entered directly off of Table Mountain Road before reaching the USFS camping and North Pole Tubing Park areas. This site can be considered as TMF Reserve in that it could be revitalized and utilized in the future for some program where its characteristics are most suitable. The TM-15 site has its own security fence and is not directly connected to the upper main compound.

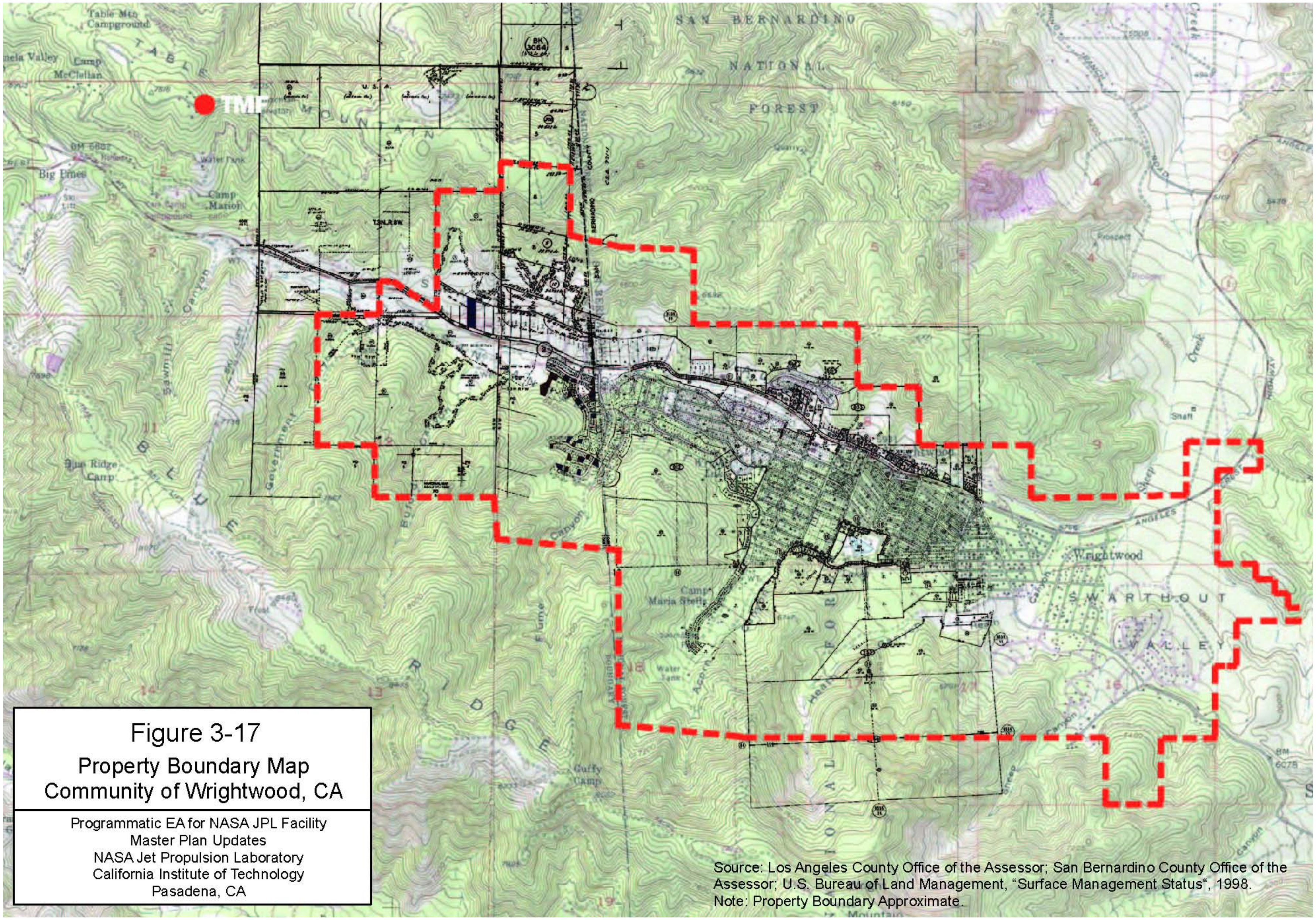
The remainder of the TMF site is largely composed of steep hillside areas covered with native forest communities. As the Table Mountain Ridge trends in a generally east-west direction its north and south hillside slopes have developed widely different plant communities with the south slope having greater representation in the oak and wood shrub species and the north slopes with pine species dominant.

Buildings and Structures

TMF consists of 15 buildings, totaling over 2,601 gross sq m (28,000 gross sq ft) in area. **Table 3-23** describes the main characteristics in each building located at TMF. The buildings at TMF are in good condition. Exceptions include various substandard building systems for which specific project proposals have been submitted by TMF to STMC for funding the improvements.

Exterior concrete flatwork is spalled and cracked at several locations throughout the facility, such as south of TM-2, and the patio behind (north of) TM-17. This may be due to freeze-thaw cycles and perhaps exposure to de-icing salt. Because of the earlier codes in place during the time of the tank construction, the USFS bolted steel water tank should be structurally reviewed for hydrodynamic response during an earthquake on the nearby San Andreas Fault. If structural issues are discovered, a new tank design should be considered since the water tank is a critical facility used for fire suppression (Leighton, 2006). The TMF facility is substantially compliant with the ADA. An ADA survey should be performed to identify any minor non-compliant areas so that they can be modified.

Figure 3-17. Property Boundary Map, Community of Wrightwood, CA



Source: Los Angeles County Office of the Assessor; San Bernardino County Office of the Assessor; U.S. Bureau of Land Management, "Surface Management Status", 1998. Property boundary is approximate.

Table 3-23. Summary of Existing TMF Facilities

Facility #	Facility Name	Building Date	Science Area	Operations & Other	Gross Floor Area	Current Equipment & Use
			sq m (sq ft)			
TM-1	FTUVS Facility	1962	353	100	453	FTUVS Projects
TM-2	Solar Testing Facility (High & Low Bays)	1966	1,705	909	2,614	High Bay: Solar Test Facility Low Bay: Celeostat Star Tracker Project, UCLA, USGS, Stanford Projects
TM-12	0.6-m Telescope Facility	1965	1,338	411	1,749	Astronomy
TM-15	Industrial Users Facilities	1965	0	140	140	Industrial User Utility building (not in use)
TM-17	Headquarters, Offices, Library, User Accommodations/2nd Floor Addition	1971/1991	754	7,466	8,219	Administration Building, library, mail room, dormitories, kitchen, eating area, offices
TM-19	Garage & Shop/Expansion	1971/1994	0	5,081	5,081	Full Machine and Carpenters Shop Equipment
TM-21	LIDAR Facility	1975	2,385	222	2,607	LIDAR Facility
TM-22	Electrical Support Building	1977	0	117	117	Electrical Equipment Building
PM-23	Pomona College Observatory (40-Inch Telescope)	1985	0	0	0	Pomona College 40-Inch Telescope Building, Non- NASA/JPL activity; operates under a MOU
TM-24	0.4-m Telescope Facility	1985	79	0	79	0.4-m Telescope, Astronomy
TM-24A	Atmospheric Viewing Monitor Instrument Housing	1995	80	0	80	Atmospheric Visibility Monitor Project
TM-25	U.C. San Diego (12-Inch Polar Telescope) (Permit)	1986	0	0	0	UCSD telescope and operations buildings, Non-NASA/ JPL activity, UCSD operates under a MOU
TM-27	1.2-m Telescope Facility	1989	2,917	108	3,025	1.2-m telescope building
TM-28	Atmospheric Studies Facilities	1998	1,469	821	2,290	Remote Sensing Instruments Laboratory
TM-29	Optical Communication Telescope Laboratory	1999	1,208	462	1,670	Optical Communications Telescope
TOTALS			12,288	15,836	28,123	

Source: JPL Table Mountain Facility.

Notes: sq ft=square feet; FTUVS=Fourier Transform Ultra Violet Spectrometer; UCLA=University of California at Los Angeles; USGS=U.S. Geological Survey; m=meter; LIDAR=Light Detection and Ranging; MOU=memorandum of understanding; UCSD= University of California at San Diego.

3.2.2 Socioeconomics

Socioeconomics is defined as the basic attributes and resources associated with the human environment, particularly population and economic activity. The Proposed Action would not alter the number of personnel assigned to TMF, nor change local population densities or distribution, or result in any increased development. Therefore, there would be no changes in area population or associated demands for housing and support services.

3.2.3 Environmental Justice

This section describes existing conditions for environmental justice in the area surrounding TMF.

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (FHWA, 1998), requires that all Federal agencies address the effects of policies on minorities and low-income populations and communities, and to ensure that there would be no disproportionately high and adverse human health or environmental effects to minority or low-income populations or communities in the area. A "minority" is defined as a person who is Black, Hispanic (regardless of race), Asian American, American Indian, and/or Alaskan Native. "Low-income" is defined as a household income at or below the U.S. Census Bureau Poverty Threshold (FHWA, 1998).

3.2.3.1 Minority Populations

A minority population is defined as any readily identifiable group of minority persons who live in geographic proximity, or are geographically dispersed or transient persons (such as migrant workers) who will be similarly affected by a proposed program, policy, or action (FHWA, 1998). Minority populations residing in the study area were compared to the population characteristics of the city and state. The CEQ guidance states that "minority populations should be identified where either (a) the minority population of the affected area exceeds 50 percent or (b) the population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographical analysis."

Census data demographic highlights were reviewed from the 2000 census, at which time the population of Wrightwood was reported to be 3,387. Almost 91 percent of the Wrightwood population was listed as white, compared to a national average of 75 percent. Additional data compiled for Wrightwood in 2008 indicates that the estimated ethnic composition was 86 percent white and 14 percent minority races (City-Data, 2008). These statistics show minor changes in the 8 years to 2008, and indicates the ratio of minority groups in the Wrightwood population continues to remain below national averages, where approximately 74.8 percent of races are identified as white (http://www.census.gov/, 2010).

3.2.3.2 Low-Income Populations

Low-income status was based upon comparing JPL income and larger study area residential population to the U.S. Census Bureau Poverty Threshold (http://www.census.gov/, 2000). CEQ guidelines do not specifically state the percentage considered meaningful in the case of low-income populations. The definition of "low income populations" is defined by the HUD as populations where "50 percent or greater are low-income individuals.

The 2000 census data reports the median household income for Wrightwood in 1999 was $50,338, while the nationwide median was $41,994. Although this indicates that Wrightwood is well above the national median income level, 63 families representing 5.8 percent of the population were reported to below the poverty line, compared to a national average of 9.2 percent. A total of 262 individuals representing 6.7 percent of the Wrightwood population were reported to be below the poverty line, compared to a national average of 12.4

percent of the population (http://www.census.gov/, 2000). This 2000 census data indicates that Wrightwood is almost 50 percent lower than, and significantly less likely to be below the poverty line than the average for the national population for both family groups and/or individuals.

Additional data compiled by Wrightwood for 2008 indicates that the estimated median household income rose to $65,841, while the California median was $61,021 (City-Data.com, 2008). Trend analysis indicates that the ratio of low-income population in Wrightwood remains significantly below national averages. The total number of people over the age of 18 living below the poverty level was compared to the total number of people in the Wrightwood community to obtain the percent of people living in poverty. The 1999/2000 Census data and the 2010 updates indicate that low income individuals do reside within the surrounding community. However, the percentages in the Wrightwood area are well below the 50 percent required to be considered a “low income population” as defined in the HUD guidelines.

3.2.4 Traffic and Transportation

This section includes discussion of the existing conditions for traffic and transportation for TMF.

3.2.4.1 Regulatory Framework

Section 3.1.4.1 describes the state and local statutes and regulations that establish the standards of transportation and circulation and must be considered by TMF when rendering decisions on projects that include construction, operation, or maintenance activities that have the potential to affect traffic and circulation.

3.2.4.2 Street System

TMF is served by a transportation system that connects it to regional highways and a local roadway system as described below.

Regional

The US Interstate 15 Mojave Freeway and the Interstate 215 Barstow Freeway combine and provide the main regional access east, out of the Los Angeles metropolitan area. Interstate 15 continues north through the San Gabriel Mountains into the San Gabriel Valley and Inland Empire. SR 138 is an east-west trending highway that crosses Interstate 15, and provides access to the community of Wrightwood. Lone Pine Canyon is accessed from SR 138, enters Wrightwood at the eastern end of the town and connects with SR 2. SR 2 also connects with SR 138 to the north. SR 2 is the main east-west access through the local community of Wrightwood. County Highway N4, also known as Big Pines Highway, provides additional westerly access heading towards Valyermo. All regional highways are two-lane roads in the vicinity of TMF.

Local

There is one direct access route to TMF. This 12.2-m (40-ft) wide, 610-m (2,000-ft) long two-lane asphalt road leads directly to the security gate entry into the TMF main compound. The access road is reached by taking the Table Mountain Road (and MHN/North Pole Tubing Park) turn-off from SR 2 (adjacent to the intersection with Big Pines Highway/County Highway N4) and proceeding up the road 1.6 km (1 mi). This section of road is fully accessible to and used heavily by the public—particularly in relation to the new MHN facility. Within the confines of the TMF site itself, TMF is served by several recently repaved on-site driveways that interconnect most of the primary TMF buildings and facilities. A separate road access to the TM-15 area of TMF is accessible from Table Mountain Road, approximately 1.2 km (0.75 mi) before MHN is reached.

3.2.4.3 Traffic Generation

Traffic in the areas surrounding Wrightwood is moderate through much of the year. However, major traffic congestion is common in the winter along State Highway 2 in east and westerly directions as a result of users of the Mountain High ski slopes. This traffic is heavy in the morning and extreme in the afternoon/evenings as skiers tend to exit MHRs adjacent to Table Mountain Road at the same times. There are no mass transit or transportation services to TMF, and parking is limited due to the high density of buildings in the main development area and lack of adequate planning early in the facility's history.

3.2.5 Utilities and Services

This section includes a description of the regulatory framework that guides the decision-making process and existing conditions of the proposed project area. The current utility infrastructure at TMF includes electrical power, propane, fuel oil and other petroleum products, nitrogen and compressed air systems, water, sanitary sewer/percolation pipes and leach pit, and telecommunications. TMF infrastructure also includes petroleum product storage and management, refuse and solid waste collection and disposal, parking and snow-removal, and emergency services. The primary utility corridors at TMF are the electrical power and water supply systems. The utility systems at TMF have been installed incrementally throughout the development of the facility. The majority of the newer utility systems are buried below grade in a relatively protected environment and their condition is not expected to have changed since construction.

3.2.5.1 Electrical Power

The main power lines in the basin area belong to SCE. Electrical power is brought to TMF by two SCE 12kV lines. The main group of buildings is fed by an underground feed which enters the site near the main gate adjacent to Building TM-17. The high voltage line runs underground along the driveway and feeds an SCE pad mounted transformer adjacent to Building TM-22. The main site electrical service is located inside this building and is rated at 400-Amps- 480V-3Phase-3W (SCE Meter #P379-1824). A maximum demand of 97kW/121kVA (145 Amps) was indicated on January 24, 2006. All buildings except Building TM-2 are connected to this service. Electricity usage was 467,280 kWh in FY 2010.

The SCE high voltage line extends south and east to a single phase transformer pad located north of Building TM-27. This feeds a USFS support building not associated with TMF. The SCE meter for this building is rated at 100-Amp, 120/240V single phase. The second SCE 12kV line comes in overhead from the southwest, adjacent to building TM-2. Service to the building is also served overhead through a 400-Amp- 480V-3Phase-3W meter.

Existing Distribution System

Distribution to the individual buildings in the main complex comes from the main electrical service at Building TM-22. All feeders run through a complex of new and existing underground conduits and hand holes. Much of this system is more than 30 years old and will need replacement if future expansion is anticipated. Also, interior wiring of the buildings range from original installation prior to 1967 to new installations as late as 1997. Building TM-15, located in the former solar panel test area south of the hill top complex, is also fed from this main service. This line is not used and assumed to be in need of repair.

The service is backed up by an emergency generator rated at 125KW/ 156kVA located in Building TM-19. The generator was installed in 1993 and has been used 28.3 hours annually since installation. It is fueled by an outdoor LP tank located on the north side of TM-19. The tank is kept filled to 80 percent, and the generator uses 13 of a 3,785-l (1,000-gal) tank for every 9 hours of usage. The transfer switch for this system is located indoors in

Building TM-22. Each building is fed by 480V-3Phase directly from the main service in TM-22 or sub-fed from an adjacent building. Distribution to Building TM-2 is directly off the overhead 480V-3 Phase Service equipment.

3.2.5.2 Petroleum, Oil, and Lubricants

There is no natural gas available to TMF. Several buildings in the main area and TM-2 are served by LP supplied by outside tanks (**Figure 3-18**). The tanks are filled periodically by a local Wrightwood supplier (Ferrellgas). The main area tanks have a capacity of 3,785 l (1,000 gal) each. TM-2 is supplied by five 1,889-l (499-gal) tanks. Approximately 18,496 gal of LP was delivered to TMF in 2009. The USFS requires proper handling of materials, flammable and hazardous chemicals, and other materials used at TMF in accordance with regulatory standards and procedures. TMF consumed an average of 246 gal/year of diesel fuel from 2007 thru 2009.

Figure 3-18. Liquid Propane Tanks at TMF

Source: AC Martin Table Mountain Facility Master Plan Update, 2011

3.2.5.3 Water Distribution

All TMF domestic and fire water needs are served by a 1.19 million-l (315,000-gal) steel tank owned by the USFS and located on the west side of the site next to the main entrance. The tank is supplied with water by single 7.6 cm (3-in) line fed from supply wells and pumps located in the Swarthout Valley. This tank also supplies water to the USFS and several local users in the general area. There is no irrigation water system on the TMF site.

The El Mirage Valley Groundwater Basin underlies Swarthout Valley and extends northwards beneath El Mirage Valley along the western border of central San Bernardino County. Elevation of the valley floor ranges from 863 m (2,833 ft) amsl at El Mirage (dry) Lake to 1,829 m (6,000 ft) near Wrightwood in Swarthout Valley. The basin is bounded by non-water-bearing rocks of the Shadow Mountains on the north, Adobe Mountain and Nash Hill on the northwest, and the San Gabriel Mountains on the south. Alluvial drainage divides extending from the San Gabriel Mountains define the western and eastern basin boundaries. The neighboring San Gabriel Mountains rise to an elevation of about 2,591 m (8,500 ft), and Silver Peak in the Shadow Mountains attains an elevation of 1,255 m (4,118 ft) (AC Martin 2011).

Domestic and fire suppression water systems are served from a common main line and are not separated. The whole water system is pressurized by a booster pump located in building TM-19. A back-up booster pump is also available and used only if fire hydrants are engaged. The main pressurized line is 15.2 cm (6-in) steel pipe and most of the site water lines are also steel pipes. There are seven fire hydrants distributed across the main site and one located on the TM-2 site. Results of flow tests performed by the County of Los Angeles Fire Department in January 2005 show the flow available from the most remote fire hydrant is 2,839 l per minute (750 gpm) at 20 psi residual pressure.

Buildings TM-17, TM-19, TM-21, TM-28 and TM-29 are equipped with fire suppression sprinkler systems. Due to the subfreezing winter temperatures on TMF, the buildings are equipped with "dry-type" automatic protection system. There are plans for installing Fire Suppression sprinkler systems in the remaining buildings without sprinklers: TM-1, TM-2, TM- 12 and TM-27.

3.2.5.4 Waste Water Collection and Treatment

Wastewater generated at TMF is primarily domestic sewage water. Because of the remote location of TMF, the sanitary sewer needs are met through a system of multiple septic tanks connected to percolation pits or perforated leach pipes. The septic tanks are cleaned regularly at approximately five year intervals.

3.2.5.5 Nitrogen and Compressed Air Systems

TMF has one 4,921-l (1,300-gal) LN storage tank, which holds approximately 4.3 tons of LN. The LN tank, built in 1959, is historically filled 4-6 times annually depending on use and weather conditions.

3.2.5.6 Communications

Telecommunications requirements at TMF, primarily telephone and Wide Area Network connection, are currently met through an UTP copper cable distribution system that supports the telephone system and certain low voltage signaling systems between buildings. Telephone service is provided by Verizon Wireless of California. TMF currently uses approximately 60 lines of dedicated service. There are two T-1 communication lines serving the TMF site, one general T-1 line connected to the TMF Local Area Network (LAN), and the other non-LAN connected line which serves as a back-up link for the Building TM-28 ACRIMS lab connecting it to the satellite.

The Data Services LAN requirements are currently met through a site wide distribution system consisting of fiber optic cable linking buildings within the facility and horizontal cable installed from the workstation outlets to equipment rooms within the buildings.

The existing communications service is a single point of entry into TMF via an underground conduit with one unshielded twisted 200-pair cable to the Minimum Point of Entry (MPOE) in Building TM-17. From the MPOE, multi-pair cables have been installed directly into buildings and through a distribution system of underground conduits, pedestals, and a vault. Lightning protection blocks have been installed on the wall of the MPOE Room for the service entry cable pairs. Various buildings have installed lighting protection on the distribution cables, one end only. The conduit ends inside the equipment rooms were open (not sealed) in many cases.

Fiber optic cable originates in Building TM-21 and is 'daisy chained' from building to building via patch panels. Dedicated pairs of fiber are labeled for use in various buildings. The existing distribution copper and fiber optic cable plant meet the current needs of TMF. Smaller buildings lack outside plant rated copper cable and lightning protection and use junction boxes or wall space in common area rooms.

3.2.5.7 Storm Water Collection

There are no storm water collection and treatment devices at TMF. The main TMF site and east TM-2 site are located on hilltops, which allow surface storm water runoff to be conveyed to the surrounding slopes through natural relief or graded swales. There are two 61-cm (24-in) drainage channels (half-pipe CMP) located west and north of building TM-19. Some buildings (TM-2, TM-19, TM-28 and TM-29) have roof drains, which are connected to underground storm drain systems for each building (**Figure 3-19**). In these locations, the runoff from the roof is conveyed through that system and discharged on the slope away from the buildings using outlet structures. The rest of the buildings have no roof gutters or roof drains.

The main surface parking area at the entrance to TMF as well as the parking immediately south of building TM-19, are draining to a common point near the south-west corner of TM-19, and then runoff is conveyed through the half pipe channel to the lower parking area north of TM-19. The runoff is then conveyed through a second channel to an earthen ditch along the TM-2 site connecting road and to an adjacent hillside discharge point.

Figure 3-19. Roof Drain Conveyance System at Building TM-29

Source: AC Martin Master Plan Update, 2011

3.2.5.8 Solid Waste

TMF generates refuse and other solid wastes from various activities. On-site refuse and other domestic waste collection points using trash bins and dumpsters are located at designated areas.

3.2.5.9 Emergency Response and Safety Management

TMF has a number of emergency systems that includes automatic warning devices, backup electrical power and lighting systems, closed-circuit television, communications systems and fire protection systems.

Safety

The TMF safety program is designed to help prevent on-site accidents and to respond to on-site and off-site accidents and disasters that may occur. Emergency response services are provided by TMF on-site and/or are provided in cooperation with other local and area agencies. Safety systems and procedures cover the use of hazardous materials, the operation of equipment, and various health regulations as well as instructions related to the unique characteristics of TMF and environment, which experiences seasonal exposure to safety concerns.

As part of JPL's safety procedures, the TMF supervisor is responsible to ensure that all employees, contractors, subcontractors and visitors under his/her cognizance are provided a safe and healthful work environment. In the State of California, there are numerous regulatory requirements that mandate this, including the CCR and the California Health and Safety Code. Additionally, TMF establishes its own standards of safety in accordance with Occupational Safety and Health Administration (OSHA) requirements.

Emergencies and Fire Suppression

Because there are essentially three local governmental jurisdictions—the County of Los Angeles within which the TMF is physically located, the County of San Bernardino where most of the community of Wrightwood is located, and the USFS ANF district where most of the recreational activities take place—there is an overlap of local responsibility in the areas of police law enforcement, fire, and paramedic services. Primary police protection for TMF is provided by the San Bernardino County Sheriff Department, which has a substation located in Phelan, CA approximately 9.7 km (6 mi) from Wrightwood. However, some patrol activity is provided by Los Angeles County Sheriff Department in the local Los Angeles County areas. As a back-up, the USFS rangers also provide assistance under various circumstances.

Similarly, fire and paramedic services are primarily provided through the San Bernardino Fire Department station in Wrightwood. Backup services are available locally through the USFS Ranger station in Big Pines. Water for fire suppression purposes is made available through the on-site 1.19 million-l (315,000-gal) water tank jointly used by TMF, the USFS, and several other local users. There are currently seven fire hydrants present on-site that can be tapped into for fire suppression.

Emergency supplies and equipment strategically stored around TMF include communications devices, debris-removal equipment, food and water rations, medical supplies, portable propane field stove, power generator, fire-fighting equipment, and search and rescue equipment. Specific buildings and other areas at TMF have been designated as emergency facilities to support emergency response efforts. These include emergency and disaster response facilities, emergency assembly areas and emergency shelters. Emergency response facilities, emergency services and emergency medical points at TMF and the local off-site facilities are listed below:

- Emergency Operations Center (EOC) in Administration Building TM-17;
- Alternate EOC in TM-19;
- TMF Security Administration in Building TM-17;
- San Bernardino County Fire Dept. in Wrightwood; and
- Medical Services in Wrightwood.

During emergencies, personnel may be required to gather in specially designated emergency assembly areas, including the main TMF parking lot in front of TM-17; and the parking lot area in front of TM-19. Designated indoor emergency shelters are also provided to support operations and house personnel during emergencies. Shelters at TMF include Buildings TM-17, TM-19, TM-21, and TM-27.

3.2.5.10 Security Management

The primary physical security feature at TMF is provided by two 8-ft fence perimeters that surround both the main compound area and the Building TM-2 area. The TM-15 area previously used by NASA contractors to test solar panels is also surrounded by a fence. These fences are not built to current NASA standards, have an excessive number of entry points and in various locations suffer from snow damage. Further, in times of high snow gates are difficult to operate and some fence lines are rendered ineffective. A proposed fence improvement project through a combination of features including improved fences, new fence lines and a new front gate would address many of the current shortcomings. Perimeter and grounds security is augmented by closed circuit TV monitoring. TMF contracts with a private security firm to provide site security services for the TMF. In the event of an emergency, a dial to 9-911 will connect on-site.

3.2.5.11 Schools

The closest schools to the project area are primarily in Wrightwood and 1.8 km (6 mi) northeast of Wrightwood in Phelan. These schools are part of the Snowline Joint Unified School District and listed in **Table 3-24**.

Table 3-24. Schools in the Vicinity of TMF

School	Address
Phelan Elementary	4167 Phelan Road, Phelan, CA
Wrightwood Elementary	1175 Highway 2, Wrightwood, CA
Heritage Elementary School	9268 Sheepcreek Rd., Phelan, CA
Piñon Mesa Middle School	9298 Sheepcreek Rd., Phelan, CA
Serrano High School	9292 Sheepcreek Rd., Phelan, CA
Chaparral Continuation High School	9258 Malpaso Rd., Phelan, CA
Desert View Independent School	3919 Nielson Road, Phelan, CA
Eagle Summit Charter School	3850 Trinity Rd., Phelan, CA

3.2.5.12 Parks

Adventuring hikers and can access points of interest and features such as Mt. Baden Powell, the Pacific Crest National Scenic Trail, and enjoy the ANF. Wrightwood is home to the some of the finest skiing in southern California. Ski Sunrise and MHR are nearby ski resorts. Throughout the ANF there are many areas available for snow play, sledding, and other winter opportunities.

3.2.6 Air Quality

The following section describes the local air resources in terms of climate, air quality standards, air quality conditions, and the TMF air pollution sources, controls and reporting requirements. Air emission sources at TMF and any applicable controls employed to minimize emissions are also discussed.

The TMF facility is located on the eastern side of the Swarthout Valley, within the Mojave Desert Air Basin (MDAB). The MDAB is comprised largely of the desert portions of Los Angeles and San Bernardino Counties, and includes the eastern portions of Kern and Riverside Counties. However the TMF facility is located in the Antelope Valley Air Quality Management District (AVAQMD), which comprises only a small portion of northern Los Angeles County. The District boundaries start on the south outside of Acton, north to the Kern County line, east to the San Bernardino County line, and west to the Quail Lake area. Air quality in this north eastern section of Los Angeles County and the Antelope Valley on the eastern side of the San Gabriel Mountains is a product of the desert climate in the MDAB and the coastal climate from the adjacent Los Angeles metropolitan area.

3.2.6.1 Climate

The MDAB is a dry-hot desert climate, with portions classified as dry-very hot desert, indicating at least three months have maximum average temperatures over 38 °C (100.4 °F). Temperatures vary from a mean winter maximum of 15.6 °C (60 °F) to a mean winter minimum of 0 °C (32 °F) in January and a mean summer maximum of 41 °C (106 °F) to a mean summer minimum of 22.8 °C (73 °F) in July. Average annual precipitation is 9.8 cm (3.87 in), with precipitation in the MDAB ranging from between 7.6 to 17.8 cm (3 and 7 in) per year. Most precipitation falls between December and March, with 16 to 30 days having at least 0.03 cm (0.01 in).

During the summer months, the MDAB climate and weather patterns are typically influenced by a Pacific subtropical high weather cell that sits off the California coast, inhibiting cloud formation and encouraging daytime solar heating. The MDAB is rarely influenced by cold weather masses moving south from Canada and Alaska, as these frontal systems are typically weak and diffuse by the time they reach the desert. Most desert air moisture arrives from infrequent warm, moist and unstable air masses from the south. Light rainfall and thunderstorms typically occur when warm, moist tropical air off the coast of Mexico enters the desert.

Regionally, winds across southern California are mild throughout the year, with a dominant daily wind pattern of onshore breezes during the day and offshore breezes at night. The predominant wind direction at TMF is from the west-northwest during much of the year. However, with normal variations in pressure systems, wind patterns for both the SOCAB and MDAB change seasonally in both strength and direction. The Antelope Valley is affected by gentle westerlies coming in from the SOCAB during summer, but during autumn is affected by occasional storms and unseasonably strong, hot, north or northeasterly windy conditions. These conditions are commonly referred to as Santa Ana winds, and occur primarily between October and December, as the result of strong high pressure systems moving into the Great Basin area of Nevada and Utah.

At a more localized scale, wind direction data for the MDAB indicates that the predominant winds are from the southwest and west-southwest for each month except November and December, when predominant winds are from the northwest. During stable conditions, wind blows from the northwest as air flows toward the lower elevations to the southeast, showing wind directions for the area are highly variable. The average wind speed for a 20-year period was recorded as 3.2 to 14.5 kph (2 to 9 mph) and the maximum extreme wind speed for a 14-year period was recorded as 141 kph (87.5 mph). Air quality is correlated to the dominant transport direction of these localized winds. The Antelope Valley is located in an area of high pollution potential due to the juxtaposition of the MDAB and SOCAB with the Los Angeles metropolitan area and associated topographic influences. During spring and summer, pollution produced during any one day is blown out of the SOCAB through the inland mountain passes towards the Antelope Valley.

Air pollutants can be transported 97 km (60 mi) or more inland by ocean air during the afternoons, and are readily dispersed into the MDAB. From early fall to winter, the transport is less pronounced because of slower average winds speeds and the appearance of land breeze winds may begin by late afternoon. Pollutants remaining in the air basin are trapped and begin to accumulate during the night and the following morning. A low wind speed in pollutant source areas is an important indicator of air stagnation and the represents the potential buildup for the primary (criteria) air pollutants.

3.2.6.2 Air Quality Standards

State and Federal air quality standards, including regulatory and General Conformity applicability are discussed in Section 3.1.6.2 – please refer to this section for the associated air quality standards for the TMF location.

3.2.6.3 Air Quality Conditions

While TMF is located within the MDAB, and within the jurisdiction of the AVAQMD, it is also affected by air quality conditions and weather or climatic patterns from the adjacent SOCAB. Pollutant transport in the SOCAB generally follows the on- and offshore air flow characteristic of coastal areas, where daytime transport is inland toward the San Gabriel Mountains and nighttime transport is off shore. The actual blend of these flow patterns is complex, and different pollutant concentrations are observed at various inland locations on any given day.

Table 3-25 summarizes the Federal and state attainment status of criteria pollutants for the areas surrounding TMF and **Table 3-26** provides AVAQMD attainment designations and classifications for pollutants.

Table 3-25. Comparison of Attainment Status (SOCAB and Antelope Valley)

Pollutant	Attainment Status South Coast Air Basin		Attainment Status Antelope Valley	
	Federal	State	Federal	State
Ozone - 1 Hour	N/A	Extreme Nonattainment	N/A	Extreme Nonattainment
Ozone - 8 Hour	Severe-17 Nonattainment	Not available	Nonattainment[1]	Not available
CO	Attainment	Attainment	Unclassified/Attainment	Attainment
NO2	Attainment	Attainment	Unclassified/Attainment	Attainment
SO2	Attainment	Attainment	Attainment	Attainment
PM10	Serious Nonattainment	Nonattainment	Unclassified	Nonattainment
PM2.5	Nonattainment	Nonattainment	Unclassified	Unclassified

Source: CARB 2006

1 In its 8-hour ozone submittal, the CARB requested that USEPA reclassify the AVAQMD portion of the Mohave Desert Air Basin as 'severe-17 nonattainment for 8-hour ozone; however, the USEPA has not formally rendered a decision on the request and designation status is pending.

Table 3-26. AVAQMD Attainment Designations and Classifications

AVAQMD Designations and Classifications	
Ambient Air Quality Standard	AVAQMD
One-hour Ozone (Federal) – standard has been revoked, this is historical information only	Non-attainment; classified Severe-17
Eight-hour Ozone (Federal 84 ppb)	Non-attainment; classified Severe-17
Eight-hour Ozone (Federal 75 ppb)	Non-attainment (expected)
Ozone (State)	Nonattainment; classified Extreme
PM10 (Federal)	Unclassified
PM2.5 (Federal)	Unclassified/attainment
PM2.5 (State)	Unclassified
PM10 (State)	Non-attainment
Carbon Monoxide (State and Federal)	Attainment
Nitrogen Dioxide (State and Federal)	Attainment/unclassified
Sulfur Dioxide (State and Federal)	Attainment/unclassified
Lead (State and Federal)	Attainment
Particulate Sulfate (State)	Unclassified
Hydrogen Sulfide (State)	Unclassified
Visibility Reducing Particles (State)	Unclassified

Source: AVAQMD 2010

3.2.6.4 Air Pollution Sources, Control, and Reporting Requirements

The types of air emission sources that require AVAQMD permits to construct or operate include boilers, internal combustion engines, emergency generators, painting operations, degreasers, fuel storage tanks, dispensers, and other R&D processes. TMF is not permitted by the AVAQMD as of September 2010.

3.2.6.5 Toxic Release Inventory

TMF complies with other reporting requirements, including Section 313 Reporting Requirements under EPCRA and toxic emission inventory reporting under Air Toxics "Hot Spots" Information and Assessment Act AB 2588.

3.2.7 Noise and Vibration

This section describes noise and vibrations as environmental considerations, and describes the existing conditions pertaining to the noise and vibration environments in the TMF area. TMF is surrounded by the ANF which is administered by the USFS. The community of Wrightwood is located approximately 3.2 km (2 mi) southeast of TMF, and provides the only noise and vibration sensitive receptors within an 8 km (5 mi) radius of TMF.

3.2.7.1 Noise

A definition of noise, sound level standards, and units of sound level measurement are discussed in detail in Section 3.1.7.1. **Table 3-16** provides a list of typical noise levels. The general principle on which most noise acceptability criteria are based is that a perceptible change in noise is likely to cause annoyance wherever it intrudes upon the existing ambient sound; that is, annoyance depends upon the sound that exists before the introduction of the new sound.

Surrounding Land Uses

The majority of the area surrounding TMF is part of the ANF, and is largely undeveloped with few inhabitants. The nearest residential community is the town of Wrightwood, located 3.2 km (2 mi) east of TMF, and includes the closest schools. Wrightwood exists as an island of privately held properties surrounded on all sides by National Forest lands (NASA, 2006). The suburban communities of Piñon Hills and Phelan are located approximately 1.8 km (6 mi) to the northeast, and include the closest hospitals. In general, noise conditions at these school and hospital sites are dominated by noise from localized vehicular traffic.

Noise Sources at TMF

Noise sources at TMF include vehicle traffic and parking, pumping stations, compressors, backup generators, building ventilation and air conditioning equipment, various blowers and exhaust fans, LN system venting equipment, equipment fabrication and maintenance shops, laboratory and testing facilities, and grounds maintenance activities. Many mechanical equipment noise sources are housed inside buildings, reducing the equipment contribution to outdoor ambient noise levels. There can be intermittently high noise levels near some types of mechanical equipment at TMF. However, noise levels due to these localized sources will decrease rapidly at increasing distances from the equipment. High levels of equipment noise are limited to localized areas within TMF and do not adversely affect noise levels at the property fence line.

3.2.7.2 Vibration

Ground borne vibration is the oscillatory motion of the ground about some equilibrium position, and is described in terms of velocity for evaluating impact. Vibration above certain levels can damage buildings, disrupt sensitive operations, and cause discomfort to humans within buildings. **Figure 3-7** illustrates ground borne vibration levels for common sources, as well as criteria for human and structural response to ground borne vibration. As shown, the range of interest is from 50 to 100 VdB, from imperceptible background vibration to the threshold of damage. Although the threshold of human perception to vibration is approximately 65 VdB, annoyance is not usually major unless the vibration exceeds 70 VdB. Airborne sound waves can also cause vibrations to structures. Studies have shown sound levels reaching a home or other structure must be greater than 137 dB to cause any damage.

3.2.8 Geology and Soils

This section describes TMF land resources in terms of topography, geology, and seismology.

3.2.8.1 Regulatory Framework

There are no specific Federal regulations addressing geology and soils issues that are not addressed by the more stringent state or local requirements. Section 3.1.8.1 describes state statutes and policies that relate to geology and soils and must be considered by TMF during the decision making process for projects that involve soil disturbance or earth moving activities such as grading, excavation, backfilling or the modification of existing structures or construction of new structures.

3.2.8.2 Topography

Topographically there are steep descending slopes around the perimeter of TMF. In the past to develop the TMF facilities, grading activity had resulted in a combination of cut and fill building areas creating some areas of surficial fill. The surficial fill along with local colluvium and weathered rock have been mapped and encountered by others in borings across TMF. These shallower earth materials are subject to erosion and surficial instability. Strong ground shaking could result in surficial slides, dynamic differential compaction and possibly lateral spreading, particularly at existing bedrock to cut/fill transitions (AC Martin 2011).

Free groundwater is generally not expected at shallow depths on the Table Mountain ridge line, but could be encountered as seeps in cuts at lower elevations, such as at TM-15, particularly in ravines. Prior borings drilled at TM-17, TM-19 and TM-29 did not encounter free groundwater. Given these and other geological factors present at the TMF site, liquefaction is not expected to be a hazard at TMF.

3.2.8.3 Geology

TMF is located in the San Gabriel Mountains along a mesa like ridge line known as Table Mountain. The geology consists of metamorphic gneiss, marble, and some granitic bedrock, which are hard, massive rocks not usually prone to slope instability. As delineated in **Figure 3-20**, soils at TMF are mapped as Balder family-Xerorthents complex, 5 to 60 percent slopes (AC Martin 2011). The Balder family soils are well drained gravelly sandy loam derived from residuum weathered from granodiorite. Xerorthents soils are somewhat excessively drained gravelly sandy loam derived from residuum weathered from granodiorite and/or residuum weathered from metamorphic rock. Surface soils on the site have been disturbed to develop the TMF facilities. Grading activities have resulted in a combination of cut and fill building areas creating areas of surficial fill (AC Martin 2011).

3.2.8.4 Seismology

TMF is located within 1.6 km (1 mi) of a major California fault, the San Andreas Fault (**Figure 3-21**). Table Mountain is north of and parallel to the Fault. The fault is the largest known fault in southern California, which had ruptured in the 1857 Fort Tejon Earthquake. The San Andreas Fault is thought to be capable of an earthquake on the order of moment magnitude (Mo=) 8 (**Figure 3-22**). Significant ground shaking should be anticipated at TMF as a result of a large magnitude earthquake on the San Andreas Fault (AC Martin 2011).

Figure 3-20. Soils Map for Angeles National Forest Area

Soils Legend:
95 = Bakeoven family-Lithic Xerorthents-Sur family, moderately deep complex, 45-80 percent slopes
640 = Balder family-Xerorthents complex, 5 to 60 percent slopes
FsD = Wilshire-Oak Glen, dry families association, 2 to 15 percent slopes
630 = Balder family-Mollic Haploxeralfs, cool-Lithic Haploxeralfs complex, 5 to 60 percent slopes
SgF = Olete Kilburn-Goulding families complex, 30 to 50 percent slopes

Figure 3-20
Soils Map for Angeles National Forest Area

Programmatic EA for NASA JPL Facility Master Plan Updates
NASA Jet Propulsion Laboratory
California Institute of Technology
Pasadena, CA

Source: Table Mountain Facility Master Plan Update 2011-2032, 2011

Figure 3-21. San Andreas Fault

File Path:F:\GISDATA2\NASA_JPL_EA\GIS_Documents\Project_Maps\Master_Plan\JPL_MasterPlan_EA_Fig3_21.mxd

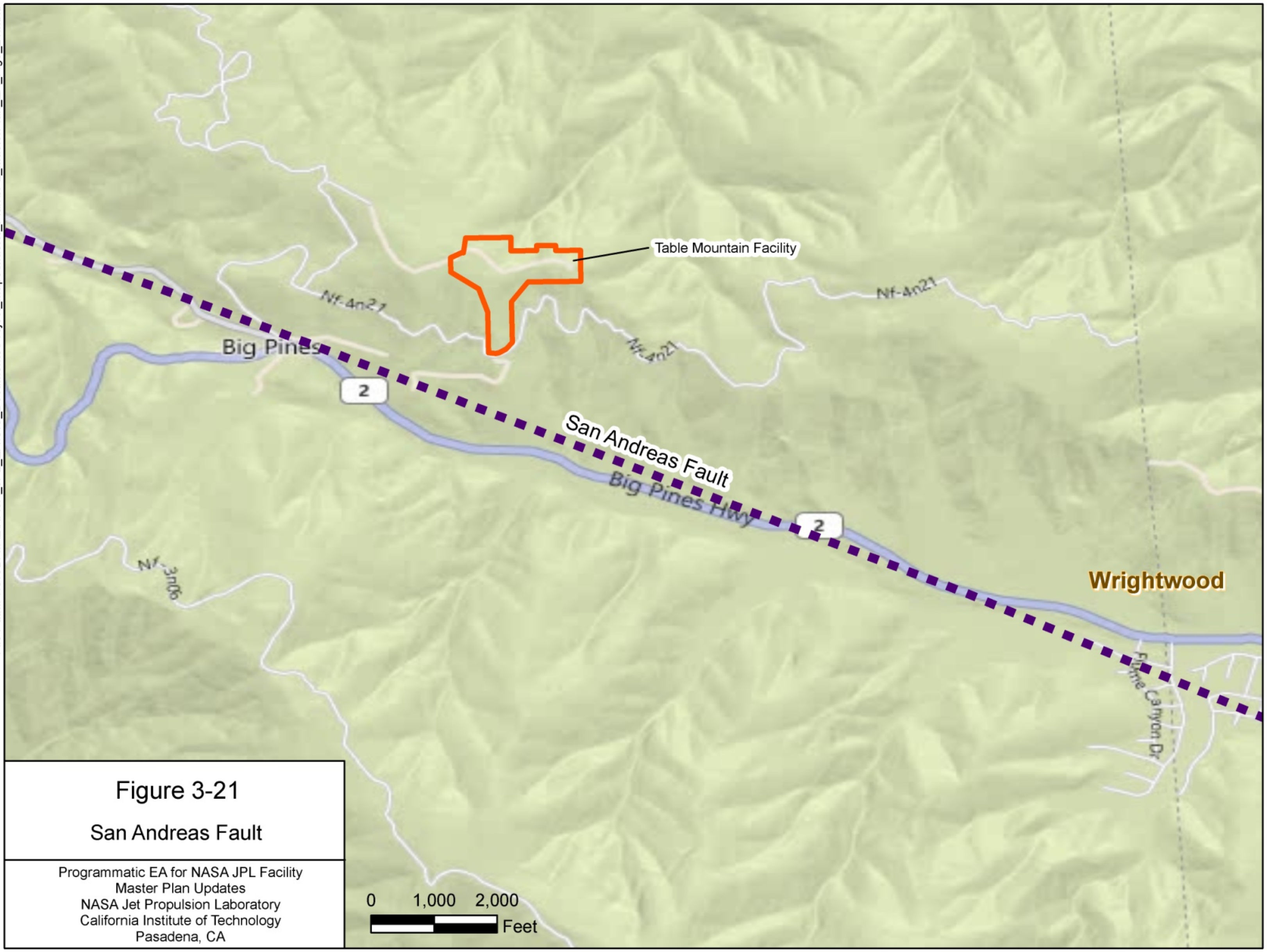
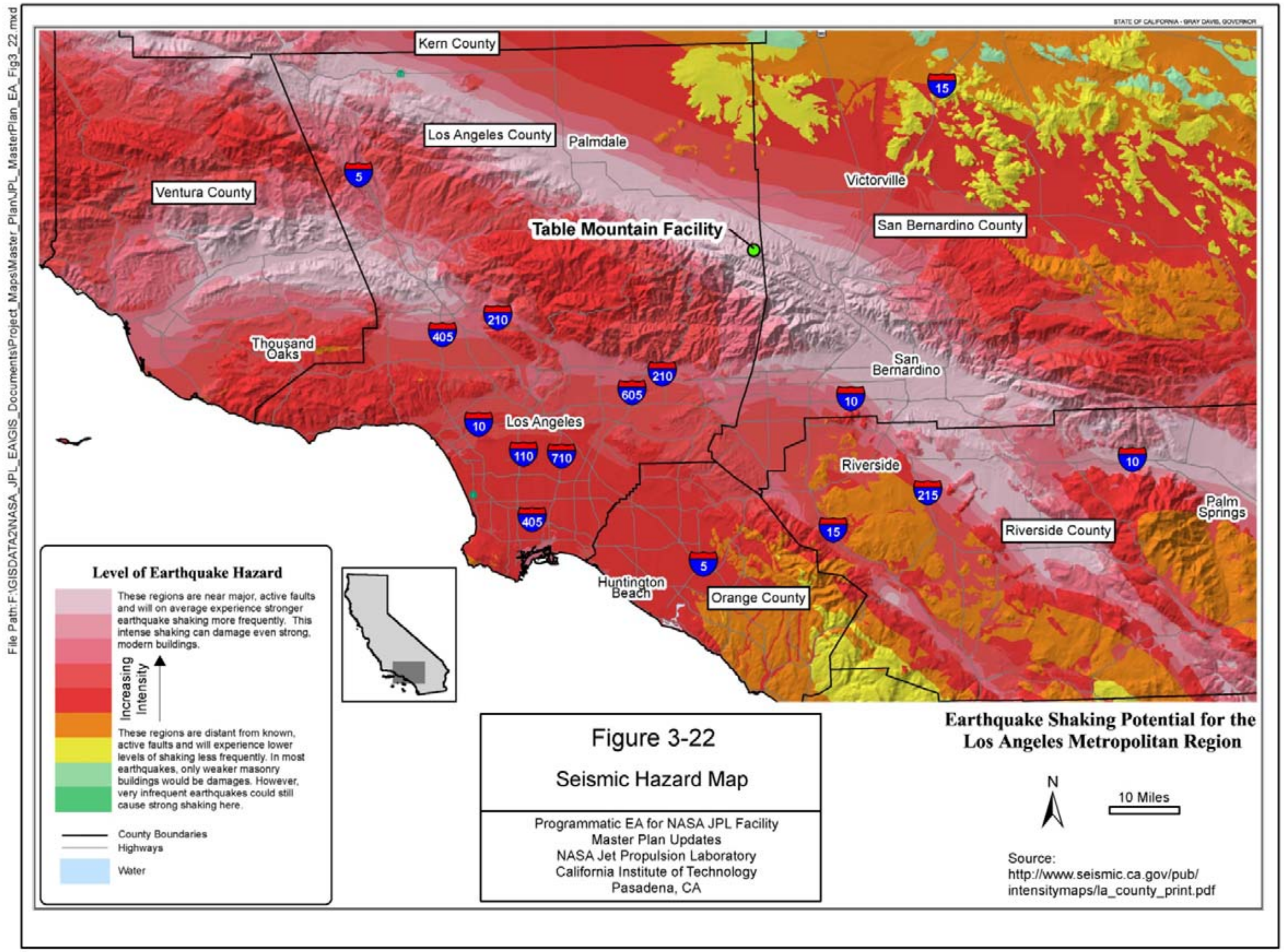


Figure 3-22. Seismic Hazard Map



3.2.9 Water Resources

NASA policies require protection of water quality consistent with the CWA. The purpose of the CWA is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters". To enact this goal, the USACE has been charged with evaluating Federal actions that result in potential degradation of waters of the U.S. and issuing permits for actions consistent with the CWA. The USEPA also has responsibility for oversight and review of permits and actions, which affect 'waters of the U.S'.

3.2.9.1 Surface Water

TMF does not contain surface waters, and is mostly dry, except for periodic runoff during storm events. There are no stormwater collection and treatment devices at the site. The main TMF site and east TM-2 site are located on hilltops, which allow the surface stormwater runoff to be conveyed to the surrounding slopes through natural relief or graded swales.

3.2.9.2 Floodplains

EO 11988, "Floodplain Management," requires Federal agencies to avoid construction within the 100-year floodplain unless no practicable alternative exists. The project area is located outside of the 100-year floodplain.

3.2.9.3 Groundwater

There is no groundwater source on TMF. Site domestic and fire water needs are served by a recently reconditioned 1,192,405-l (315,000-gal) steel tank owned by the USFS, which is supplied with water from wells and pumps located in the Swarthout Valley. The El Mirage Valley Groundwater Basin underlies the Valley.

The El Mirage Valley Groundwater Basin extends northwards beneath El Mirage Valley along the western border of central San Bernardino County. Elevation of the valley floor ranges from 863.5 m (2,833 ft) amsl at El Mirage Lake to 1,829 m (6,000 ft) near Wrightwood in Swarthout Valley. The basin is bounded by non-water-bearing rocks of the of the Shadow Mountains on the north, Adobe Mountain and Nash Hill on the northwest, and the San Gabriel Mountains on the south. Alluvial drainage divides from the San Gabriel Mountains define the western and eastern boundaries of the basin. The neighboring San Gabriel Mountains rise to an elevation of 2,591 m (8,500 ft) and Silver Peak in the Shadow Mountains attains an elevation of 1,255 m (4,118 ft) (AC Martin 2011).

3.2.9.4 Water Quality Standards

In Swarthout Valley and most of the southern part of the basin, groundwater is calcium bicarbonate in character. In the central part of the basin east of Gray Mountain and Black Mountain, groundwater is sodium sulfate-bicarbonate in character. Near El Mirage Lake and in the northern part of the basin, groundwater is sodium sulfate-chloride in character. Groundwater of suitable quality for most beneficial uses is found in the southern half of the basin; whereas, water of marginal to inferior quality is found in the northern half. In the southern part of the basin, total dissolved solids (TDS) content ranges from about 275 to 600 mg/L, with an average of about 425 mg/L. In the northern part of the basin, the quality of the groundwater is rated marginal to inferior for both domestic and irrigation purposes because of elevated concentrations of fluoride, sulfate, sodium, and TDS.

3.2.10 Biological Resources

This section includes a discussion of TMF's local vegetation, wetlands, and wildlife. A biological resources inventory was conducted for TMF in 2006 to assure to gain a general understanding of TMF's biological resources so that they can be conserved where possible through the provisions of the TMF Master Plan (AC Martin 2011). Prior to conducting the field portion of the biological analysis, a review of a biological assessment for TMF prepared by CMBC in 2003 was conducted. A biological reconnaissance site visit was conducted in order to confirm the resources identified in the CMBC report and to update existing biological conditions, as necessary. Focused plant and wildlife surveys were not conducted as part of the survey. A species list containing observed vegetation and wildlife is included in **Appendix D**.

Vegetation in the area can be described as Jeffery Pine series or Jeffery Pine forest. Jeffery pine (*Pinus jeffreyi*) is the dominant conifer species, and other trees present in the area include white fir (*Abies concolor*), black oak (*Quercus kellogii*), and canyon live oak (Q. *chrysolepis*). The forest floor is fairly open, with scattered shrubs including mountain whitethorn (*Ceanothus cordulatus*), gray horsebush (*Tetradymia canescens*), rubber rabbitbrush (*Chrysothmanus nauseosus*), greenleaf Manzanita (*Arctostaphylos patula*), and snowberry (*Symphorocarpus rotundifolius*) (USDA, 2005).

Perennial grasses present include California brome (*Bromus carinatus*), desert needlegrass (*Achnatherum speciosum*), Indian ricegrass (*Achnatherum hymenoides*), and squirretail (*Elymus elemoides*). Annuals plants onserved include wallflower (*Erysimum capitatum*), spiny stephanomeria (*Stephanomeria spinosa*), and tansy-mustard (*Descurania sp*.). Several non-native exotic plant species and disturbance adapted native species are present, indicating previous disturbance of the site. These include cheat grass (*Bromus tectorum*), common rip-gut grass (*B. diandrus*), and Russian thistle (*Salsola tragus*) (USDA, 2005).

EO 11990, "Protection of Wetlands," requires Federal agencies to avoid, where possible, adversely impacting wetlands. Proposed actions that have the potential to adversely impact wetlands must be addressed in a statement of findings. The CWA sets the basic structure for regulating discharges of pollutants into U.S. waters. Section 404 of the CWA establishes a Federal program to regulate the discharge of dredge and fill material into waters of the U.S., including wetlands. The National Wetlands Inventory (a department within the USFWS), USEPA, and the NRCS help in identifying wetlands. No wetlands are located in the vicinity of the proposed TMF project area.

Bird species observed in the area include white breasted nuthatch (*Sitta carolinensis*), dark-eyed junco (*Junco hyemalis*), and common raven (*Corvus corax*) (USDA, 2005).

3.2.11 Threatened, Endangered, and Other Sensitive Species

This section includes a discussion of TMF and local vegetation and wildlife species of special concern, including sensitive and protected plant and animal species and those listed as threatened or endangered by the USFWS or State of California. The ESA (1973) requires the analysis of impacts to all federally listed threatened or endangered species that could be affected by the proposed project. Section 7 of the ESA requires all Federal agencies to consult with the USFWS or designated representative to ensure that any action authorized, funded, or carried out by the agency does not jeopardize the continued existence of listed species or critical habitats.

Further protection under the Migratory Bird Treaty Act makes it unlawful to pursue, hunt, kill, capture, possess, buy, sell, purchase, or barter any migratory bird, including the feathers or other parts, nests, eggs, or migratory bird products. In addition, this act serves to protect environmental conditions for migratory birds from pollution or other ecosystem degradations.

3.2.11.1 Inventory and Survey Methods

A biological resources inventory was conducted for TMF in 2006 to assure the identification of any protected species on the TMF site, (AC Martin 2011). No Federal or state-listed plant or wildlife species are known to occur on site.

Prior to conducting the field portion of the biological analysis, a review of a biological assessment for TMF prepared by CMBC in 2003 was conducted. A search of the California Department of Fish & Game's (CDFGs) CNDDB and the CNPS Electronic Inventory was also conducted to determine the current special-status plant and wildlife species that had been reviewed by CMBC for the 2003 literature search (Mescal Creek, Valyermo, Crystal Lake, Mount San Antonio, and Telegraph Peak 7.5' USGS topographic quadrangles). One additional quadrangle (Phelan) was added to the literature review due to its close proximity to the project area. The USFS list of sensitive plants and wildlife for the ANF was also reviewed for updated information (USDA, 2005).

A brief biological reconnaissance site visit was conducted in order to confirm the resources identified in the CMBC report and to update existing biological conditions, as necessary. Focused plant and wildlife surveys were not conducted as part of the survey.

3.2.11.2 Vegetation

Four special-status plant species, Big Bear Valley woollypod (*Astragalus leucolobus*), crested milk vetch (*Astragalus bicristatus*), Parish's onion (*Allium parishii*), and pine-green gentian (*Swertia neglecta*), were detected on site during the 2003 CMBC surveys. Twenty additional special-status plant species have potential to occur. Five of these species were not addressed by the CMBC report and four of these previously disregarded by CMBC as having no potential to occur, were found to have potential to occur by ECORP.

Although these species were not specifically surveyed for during CMBC's focused surveys conducted in 2003, these surveys were conducted at an appropriate time of year for detection of six of the nine additional plant species and these species were not recorded on site. Johnston's buckwheat (*Eriogonum microthecum* var. *johnstonii*), lemon lily (*Lilium parryi*), and woolly mountain parsley (*Oreonana vestita*) bloom later in the year and surveys were not conducted at an appropriate time of year to determine presence/absence of these species.

As described by the Biological Evaluation (BE)/Biological Assessment (BA) and as shown by CMBC's Figure 2, Big Bear woollypod (CNPS List 1B) was identified on a southeast-facing slope within the core, developed area of the facility, between Buildings TM-25 and TM-12. Additional subpopulations are scattered throughout the site at more than ten locations, and most contain 100+ individuals, including northeast of Building TM-19, west of Building TM-27, and north of and surrounding Building TM-15.

Locations of crested milkvetch, Parish's onion, and pine green gentian were not mapped in the BE/BA but were described in the text. Crested milkvetch (USFS and CNPS List 4) was found scattered throughout the site. Parish's onion (CNPS List 4) was found on talus slopes below the main site and above Site TM-15. Pine green gentian (USFS and CNPS List 4) was found on north-facing slopes north of TM-15.

3.2.11.3 Wildlife

Two listed wildlife species, California condor (*Gymnogyps californianus*) and peregrine falcon (*Falco peregrines*), have a low potential to utilize the site for foraging, but are unlikely to nest on site due to lack of suitable nesting habitat. A golden eagle (*Aquila chrysaetos*), a state protected species, was detected foraging over the site during the CMBC 2003 surveys, but is also unlikely to nest on site due to lack of suitable habitat. Nelson's bighorn sheep (*Ovis canadensis nelson*), a state fully protected species, is unlikely to occur in the project vicinity except for the occasional transient or dispersing individual.

Thirteen additional special-status wildlife species have potential to occur on site. Most of the special-status amphibian and reptile species that have potential to occur, including yellow-blotched salamander (*Ensatina* *eschscholtzii croceator*), San Diego horned lizard (*Phrynosoma coronatum blainvillii*), coast horned lizard (*Phrynosoma coronatum frontale*), San Diego mountain kingsnake (*Lampropeltis zonata pulchra*), and San Bernardino mountain kingsnake (*Lampropeltis zonata parvirubra*), are unlikely to be detected during focused surveys.

Special-status bird and bat species, including northern goshawk (*Accipiter gentilis*), California spotted owl (*Strix occidentalis occidentalis*), olive-sided flycatcher (*Contopus cooperi*), spotted bat (*Euderma maculatum*), Townsend's big-eared bat (*Corynorhinus townsendii*), greater western mastiff bat (*Eumops perotis californicus*), pallid bat (*Antrozous pallidus*), and western red bat (*Lasiurus blossevillii*), and migratory birds that have potential to nest within the pine woodland or existing buildings, would require focused surveys during the appropriate time of year and time of day/night to determine breeding status. Some migratory birds may be potential transients of the general area, but the immediate project area contains little to no suitable habitat for migratory birds. There are no known nesting sites in this area, and these lands are not vital for foraging or roosting.

3.2.12 Cultural Resources

This section includes a discussion of NASA JPL and local archaeological resources, historic development, and cultural facilities. A definition of historic properties and NHPA requirements and implementing regulations are discussed in detail in Section 3.1.12.

In 2005/2006, consultants conducted a cultural resources investigation of TMF consisting of record searches, an archaeological survey, and a building inventory. To identify cultural resources within the project area that could be affected by development, record searches were conducted at the South Central Coastal Information Center, located at California State University, Fullerton, and at the ANF Supervisor's Office in Arcadia, California. After reviewing the record search results, an intensive archaeological field survey of the project area was conducted, followed by an inventory of all of the buildings and structures at the TMF. The findings are discussed below

3.2.12.1 Archeological Resources

No known or recorded archaeological resources were identified within the boundaries of TMF as a result of the record search or the field survey. Although the TMF site turned up no evidence of archaeological resources, the cultural site record searches identified the presence of three recorded prehistoric resources within 1.6 km (1 mi) of TMF. These resources consisted of a rhyolite flake, a chert flake and a prehistoric habitation site.

Pre-history

It is generally believed that human occupation of southern California dates back to at least 10,000 years before present (BP). Four cultural periods of prehistoric occupation of California during the Holocene Epoch (10,000 years BP to present) are discussed below: the Early Holocene Period, the Early Horizon Period, the Middle Horizon Period, and the Late Horizon Period.

During the Early Holocene Period (10,000 to 8,000 years BP), hunters/ gatherers utilized lacustrine and marshland settings for the varied and abundant resources found there. Milling-related artifacts are lacking from archaeological sites dating to this period, but the atlatl and dart are common. Hunting of large and small game occurred, as well as fishing. A few, scattered permanent settlements were established near large water sources, but a nomadic lifestyle was more common.

Milling-related artifacts first appear in archaeological sites dating to the Early Horizon Period (8,000 to 4,000 years BP). Hunting and gathering continued during this period, but with greater reliance on vegetal foods.

Mussels and oysters were a staple among coastal groups. This gave way to greater consumption of shellfish in the Middle Horizon Period (4,000 to 2,000 years BP). Use of bone artifacts appears to have increased during this period, and baked-earth steaming ovens were developed. Occupation of permanent or semi-permanent villages occurred in this period, as did reoccupation of seasonal sites.

During the Late Horizon Period (2,000 years BP to the time of European Contact [A.D. 1769]), population densities were high and settlement in permanent villages increased. Regional subcultures developed, each with its own geographical territory and language or dialect. These groups, bound by shared cultural traits, maintained a high degree of interaction, including trading extensively with one another (JPL 2008).

Ethno-History

The project area lies at the northern edge of the San Gabriel Mountains near the territorial junction of two well-known groups of southern California Native Americans: the Serrano, and the Tongva (or Gabrielino). While the Serrano were most likely the principal Native American occupants of the area, both groups are likely to have utilized resources in the vicinity prior to contact with Europeans around A.D. 1769. A third, less-understood Native American group, the Vanyume, may also have used the area.

European Period and Recent History

Documentation of the modern period of history related to the Wrightwood area may be conceptualized as a broad historical descriptions about regional events for earlier periods with a more refined picture emerging as the European influence in the area progressively deepened. The European period is often divided into Spanish, Mexican and American periods.

The Spanish Period (1769 to 1821) was largely associated with early Spanish explorations and the establishment of the Franciscan missions in California including the Mission of San Gabriel Arcangel (1771 and 1776) located southwest of Wrightwood in the San Gabriel Valley. Another landmark event occurring during the Spanish Period was the founding of the Pueblo of Los Angeles in 1781.

The Mexican Period (1821 to 1848) began with the Mexican Revolution in 1821, which brought changes to the mission system and the further development of the ranchos in southern California. The American Period emerged as California joined the U.S. in 1850. The first known European-American settlers near Wrightwood were two Mormon brothers, Nathan and Truman Swarthout. In 1851, the brothers set out from the Mormon settlement of San Bernardino and homesteaded in the valley just to the south of Table Mountain Ridge, thereby bringing their name to the area that has become known as Swarthout Valley.

Seventy years later, west of Wrightwood, and adjacent to the area that would be occupied by the TMF, 760-ac of land was purchased from private owners by the Los Angeles County Board of Supervisors to create the recreation area known as Big Pines. Chairman of the Board of Supervisors R.F. McClellan envisioned Big Pines as a mountain recreation center for families, and construction of facilities there began in 1923. Many of the original buildings and structures, including the large rustic stone tower at the junction of Angeles Crest Highway and Table Mountain Road, can still be seen. The popularity of Big Pines County Park was so great that the USFS gave Los Angeles County a SUP to expand the recreation area by 3,560 ac in 1925. Today, the Big Pines-Wrightwood area represents the largest recreational area in the San Gabriel Mountains. The history of TMO is described in Section 1.2 of this EA.

3.2.12.2 Historic Resources

TMF prepared a *Historic Resources Study NASA JPL Table Mountain Facility, Wrightwood, CA* in 2009 (Page & Turnbull, 2009a). The study was completed to assist JPL in meeting its obligations under Sections 106 and 110 of the NHPA. The study resulted in an assessment of historic structures and a selective reconnaissance level survey of structures on the TMF property. All 15 TMF resources were inventoried in the study, although no resources are over fifty years of age (as of 2009). Fifty years is generally recognized by the National Park Service as the minimum age necessary for a property to become historically significant. Three buildings were evaluated for their eligibility to the NRHP. These buildings, with their date of construction, include:

- Building TM-1, Observatory, 1962
- Building TM-2, Solar Testing Facility, 1962
- Building TM-12, Observing Facility, 1966

In the study, TM-1 and TM-2 were considered age-eligible (forty-five years or older in 2009), and TM-12 was evaluated because it appears to be potentially historically significant. After evaluation, the study concluded that one building, TM-2, is eligible for listing on the NRHP should NASA decide to nominate the buildings. TM-2 was determined to be eligible under NRHP Criterion A (Event): Properties associated with events that have made a significant contribution to the broad patterns of our history.

NASA JPL has initiated consultation through the Section 106 process with the California SHPO. As a result of this consultation, a programmatic agreement is being developed that identifies any mitigation measures to be implemented as well as preservation design guidelines for the defined character areas in TMF.

A record search identified a number of historic resources within 1.6 km (1 mi) of TMF. Several of these resources were associated with the Big Pines County Park which was an important recreation area serving in many ways as the forerunner of the present day multi-recreational attractions in the Wrightwood area.

3.2.13 Hazardous Materials and Waste

This section discusses hazardous materials, hazardous wastes, pollution prevention and waste minimization, non-hazardous wastes, and toxic substances. Management of hazardous materials and wastes at TMF focuses on evaluation of the storage, handling and transportation capabilities for the site. Evaluation extends to the generation and disposal of hazardous wastes, and includes fuels, solvents; acids and bases; and POL. In addition to being a threat to humans, the improper release of hazardous materials and wastes can threaten the health and well-being of wildlife species, botanical habitats, soil systems, and water resources. In the event of a release of hazardous materials or wastes, the extent of contamination varies based on the type of soil, topography, and water resources.

In general, hazardous materials, hazardous substances, and hazardous wastes include elements, compounds, mixtures, solutions, and substances that, when released into the environment or otherwise improperly managed, could present substantial danger to the public health, welfare, or the environment.

Regulatory Framework

The principal Federal regulatory agency responsible for setting laws and guidelines for hazardous materials and wastes is the USEPA. The key Federal laws and regulations pertaining to hazardous materials associated with implementation of the Master Plan at TMF are the CERCLA; SARA; TSCA; and RCRA. These laws and regulations are described in Section 3.1.13.1.

3.2.13.1 Hazardous Materials

The USEPA definition of hazardous material includes any item or chemical that may cause harm to people, plants, or animals when released by spills, leaks, pumping, pouring, emitting, discharging, injecting, escaping, leaching, dumping, or disposing into the environment. Hazardous materials include any substance or chemical that is a "health hazard" or "physical hazard", including: chemicals which are carcinogens; toxic agents; irritants; corrosives; sensitizers; agents that act on the hematopoletic (blood-related) system; agents that damage the lungs, skin, eyes, or mucous membranes; chemicals that are combustible, explosive, or flammable; oxidizers or pyrophorics; unstable-reactive or water-reactive substances; and chemicals that during normal handling, use or storage may produce or release dusts, gases, fumes, vapors, mists or smoke that may have any of the previously mentioned characteristics.

OSHA is responsible for enforcement and implementation of Federal laws and regulations pertaining to worker health and safety under 29 CFR Part 1910, and includes the regulation of hazardous materials in the workplace and ensures appropriate training in their handling.

3.2.13.2 Hazardous Wastes

Hazardous waste is defined as any solid, liquid, contained gaseous, or semi-solid waste; or any combination of wastes that pose a substantial present or potential hazard to human health or the environment. TMF uses various chemicals in R&D activities and for laboratory maintenance. As a result, TMF generates a variety of chemical wastes in small quantities. Typical wastes include mixed solvents, contaminated laboratory glassware, reaction products, and out-of-date or excess chemical reagents. Large amounts of non-hazardous waste are also generated.

Certain types of hazardous wastes are subject to special management provisions intended to ease the management burden and facilitate the recycling of such materials. These are called 'Universal Wastes', and their associated regulatory requirements are specified in 40 CFR 273. Types of waste currently covered under the universal waste regulations include hazardous waste batteries, hazardous waste thermostats, and hazardous waste lamps.

TMF Hazardous Waste Generation and Handling

TMF produces less than 1,000 kg (2,204 pounds) of hazardous wastes per calendar month, and is therefore classified as a SQG. The TMF operations, R&D activities generate various types of chemical wastes, which are generated in small quantities and are commonly chemicals that have either exceeded their shelf life, are excess after completion of a project, or are spent after being used in a given project. The waste streams that are generated at TMF are typically associated with routine maintenance for vehicle or facility, or routine facility operations. These waste streams include oil, oily wipes, alcohol wipes, and aerosol cans.

TMF also generates universal waste in the form of used automotive batteries and spent fluorescent lamps, and collects spent and hot-drained oil filters. Because their accumulation is minimal, TMF does not have a central accumulation area. These areas follow Federal SQG 180-day accumulation restrictions and the hazardous wastes are picked up from each satellite accumulation area at the time of transport.

An inventory of hazardous chemicals or flammable and combustible materials storage at any given time may include over 150 different substances. In most cases, the quantity of any one waste stream is less than 7.6 l (2 gal) of liquid or 0.9 kg (2 pounds) of solid material. **Table 3-27** lists the 2010 total of flammable and combustible materials storage for TMF.

Materials are removed from accumulation points by a licensed hazardous waste hauler and transported to permitted treatment storage and disposal facilities. The actual type and quantity can vary daily, and from week to week. Hazardous wastes are containerized and labeled with a hazardous waste disposal form that meets California hazardous waste labeling requirements. Decisions about whether a particular material is hazardous or non-hazardous are made by TMF in accordance with applicable state and Federal hazardous waste regulations.

3.2.13.3 Pollution Prevention and Waste Minimization

TMF provides a systematic approach to pollution prevention through a Pollution Prevention Plan. The objectives of the plan are to develop a program for preventing, reducing, reusing, and recycling waste and emissions. The plan builds on existing programs and activities that currently meet compliance requirements and identify additional activities while trying to reduce costs associated with pollution prevention programs. The plan also encourages pollution prevention concepts to be implemented in the day-to-day business processes to aid employees in understanding pollution prevention and environmentally related activities. TMF identifies all routinely generated waste streams that result from ongoing processes and has achieved a 95 percent reduction in hazardous waste generation since CY 1992.

Waste minimization measures that have been implemented include:

- Waste stream characterization;
- Source reduction;
- Materials Management through computerized tracking systems;
- Centralized purchase of chemicals;
- Use of *iProcurement* purchasing, enabling rapid procurement of materials in only needed quantities, reducing waste generation of excess chemicals and the need to stockpile extra chemicals; and,
- Hazardous Waste Generator Training classes that include instruction on hazardous waste source reduction principals.

3.2.13.4 Non-Hazardous Wastes

Non-hazardous solid waste (e.g., garbage) is collected in containers and disposed of weekly by the USFS. A large construction materials container is provided and removed as needed. Paper and cardboard are periodically recovered and recycled and sent to a local recycler in Wrightwood.

3.2.13.5 Toxic Substances

Other toxic or hazardous substances that are or were present at TMF include PCBs, asbestos, and pesticides. Information regarding status, chemical safety, and reporting requirements is discussed below.

Table 3-27. TMF Flammable/Combustible Materials Storage, 2010

Hazardous Material	Container Size	# of Containers
Methanol	1 Gal	3
Alcohol, GR	1 Gal	1
Butyl Alcohol	1L	1
2-propanol	4L	1
n-propyl alcohol	1L	1
Rubbing Alcohol	16 oz	1
Rust Reformer	8 oz	1
Engine Enamel	12 oz	1
Gear Oil	32 oz	1
Oil	4 oz	4
Oil	3 oz	1
Spray Adhesive	11 oz	3
Dust Off	10 oz	2
Acetone	500ml	1
Acetone	4L	1
Hydraulic Fluid	32 oz	1
Gear Oil	1 Gal	1
Lubricant	4 oz	1
Grease	14 oz	2
Bearing Grease	16 oz	1
RTV Silicone	8 oz	1
Contact Cleaner	16 oz	1
Lift Off	10 oz	1
Cutting Fluid	4 oz	3
Spray Adhesive 77	16 oz	2
Acrylic Spray coating	11 oz	1
Penetrating oil	4 oz	2
Penetrating oil	18 oz	1
Pipe Dope	8 oz	1
Spray Enamel	12 oz	1
Rust Stop Enamel	15 oz	2
5 Minute Epoxy	1 oz	1
Contact Cleaner	16 oz	1

Table 3-27. TMF Flammable/Combustible Materials Storage, 2010

Hazardous Material	Container Size	# of Containers
Silicone Lubricant	11 oz	1
Vacuum Oil	12 oz	1
Diffusion Oil	500ml	1
Vacuum Oil	500ml	1
Sealant	10 oz	14
Calcium Carbonate	500 g	1
Sodium Hydroxide	2.5 kg	1
Foam Cleaner	15 oz	1
ATF	1qt	1
Antifreeze	1Gal	1
Gas Duster	10oz	10
Cutting oil	4oz	1
Silicon Lubricant	10oz	2
Ant & Roach	15oz	1
Santovac 5 oil	500ml	1
TKO oil	1L	1
TKO oil	1 gal	6
GP oil	1L	2

Source: TMF Facility Inventory – May 14, 2010
Notes: Gal=gallons; oz=ounces; qt=guarts; kg=kilogram; ml=milliliter; L=liter; g=gram

PCBs

Through the 1980s up to 1993, TMF initiated and proceeded with a facility-wide program to identify and remove all PCB transformers and capacitors. A PCB transformer or capacitor is defined as an item containing more than 500 ppm PCBs. A PCB-contaminated item contains 50 to 500 ppm PCBs. Items may contain up to 500 ppm PCB per Federal definition and be classified as a non-PCB item. As part of the program, PCB transformers were either removed from the facility and disposed of or reclassified as non-PCB transformers. In both cases, the PCB oil removed from the transformers and sent off site for disposal was incinerated. Regarding PCB capacitors, all were taken out of service and removed from the facility. Currently, there are no PCB transformers or capacitors remaining on site.

Asbestos

Asbestos is the only substance currently in use on the TMF facility that is regulated by the Federal government under TSCA. Asbestos removal or abatement is dictated by the renovation or remodeling needs of TMF. Asbestos is found in spray applied fireproofing and piping insulation. Non-friable asbestos may be contained in flooring tile and adhesive. Asbestos is removed by a licensed contractor in accordance with the asbestos standard of OSHA, 29 CFR, 1926-58. ACM are handled and disposed of offsite consistent with TSCA.

Pesticides

Use of insecticides, fungicides, herbicides, and rodenticides is regulated by the California Department of Food and Agriculture and the FIFRA. A range of pesticides is used at TMF for rodent control and grounds maintenance. Pesticides are usually applied by licensed contractors and only occasionally by the grounds maintenance workers (ant bait stations), which are both overseen by certified advisors and applicators. TMF reduces potential environmental impacts of pesticides in use by controlled applications, inventory inspection, and monitoring. All insecticides, fungicides, herbicides, and rodenticides are handled, applied, and disposed of consistent with the California Department of Food and Agriculture requirements and FIFRA.

Chemical Safety and Reporting Requirements

TMF complies with EPCRA and the more strict State of California community right-to-know requirements. TMF is in compliance with Title 19 of the CCR and California Business Plan requirements.

3.3 Goldstone Deep Space Communications Complex

3.3.1 Land Use

The following sections describe regional and site land use in and around the GDSCC site. Future expansion at GDSCC is limited by local topography and surrounding regional land use.

3.3.1.1 Regional Land Use

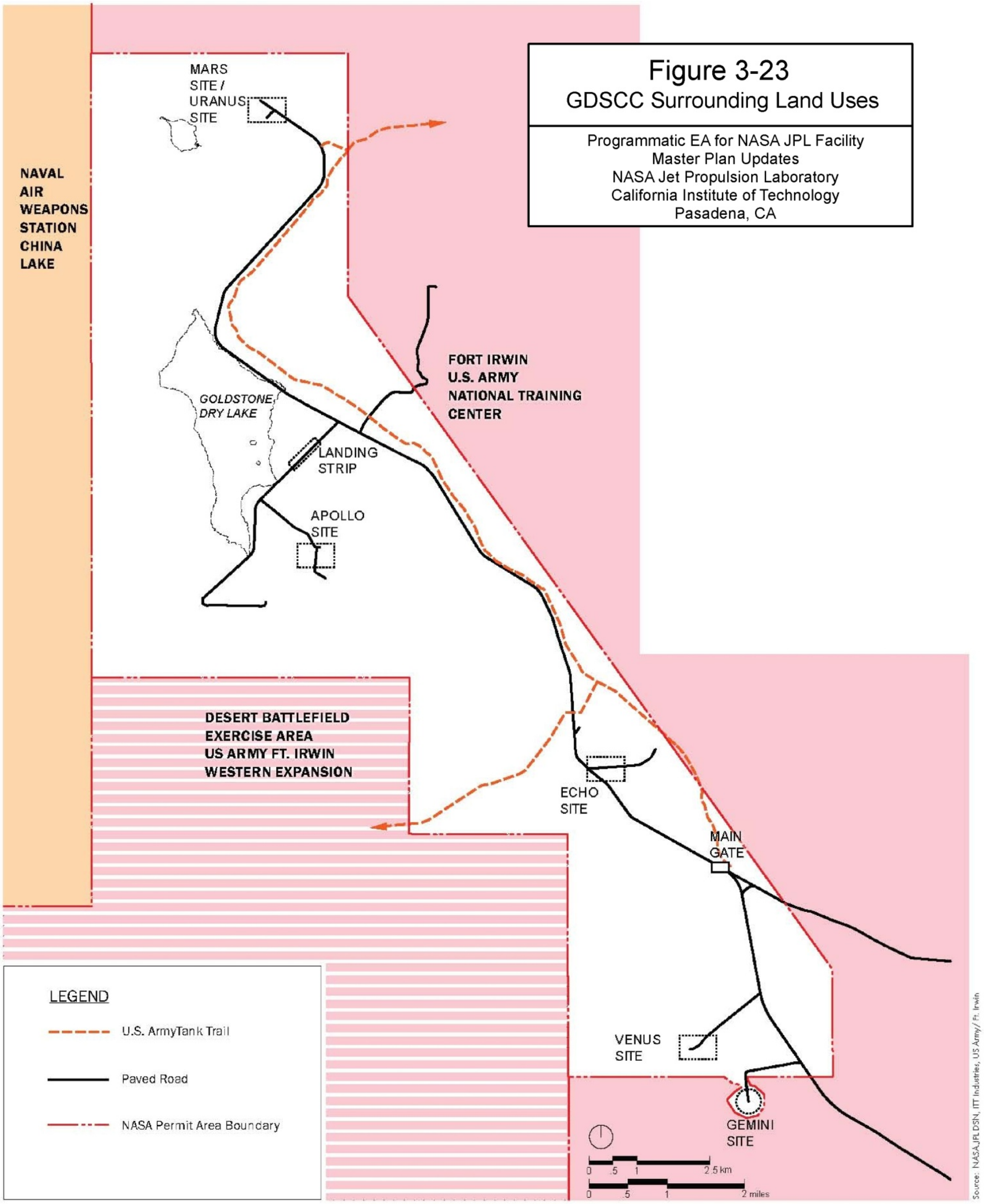
GDSCC is surrounded by restricted-access military land uses on all sides, as shown in **Figure 3-23**. Fort Irwin covers adjacent land use to the north, east and south, and the China Lake NAWC is located to the west. GDSCC represents an extremely low-intensity development for its 114 sq km (44 sq mi) size. With its high sensitivity to physical and electromagnetic interference, major changes to land use in the surrounding vicinity at GDSCC could jeopardize radio transmissions and receptions by the various antennas. The military has designated GDSCC as off-limits for maneuvers, although a road completed in 2010 allows for transport of military personnel and equipment across Goldstone into the Fort Irwin Expansion area located to the southwest of GDSCC. The land uses of the areas surrounding GDSCC are depicted in **Figure 1-6** and described below.

Fort Irwin

The NTC and Fort Irwin are considered to be the US Army's premier combat training center. With over 2,590 sq km (1,000 sq mi) for maneuver and ranges, an uncluttered electromagnetic spectrum, airspace restricted to military use, and its isolation from densely populated areas, Fort Irwin was chosen as an ideal site for the Army's national training activities. The NTC was officially activated in 1980 and Fort Irwin returned to active status the following year. The daily population of Fort Irwin is estimated at approximately 22,000 persons (2008), many of who live on-site within the Fort Irwin cantonment area which is located about 11.2 km (7 mi) southeast of the GDSCC Echo Site.

During the course of a year, approximately 4,000 to 6,000 soldiers visit Fort Irwin during training rotations before assignment to other Army facilities or before deployment overseas. There are about 10 rotations a year. About half of Fort Irwin's land area is used for desert battlefield training. In 1963, NASA was granted a permit to use and occupy land the within Fort Irwin and continues to operate under its original permit. In January 2011, NASA and the Army signed an updated MOU that governs interagency cooperation between Fort Irwin, the NTC, and NASA with regards to GDSCC.

Figure 3-23. GDSCC Surrounding Land Uses



Source: Deep Space Network Facilities Master Plan Update 2011-2032, 2011

China Lake NAWC

China Lake NAWC Mojave "B"-Randsburg Wash Test Range Complex lies directly west of, and adjacent to the GDSCC. The land is largely undeveloped and is expected to remain at its current level of usage. The mission of the NAWC is to establish and maintain the primary in-house research and development capability for Navy and Marine Corps systems, subsystems, and technologies (Department of the Army, 1979). The Complex has been used for joint training military exercises with Fort Irwin. With the GDSCC lying between and separating these two military installations, military equipment is commonly transported across the GDSCC using both Goldstone Road and unpaved roads.

San Bernardino County

GDSCC lies within San Bernardino County, the largest county in the nation. Land immediately south of Fort Irwin and GDSCC consists of public lands administered by the U.S. Bureau of Land Management (BLM), interspersed with non-continuous private ownership. This discontinuity of ownership represents a barrier to effective land use planning. San Bernardino County approved a joint resolution calling for consolidation of discontinuously held parcels in the area. While the joint resolution contains no enforcement provisions, it has established a policy that may assist in the establishment of a continuous buffer zone around installations such as Fort Irwin and GDSCC.

The county of San Bernardino General Plan has designated all properties at least 16 km (10 mi) south of Fort Irwin as Rural Conservation (RCN) areas. The RCN designation permits a variety of low-intensity land uses such as agricultural croplands, mining areas, national forest, wilderness and residential units. The area is zoned DL-40, which has two dwelling units per 16 ha (40 ac), and would require County of San Bernardino Planning Commission approval for proposals with three or more dwelling units per 16 ha (40 ac).

City of Barstow

The City of Barstow, incorporated in 1947, encompasses 103.6 sq km (40 sq mi). With no housing facilities at GDSCC, most GDSCC employees reside in Barstow. Since 2004, the population of Barstow has remained relatively stable at 23,208. Fort Irwin is a major contributor to Barstow's economy. The GDSCC, with less employees, contributes to a lesser extent. Barstow benefits from both of these facilities through consumer spending and direct employment opportunities. Barstow's economic viability has been historically dependent on railroad and trucking industries, tourism, and the military. Military influences include Fort Irwin, the Marine Corps Logistics Base, NAWC, and Edwards Air Force Base. Future economic opportunities for Barstow may lie within the tourism industry as travel increases between the Los Angeles region and Las Vegas.

3.3.1.2 Facility Land Use and Zoning

NASA JPL facilities at GDSCC include 9 parabolic dish antennas, an airstrip, miscellaneous support buildings, and a remote support facility in Barstow, CA, located 64.4 km (40 mi) south of GDSCC. The core facilities of GDSCC are concentrated into five separate facility clusters referred to as sites: Echo Site, Mars/Uranus Site, Apollo Site, Venus Site, and Gemini Site. Originally built as isolated ‘quiet’ sites to minimize the potential for mutual radio interference, these sites are spread out across the 114 sq km (44 sq mi) desert area used by NASA under an arrangement with the US Army. Each site has a specific role within GDSCC supporting the operation of the DSN, research, development and testing of new earth station communications technologies, radio astronomy, and public outreach. The locations of these sites are depicted in **Figure 1-8** and a summary of their functions are contained in **Table 3-28**. Detailed descriptions of each GDSCC site follow in the sections below.

Table 3-28. Summary of Major GDSCC Facilities

	Buildings		Antennas		
Sites	No. Buildings	Total Area sq m (sq ft)	Station No.	Construction Date	Height (ft)
Echo Site	25	7,359 (79,208)	DSS-12 (GAVRT) [a]	1961	34 (111.5)
Venus Site	15	1,170 (12,589)	DSS-13 (new)[b] DSS-13 (old)[c]	1991 1962	34 (111.5) 26 (85)
Mars Site	14	3,879 (41,754)	DSS-14 DSS-15 (HEF)	1966/1998 1984	70 (230) 34 (111.5)
Apollo Site	14	4,086 (43,978)	DSS-16 (deactivated)[d] DSS-24 (BWG) DSS-25 (BWG) DSS-26 (BWG)	1965[f] 1994 1996 1996	26 (85) 34 (111.5) 34 (111.5) 34 (111.5)
Gemini Site [e]			DSS-27 (HSB) DSS-28 (GAVRT)	1994 1994	34 (111.5) 34 (111.5)
Miscellaneous	3	133 (1,430)			

Legend: DSS=Deep Space Station; sq ft = square feet; sq m=square meters; GAVRT= Goldstone Apple Valley Radio Telescope; HEF=High Efficiency Antenna; BWG=Beam Wave-Guide Antenna; HSB=High-Speed Beam Wave-Guide Antenna.

Notes:

a This 26-m (85-ft) antenna, built in 1961and extended to 34 m (111.5 ft) in 1978, is now being used with the GAVRT program.

b This antenna is used for research and development for the Deep Space Network (DSN) Project.

c Antenna constructed at Echo Site in 1959 and moved to Venus site in 1962. No longer being used and being offered to any party willing to remove it from GDSCC.

d This antenna originally was constructed for the NASA Goddard Space Tracking and Data Network. Operation began in October 1984 and the antenna is now deactivated.

e These two antennas were transferred to NASA JPL from the U.S. Army. Currently, DSS 27 is operational for the DSN and is remotely controlled from SPC-10 at the Mars Site. DSS 28 is being prepared for use with the GAVRT Program.

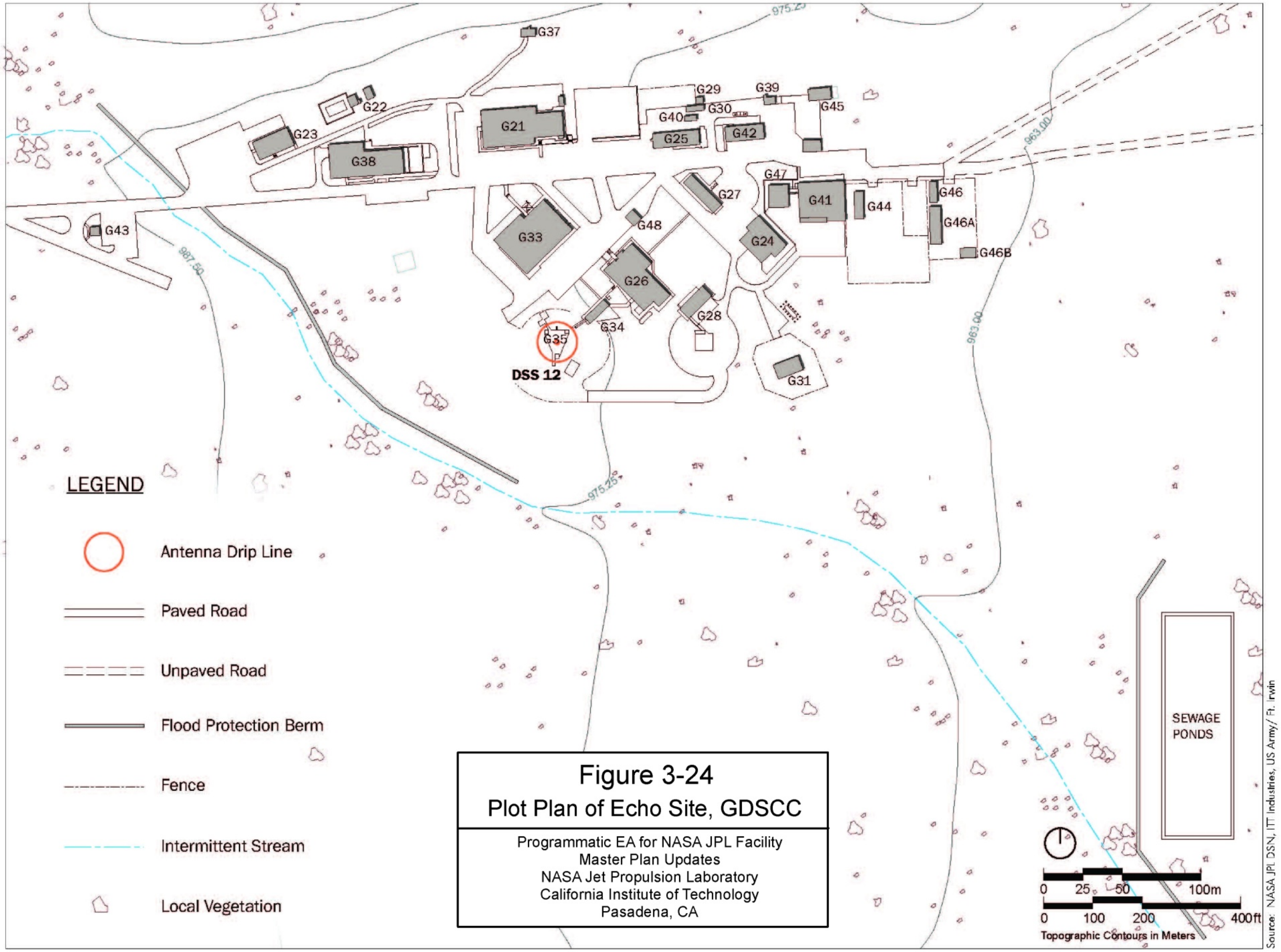
Source: *Directory of Goldstone DSCC Buildings and Supporting Facilities (Gold) Book,* JPL Document 880-165, internal document, Jet Propulsion Laboratory, Pasadena, California, October 1989 (revised edition). Updated April 2011.

Echo Site (DSS 12)

Echo Site is the administrative, community and public outreach center for GDSCC. It has one 34–m (111.5-ft) antenna and 24 support buildings, with a combined area of 7,359 sq m (79,208 sq ft). Facilities include a central cafeteria, a Goldstone/ DSN Museum, a modest dormitory facility, the antenna and classroom facilities that help support the GAVRT program and an Emergency Control Center. Additionally, there are a series of maintenance, shop, yard and storage facilities that support a variety of maintenance and operations functions for Goldstone. A large number of Goldstone employees may visit Echo Site on any given day (**Figures 3-24 and 3-25**).

The GAVRT project is a partnership involving NASA, JPL, and the Lewis Center for Educational Research (LCER) in Apple Valley, California and more recently, with teachers and students who have joined the GAVRT team from around the U.S. Teachers and students partner with professional science teams as they conduct GAVRT science research projects. As the primary radio telescope instrument, JPL makes available to GAVRT its 34 m (111.5 ft) antenna (DSS-12) located at the GDSCC Echo Site. DSS-28 at the Gemini Site has recently been made available for GAVRT uses.

Figure 3-24. Plot Plan of Echo Site, GDSCC



Source: Deep Space Network Facilities Master Plan Update 2011-2032, 2011

Figure 3-25. Photo of Echo Site, GDSCC

Source: Deep Space Network Facilities Master Plan Update 2011-2032, 2011

GAVRT teaches students to conduct radio astronomy, to control a huge antenna, and to collect science data from objects in the universe at which the antenna is pointed. The program trains teachers, provides curriculum, and supports classroom implementation. It uses the internet to connect students to the DSS-12 antenna via an operations center maintained by LCER. Students are actively involved in handling data for real science applications and learn that science is an ongoing process.

Venus Site (DSS 13)

The Venus Site continues to function as an R&D and testing facility for DSN communications technologies. The site was named after its now decommissioned Azimuth-Elevation 26-m (85-ft) antenna radar detected the planet Venus in the early 1960s. The antenna also detected Mars and Mercury during the same time period. In the early 1990s, the BWG antenna technology was developed and tested at the Venus Site facilities when a prototype 34-m (111.5-ft) BWG antenna (the new DSS-13) demonstrated its ability to operate effectively at S-band, X-band, and Ka-band frequencies (**Figure 3-26**).

This antenna has continued to be used for R&D activities as well as serving as a radio telescope for scientific observations. There are 15 buildings at Venus Site, with a combined area of 1,170 sq m (12,589 sq ft) (**Figure 3-27**). To function as an R&D complex, the Venus Site includes a complement of support office, laboratory, engineering and operations control facilities. The support buildings provide space for operations control, laboratories, offices, security, workshops, warehouses, and mechanical equipment.

Mars Site (DSS 14) and Uranus Site (and DSS 15)

Due to their close proximity, the Mars and Uranus Sites are referred to as the Mars/Uranus Site (**Figure 3-28**). The two Sites work in tandem and are jointly considered the Mars Deep Space Station. The Mars Site was constructed in 1966 to support NASA's Mariner 4 Probe to Mars and is centered on the massive 70-m (230-ft) azimuth-elevation deep space antenna, DSS-14 (**Figure 3-29**).

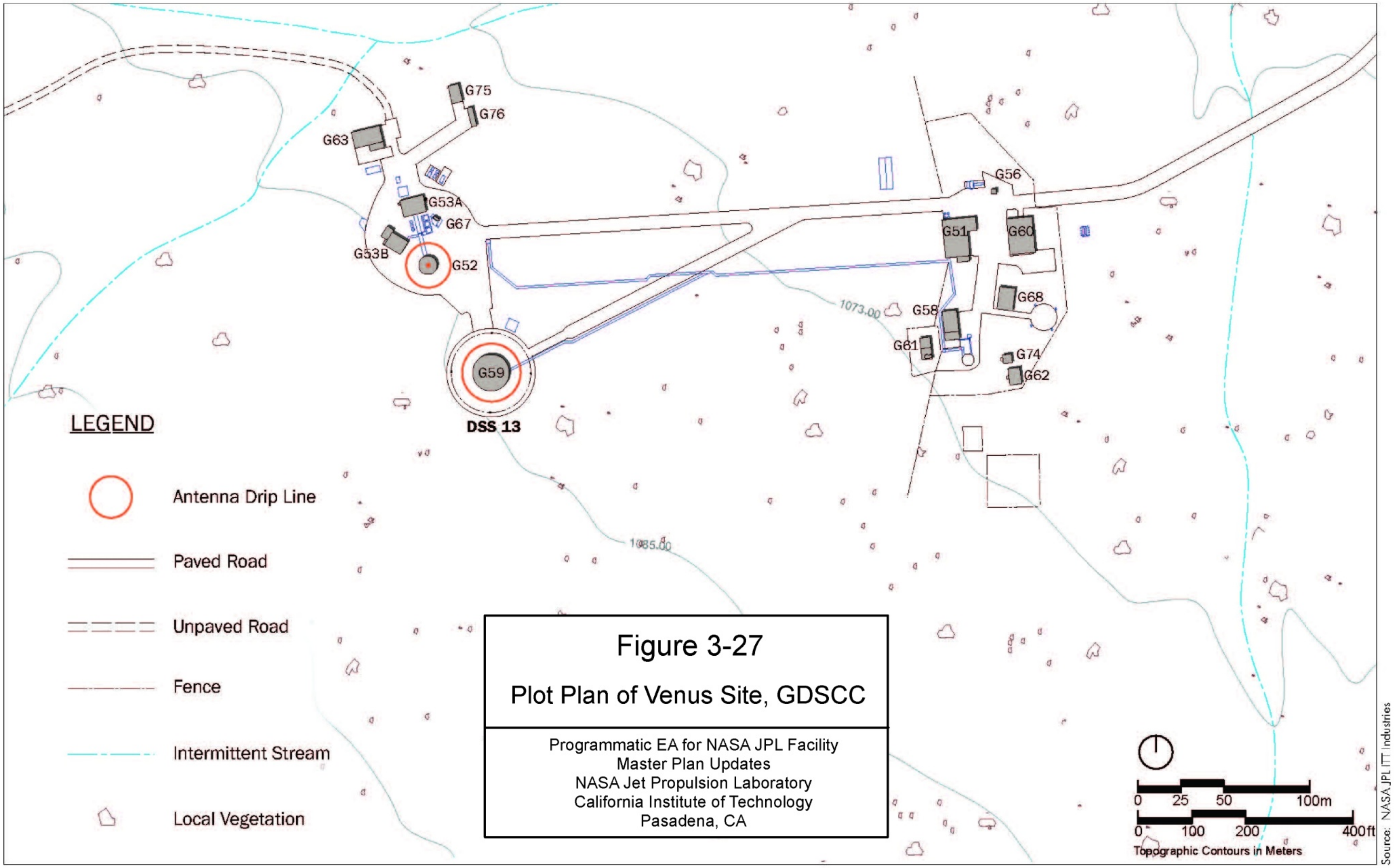
This antenna has recently undergone major rehabilitation and is expected to remain an important part of NASA's DSN into the future. Located 500 m (1,640 ft) southeast of the Mars antenna, the Uranus Site's 34-m (111.5-ft) High Efficiency (HEF) antenna, DSS-15, was built in 1984 to augment the Mars antenna with both antennas supporting the Voyager 2 mission that gathered imagery of Uranus. This mutual operational role of the antennas remains to this day. Based on the 2010 Historic Survey of the GDSCC site, and because of its age and important role for NASA and the U.S. space program (the GSSR program in particular), Mars antenna appears to be eligible for historic listing under the NRHP under Criteria A (Event) and C (Design/Construction).

Another integral component of the Mars/ Uranus Site is the SPC-10 that houses the electronic control system for most of the operational GDSCC antennas including DSS 14 (Mars), DSS 15 (Uranus), DSS-24, DSS-25, and DSS-26 (Apollo) and DSS-27 (Gemini). The Site is supported by 14 buildings, with a combined area of 3,879 sq m (41,754 sq ft), for control, maintenance, storage, and emergency power back-up. Because the Site has many personnel assigned to it, there are also facilities for water purification and wastewater treatment.

Figure 3-26. DSS-13 Venus Site, GSDCC

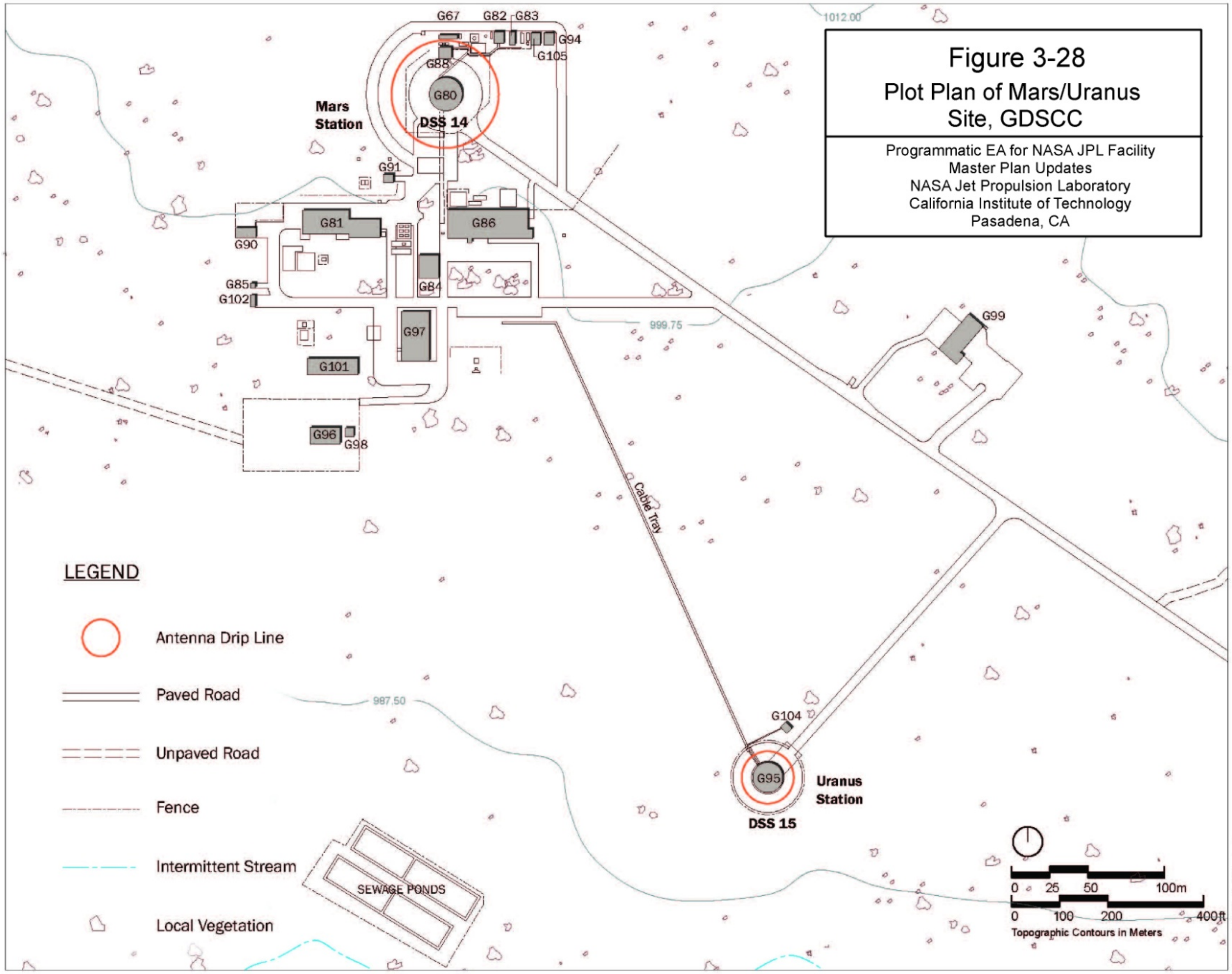
Source: Deep Space Network Facilities Master Plan Update 2011-2032, 2011

Figure 3-27. Plot Plan of Venus Site, GDSCC



Source: Deep Space Network Facilities Master Plan Update 2011-2032, 2011

Figure 3-28. Plot Plan of Mars/Uranus Site, GDSCC



Source: Deep Space Network Facilities Master Plan Update 2011-2032, 2011

Figure 3-29. DSS-14, 70-m (230-foot) Antenna at Mars Site, GDSCC

Source: Deep Space Network Facilities Master Plan Update 2011-2032, 2011

Apollo Site (DSS 16, 24, 25, and 26)

First built in 1966 and named for its tracking support for the manned Apollo mission, the Apollo Site contains three 34-m (111.5-ft) BWG antennas (DSS-24, DSS-25, DSS-26) and would be the site for the construction of an additional 34-m (111.5-ft) BWG antenna under the Proposed Action. Additionally, the Apollo Site contains the 26-m (85.3-ft) X-Y antenna, DSS-16, which is now deactivated. The Apollo Site has 14 buildings, with a combined total area of 4,086 sq m (43,978-sq ft) (**Figure 2-5**). Since the Apollo Project, this site has supported several unmanned missions including the important Earth Resources Technology Satellite (later to become the Landsat program) initiated in 1972 when it served as a primary ground station. Site support buildings including those associated with the three primary antennas (**Figure 3-30**) and those grouped with the main operations building (G-201) make up the remainder of the Apollo Site facilities. Under a separate project, GDSCC is proposing to demolish G-202, a logistic building that has been empty for 20 years and is in disrepair.

Gemini Site (DSS 27 and DSS 28)

The Gemini Site lies on the south end of the GDSCC and is located before the approach to the Venus Site as one approaches the GDSCC from Barstow. Originally developed for the US Army by NASA JPL as part of the Strategic Defense Initiative Organization (SDIO), the Gemini Site contains two 34-m (111.5-ft) High Speed Beam Waveguide (HSB) antennas developed as uplink antennas for spacecraft in LEO (**Figure 3-31**). The antennas (DSS-27 and DSS-28), known to the U.S. Army as the Antenna Research System (ARS), were transferred to NASA in 1997. At present, only DSS 27 is operational and is remotely controlled by SPC-10 at the Mars Site. The DSS-28 antenna has been added to the instruments available to the GAVRT K-12 educational program operated by the LCER located in Apple Valley, CA. DSS-28 is operated remotely from the LCER.

Legacy Sites and Support Facilities

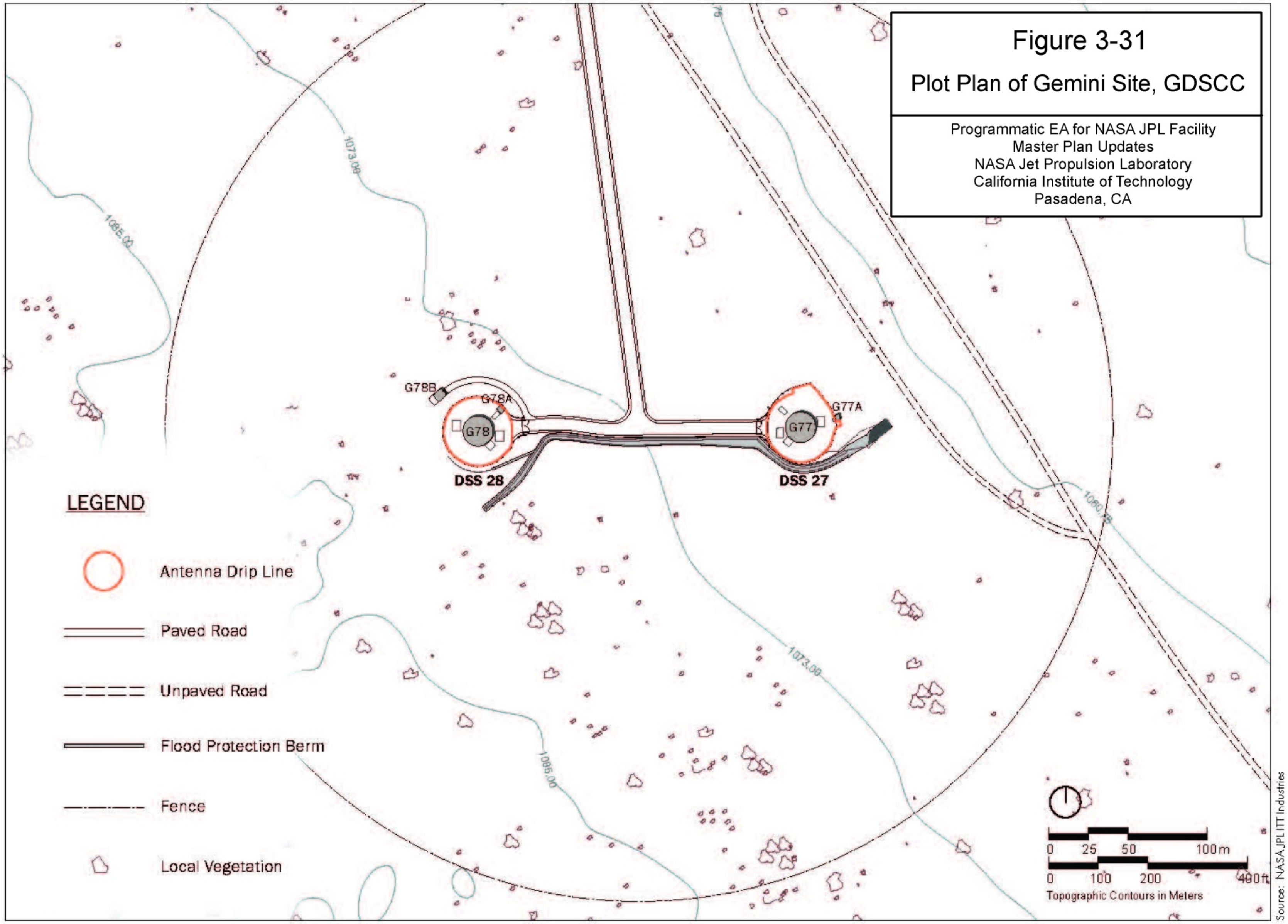
Since its inception in the late 1950’s, GDSCC has developed a range of deep space tracking, telemetry, data acquisition, command, control, monitoring, testing, and training facilities constructed in discrete locations across GDSCC. Several facilities have been decommissioned, removed, and/or relocated. The Pioneer Site, developed as the first Goldstone DSN antenna facility in 1958, is decommissioned and lying outside the current NASA/Goldstone lease area. Decommissioned in 1981, the Pioneer Site Antenna DSS- 11 was recognized as a NHL in 1985. Several Pioneer facilities are listed on a NASA 2009 Current Replacement Value list: the DSS-11 Antenna, the Hydro-mechanical Building, and Water Tank # 6.

Support facilities include the Goldstone Dry Lake Airstrip, three miscellaneous buildings, and an Off-Site Facility in Barstow. The restricted airstrip consists of a 557-m (6,000-ft) x 9.3-m (100-ft) paved runway. While NASA no longer uses this airstrip, it is currently used by Fort Irwin for practicing with and testing unmanned drone aircraft. Three miscellaneous buildings and structures comprising 133 sq m (1,430 sq ft) include the main gatehouse, pump house, and radio spectrum monitor. GDSCC also leases an office and warehouse support facility, a single-story, 2,633-sq m (28,343-sq ft) structure located in Barstow. This facility is responsible for calibration and repair of station test equipment, personnel administration, support of antenna hydraulic systems, and general logistic support.

Figure 3-30. DSS-25, 34-m (111.5-foot) BWG Antenna at Apollo Site, GDSCC

Source: Deep Space Network Facilities Master Plan Update 2011-2032, 2011

Figure 3-31. Plot Plan of Gemini Site, GDSCC



Source: Deep Space Network Facilities Master Plan Update 2011-2032, 2011

3.3.2 Socioeconomics

This section describes population, demographics, economy/ employment, and housing in the area surrounding the GDSCC. The study area includes San Bernardino County and the City of Barstow.

3.3.2.1 Population and Demographics

Information regarding the current population data for the project area was gathered from the 2000 Census and the 2006 – 2008 American Community Survey. GDSCC is located within the Fort Irwin Army National Training Center in San Bernardino County, CA. The City of Barstow, which is the home to the majority of GDSCC employees, is located approximately 72.4 km (45 mi) south of the complex. Employees of the GDSCC primarily consist of technicians and engineers. In 2006 – 2008, the labor force in Barstow, CA was approximately 11,476 people and approximately 1.6 percent of the labor force, or 184 people, were employed by the GDSCC.

According to the 2006 – 2008 American Community Survey, the estimated population for Barstow was 24,957 persons, which represents an 18.1 percent increase since 2000. From 2006 – 2008, the percentage of people in Barstow, CA reporting as one race was 93.4 percent while 6.6 percent reported themselves as being two or more races. See **Table 3-29** for specific information regarding race and ethnicity demographics for San Bernardino County and Barstow.

There is a major population of Hispanic or Latino persons residing in Barstow, as well as a large percentage, 27.2 percent, of people who speak a language other than English at home. The U.S. national average of persons speaking a language other than English at home is 17.9 percent.

Approximately 9.0 percent of Barstow residents have a Bachelors degree or higher and about 78.8 percent are high school graduates. These percentages are both lower than the national averages. The percentage of persons having a Bachelors degree or higher in the U.S. is 27.5 percent and 84.5 percent of persons are high school graduates.

Table 3-29. 2006 – 2008 Estimates of Social Characteristics of Barstow and San Bernardino County - Race & Ethnicity

Area	Total Population	Percentage of Population by Race & Ethnicity						
		Non-Latino White Alone	Black or African American Alone	American Indian or Alaska Native Alone	Asian Alone	Native Hawaiian or Other Pacific Islander Alone	Two or More Races	Hispanic or Latino (regardless of race)
City of Barstow	24.957	55%	15.2%	2.1%	1.7%	1.4%	6.6%	38.6%
San Bernardino County	1,999,753	60.4%	8.8%	1.0%	5.9%	0.3%	4.1%	46.7%

Source: U.S. Census Bureau, Race and Ethnicity 2006-2008 American Community Survey data.
Note: Data may not add up to 100 percent because persons may report more than one racial category.

3.3.2.2 Economy/Employment

As of 2010, total GDSCC employment was 178 people. In addition, approximately 1,000 non- GDSCC, service and contract personnel are assigned to the GDSCC. The median household income in Barstow in 2006–2008 was $48,042, which was slightly lower than the national average of $52,175. See **Table 3-30** for families and individuals below poverty levels.

Table 3-30. GDSCC Study Area Low Income and Poverty Levels (2000)

Area	Population Total	Median Household Income	Families Below Poverty Level	Persons Below Poverty Level
City of Barstow	21,119	$35,069	816 (15.6%)	4,158 (20.3%)
San Bernardino County	1,709,434	$42,066	51,186 (12.6%)	263,412 (15.8%)

Source: U.S. Census Bureau 2000.

3.3.2.3 Housing

The Fort Irwin Army training facility surrounds GDSCC, so employees typically reside in Barstow, which represents an approximately 72-km (45-mi) commute to, and from work stations. In 2006 – 2008, there were 9,870 total housing units in Barstow and 48.4 percent of these were rental properties. The median home value was $171,400 which was only slightly less than the U.S. median of $192,400.

3.3.3 Environmental Justice

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (FHWA 1998), requires that all Federal agencies address the effects of policies on minorities and low-income populations and communities, and to ensure that there would be no disproportionately high and adverse human health or environmental effects to minority or low-income populations or communities in the area. A "minority" is defined as a person who is Black, Hispanic (regardless of race), Asian American, American Indian, and/or Alaskan Native. "Low-income" is defined as a household income at or below the U.S. Census Bureau Poverty Threshold (FHWA 1998).

3.3.3.1 Minority Populations

A minority population is defined as any readily identifiable group of minority persons who live in geographic proximity, or are geographically dispersed or transient persons (such as migrant workers) who will be similarly affected by a proposed program, policy, or action (FHWA 1998).

Minority populations in the study area were compared to the population characteristics of the city and state. The CEQ guidance states that "minority populations should be identified where either (a) the minority population of the affected area exceeds 50 percent or (b) the population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographical analysis." As depicted in **Table 3-31**, Barstow and San Bernardino County as a whole meet the definition of a minority population. These may be areas of potential Environmental Justice Concern due to minority populations.

Table 3-31. GDSCC Study Area Minority Populations (2000)

Area	Population Total	American Indian	Black	Hispanic	Asian	Total Minority
City of Barstow	21,119	510 (2.4%)	2,450 (11.6%)	7,708 (36.5%)	650 (3.1%)	11,318 (53.6%)
San Bernardino County	1,709,434	19,915 (1.2%)	155,348 (9.1%)	669,387 (39.2%)	80,217(4.7%)	924,867 (54.2%)

Source: U.S. Census Bureau 2000.

3.3.3.2 Low-Income Populations

Low-income status was based upon comparing the income of the proposed project site and larger study area residential population to the U.S. Census Bureau Poverty Threshold (U.S. Census Bureau, Housing and Household Economic Statistics Division 2000). The CEQ guidelines do not specifically state the percentage considered meaningful in the case of low-income populations. The definition of "low income populations" is defined by the HUD as populations where "50% or greater are low-income individuals."

Census data (2000) were reviewed to determine the number of persons from Barstow, CA and San Bernardino County that are low-income individuals living below the poverty level. **Table 3-30** provides low-income level data for San Bernardino County and Barstow, CA. As shown in **Table 3-30,** low income individuals do reside within the surrounding community. However, the percentages in the potentially affected areas are well below the 50 percent required to be considered a "low income population" as defined in the HUD guidelines.

3.3.4 Traffic and Transportation

3.3.4.1 Regulatory Framework

This section describes the state and local statutes and regulations that establish the standards of transportation and circulation and must be considered by the GDSCC when rendering decisions on projects that include construction, operation, or maintenance activities that have the potential to affect traffic and circulation. The State has mandated the implementation of a CMP that was enacted by the State Legislature with the passage of Proposition 111 in 1990. The program is intended to address the impact of local growth on the regional transportation system and is addressed as part of the traffic analysis.

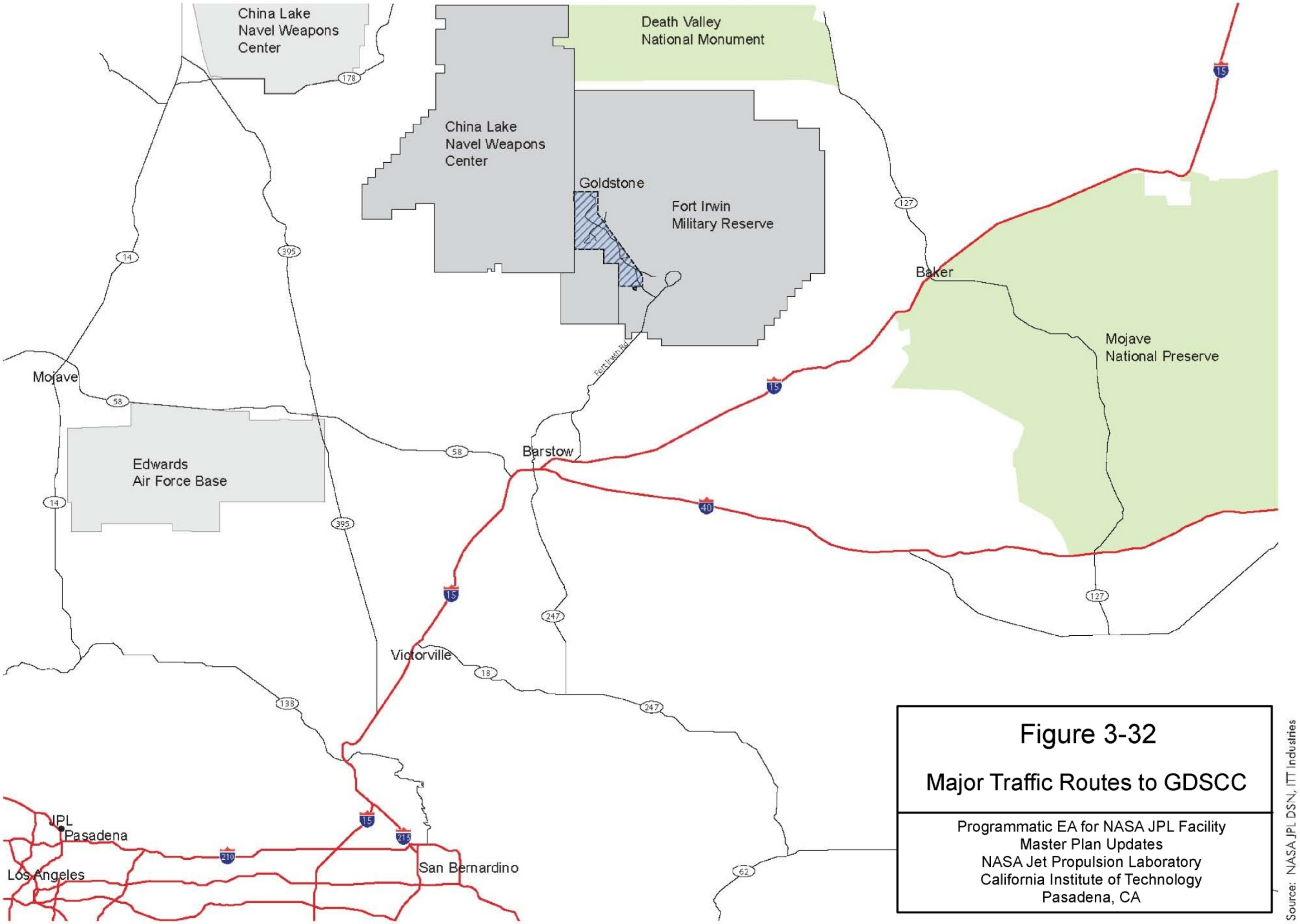
3.3.4.2 Street System

Regional freeways and a local roadway system provide access to GDSCC entrances (**Figure 3-32**). Regional access to the GDSCC is provided by Interstates 15 and 40 and State Highways 58 and 247. The only surface transportation route to GDSCC is via Fort Irwin Road, which connects to I-15 about 8 km (5 mi) northeast of Barstow. The NASA Road cut off from Fort Irwin Road leads into GDSCC. The paved two-lane NASA Road merges with Goldstone Road, which is the only north-south paved access road within the complex. It runs the axis of the complex from which a series of two-lane paved branch roads provide access to antenna sites and the main administrative Echo Site.

Each of the branch roads are named for the antenna site that they serve. Goddard Road intersects Goldstone Road near Goldstone Dry Lake and proceeds southwest directly serving the Goldstone airstrip and as an access point to Apollo Road. Goddard Road past the Apollo turn-off leads to the now cleared Mojave site and is in degraded condition (A.C. Martin 2011). Scattered unimproved dirt roads and tracks are also found across GDSCC, the most important of which is a tank trail road used by military vehicles. This dirt roadway parallels Goldstone Road running from a point approximately 2.4 km (1.5 mi) south of the Mars/ Uranus Site to the Goldstone Main Gate. A branch of this tank trail crosses Goldstone Road approximately 1.6 km (1 mi) north of the Echo Site, and proceeds southwest to access Fort Irwin's southwest expansion training area.

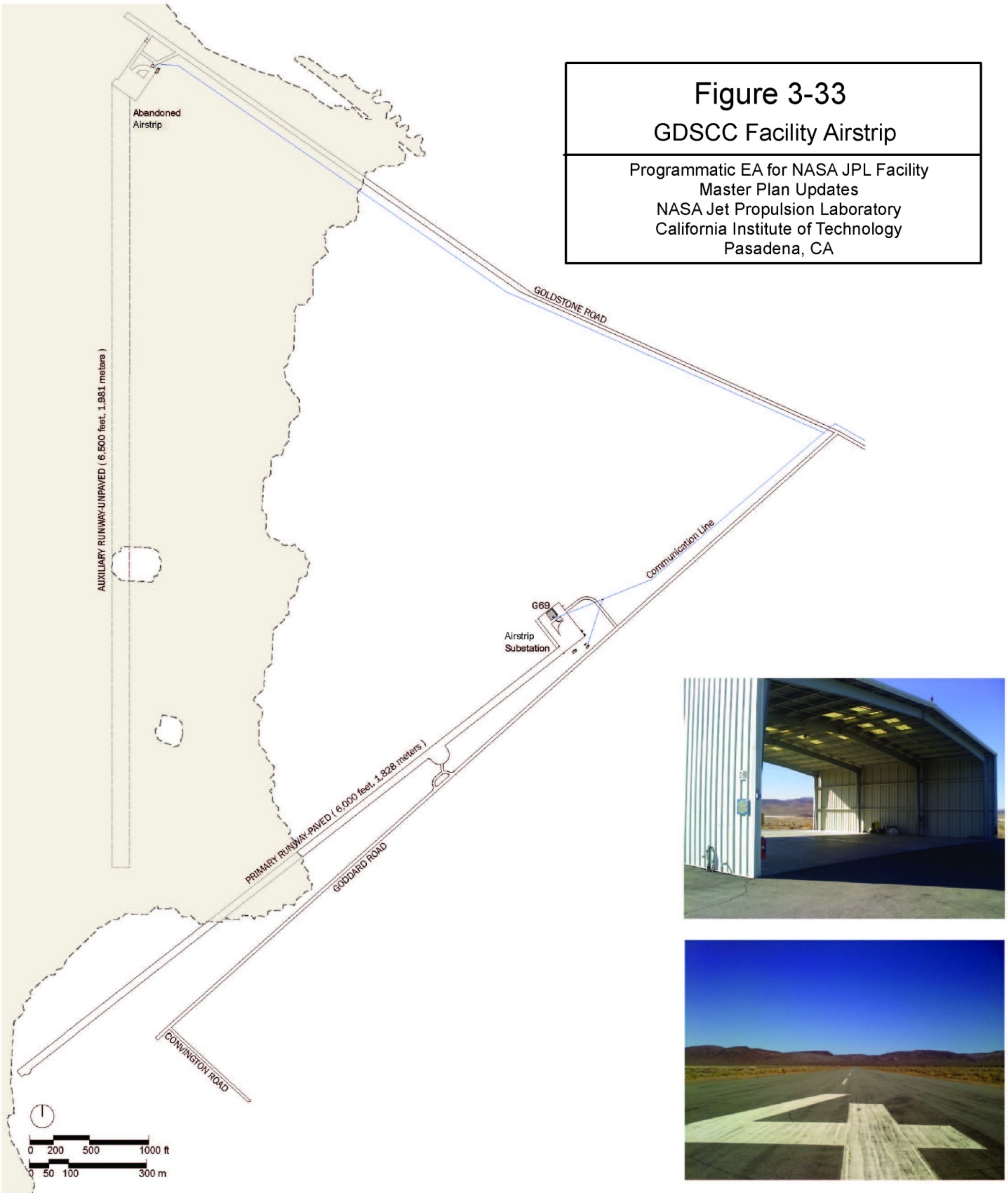
A 1,828-m (6,000-ft) all-weather paved airstrip is located adjacent to the Goldstone Dry Lake (**Figure 3-33**). Associated facilities include a 394-sq m (4,236-sq ft) airport shelter/hangar structure, as well as a 1,981-m (6,500-ft) long unpaved auxiliary runway. Although this facility is not currently in use, NASA anticipates retaining the airstrip as a viable resource for future mission purposes. Under the current MOU with Fort Irwin, NASA and DoD consider the airstrip a shared-use facility (AC Martin, 2011).

Figure 3-32. Major Traffic Routes to GDSCC



Source: Deep Space Network Facilities Master Plan Update 2011-2032, 2011

Figure 3-33. GDSCC Facility Airstrip



Source: Deep Space Network Facilities Master Plan Update 2011-2032, 2011

3.3.4.3 Traffic Generation

Approximately 99 percent of traffic using Fort Irwin Road is generated by Fort Irwin. Fort Irwin Road is a two-lane road approximately 10 m (32 ft) wide with 0.6-1.8 m (2-6 ft) graded shoulders. The road was designated a Defense Access Route in July 1980 and the county currently receives annual funds from the DoD for improvements and upkeep of the road. The majority of employees at the GDSCC commute from the city of Barstow south of the complex. Daily trips between Barstow and the GDSCC are primarily concentrated on Barstow and Fort Irwin Roads, to NASA Road and Goldstone Road (**Figure 3-34**).

Vanpools offer the only mass-transit services for on-site GDSCC employees, with each van operating a single round trip daily between the surrounding community area and GDSCC. Most employees use this commuter service from Barstow (AC Martin, 2011) Vehicle parking is available adjacent, or nearby each GDSCC building and structures. Parking areas are unpaved, and without designated space allocation.

3.3.5 Utilities and Services

Utilities and services supporting the six stations across GDSCC include primarily of electrical power, water supply, sanitary sewer, telecommunication, propane gas, stormwater collection system, wastewater collection and treatment, fuel oil services and storage, refuse collection and disposal, and emergency services. The analysis of these public services includes a description of the respective regulatory framework that guides the decision-making process, existing conditions of the proposed project area, impact significance thresholds, anticipated impacts, and proposed mitigation measures.

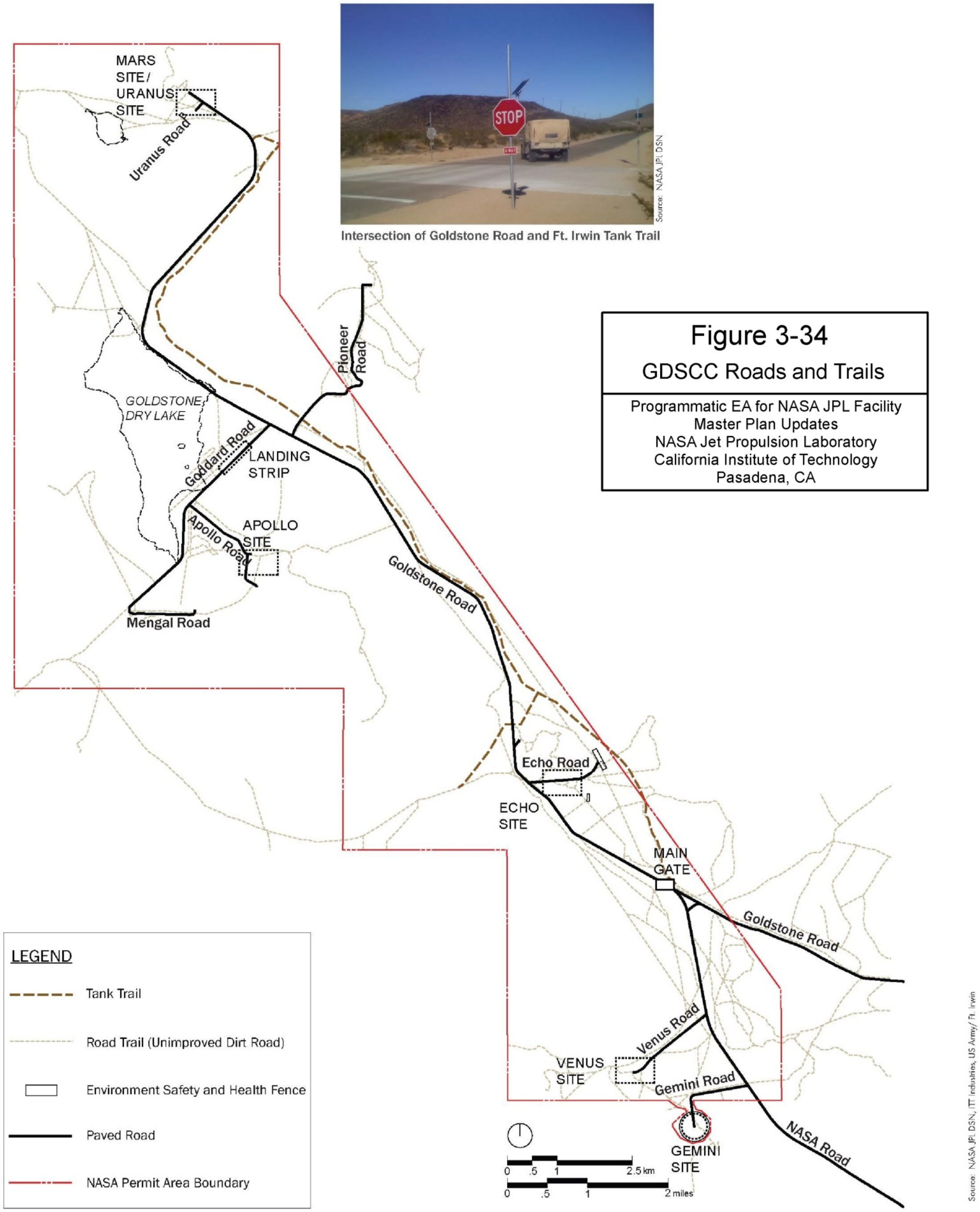
Facilities at GDSCC include nine (9) parabolic antennas, an airstip, and approximately 90 miscellaneous buildings and structures constructed from the late 1950s through the present (AC Martin 2011). A remote support facility located in Barstow is also part of GDSCC. The construction of additional buildings and structures continues today as GDSCC increases its activities and operations. Conversely, the utility systems at GDSCC have been installed incrementally throughout facility development. Most of the newer utility systems are buried below grade in a protected environment and their condition is not expected to have changed since construction. The main utility corridors are the power distribution system and water distribution system.

3.3.5.1 Electrical Power

As depicted in **Figure 3-35**, the GDSCC distribution system is fed from a 34.5 KV high voltage line coming from the SCE Tiefort Substation located at the south end of the site. A combination of overhead and underground 34.5 KV service conductors route north to the Mars Substation where the transmission lines then terminate in a 7.5 MVA SCE transformer. This feeds the site service at 2,400V. The service equipment is backed up by a new 4.0 MW UPS system and bank of generators to provide a total site uninterrupted power system.

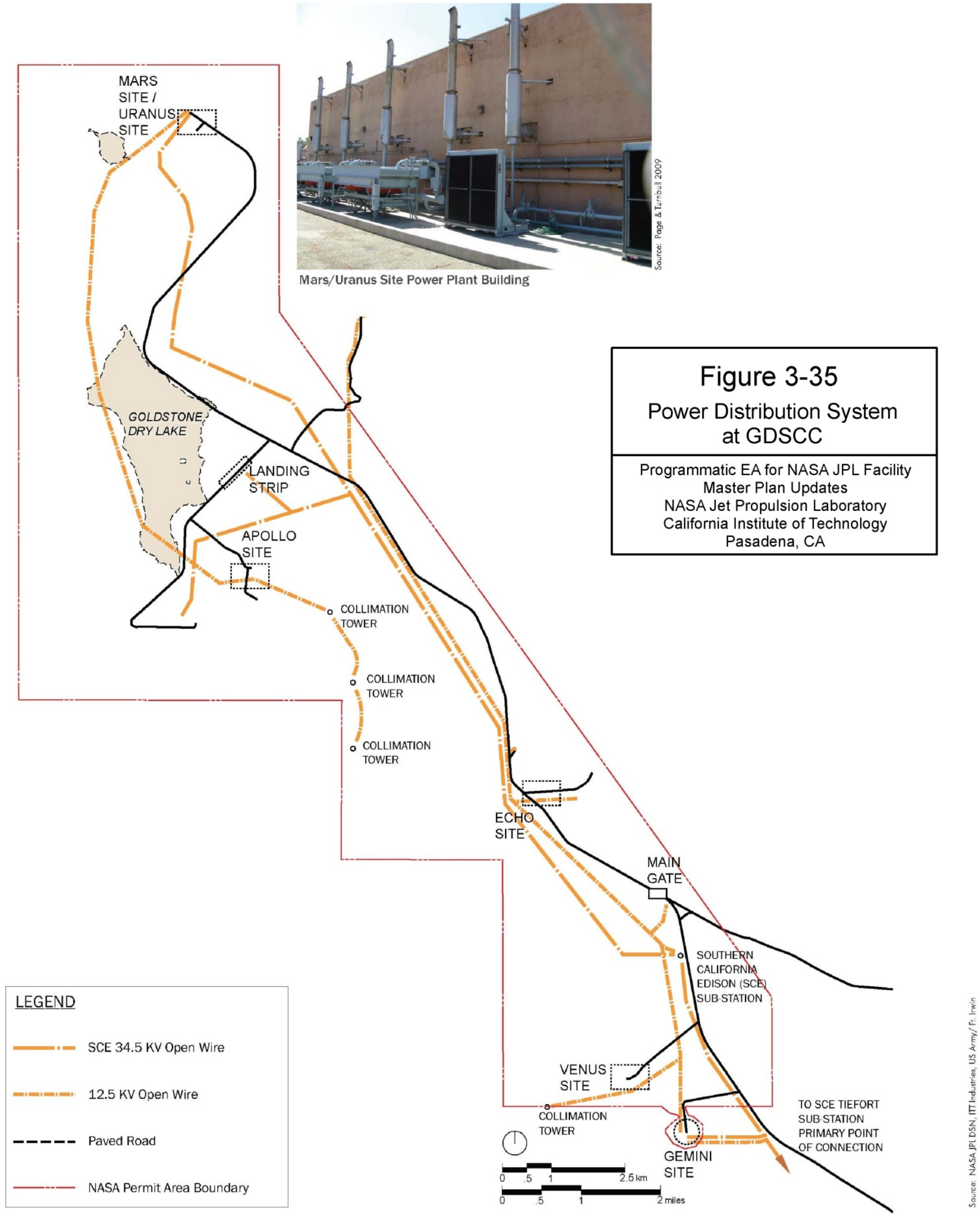
Power distribution throughout GDSCC is achieved by stepping up the 2,400V system at the Mars substation to 12.47 KV. This voltage is then fed by an overhead/underground wiring system to the various antenna facility support buildings throughout the Goldstone complex. Once at an antenna location, the voltage is transformed to 480V for local power requirements. Although the entire GDSCC power system has uninterrupted power provided at the Mars substation, most of the individual sites have their own localized redundant UPS and generator system backup. Currently, metering of electrical energy to GDSCC is provided by Fort Irwin, which is the primary purchaser of electricity from SCE. Although more sophisticated metering is in place, it is not being used at this time. At present, no “Time of Use” metering is being applied to the energy bill. Existing total power demand for the site is 2.8 to 3.0 MW with a peak load of 3.8 MW occurring during major antenna operations.

Figure 3-34. GDSCC Roads and Trails



Source: Deep Space Network Facilities Master Plan Update 2011-2032, 2011

Figure 3-35. Power Distribution System at GDSCC



Source: Deep Space Network Facilities Master Plan Update 2011-2032, 2011

The U.S. Army signed a memorandum of agreement (MOA) in October 2009 for an enhanced-use lease to begin development of a 500-MW solar power plant at Fort Irwin (News Release, U.S. Army, October 16, 2009). This MOA would allow commercial developers to use land at Fort Irwin to construct a solar power plant between 2013 and 2022 that would provide power to the civilian power grid in California and to Fort Irwin. Three of the five identified sites proposed for this project are located on GDSCC. The solar photovoltaic system locations at GDSCC are shown in **Figure 3-36.** NEPA scoping and environmental analysis for this project is currently being coordinated by the Army with NASA and the BLM.

3.3.5.2 Petroleum, Oil and Lubricants

The GDSCC is not served by natural gas lines, and instead relies upon LP. LP is used at GDSCC for food preparation/cooking at the Echo Site and is delivered by truck from a local supplier. The need to replace the existing LP distribution system to meet current State of California regulations, provide cathodic protection and comply with periodic pressure testing requirements has been identified by ITT Industries (AC Martin, 2011).

As a large-scale facility located in a remote, isolated desert region, the GDSCC operations to support the various DSS antennas require numerous on-site storage facilities for gasoline, diesel oil, hydraulic oil, and waste oil. GDSCC currently has 9 ASTs and 10 USTs (JPL 2008). Gasoline, diesel oil, and hydraulic oil are stored in the double-walled USTs fitted with sensors between the walls to detect leaks.

Three USTs are located in Echo Site, five in Mars Site (including two USTs in DSS-14), and two in the gasoline dispensing facility. The capacity of the USTs ranges from 7,571-94,635 l (2,000-25,000 gal). Nine of the USTs are permitted by the Lahontan RWQCB. The remaining UST and several concrete catchment basins are not permitted since they are normally empty and used as emergency spill containment tanks or for temporary containment of stormwater. The USTs were upgraded in 2003 to meet SB 989 UST standards, and are double-walled and are constructed of fiberglass for corrosion protection. Two of the USTs (one each at Echo and Mars Sites) are used to store waste oil and regulated as 90-day hazardous waste accumulation areas.

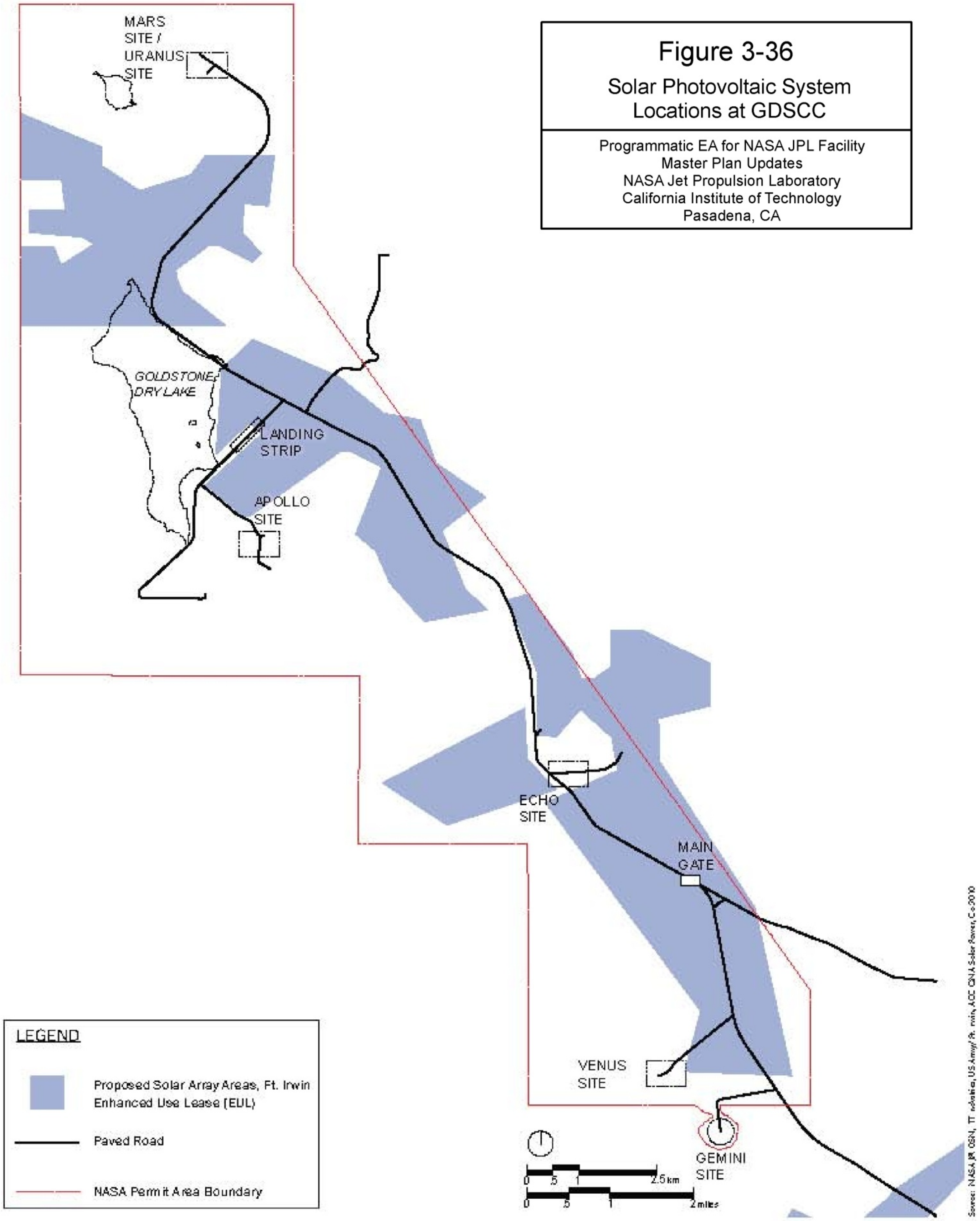
The 9 ASTs (three in Echo Site, one in Venus, four in Mars, and one in Apollo) are primarily used to store diesel fuel and lube oil for emergency generators or fire water supply pumps. The Echo Site and Mars Site power plants each have diesel fuel day tanks and lubricating oil ASTs. . The GDSCC AST capacity ranges from 379-3,407 l (100-900 gal) (URS, 2008).

3.3.5.3 Water Distribution

GDSCC water supply system is managed by Fort Irwin. Water is supplied to GDSCC by Fort Irwin supply wells from three aquifer areas within the groundwater basin. Fort Irwin maintains a 3.8 million-l (1,000,000-gal) reservoir that feeds the GDSCC distribution system via the Fort Irwin Booster Pump Station.

The booster pump station (consisting of three booster pumps) and substation (Building B-92) provide raw water supply, via the GDSCC distribution system, to seven steel water storage tanks at GDSCC. Two of the tanks are located near the Mars/Uranus Sites; one tank each located at Apollo and Echo, two tanks located near the Venus Site; and one tank located at the former Pioneer Site that has been transferred to the Army. One of the Mars water tanks is designated as the diesel fire pump reservoir. Tank capacities range from 681,000-1,400,000 l (180,000-380,000 gal) and are 11 m (36 ft) in diameter, except for the Venus Complex reservoir which has a diameter of 15.2 m (50 ft) (Civiltec 2010). The tanks are 7-9.8 m (23-32 ft) tall. Each tank is equipped with an altitude valve on the inlet pipe, a meter, cathodic protection, and telemetry.

Figure 3-36. Solar Photovoltaic System Locations at GDSCC



Source: Deep Space Network Facilities Master Plan Update 2011-2032, 2011

The water distribution system provides water to the entire GDSCC for domestic use in toilets and sinks, fire protection and irrigation purposes, antenna cooling, other industrial purposes, and feed a Reverse Osmosis (RO) potable water system for the cafeteria. Water distributed by the existing water system is considered non-potable water due to certain water quality issues. The pipelines conveying raw water from the booster station to the seven tanks form the backbone of the system and consist of 15-cm (6-in) diameter steel pipe **(Figure 3-37).** The pipelines connecting the tanks to the sites consist of 20 cm (8-in) diameter steel pipe. Cathodic protection is provided in all transmission and distribution pipelines.

GDSCC water supply is pumped from the Fort Irwin reservoir into the Complex water reservoir located next to the Venus Site which has a capacity of 1.4 million l (380,000 gal). The Venus Site also has a water tank of 670,000 l (177,000 gal). The water supply to the other six tanks at GDSCC is gravity-fed from the Complex water reservoir through approximately 42 km (26 mi) of 15-cm (6-in) diameter water lines. The Complex reservoir was refurbished in 2004, including recoating the inside and outside of the tank, and seismic-bracing of the tank to the pad. The other six tanks were also refurbished in 2003-2005 and seismically-retrofitted. There is no record of failures of these tanks in the past.

There are concerns on the water distribution system since there have been multiple and increasing failures of the lines outside of the tanks. The original piping had numerous breaks and repairs over the years.

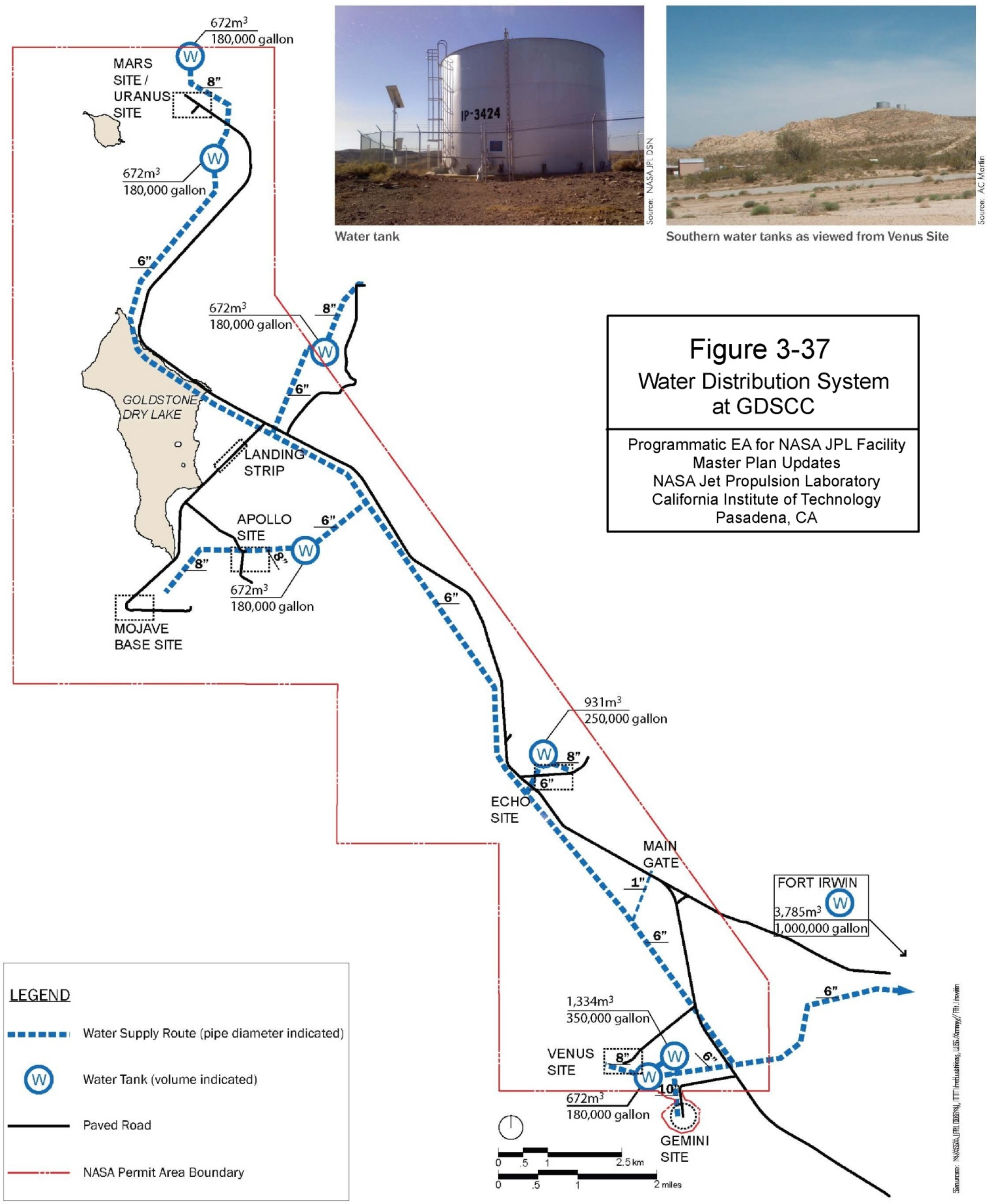
Also, the 45-year-old transmission pipeline between the Fort Irwin Booster Pump Station and the Complex water reservoir adjacent to the Venus Site has been identified to have impacts, mainly due to corrosion, and therefore requires replacement. In all, it is estimated that 41,150 linear m (135,000 linear ft) or over 41 km (25 mi) of water pipeline need to be replaced (AC Martin 2011).

Other phases of pipeline replacement projects would follow after the completion of the Fort Irwin to Venus stretch (Civiltec 2010). Monthly preventative maintenance is performed on the entire water system to be proactive in identifying discrepancies in their early stages. The cathodic protection system is also checked on a quarterly basis to ensure that it is emitting the proper current throughout the system. A recent estimate of water sustainability for the current Fort Irwin supply indicated that the local aquifers will be depleted in 20 years taking into consideration evolving plans to increase the population of Fort Irwin, and develop an on-site solar-thermal power generation facility. Efforts to expand the water supply system to other aquifers in the region are underway (Civiltec 2010).

Potable Water

Due to the poor quality of the GDSCC water supply, it is not deemed suitable for human consumption. The water supplied to GDSCC from Ft. Irwin does not meet the requirements for the fluoride or arsenic maximum contaminant level (MCLs). Further water quality complications are attributable to zero chlorine residuals measured in the GDSCC 27.3 km (17 mi) dead-end water transmission line. As a result, bottled water is used as the drinking water supply at GDSCC and is purchased and delivered to the stations by Sparkletts. Water used in the cafeteria is treated using a small RO system (capacity of 30 gal at 1 gpm) to provide potable water for food preparation, cleaning, and other limited domestic purposes.

Figure 3-37. Water Distribution System at GDSCC



Source: Deep Space Network Facilities Master Plan Update 2011-2032, 2011

3.3.5.4 Wastewater Collection and Treatment

Wastewater generated at GDSCC is primarily domestic in nature. Sanitary sewage at each individual GDSCC site has its own independent wastewater system utilizing either oxidation ponds, and/or septic/leech fields for localized treatment and discharge. A contractor pumps sewage from the septic tanks and the accumulated bio-solids from the evaporation ponds when necessary (AC Martin 2011). In compliance with the CWA, California developed strategies to manage wastewater discharge. The CWA requires that pretreatment standards be developed, and makes these standards enforceable. Wastewater is composed of sanitary or industrial wastewater discharged to POTW or federally owned treatment plants, or stormwater discharge associated with industrial activity to a receiving stream or water body. Pretreatment standards established by local water quality control boards determine allowable discharges to discharge points.

The Lahontan RWQCB issued Waste Discharge Requirements (WDRs) for management and monitoring of these evaporation ponds (NASA EFR, EMD, 2009). The Echo Site ponds are permitted to receive up to 15,142 l per day (4,000 gpd) of effluent, while the Mars Site is permitted to receive up to 12,870 l per day (3,400 gpd). However, current domestic wastewater volumes discharged to the evaporation ponds are lower than the permitted amounts due to reduced facility staff at GDSCC. The WDR specifies monitoring requirements and effluent limits for these ponds. The WDR originally required direct measurement of wastewater flows into each set of ponds, but the facility has used unit factors to estimate flow based on an inability to accurately measure the discharge.

Six functioning sewage evaporation ponds (two oxidation ponds at the Echo Site and four at the Mars Site) are designed to receive wastewater effluent from an upstream septic tank system. Wastewater discharge from each site flows by gravity to a distribution box that feeds several septic tanks. The effluent from the septic tanks is then recombined and flows into evaporation pond cells (**Figures 3-38 and 3-39**).

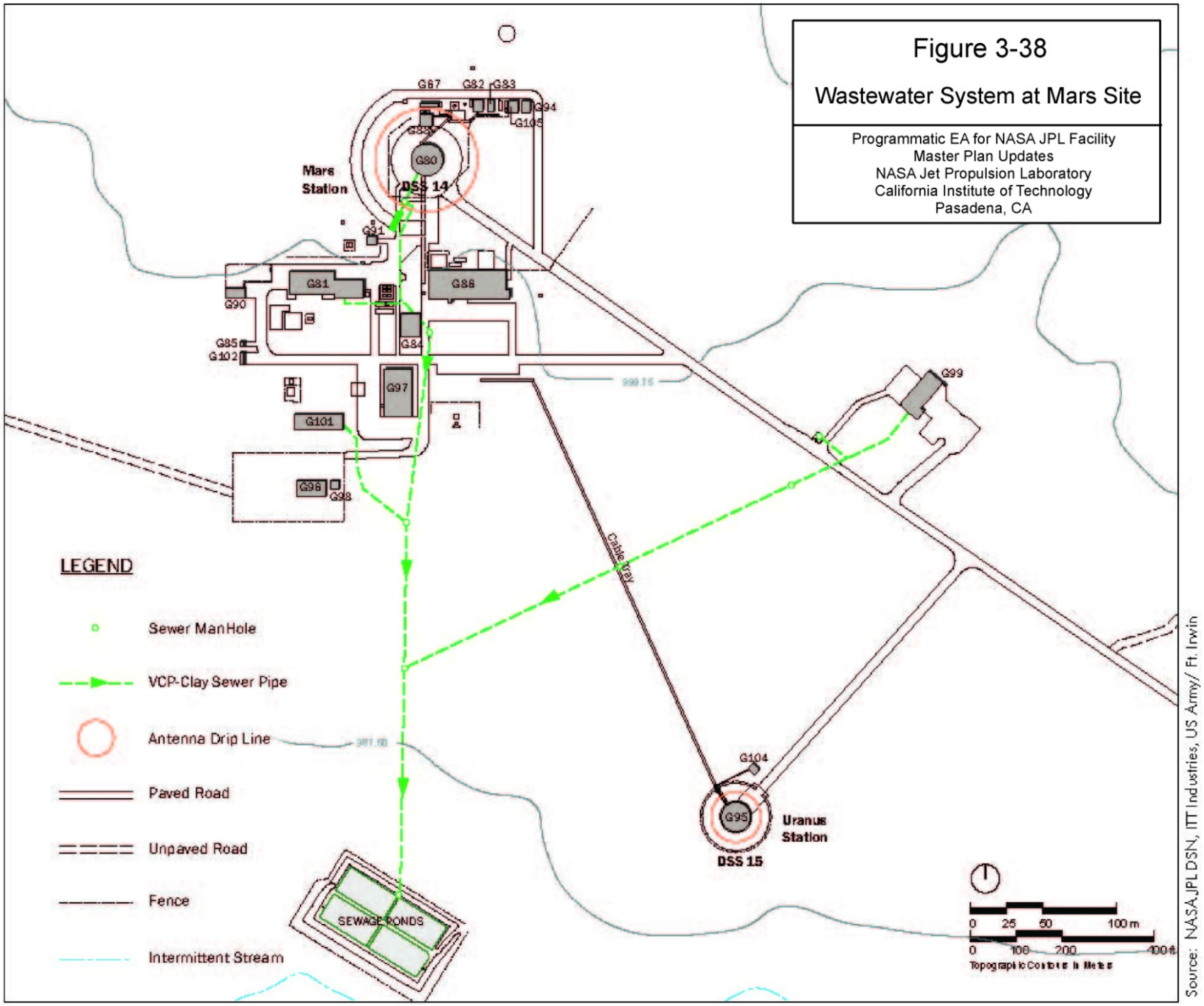
Leech fields were originally associated with these ponds, but are reported to have collapsed and therefore no longer used. Extensive work was completed in the spring of 1989 to repair and reshape the previously eroded embankments of the wastewater evaporation ponds (JPL 1989). Recent determination also indicates that the erosion control lining of these ponds are still leaking and requires replacement. Other outlying facilities at GDSCC also discharge wastewater to the septic tanks and leech field systems. These include the Venus, Apollo, and Gemini Sites, and the GDSCC guard station (AC Martin, 2011).

3.3.5.5 Heating, Ventilation, and Air Conditioning System

In accordance with the American Society of Heating, Refrigeration and Air Conditioning Engineers, equipment service life of intermittently operated HVAC equipment is between 15 to 20 years. Most of the GDSCC equipment has been in continuous operation over 20 years. In the late 1980s, the Facilities and Power Subsystems began integrating the use of Programmable Logic Controllers (PLC) in the power generation plants and in the HVAC systems. The existing power control system was the prototype for the first commercially available systems, and was designed later to include automatic switching capability from commercial to generated power at GDSCC in the early 1990s. The original Square D (Symax) PLCs were used to support most HVAC operations and remain in place today at GDSCC (Civiltec 2010). Several deficiencies have been identified on the existing GDSCC HVAC equipment and recommendations for improvements include:

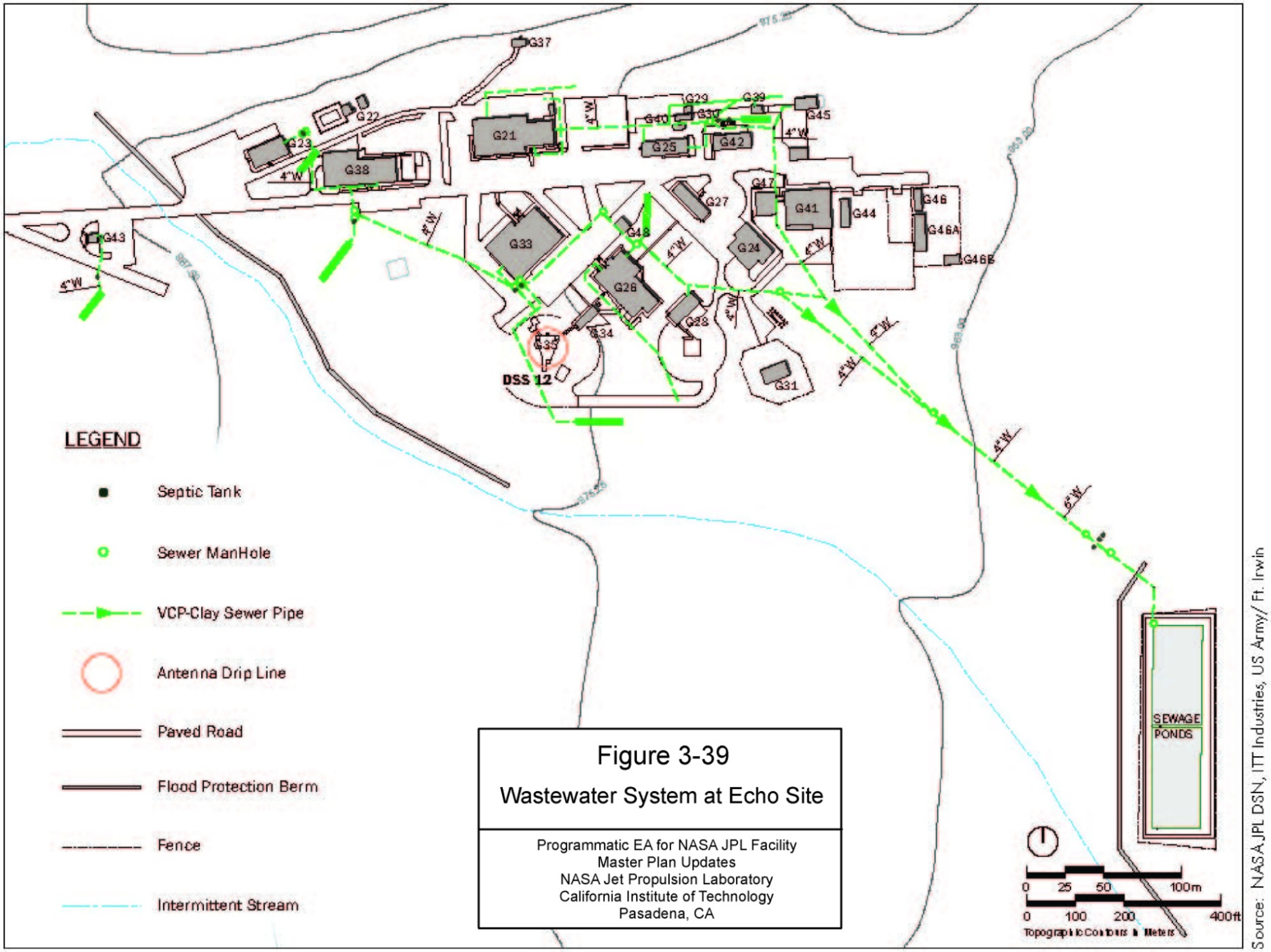
- Replace aging maintenance intensive HVAC equipment: Chiller #1, Chiller #3, Air Handler #2, Air Handler #3 and MCC-1.

Figure 3-38. Wastewater System at Mars Site



Source: Deep Space Network Facilities Master Plan Update 2011-2032, 2011

Figure 3-39. Wastewater System at Echo Site



Source: Deep Space Network Facilities Master Plan Update 2011-2032, 2011

- Install air-cooled chiller and upgrade HVAC controls at DSS-14. Increased cooling system capacity at DSS-14 will reduce the load on the cooling tower.
- Implement a Water Treatment Program for the NVAC, TXR and UWV loops. Provide for the routine testing, analysis and remediation of all cooling water loops at GDSCC
- Replace aging air conditioning equipment at Apollo, Echo, Gemini, Mars and Venus Sites.
- Replace aging chillers with new units that use environmentally friendly refrigerant. Existing chillers use R-22 which is being phased out per the Montreal Protocol.
- Modify HVAC equipment at DSS-13 (Building G-61). The modifications would serve as the test bed for the 80-kW transmitter cooling design approach to be implemented at new transmitter locations.

All other HVAC equipment is assumed to be in working order and subject to replacement based on age and efficiency observations of GDSCC maintenance staff (Civiltec 2010).

3.3.5.6 Communications

Communications to GDSCC are based on one main underground cable route and one open wire route which enter GDSCC adjacent to the main gate. These lines provide connections from the south through Fort Irwin and into Echo Site. From Echo Site, the communication lines are installed as either overhead lines or in an underground conduit and disperse site-wide interconnecting the various antenna facility buildings (**Figure 3-40**). These lines are comprised of a primary fiber optic cable backbone system and multi-pair copper cable system which serves telephone, security, and fire alarm lines (AC Martin, 2011).

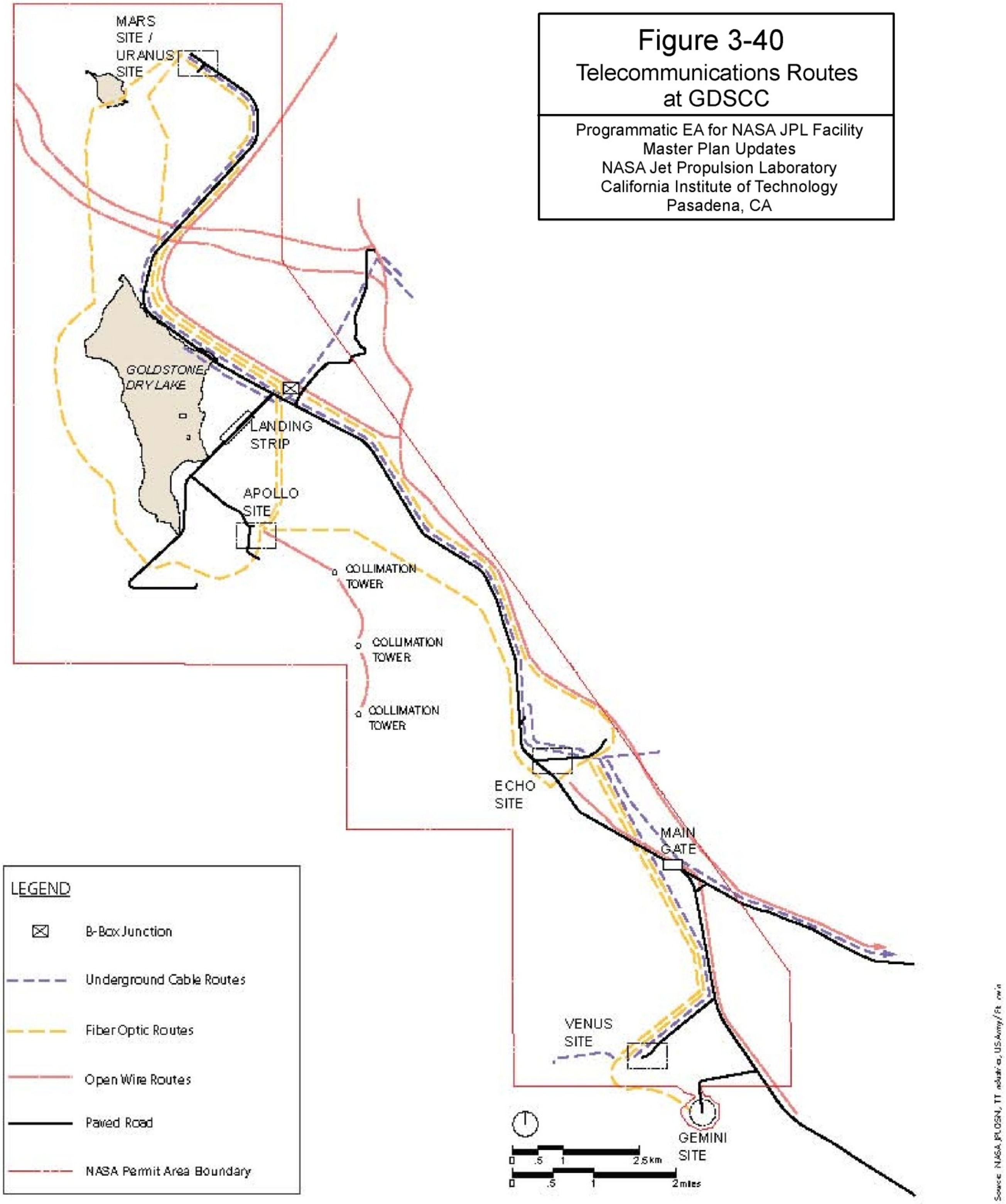
Multi-pair copper wiring was the original method of communication cabling and is still used today for less intensive demands. Copper cables are distributed in a variety of sizes from several hub-locations located throughout GDSCC. The fiber optic network, both single and multi-mode offers greater speeds, larger bandwidth or carrying capacity, and the ability to go longer distances without amplification. Fiber optic cables are comprised primarily of 12, 24, 48, and 96 strand Multi-mode and single-mode cables and used throughout the site where high speed and large bandwidth data transmission is required. Most of the buildings at GDSCC have fiber feeds (AC Martin 2011).

3.3.5.7 Stormwater Collection

Due to its location in a desert environment, stormwater and run-off evaporates or infiltrates into the dry desert soils quickly. Stormwater accumulation and flow is not a frequent occurrence, and only occurs after intense rainfall periods so storm water collection facilities or improvements are generally limited at GDSCC. During heavy rainfall, water occasionally reaches Goldstone Lake, which becomes inundated for short periods (JPL 2006).

Structures are equipped with rain gutters and downspouts, and generally disperse collected rain waters to storm-channels or percolation areas immediately adjacent to the collection point. Stormwater collection from paved or surface areas at each site is based on a combination of natural swales or constructed drainage channels, which use local topographical contours to remove waters into main drainages ditches. There are also flood diversion berms/ditches'/channels at Echo, Apollo, and Gemini Sites which are used to disperse stormwater under flash-flooding conditions around the perimeter of each antenna. There is a culvert at Echo Site associated with the drainage channel and one located at Mars Site.

Figure 3-40. Telecommunications Routes at GDSCC



Source: Deep Space Network Facilities Master Plan Update 2011-2032, 2011

3.3.5.8 Solid Waste

Management of solid waste streams is primarily related to the collection and availability of landfills to support a population's residential, commercial, and industrial needs. Alternative means of waste disposal might involve waste-to-energy programs or incineration. In some localities, landfills are designed specifically for, and limited to, disposal of construction and demolition debris. Recycling programs for various wastes categories (e.g. glass, metals, papers, asphalt and concrete) reduce reliance on landfills for disposal.

GDSCC generates refuse and other solid wastes from various activities, maintains dumpsters for waste collection throughout the complex, and removes solid wastes from the dumpsters for off-site disposal. Solid waste from the GDSCC is now transported to the State permitted solid waste disposal facility at Fort Irwin. The 4 ha (10-ac) Echo Site solid waste disposal site located northeast of the Echo Site of the GDSCC stopped accepting any waste in October 1993. The landfill was operated as a Class III landfill as defined by the waste management unit classification system of Chapter 15, Division 3, Title 23 of the CCR. During its life, the landfill received Class III non-hazardous solid wastes and unclassified inert waste consisting primarily of cardboard, tree and lawn clippings, and dry cafeteria waste. The site operations conformed to Title 14 standards for handling and disposal of solid waste.

Five groundwater monitoring wells have been installed at the landfill. Water level data from these wells indicate that groundwater beneath the site occurs in fractured bedrock at an elevation of about 870 m (2,855 ft) above mean sea level (AC Martin 2011). Because of new, more stringent requirements, this landfill has been officially closed (JPL 1987). The final post-closure maintenance plan was dated 23 December 1997. CRWQCB, Lahontan Region, Board Order No. 6-95-118, WDID No. 6B360335003, requires semiannual monitoring reports. In response to VOCs detected in the groundwater, the Evaluation Monitoring Program was initiated to evaluate the nature and extent of groundwater impacts (NASA EFR, EMD, February 2009).

3.3.5.9 Emergency Response and Safety Management

The GDSCC maintains both a security guard patrol and emergency response team. The emergency response team will respond to emergencies involving fire, rescue, medical, hazmat and natural disaster. The GDSCC also maintains emergency vehicles. In addition to these on-site resources, GDSCC has a working agreement with neighboring Fort Irwin for provision of fire and police protection when additional assistance is required. Fort Irwin has implemented an emergency telephone system to facilitate communication between the two installations. Emergency medical attention for GDSCC employees also is provided by Fort Irwin, which operates a hospital. Immediate medical emergencies are stabilized at GDSCC and prepared for transport to the appropriate facility.

3.3.5.10 Security Management

Entry to GDSCC is through a restricted access gateway, located on Goldstone Road which is the main road into the site. Individual facility sub-components at each of the five stations are enclosed with perimeter security fencing.

3.3.6 Air Quality

The following section describes the local air resources in terms of climate, air quality standards, air quality conditions, air pollution sources, controls and reporting requirements. Air emission sources at GDSCC and the controls employed to minimize emissions are also discussed.

3.3.6.1 Climate

At a regional scale, the GDSCC lies within the National Weather Service Desert Climatic Area 7, where the climate is characterized by infrequent rainfall, large seasonal and diurnal temperature ranges, low relative humidity, and a high percentage of sunshine. At the local scale, the GDSCC is located within the MDAB, which is comprised largely of the desert portions of Los Angeles and San Bernardino Counties.

The MDAB is a dry-hot desert climate, with portions being dry-very hot desert, to indicate at least three months have maximum average temperatures over 38 °C (100.4 °F). Temperatures vary from a mean winter maximum of 15.6 °C (60 °F) to a mean winter minimum of 0 °C (32 °F) in January and a mean summer maximum of 41 °C (106 °F) to a mean summer minimum of 22.8 °C (73 °F) in July. Average annual precipitation for the region is 9.8 cm (3.87 in), with precipitation in the MDAB ranging from 7.6 and 17.8 cm (3 and 7 in) per year. Most precipitation falls between December and March, with 16 to 30 days having at least 0.025 cm (0.01 in).

During the summer, the MDAB climate and weather patterns are influenced by a Pacific subtropical high weather cell that sits off the California coast, inhibiting cloud formation and encouraging daytime solar heating. The MDAB is rarely influenced by cold weather masses moving south from Canada and Alaska, as these frontal systems are typically weak and diffuse by the time they reach the desert.

Most desert air moisture arrives from warm, moist, and unstable air masses from the south. Light rainfall and thunderstorms occur when warm, moist tropical air off the coast of Mexico enters the desert. However wind direction data indicates that the predominant winds are from the southwest and west-southwest for each month except November and December, when predominant winds are from the northwest. During stable conditions, wind blows from the northwest as air flows toward the lower elevations to the southeast, showing wind directions for the area are highly variable. The average wind speed for a 20-year period was recorded as 3.2 to 14.5 kph (2 to 9 mph) and the maximum extreme wind speed for a 14-year period was recorded as 140.8 kph (87.5 mph).

Air quality is correlated to the dominant transport direction of local winds. During spring and summer, pollution produced during any one day is typically blown out of the Los Angeles metropolitan area and the SOCAB through the inland mountain passes. Air pollutants can be transported 96.6 km (60 mi) or more inland by ocean air during the afternoons, and the GDSCC location is therefore affected by coastal pollution sources. From early fall to winter, the transport is less pronounced because of slower average winds speeds and the appearance of land breeze winds may begin by late afternoon. Pollutants remaining in the air basin are trapped and begin to accumulate during the night and following morning. A low wind speed in pollutant source areas is an important indicator of air stagnation and the represents the potential buildup for the primary (criteria) air pollutants.

Air stagnation may occur during the early evening and early morning during periods of transition between day and nighttime flows. The hot, dry Santa Ana winds that form in the desert during the fall and winter months due to a Canadian high-pressure system over the Great Basin. If the Santa Ana winds are strong, they can surpass the strength of the onshore sea breeze, thus transporting additional suspended dust and pollutants out over the ocean.

3.3.6.2 Air Quality Standards

State and Federal air quality standards, including regulatory and General Conformity applicability are discussed in Section 3.1.6.2. Please refer to this section for associated air quality standards for GDSCC.

3.3.6.3 Air Quality Conditions

GDSCC and Fort Irwin are located within the MDAB, which is comprised of the desert portions of Los Angeles and San Bernardino Counties, the eastern desert portion of Kern County, and the northeastern desert portion of Riverside County (**Figure 3-41**). The Mojave Desert Air Quality Management District (MDAQMD) is the regulatory jurisdiction for the area of the MDAB where GDSCC is located. Air districts have primary responsibility to control air pollution from all sources other than motor vehicles. The MDAQMD develops and adopts an Air Quality Management Plan to bring their district into compliance with applicable Federal and state clean air standards. Rules are adopted to reduce emissions from various sources, including specific types of equipment, industrial processes, paints and solvents, even consumer products. Permits are issued to many businesses and industries to ensure compliance with air quality rules.

Air quality conditions in the MDAQMD and surrounding GDSCC area is typical of open desert. No major sources of air pollutants, such as large industrial power or refining plants are located in this part of San Bernardino County. Air pollution from the Los Angeles Basin and particulate matter from desert windstorms dominate air quality at GDSCC. Pollutant transportation patterns and measurable pollutant concentrations in the MDAB are affected by a complex interrelationship between meteorological conditions and the local/ regional topography. Although some winds come from the Los Angeles Basin via the canyons, most are a result of the orographic effect and desert heat low-pressure systems.

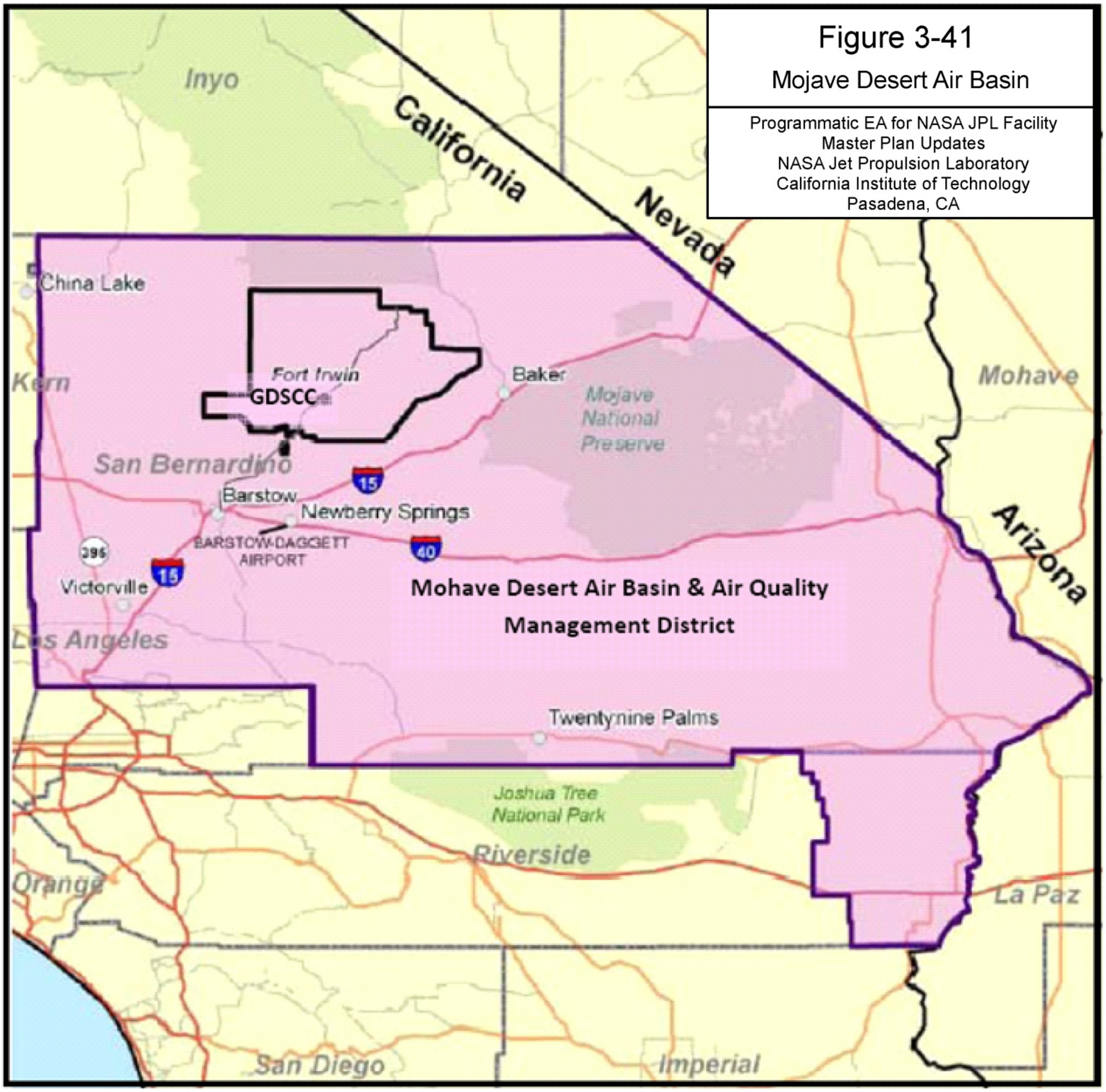
Prevailing winds in the MDAB are out of the west and southwest. These winds are due to the proximity of the MDAB to coastal and central climatic regions, and the blocking nature of the Sierra Nevada Mountains to the north: air masses pushed onshore in Southern California by differential heating are channeled through the MDAB. The MDAB is separated from the southern California coastal and central California Valley regions by high mountain ranges (San Gabriel, San Bernardino, and San Jacinto), with highest elevations at 3,048 m (10,000 ft) amsl, forming a physical and climatological barrier between the MDAB and SOCAB.

The gaps that occur along this meteorological barrier are instrumental in allowing air pollutant transport from the heavily urbanized SOCAB into the MDAB. The most important gaps are the Cajon Pass between the San Bernardino and San Gabriel Mountains, the San Gorgonio pass between the San Jacinto and San Bernardino Mountains, and Soledad Pass in the San Gabriel Mountains, through which pollutants from the heavily developed south coast area are transported. Other pollutants are transported over mountains by convective chimney effects.

The MDAQMD monitors air quality at 16 stations in the MDAB. The nearest stations to GDSCC are the Barstow Monitoring Station, 35 mi to the south, and the Trona Monitoring Station, 45 mi to the northwest. Portions of the district, commonly referred to as ‘sub-areas’, are in nonattainment for a variety of pollutants, meaning that the air quality measurements in the region exceed either the national or California ambient air quality standards. Some of these designations have an associated classification, which indicates how sever the exceedances are.

The southern portion of San Bernardino County is in nonattainment with current Federal 8-hour ozone standard. This region is included within the Los Angeles–San Bernardino Counties (West Mojave), CA area which is classified as a moderate nonattainment area. The remainder of San Bernardino County under MDAQMD jurisdiction is unclassified/attainment zone for ozone. The entire MQAQMD is in nonattainment for the state ozone standard, which is more stringent than the Federal standard.

Figure 3-41. Mojave Desert Air Basin



Most of the district is in nonattainment with the Federal PM_{10} standard. The San Bernardino County CA nonattainment area is classified as a moderate nonattainment area since 2007. The nonattainment area consists of San Bernardino County, excluding that portion located in the Searles Valley Planning Area, and excluding that area in the SOCAB. The entire MDAQMD is in nonattainment for the state PM_{10} standard, which is more stringent that the Federal standard. The MDAQMD is in attainment with the Federal NAAQS for the other criteria air pollutants including CO, NO_2, SO_2, $PM_{2.5}$ and Pb. The MDAQMD is in attainment with the CAAQS for the criteria pollutants of CO, NO_2, SO_2, and Pb. However, the southern portion of San Bernardino County, defined by the same boundaries as the Federal ozone nonattainment area is also in nonattainment for the state $PM_{2.5}$ standard.

Table 3-32 depicts the State of California and Federal designations for attainment status in the MDAB air quality control region as of March 2010. With regards to General Conformity regulations, GDSCC is in nonattainment with the NAAQS for PM_{10}, and although GDSCC does not lie within the Western Mojave Desert Ozone nonattainment area, the neighboring communities of Barstow, Victorville, and Apple Valley are located within this area. Therefore, air quality analysis needs to consider non-point or mobile sources of pollutant emissions associated with commuter traffic between these locations and GDSCC, as this has the potential to affect air quality in the adjacent nonattainment area (AC Martin, 2011).

3.3.6.4 Air Pollution Sources, Controls, and Reporting Requirements

GDSCC is required to comply with appropriate MDAQMD regulations, and therefore must hold permits for all applicable equipment, operations and activities producing pollutants. The type of air emission sources that usually require MDAQMD permits to operate (Rule 201 and Rule 203) include boilers, internal combustion engines, emergency generators, painting operations, degreasers, fuel storage tanks, dispensers, and various other research and development processes. Various types of these sources currently operate under permit at GDSCC.

Emissions sources contributing to this classification include such emissions units as boilers, diesel engine-driven generators, fuel tanks and additional miscellaneous equipment. The emission sources at GDSCC were identified through a review of MDAQMD permits held by GDSCC and review of the criteria air pollution inventory reports on file at the MDAQMD office (Ref. Title V, Federal Operation Permit Application dated January 20, 1997). A list of these sources is provided in **Table 3-33**. GDSCC is classified as a major pollution source and requires a Title V permit (a Federal EPA operating permit). The permit is the air pollution control permit system required to implement the Federal Operating Permit Program as required by Title V of the CAA, as amended in 1990.

3.3.6.5 Toxic Release Inventory

GDSCC complies with other reporting requirements such as Section 313 Reporting Requirements under EPCRA and toxic emission inventory reporting under Air Toxics "Hot Spots" Information and Assessment Act AB 2588.

Table 3-32. Comparison of State of California and Federal Attainment Status for Mojave Desert Air Basin

State of CA Designations		Federal Designations	
Ozone	Nonattainment	Ozone (8-hr)	Southeast Desert Modified is 'Nonattainment' (Antelope Valley & Western Mojave Desert); remainder of MDAB is Unclassified/Attainment'
$PM_{2.5}$	Nonattainment	$PM_{2.5}$	Unclassified/Attainment
PM_{10}	Nonattainment	PM_{10}	Nonattainment
CO	Attainment	CO	Unclassified/Attainment
NOx	Attainment	NOx	Unclassified/Attainment
SO_2	Attainment	SO_2	Unclassified
Sulfates	Attainment	N/A	N/A
Lead	Attainment	N/A	N/A
Hydrogen Sulfide	Unclassified	N/A	N/A
Visibility Reducing Particles	Unclassified	N/A	N/A

Table 3-33. Inventory of Stationary Emission Sources at GDSCC

Permit Number	ID Number	Equipment Description	Location
B000266	2010	Diesel Engine, Caterpillar Model 398 875 BHP, Drives 600 kW Generator Set #2	Building G-24, Echo Site
B000267	2012	Diesel Engine, Caterpillar Model 398 875 BHP, Drives 600 kW Generator Set #3	Building G-24, Echo Site
B000268	2013	Diesel Engine, Caterpillar Model 398 875 BHP, Drives 600 kW Generator Set #4	Building G-24, Echo Site
B000269	2014	Diesel Engine, Caterpillar Model 398 875 BHP, Drives 600 kW Generator Set #5	Building G-24, Echo Site
B002057	2007	Diesel Engine, Caterpillar Model 398 875 BHP, Drives 600 kW Generator Set #1	Building G-24, Echo Site
B000273	1963	Diesel Engine, Caterpillar Model 398 875 BHP, Drives 600 kW Generator Set #1C	Building G-81, Mars Site
B000274	1964	Diesel Engine, Caterpillar Model 399 1280 BHP, Drives 860 kW Generator Set #2B	Building G-81, Mars Site
B000275	1967	Diesel Engine, Caterpillar Model 399 1280 BHP, Drives 860 kW Generator Set #3B	Building G-81, Mars Site
B000276	1996	Diesel Engine, Caterpillar Model 399 1280 BHP, Drives 860 kW Generator Set #1B	Building G-81, Mars Site
B000277	1997	Diesel Engine, Caterpillar Model 399 1280 BHP, Drives 860 kW Generator Set #4B	Building G-81, Mars Site
B000278	2916	Diesel Engine, Caterpillar Model 389 875 BHP, Drives 600 kW Generator Set #4A	Building G-81, Mars Site
B000279	2918	Diesel Engine, Caterpillar Model 389 875 BHP, Drives 600 kW Generator Set #3A	Building G-81, Mars Site
B000280	2920	Diesel Engine, Caterpillar Model 389 875 BHP, Drives 600 kW Generator Set #1A	Building G-81, Mars Site
B000281	2993	Diesel Engine, Caterpillar Model 398 875 BHP, Drives 600 kW Generator Set #2A	Building G-81, Mars Site
B000272	1961	Diesel Engine, Caterpillar Model 398 875 BHP, Drives 600 kW Generator Set #2C	Building G-81, Mars Site
E003381	1999	Diesel Engine, Cummins Model V6-1551 140 BHP, S/N 8909, Drives Emergency Fire Pump	Building G-212, Apollo Site
E003382	2018	Diesel Engine, Cummins Model 230 DFBE 375 BHP, S/N 8237, Drives 230 kW Generator Set	Echo Site, outside G-24
E004635	2021	Diesel Engine, Palmer Model 100-3P-18 135 BHP, S/N 66D5416 Drives 100 kW Generator Set	Echo Site Portable
E005133	966	Emergency I.C.E. Diesel, 345 BHP, Drives A Generator	Apollo Site
E007893	5830	Emergency I.C.E. Diesel, 166 BHP, Drives 88 kW Generator	Echo Site Portable
T003003	1998	Underground Tanks: 2 at 25,000 gallons each for storage of No. 2 diesel fuel. Tanks are double walled plastic-steel with leak and level detection	Adjacent to Building G-81, Mars Site

Table 3-33. Inventory of Stationary Emission Sources at GDSCC

Permit Number	ID Number	Equipment Description	Location
		and overfill protection.	
T003004	2024	Underground Tanks: 2 at 25,000 gallons each for storage of No. 2 diesel fuel. Tanks are double walled plasti-steel with leak and level detection and overfill protection.	Adjacent to Building G-24, Echo Site
S000283	2019	Paint Spray Booth, comprised of: Spray Booth 25' L x 15' W x 15' H, Binks Model 30-770, with metal air-flow baffles and 5 HP blower motor.	Building G-39, Echo Site
A007644	5054	Sandblasting Unit	Mars Site
N001477	2028	Underground Tanks 2 - 10,000 gallon tanks for storage of gasoline & diesel (non-retail), comprised of 2 gasoline dispensing nozzles and Vapor Recovery Systems. Tanks have electronic leak detection and overfill protection and are double walled. Two pumps, gasoline w/2 nozzles, diesel w/ 1 nozzle	Adjacent to Building G-26
E009241	98985	Fire Pump, I.C.E. Diesel, (JPL 8995) Four-Cylinder Detroit Diesel Model 10447110, S/N, 4A0254393, 117 HP.	Building G-94, Mars Site
E009240	98397	Fire Pump, I.C.E. Diesel, (JPL) Three-Cylinder Detroit Diesel Model 10347012, 3A10226A 99 HP.	Building G-22A, Echo Site
E009239	98986	Fire Pump, I.C.E. Diesel, (JPL 8986) Three-Cylinder Detroit Diesel Model 10347012, S/N 3A0102239, 99 HP.	Building G-64, Venus Site

Notes: BHP = Brake Horse Power; I.C.E. = Internal Combustion Engine, S/N = Serial Number, kW = Kilowatt

3.3.7 Noise and Vibration

This section describes the existing conditions that pertain to the noise and vibration environments in the GDSCC area. Noise sensitive receptors within 16 km (10 mi) of GDSCC include family housing units, a school, a religious facility and a hospital associated with Fort Irwin. Nearby towns with noise sensitive receptors include Harvard, Baker, Yermo, and Barstow. Potential noise and vibration sensitive animals in the region include ground squirrels, desert tortoises, bats, raptors, and bighorn sheep.

3.3.7.1 Noise

A definition of noise, sound level standards, and units of sound level measurement are discussed in detail in Section 3.1.7.1. **Table 3-16** provides a list of typical noise levels. The general principle on which most noise acceptability criteria are based is that a perceptible change in noise is likely to cause annoyance wherever it intrudes upon the existing ambient sound; that is, annoyance depends upon the sound that exists before the introduction of the new sound.

Surrounding Land Uses

The majority of the area surrounding GDSCC is part of the Mojave Desert - mostly dry and rugged with few inhabitants. The closest community, the City of Barstow, is located 56 km (35 mi) southwest of GDSCC. GDSCC is subject to noise generated by off-site sources, primarily related to noise created by military operations from surrounding military installations. Ground-based military training exercises at Fort Irwin produce noise attributed to ground maneuvers by Army tactical vehicles including heavy vehicles and tanks, weapon firing, and transportation of equipment adjacent to and through GDSCC during and after maneuvers.

To identify and address noise concerns, the Army has developed an Environmental Noise Management Plan and the Air Installation Compatible Use Zone (AICUZ) program. Based upon interviews with DSN employees, noise and vibration levels experienced at GDSCC do not appear to affect Goldstone operations (A.C. Martin 2011). Military air operations traffic is associated with aircraft from Nellis Air Force Base near Las Vegas, Nevada; Edwards Air Force Base near Lancaster, California; and nearby China Lake NAWC. The air operations noise is derived from low-level flights, air-to-ground gunnery exercises, helicopter training, and supersonic activities. A supersonic air corridor covers the southern section of Fort Irwin, and sonic booms occasionally affect GDSCC.

The MOU between NASA and Fort Irwin governing the use of the Goldstone permit area establishes a framework for coordinating the use of Goldstone airspace. As part of the MOU related discussions, NASA reviewed and agreed to a proposal by Fort Irwin to create an operational/training aircraft around the- clock over-flight corridor extending from 61 m (200 ft) AGL to 305 m (1,000 ft) AGL across GDSCC. This zone, to be a minimum of 1,000 m (3,281 ft) wide, connects the NTC areas to the east of GDSCC to the new Desert Battlefield Exercise Area to the west and south of Goldstone. The Army also anticipates ‘full spectrum’ military exercises that might affect the roads, noise levels, and the electromagnetic environment of the eastern part of GDSCC.

The primary source of appreciable non-military vehicle noise would be along the heavily-traveled Fort Irwin Road, which serves as the main ingress and egress highway between Barstow and Fort Irwin, and onto which NASA Road, the roadway providing access to GDSCC is located. Other nearby cities includes Hinkly, which is 64 km (40 mi) to the southwest; and Victorville, which is located approximately 97 km (60 mi) to the southwest.

Noise Sources at GDSCC

The GDSCC noise environment is typical of quiet desert locations. GDSCC is sparsely developed and surrounded by restricted airspace, which minimizes interference with communications, and promotes a quiet environment. On-site noise sources include surface traffic, aircraft operations, and activities at each of the antenna sites. GDSCC surface traffic and its associated noise level are relatively low with the extensive use of carpools. Fort Irwin personnel frequently cross GDSCC to gain access to China Lake NAWC.

3.3.7.2 Vibration

Ground borne vibration is the oscillatory motion of the ground about some equilibrium position, and is described in terms of velocity for evaluating impact. Vibration above certain levels can damage buildings, disrupt sensitive operations, and cause discomfort to humans within buildings. **Figure 3-7** illustrates ground borne vibration levels for common sources, and criteria for human and structural response to ground borne vibration. As shown, the range of interest is from 50 to 100 VdB, from imperceptible background vibration to the threshold of damage. Although the threshold of human perception to vibration is 65 VdB, annoyance is not major unless the vibration exceeds 70 VdB. Airborne sound waves can also cause vibrations to structures. Studies have shown sound levels reaching a home or other structure must be greater than 137 dB to cause any damage (JPL 2008).

3.3.8 Geology and Soils

Land resources are described in terms of topography, geology, and seismology.

3.3.8.1 Regulatory Framework

There are no specific Federal regulations addressing geology and soils issues that are not addressed by the more stringent state or local requirements. Section 3.1.8.1 describes state statutes and policies that relate to geology and soils and must be considered by GDSCC during the decision making process for projects that involve soil disturbance or earth moving activities such as grading, excavation, backfilling or the modification of existing structures or construction of new structures.

3.3.8.2 Topography

GDSCC is located in the Mojave Desert province as defined by the California Division of Mines and Geology. This province is a wedge-shaped region located between the Garlock fault zone to the north, the San Andreas Fault zone to the south, and the eastern Mojave shear zone to the east. The province is also bounded by a series of Garlock Fault-formed mountains to the north, the southern Sierra Nevada mountain range to the northwest, and the Transverse ranges to the southwest and south. The province is typified by broad, flat plains with occasional low mountains. GDSCC is situated within one of these low mountain areas. Elevations in the area range from 882 to 1,369 m (2,895 to 4,491 ft) amsl. GDSCC lies within a 181 sq km (70-sq mi) drainage area that includes Goldstone Dry Lake. The lake elevation is 921 m (3,021 ft) amsl. (AC Martin 2011).

3.3.8.3 Geology

Figure 3-42 summarizes the geological composition for GDSCC and the surrounding area, and shows GDSCC located within a naturally occurring bowl-shaped depression area bounded on three sides by geological faults. The Garlock Fault lies to the north, while the Blackwater and Calico Faults lie, respectively, to the west and south. GDSCC is bounded on the east by the Tiefort Mountains. Each antenna site at GDSCC is located on natural alluvial material, ranging in thickness from 4.6 m (15 ft) at the Venus Site to more than 21 m (70 ft) at the Echo Site. The alluvium is derived from surrounding hills.

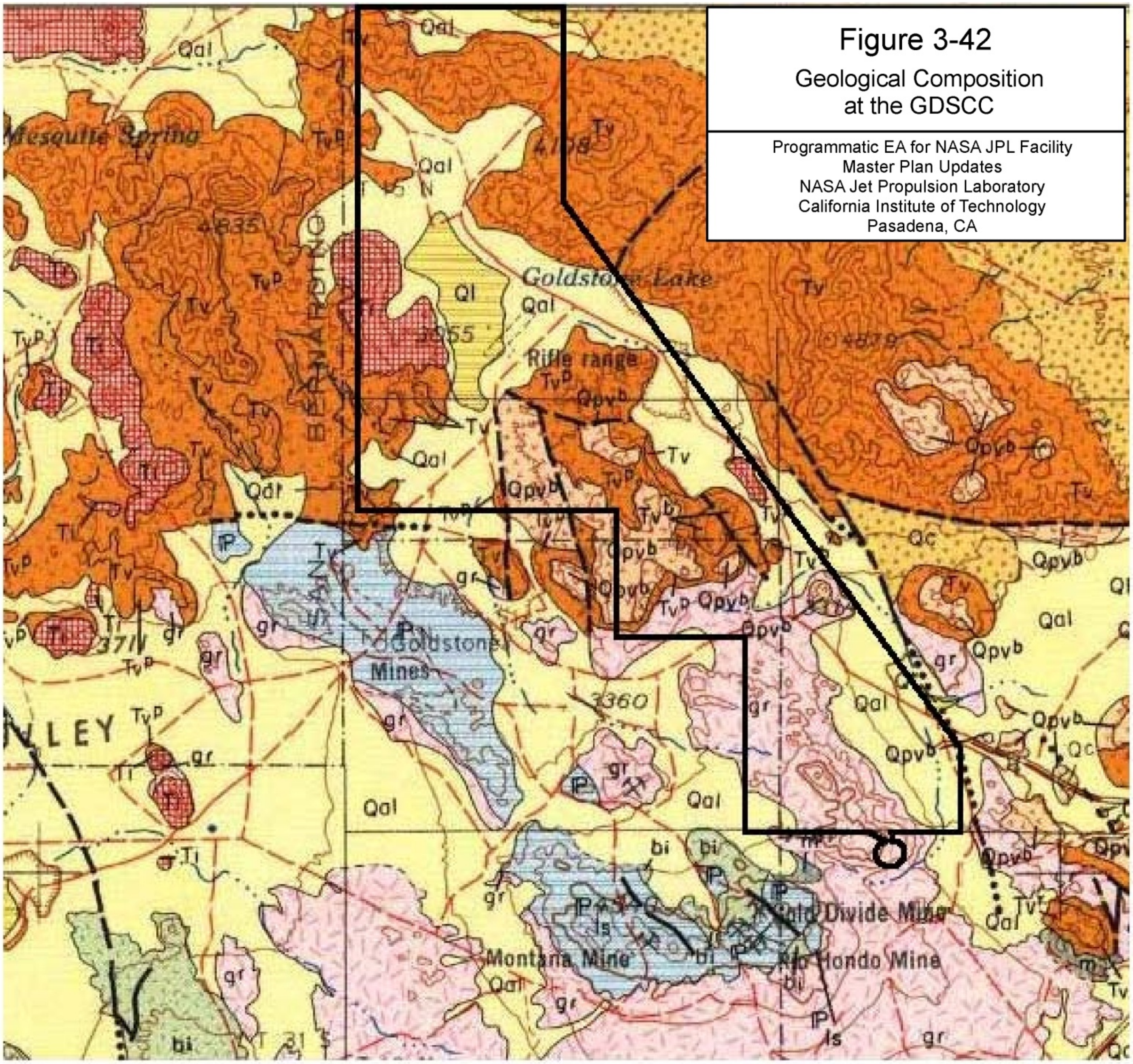
Referring to **Figure 3-42**, the orange colored areas correspond to volcanic basalts and pyroclastic rocks of Tertiary or Pleistocene age. Most of the hills north of Echo Site are of this predominant composition. The hilly areas at GDSCC south of the Echo Site shown in pink color including those around both the Venus and Gemini Sites are composed of granitic rocks of the Mesozoic period. The vast majority of the lower level flatter desert areas that flank Goldstone Road are composed of Quaternary alluvial deposits eroded from surrounding hillsides. The Goldstone Dry Lake area soil and rock formations are composed of Quaternary lake deposits. In Pleistocene times many of the dry lakes of the Mojave Desert were actually large inland lakes.

Soils

Table 3-34 is a stratigraphic sequence of the Mojave Desert Province in the Goldstone area that gives the maximum thickness and a brief lithologic description of each stratigraphic unit. This is a generalized sequence and at any given site some of the units may or may not be present or may or may not be present in the given thickness. The stratigraphic column in **Table 3-34** was constructed from data obtained from Kieffer (1961). Based on soil texture and parent material, the following three soil types predominate GDSCC: (1) silty, sandy gravel derived from granitic rocks; (2) silty gravel derived from decomposing granitic rocks; and (3) very rocky soils derived from older, desiccated alluvial deposits and terrace gravels. The volcanic and granitic soils have medium to low permeability (JPL 2006).

Soils at GDSCC have low to medium surface soil erodibility (US Army and NTC 2008). The specific soil series information identified on **Figure 3-43** was provided by Ft. Irwin and is based upon the Official Soil Series Descriptions defined by the NRCS probably as classified for the Fort Irwin Survey Area, 2000. Precise definitions of soils can be obtained at: https://soilseries.sc.egov.usda. gov/osdlist_show.aspx. Underlying volcanic parent rocks are prevalent on the northern parts of GDSCC. Soils developed around Goldstone Lake and the dry lake west of the Mars Site are generally saline playa soils which experience periodic flooding and drying periods.

Figure 3-42. Geological Composition at the GDSCC



Source: Rogers, T.H., 1967, Geologic Map of California (Scale 1:250,000)

Table 3-34. Generalized Stratigraphic Sequence in the GDSCC Area (after Kieffer, 1961)

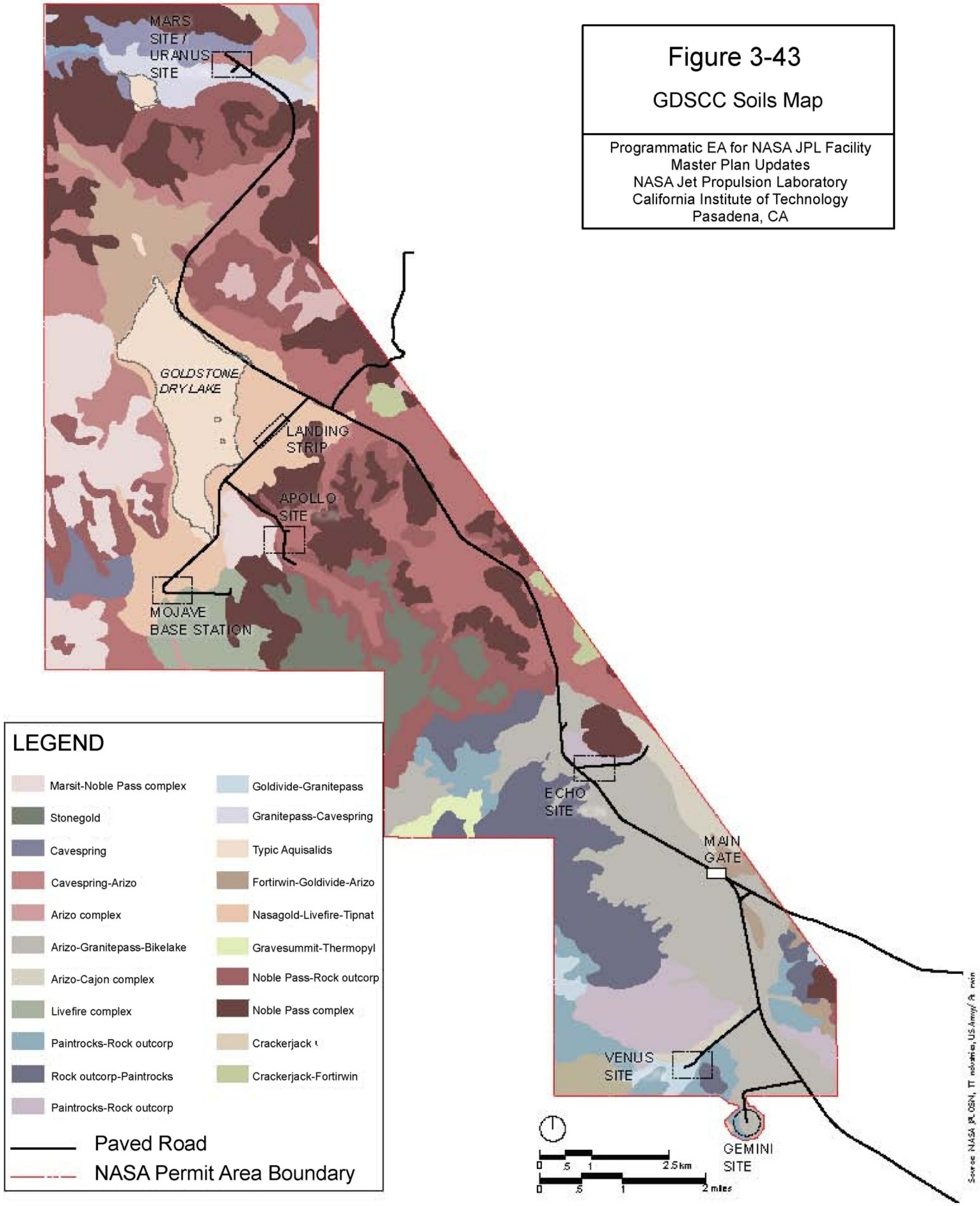
Series	Stratigraphic Unit	Maximum Thickness (m [ft])	Descriptions
Quarternary (Pleistocene) [a]	Gravel Deposit	300+	Comprised of cobbles/boulders of volcanic rocks. Occurs in northern part of area. Alluvial fan deposit has been uplifted and cemented in caliche matrix.
Quarternary (Pleistocene) [a]	Basalt Flow	b	Vesicular olivine basalt. Resistant to erosion. Caps several ridges. Dips gently north. Offset by faults only southeast of the area.
Quarternary to Tertiary	Conglomeratic Sandstone	b	Overlies andesite southeast of Pink Canyon.
Quarternary to Tertiary	Black Glass Dikes	c	General trend N70E. Intrusive andesite flows only. Assumed occurrance near end of andesite extrusion.
Tertiary	Andesite Flows	1000+	Thick sequence of lava flows. Comprised of homblende andesite, and porphyritic plagioclase. Flowed from several volcanic vents. Very resistant.
Tertiary	Andesite Breccia	600+ (with Tuff)	Angular blocks of volcanic rock set in a matrix of volcanic ash. Coarse grained with large clasts resistant to erosion. Common cap rocks.
Tertiary	Andesite Tuff	600+ (with Breccia)	Volcanic ash bedded, soft, and nonresistant to erosion.
Cretaceous	Jack Spring Quartz Monzonite	c	Quartz monzonite pluton that extends over 85 sq mi. Has an orthogonal fracture system, parallel jointing, and is very solid and homogeneous.
Paleozoic	Rustic Formation	b	Limestone and metamorphic rocks derived from fine-grained sediments. Foliated, very hard, and fractured, containing quartz veins with gold and tungsten.
Paleozonic to Precambrian	Granitic Complex	c	Metamorphic and intrusive granite rocks. Schists and gneisses. Highly shattered. Low resistance to erosion.

Notes:
a This unit is apparently of Pleistocene Age; however, its exact age has not been confirmed.
b Thickness was undocumented in available source literature.
c Thickness cannot be determined for this type of rock body.

3.3.8.4 Seismology

The primary fault system on GDSCC trends northwest from the southern boundary of GDSCC to the southern tip of Goldstone Dry Lake. This fault system roughly parallels the San Andreas Fault zone. GDSCC is located in an area that is classified as a Zone 4 seismic risk in the Uniform Building Code. Zone 4 is defined as a zone susceptible to damage corresponding to a Modified Mercalli Scale Intensity VII or greater earthquake. The Mercalli Scale is a scale of earthquake intensity, ranging from I for an earthquake detectable only with instruments to XII for an earthquake resulting in total destruction. Like most of Southern California, GDSCC has experienced moderate seismic activity in the recent past. The 7.5 magnitude Landers earthquake and the 6.5 magnitude Big Bear earthquake both occurred on June 28, 1992. As recently as October 1999, a strong fault moved in the Hector railroad siding area, causing damage and displacement just south of Fort Irwin. (JPL 2006; US Army and NTC 2008).

Figure 3-43. GDSCC Soils Map



Source: Deep Space Network Facilities Master Plan Update 2011-2032, 2011

Updated geologic mapping of areas of the Mojave Desert that include Goldstone were undertaken by the USGS in 1999 and 2000. This mapping is in a draft stage awaiting publication and when available should be consulted as part of any planning activities anticipating major construction at GSDCC. The draft map was discussed with the USGS and it was found to contain many faults that were previously not mapped. Faults located near the Mars, Apollo, and Venus Sites were noted.

3.3.9 Water Resources

This section describe water resources in the vicinity of GDSCC in terms of surface water, groundwater, and water quality standards. Potential water resources at GDSCC include surface water and springs, subsurface water (groundwater), and stormwater. Goldstone Lake is also present at GDSCC, however, is considered a dry lake.

3.3.9.1 Surface Water

There are no perennial surface water bodies at GDSCC. Surface water flow occurs only after intense rainfall periods, with runoff quickly evaporating or infiltrating the dry desert soils. As depicted in **Figure 3-44**, two playas, or dry lakes, are found on the complex (Goldstone Lake and an unnamed lake in the northern portion of the complex near the Mars Site). During heavy rainfall, water occasionally reaches Goldstone Lake, which becomes inundated for short periods. This intermittent water supply is inappropriate for domestic use due to its high levels of suspended and dissolved solids. Their soils usually are alkaline and wildlife use of these areas is restricted due to the high salt content of the playa vegetation.

Most of the buttes and bajadas found on GDSCC are bisected by ephemeral washes that carry runoff from rain. Some storage of moisture occurs in the sandy soil of these washes. This provides an important environment for many insects and annual plant species. These washes, therefore, are an essential part of the desert ecosystem. Ten springs occur at Fort Irwin and within its immediate vicinity. The current status of these springs is not known. Six springs are permanent and four are intermittent, which produce meager to small quantities of water.

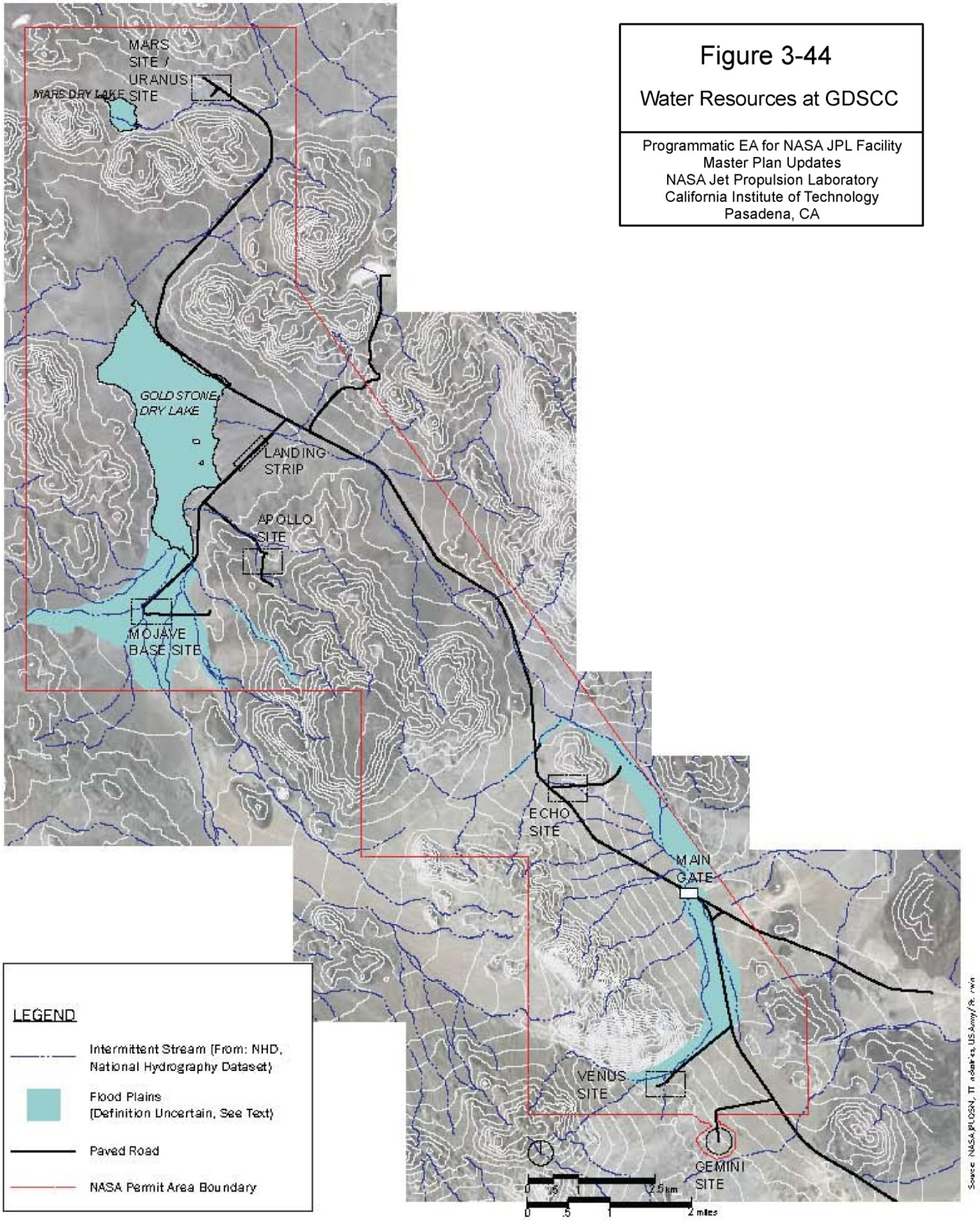
3.3.9.2 Floodplains

A flood plain is a portion of a river valley, adjacent to the channel built of sediments deposited during the present regimen of the stream and is covered with water when the river overflows its banks at flood stages. FEMA has digitally mapped floodplains in the vicinity of Fort Irwin; however, it has not performed a detailed study at GDSCC. The proposed project areas are characterized by FEMA as 'Zone D,' indicating that flood hazards have not been determined, but are possible (www.fema.gov, accessed on 7/27/10). Approximately 90 percent of the land area in the southeast desert of California is classified as Zone D, and no analysis of flood hazards has been conducted.

3.3.9.3 Groundwater

The Mojave River, which is the primary subsurface water source for the region, does not currently supply water to Fort Irwin and is not considered a potential future water source. Five major groundwater basins have been identified in the vicinity of Fort Irwin: Irwin, Bicycle, Langford, Nelson, and Coyote Basins. Within these basins, non water-bearing basement complex rocks underlie and surround the water-bearing sediments. This configuration creates a single, closed groundwater regime within each basin, although intra-basin geologic features, such as faults, may influence individual regimes. Of the five basins, only the Irwin, Bicycle, and Langford Basins are currently being used as water supply sources for Fort Irwin.

Figure 3-44. Water Resources at GDSCC



Source: Deep Space Network Facilities Master Plan Update 2011-2032, 2011

Although the Nelson Basin is being considered as a potential source of water for Fort Irwin, it is relatively distant from the cantonment area and would require high pumping lifts to reach it. The Army has purchased land for water rights in Coyote Basin. This land could be developed as a groundwater resource for the NTC, if required.

The Irwin Groundwater Basin underlies and surrounds the NTC cantonment area. It has a surface area of approximately 19.4 sq km (7.5 sq mi) and ranges in depth to more than 152 m (500 ft). Water saturated sediments are currently present from an approximate elevation of 701 m (2,300 ft) amsl to the total depth of the basin. The most important water basin zone for development is between elevations 701 and 610 m (2,300 and 2,000 ft) amsl, a thickness of 91 m (300 ft). Analyses of water bearing sediments indicate Irwin Basin contains approximately 33,200 ac-ft of recoverable groundwater storage.

The only natural source of recharge for groundwater in the Irwin basin is rainfall. During periods of high precipitation, percolation and infiltration of surface water along intermittent stream courses recharges the basin aquifer. Under normal conditions, percolating water enters the fan and valley floor alluvium and migrates downward to the water table. Upon entering the aquifer, groundwater moves generally toward the lowest point of groundwater elevation. In the Irwin basin, the lowest groundwater elevations occur southeast of the Fort Irwin cantonment area. The natural average annual groundwater recharge to the basin is calculated to be about 500 ac-ft. Water for Fort Irwin currently comes solely from seven groundwater production wells in the Irwin basin (AC Martin 2011). Depth to groundwater at these wells is between 30.5 and 91 m (100 and 300 ft) below the ground surface. The present source of all water used at GDSCC is from the Fort Irwin wells.

The NTC has finalized a Water Master Plan to aid in planning for future water demand at the NTC and provide recommendations for meeting projected water supply needs of the permanent and transient base population. The approved water supply project involves development of three new production wells in Langford Basin to meet the anticipated future water demands of the NTC. The USGS also has recently initiated a comprehensive groundwater study for the NTC that will provide additional information on the quantity and quality of groundwater in the basins used by the NTC. The need for future water development may be delayed by water conservation measures that reduce demand within the GDSCC and Fort Irwin cantonment area.

Groundwater in the Goldstone area is generally confined and is found at depths ranging from 52 m (170 ft) at the north end of Goldstone Dry Lake to approximately 76 m (250 ft) below the Echo Site Solid Waste Landfill. Chemical analysis of the groundwater at the Goldstone Dry Lake well has yielded TDS values in excess of 1,000 ppm, indicating that the groundwater is brackish. Chemical analysis indicates that the water below the Echo Site landfill may have been impacted by an inorganic release and that biodegradation may be occurring in the groundwater. Groundwater quality monitoring is performed semi-annually on the three wells at the Echo Site landfill (Geologic Associates Monitoring Report April 2004). GDSCC currently obtains water from a group of wells located at Fort Irwin, approximately 10 mi to the southeast of the complex.

3.3.9.4 Water Quality Standards

The EPA has delegated to California the responsibility for administering a water pollution program consistent with the requirements of the CWA. The California Porter-Cologne Water Quality Act establishes the SWRCB and the nine CRWQCBs, which are responsible for implementing the water pollution control program including the NPDES program and the implementation of POTW and pretreatment standards. Fort Irwin is under the jurisdiction of the Lahontan RWQCB. Groundwater from active wells in the Irwin basin has a sodium sulfate-bicarbonate or sodium bicarbonate character and a TDS concentration between 400 and 600 milligrams per liter (mg/1) (JPL 2006).

Mineral quality of basin waters is good except for iron and fluoride, which are characteristically higher than allowable for domestic uses. Because of the high fluoride content, water to be used for human consumptive uses such as cooking and drinking, must be processed through an RO treatment system before it is delivered to base housing at Fort Irwin. Because there are no permanent residences at the GDSCC, this treatment is not required. However, water used at the Goldstone cafeteria is processed through a point-of-use RO system. The water from the producing wells is disinfected with chlorine prior to entering the storage and distribution system.

State water quality objectives for the South Lahontan Basin are shown in **Table 3-35**. Federal and state water quality standards (applicable or relevant and appropriate requirements [ARARS]) are presented in **Table 3-36** (JPL 2006).

Table 3-35. State Water Quality Objectives for the South Lahontan Basin

Constituent	Unit	Standard
pH	pH units	6 to 8.5
Dissolved Oxygen Warm Cold	mg/1	 Not to exceed 5.0 mg/1 Not to exceed 7.0 mg/1
Fecal Coliform (Membrane Filter Technique)	Cells/100 ml	Not to exceed one cell per 100 ml (monthly)
Temperature	^{0}F	Shall not be increased by more than 50 ^{0}F above natural receiving water temperature
Oil and Grease		Shall not contain concentrates that result in a visible film or coating on the surface of the water or on objects in the water that cause nuisance or that otherwise adversely affect beneficial uses
Total Suspended Solid	mg/1	500 to 1,500 mg/1

* Source: California Regional Water Quality Control Board, 1998

Notes: mg/l=milligrams per liter; ml=milliliters; ^{0}F=degrees Fahrenheit

Table 3-36. GDSCC Echo Class III Landfill State and Federal ARAR Standards

Compound	California Primary Drinking Water Standards	California Secondary Drinking Water Standards	Federal MCLs
Inorganic Compounds (mg/l)			
Aluminum	1.0		
Antimony	0.0006		0.0006
Arsenic	0.05		0.5
Asbestos (fibers > 10 um in length/liter)	7,000,000		7,000,000
Barium	1.0		2.0
Beryllium	1.0		2.0
Cadmium	0.005		0.005
Chloride		250 to 500	

Table 3-36. GDSCC Echo Class III Landfill State and Federal ARAR Standards

Compound	California Primary Drinking Water Standards	California Secondary Drinking Water Standards	Federal MCLs
Chromium	0.05		0.1
Color		15 units	
Copper		1	1.3
Corrosivity		Non-Corrosive	
Cyanide (as CN)	0.2		0.2
Fluoride (allowable concentration is temperature dependent)	14. to 2.4		4.0
Foaming Agents (Methylene Blue Active Substances)		0.05	
Iron		0.3	
Lead			0.015
Manganese		0.05	
Mercury	0.002		0.002
Nickel	0.1		0.1
Nitrate (as Nitrogen)	10		10
Odor - Threshold		3 units	
Total Nitrate and Nitrite (as Nitrogen)	10		10
Selenium	0.05		0.05
Silver	0.05	0.1	0.05
Specific Conductance		900 to 1600	
Sulfate		250 to 500	
Thallium	0.002		0.002
Total Dissolved Solids		500 to 1000	
Turbidity (NTUs)		5 NTUs	
Zinc		5.0	
Volatile Organic Compounds (ug/L)			
1,1,1 – Trichloroethane	200		200
1,1,2,2 – Tetrachlorethane	1.0		
1,1,2 – Trichloro 1,2,2 - Trifluoroethane (Freon 113)	1200		
1,1,2 – Trichloroethane	5.0		5.0
1,1 – Dichloroethane	5.0		
1,1 - Dichloroethene	6.0		7.0

Table 3-36. GDSCC Echo Class III Landfill State and Federal ARAR Standards

Compound	California Primary Drinking Water Standards	California Secondary Drinking Water Standards	Federal MCLs
1,2,4 - Trichlorobenzene	70		70
1,2 - Dichlorobenzene	600		600
1,2 – Dichloroethane	0.5		0.5
1,4 - Dichlorobenzene	5.0		75
Benzene	1.0		5.0
Bromodichloromethane			100
Bromoform			100
Carbon Tetrachloride	0.5		5.0
Chlordane	0.1		2.0
Chlorobenzene	70		100
Chloroform	100		100
Cis - 1,2 - Dichloroethene	6.0		70
Ethylbenzene	700		700
Styrene	100		100
Tetracholorethene	5.0		5.0
Toluene	150		1,000
Total Trihalomethanes	100		100
Trans - 1,2 – Dichloroethene	10		100
Trichloroethene	5.0		5.0
Vinyl Chloride	0.5		2.0
Xylenese (MCL for single isomer or sum of isomers)	1,750		10,000
Semi-Volatile Organic Compounds (ug/L)			
Bis (2-ethylhexyl) phthalate	4.0		6.0

Notes: ARAR= applicable or relevant and appropriate requirements; MCL=maximum contaminant level; mg/l=milligrams per liter; ml=milliliters; um=micrometers; NTUs=Nephelometric Turbidity Units; ug/L=micrograms per liter

3.3.9.5 Storm Water Management

GDSCC does not have a multi-sector General Construction Stormwater Permit. Since GDSCC is located in a remote desert environment where stormwater flow occurs only after intense rainfall periods, stormwater is typically managed through use of topographical characteristics at each station because run-off quickly evaporates or infiltrates into the dry desert soils (JPL 2006). Stormwater is discussed in further detail in Section 3.3.5.8 Storm Water Collection.

3.3.10 Biological Resources

This section includes a discussion of GDSCC and local vegetation, wetlands, and wildlife. Recognizing that the Fort Irwin NTC is ultimately responsible for the long-term stewardship of natural resources at GDSCC, NASA and the NTC entered into an MOU in 2011 to ensure all natural resources issues at GDSCC would be addressed cooperatively by the two parties. Natural resources are managed by Fort Irwin NTC through its Integrated Natural Resources Management Plan (INRMP), and related NASA planning documents generated by GDSCC would be incorporated into the INRMP (Department of the Army, 2011).

3.3.10.1 Inventory and Survey

Two biological resource areas have been identified at GDSCC (Circle Mountain 2003), including 20.7 sq km (8 sq mi) of desert tortoise critical habitat in portions of the Echo Site and Mojave Site; and undeveloped areas that are not associated with existing buildings or established utility corridors. Five plant, three reptile, 17 bird, and six mammal species have been reported from the GDSCC area that are considered rare by the USFWS and CDFG. Of these species, only the desert tortoise and Lane Mountain Milk-Vetch are federally listed or proposed for listing. These two species are described in Section 3.3.11.

Habitat designations are according to the classification system of Numz and Keck (1959) and Barbour and Major (1977). The floral taxonomy used follows the flora of M. DeDecker (1984) and the current checklist of Kartesz and Kartesz (1980). Common plant names, where not available from Munz (1974), are taken from Abrams (1923), Robbins, et al. (1951), Niehaus and Ripper (1976), and Jaeger (1941). Vertebrates identified in the field by sight, calls, tracks, scat, or other signs are cited according to the nomenclature of Jennings (1983) for reptiles; the American Ornithologists, Union (1983) for birds; and Jones, et al. (1982) for mammals.

3.3.10.2 Vegetation

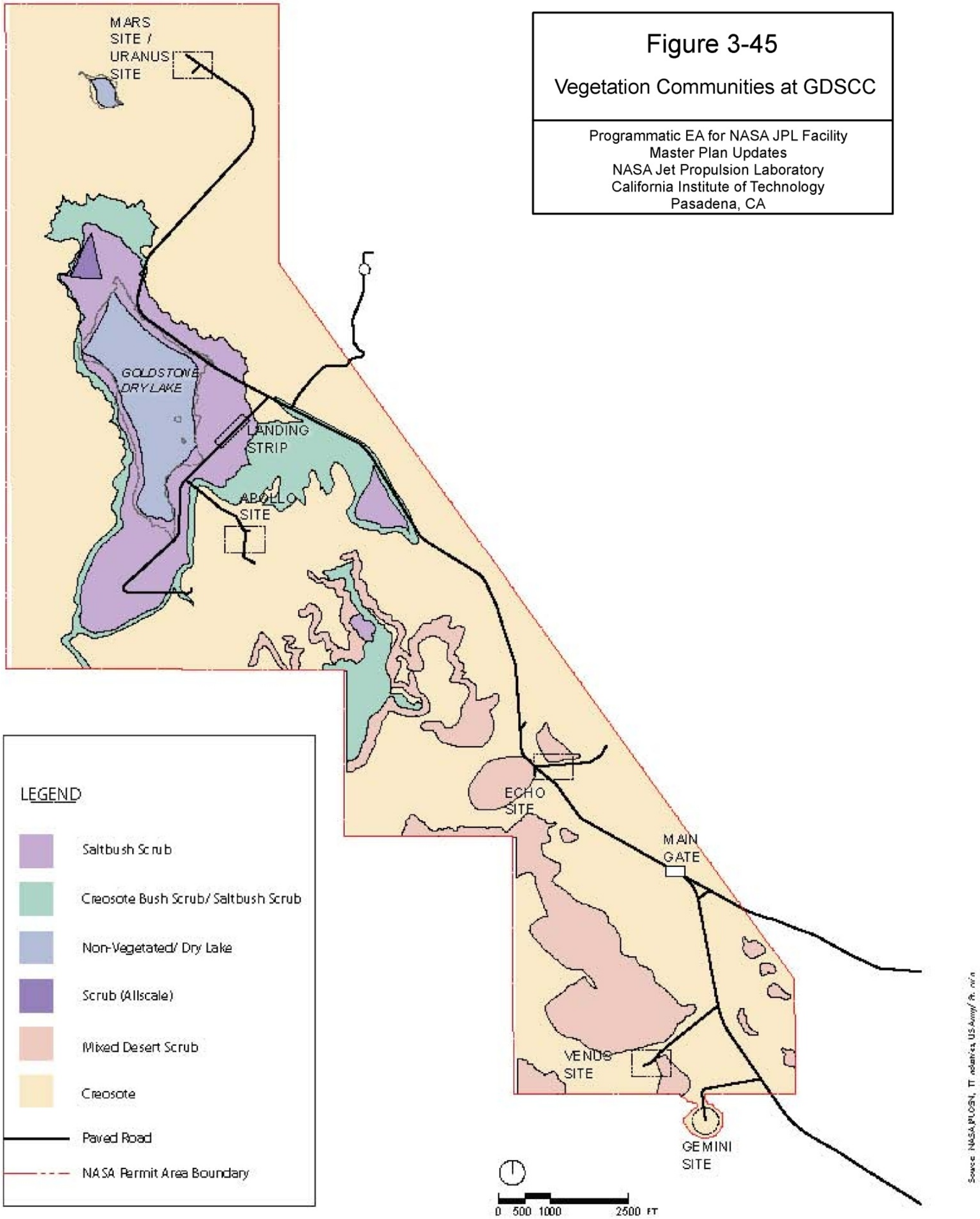
Primary plant associations at GDSCC include creosote scrub, saltbush scrub, shadscale scrub, blackbush scrub, and desert woodland. Vegetation communities are depicted in **Figure 3-45**.

Creosote Scrub Brush

The creosote bush scrub found on the complex represents the dominant plant community throughout the Mojave Desert. The community is commonly found on the flats, bajadas (alluvial plains formed at the base of a mountain by the coming together of several alluvial fans), steeper slopes, and hilltops below an elevation of 1,219 m (4,000 ft). The dominant plant species of the creosote bush scrub are creosote bush (*Larrea tridentata*) (**Figure 3-46**) and burro-weed (*Ambrosia dumosa*). Hop-sage (*Gravia spinosa*) and goldenhead (*Acamptopappus sphaerocephalus*) are examples of other common creosote bush scrub species. The visual aspect of this community is one of widely and uniformly spaced creosote bush shrubs with interspersed low, sparse ground cover. Plant cover is commonly as low as 10 to 20 percent of the area.

Although the creosote bush scrub seems uniform, there may be local differences in species composition. Diversity increases with topographical diversity and is strongly affected by substrate. In sandy washes or rocky soil, which are relatively common at GDSCC, the creosote brush scrub is present but not dominant. In the sandy washes, Anderson thornbush (*Lycium andersonii*), bladder sage (*Salazaria mexicana*), senna (*Cassia armata*) and cheesebush (*Hymenoclea salsola*) are common. The rocky hillside association supports species such as desert trumpet (*Eriogonum inflatum*), winterfat (*Eurotia lanata*) and desert holly (*Atriplex hymenelytra*).

Figure 3-45. Vegetation Communities at GDSCC



Source: Deep Space Network Facilities Master Plan Update 2011-2032, 2011

Figure 3-46. Creosote Bush (*Larrea tridentata*)

Source: Deep Space Network Facilities Master Plan Update 2011-2032, 2011

Large areas where the dominant ground cover consists of introduced annual grasses such as abu-mashi (*Schismus arabicus*) red brome (*Bromus rubens*), and annual forbs, such as red-stemmed filaree (*Erodium cicutarium*) are also common within the creosote bush scrub community. These areas may support diverse displays of annual wildflowers, such as cryptantha (*Cryptantha spp*.), pebble pincushion (*Chaenactis carphoclina*), brown-eyed evening primrose (*Camissonia claviformis*), desert dandelion (*Malacothrix glabrata*), gilia (*Gilia spp*.) and desert aster (*Machaeranthera tortifolia*). Joshua trees (*Yucca brevifolia*) are an infrequent component of the creosote bush scrub community in the southern portion of GDSCC.

Saltbush Scrub

The saltbush scrub community, or alkali sink community, is found on poorly drained alkaline flats and playas (dry lake beds) throughout the Mojave Desert region. On the GDSCC, saltbush scrub is found around Goldstone Lake and an unnamed dry lake at the northern end of the complex. Typical species of the saltbush scrub community include plants that are very tolerant of high salt (concentrations, such as saltbush (*Atriplex canescens*) and salt grass (*Distichlis spicata*). Further from the edges of the playa, where the soil is less alkaline, shrub species such as desert holly (*Atriplex hymenelytra*) grade into the creosote bush scrub community.

The CNDDB four plant species not observed during previous surveys that have the potential to inhabit the GDSCC area based on local landscape : Parish's rupertia (*Rupertia rigida),* San Gabriel oak (*Quercus durata var.gabrielensis),* Fragrant pitcher sage (*Lepechinia fragrans), and* Western spleenwort (*Asplenium vespertinum).*

3.3.10.3 Wetlands

The USFWS classifies an area as wetlands if the area has a least one of these attributes: (1) at least periodically, the land supports hydrophytes, (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is non-soil and is saturated with water cover or covered by shallow water at some time during the growing season of each year. The definition includes springs, seeps, and portions of lakes, ponds, rivers, and streams.

There are no permanent sources of water at GDSCC in the form of seeps, springs, streams, or lakes. Most of the buttes and bajadas found on the complex, however, are bisected by ephemeral washes that carry runoff from rain. Some storage of moisture occurs in the sandy soil of these washes. This provides an important mesic environment for many insects and annual plant species. These washes are essential part of the desert ecosystem.

The USFWS has developed a National Wetlands Inventory (NWI) which has mapped wetlands throughout the U.S., including the Goldstone Valley and surrounding valleys in Fort Irwin. Two playas, or dry lakes, also are found on the complex (Goldstone Lake and an unnamed lake in the northern portion of the complex near the Mars Site). These playas catch and hold both rainfall and runoff and may remain visibly damp for several weeks after a storm. Their soils usually are alkaline and wildlife use of these areas is somewhat restricted due to the high salt content of the playa vegetation.

According to the USFWS NWI, wetlands are present at Fort Irwin (JPL 2006), with the majority of wetlands of two main types: 'lacustrine', which are lakes, and 'palustrine', which are ponds. These areas are either intermittent flooded or saturated. The USACE defines wetlands as "those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for like in saturated soil conditions (33 CFR 328.3(b); 40 CFR 230.39(t)). The Fort Irwin Real Property Master Plan Update (2008) identified a few minor wetlands existing on GDSCC as listed on the NWI. Three of these small areas appear to be associated with Goldstone Dry Lake. Two others are immediately adjacent to Goldstone Road. Review of the NWI within the Fort Irwin and GDSCC boundaries do not indicate any wetlands requiring permits under USACE jurisdiction.

3.3.10.4 Wildlife

GDSCC supports a variety of wildlife, including reptiles, birds, and mammals. Based upon field observation and literature search, the wildlife expected to occur in the habitats of the GDSCC is described below. With a few noted exceptions, these species are common throughout the Mojave Desert.

Amphibians and Reptiles

Because of the absence of surface water at GDSCC, no amphibians are expected. Several varieties of reptiles present in both the creosote bush and saltbush scrub, are expected to occur at the GDSCC. Common lizards including the western whiptail (*Cnemiodophorus tigris*), zebra-tailed lizard (*Callisaurus draconoides*) and side-blotched lizard (*uta stansburiana*) were observed during field surveys. Other reptile species expected to occur with some frequency throughout the creosote bush scrub community are desert iguana (*Dipsosaurus dorsalis*), desert horned lizard (*Phrynosoma platvrhinos*), common leopard lizard (*Gambelia wislizenii*), coachwhip (*Masticophis flagellum*) and sidewinder (*Crotalus cerastes*).

The desert tortoise (*Gopherus agassizi*) is a Federal and state-listed (threatened) reptile species, which is known to occur on the GDSCC. The entire GDSCC complex provides habitat for the species, and a portion of the site provides critical habitat, the Superior-Cronese Critical Habitat Unit, which is located on a small southern portion of the site (US Army and NTC, 2008).

Birds

A number of bird species are expected to breed in the creosote bush scrub community found at the GDSCC. These include the black-throated sparrow (*Amphispiza bilineata*), Say's phoebe (*Savornis sava*), Le Conte's thrasher (*Toxostoma lecontei*), mourning dove (*zenaida macroura*), loggerhead shrike (*Lanius ludovicianus*), and horned lark (*Eremo-phila alpestris*).

Four species of raptors may breed or forage on or in the vicinity of the GDSCC. Common barn owls (*Tvto alba*) nest in crevices and caves, that are found on several buttes within the complex. Red-tailed hawks (*Buteo jamaicensis*) may breed locally, although they are more frequently observed in this region during the winter. A prairie falcon pair (*Falco mexicanus*) was observed nesting in a cliff area on the northwestern edge of the complex during a survey. This species is an uncommon breeding resident of the GDSCC. The golden eagle (*Acfuila chrysaetos*) may also breed in the area, but generally does not forage over the low desert, preferring higher ground with more topographic relief. These species have been recorded in the Goldstone area (Griffith).

Mammals

Small mammals, primarily nocturnal, are common in the Mojave Desert. The long-tailed pocket mouse (*Perocrnathus formosa*), canyon mouse (*Peromyscus crinitus*) and desert wood rat (*Neotoma levida*) are found in rocky terrain. The little pocket mouse (*Perognathus longimembrus*) is common in washes. Merriam's kangaroo rat (*Dipodomys merriami*) is likely the most abundant and widespread small mammal within GDSCC. The black-tailed jack rabbit (*Lepus californicus*) and desert cottontail (*Sylvilagus audubonii*) are also common.

The Mojave ground squirrel (*Spermophilus mohavensis*) a diurnal state-listed (threatened) species, is present on GDSCC. A population was monitored at the Mojave base station (JPL 2006). In 2010, the USFWS initiated status review for the Mojave Ground Squirrel, and as of January 2011 is conducting further review to determine if the species should be listed as endangered. If the endangered status is confirmed, the USFWS will make a determination on suitable critical habitat, which could affect areas of GDSCC and Fort Irwin (USFWS, 2010). Predators expected in the area include the coyote (*Canis latrans*), kit fox (*Vulpes macrotis*), ringtail (*Bassariscus astutus*) and bobcat (*Felis rufus*), and feral burro. The CNDDB lists two animal species not observed during previous surveys that have the potential to inhabit the GDSCC area based on local landscape: the burrowing owl (*Athene cunicularia*) and the silver-haired bat (*Lasionycteris noctivagans*).

3.3.11 Threatened, Endangered, and Other Sensitive Species

Only species considered sensitive at GDSCC or in the complex's vicinity are included in this discussion. These species have been given special recognition by Federal, state, or local resource conservation agencies and organizations due to declining, limited or threatened populations. The CDFG issued a *Programmatic Biological Opinion (CDFG,* 1998*)* to NASA in 1998 that (a) provides for the protection of sensitive biological resources at the GDSCC; (b) avoids the need to consult on a project-by-project basis; and (c) implements terms and conditions and identify responsible parties to ensure that future construction projects at the GDSCC are in compliance with the Endangered Species Act (CMBC 2003). The Biological Opinion states:

> *"It is the opinion of the Service that the proposed actions are not likely to jeopardize the continued existence of the desert tortoise or the Lane Mountain milkvetch, or to adversely modify critical habitat of the desert tortoise. Critical habitat has not been proposed for the Lane Mountain milkvetch."*

3.3.11.1 Vegetation

A number of sensitive plant species are found in the vicinity of the GDSCC (**Table 3-37**). However, many of these species are found in habitats that are not present at the GDSCC. The Lane Mountain Milk-vetch is the only Federal or state listed threatened or endangered species at GDSCC. Plant surveys were conducted for Lane Mountain Milk-vetch in 1992. The entire known existing and historic range of the species (Chambers Group, Inc., 1994) is in the Lane Mountain and Goldstone areas (**Figure 3-47**).

Table 3-37. Sensitive Plant Species that May Occur at the GDSCC

Species	Status		Habitat
	USFWS	CNPS	
Small-flowered Androstephium (*Androstephium breviflorum*)		2	Gravelly to rocky soils below 7,000 feet
Jaeger's Locoweed, Lane Mountain Milk-Vetch (*Astragalus jaegerianus*)	C2	1B	Sandy to gravelly soils below 4,000 feet elevation
Mojave spiny herb (*Chorizanthe spinosa*)	C2	4	Sandy to gravelly soils below 4,000 feet elevation
Desert cymopterus (*Cymopterus deserticolus*)	C2	1B	Sandy to gravelly soils below 4,000 feet elevation
Panamint dudleya (*Dudleya saxosa ssp. Saxosa*)	C2	4	Rocky, steep slopes
Mojave eriophyllum (*Eriophyllum mohavense*)	C2	1B	Sandy to gravelly soils below 4,000 feet elevation
Sand linanthus *(Linanthus areniclola*)	C3	2	Deep, sandy soils
Mojave indigo bush * *(Psorothamus arborescens*, *var. arborescens Dalea a*)	C3	4	Deep, sandy soils
Mojave fish hook cactus (*Sclerocatus polyancistrus*)	C2	4	Rocky soil

Listing Agencies:

USFWS - U.S. Fish and Wildlife Service; CNPS - California Native Plant Society

2 Rare and endangered in California, but more common elsewhere

* Located during a May 1987 MBGA survey

C2 Federal Category 2 candidate: decline of the species is suspected. Insufficient data exists, however, to support a proposed listing.

1B Rare and endangered in California and elsewhere

4 Species has limited distribution

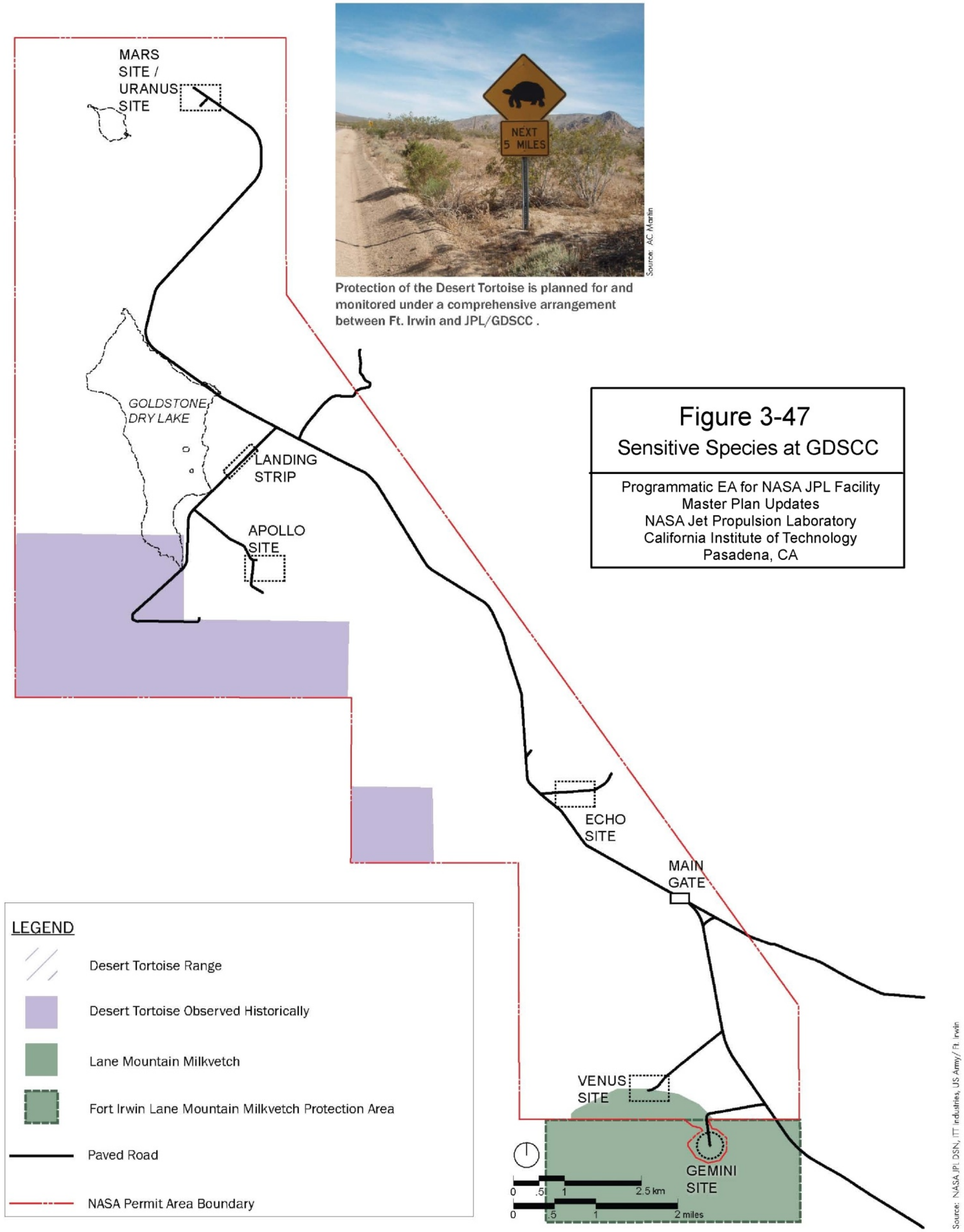
C3 Species is too widespread to warrant listing and/or species is not threatened

It is a perennial herb with thin, relatively weak stems that become woody during the growing season. Plants are usually found growing through and within small desert shrubs. Flowers are lavender-rose fading to dull yellowish-white (Charis study). It blooms in the spring, from April to May. The Lane Mountain Milk-vetch was federally listed as endangered on October 6, 1998. However, according to the Weekly Federal Register Summary – Report for NASA dated April 3, 2005:

> *"FWS will not designate any critical habitat for the Lane Mountain Milk-Vetch. FWS had identified 29,522 acres of habitat essential in their April 6, 2004 rule. The statutory exemption for DOD lands covered by an approved Integrated Natural Resources Management Plan (INRMP) (section 4(a)(3)(B) of the Act) was not applicable to Fort Irwin lands, because Fort Irwin's INRMP was still in draft form. However, all DOD lands at Fort Irwin were excluded under Section 4(b) (2) for national security."*

NASA commented that individual milk-vetch plants, in GDSCC's Venus Site, do not significantly contribute to the overall milk-vetch populations, and should not be considered in the critical habitat designation. USFWS excluded this area under 4(b) (2) for national security, because NASA's area is within Ft. Irwin. This rule is effective June 7, 2005."

Figure 3-47. Sensitive Species at GDSCC



Source: Deep Space Network Facilities Master Plan Update 2011-2032, 2011

3.3.11.2 Wildlife

A number of sensitive animal species are found in the vicinity of GDSCC. Many of these species however, also are found in habitats that are not present at GDSCC (e.g., Mojave chub species or desert bighorn sheep). Migratory bird species that are considered sensitive or endangered (bald eagle) occur only rarely as strays in the Mojave Desert. Others, especially birds on the National Audubon Society's (NAS) Blue List (JPL 2006, American kestrel and loggerhead shrike) are considered sensitive due to declining populations in other parts of their range. Five species of vertebrates designated as rare, threatened, or endangered by USFWS, CDFG, BLM, or NAS have been found in appropriate habitats on or in the vicinity of GDSCC (**Table 3-38**).

Table 3-38. Sensitive Wildlife Species Located on or in the Vicinity of GDSCC

Species	Status				Habitat
	USFWS	CDFG	BLM	NAS	
Desert Tortoise (*Gopherus agassizi*)	T	T	S		Creosote bush scrub
Golden Eagle (*Aquila chrysaetos*)		SC3	PS		Nests in cliffs, forages over creosote bush scrub
Prairie Falcon ** (*Falco mexicanus*)		C3			Nests in cliffs, forages over creosote bush scrub
Burrowing Owl (*Athena cuniclaria*)		SC2		2	Nests in banks of washes
Mojave Ground Squirrel (*Spermophilus mohavensis*)		T			Creosote bush scrub

Listing Agencies:
FWS - U.S. Fish and Wildlife Service; CDFG - California Department of Fish and Game; BLM - Bureau of Land Management; NAS - National Audubon Society
** This species was located during a MBGA survey
C1 Federal Category 1 candidate: sufficient data exists to propose this species for listing as threatened or endangered.
S BLM considers species to be sensitive, due to small population size, limited distribution, or threat from human activity.
SC3 State Species of Concern, List 3: the species is not in immediate danger of extirpation. Small population sizes, however, warrant observation.
PS BLM proposed sensitive species, pending accumulation of sufficient data to support concern.
SC2 State Species of Concern, List 2: the species warrants active monitoring due to population decline.
2 NAS Second Priority Species: special concern due to observed decline in population.
T Listed as threatened

The Mojave Ground Squirrel is a state-listed (threatened) species that is present on GDSCC. On April 27, 2010, the USFWS published notice of a 90-day petition finding and initiation of status review for the species (USFWS 2010). With the publication of this notice in the Federal Register, the USFWS found that the petition for listing presented substantial scientific or commercial information indicating that listing the species may be warranted and that the USFWS is conducting further review to determine if the species should be listed as endangered. If it is determined that the Mojave Ground Squirrel should be listed, the USFWS will also make a determination on critical habitat for the species (USFWS 2010).

The desert tortoise (**Figure 3-48**), a Federal and state-listed threatened reptile species, has been reported to occur at GDSCC (JPL 2006). Although not observed during the present survey, the desert tortoise is expected to occur at the GDSCC because the complex represents a suitable, undisturbed habitat within the known range for the species. On June 22, 1989, the California Fish and Game Commission listed the species as threatened under the California Endangered Species Act, and the USFWS emergency-listed the desert tortoise as endangered on August 4, 1989.

Figure 3-48. Desert Tortoise (*Gopherus agassizii*)

Source: Deep Space Network Facilities Master Plan Update 2011-2032, 2011

In 1994, the USFWS designated critical habitat for the Mojave population of desert tortoise, encompassing approximately 2.6 million ha (6.5 million ac). A total of 20.7 sq km (8 sq mi) (sections 5 through 10, and sections 23 and 24 int. 14N, R.I.E.) of the critical habitat are on the GDSCC south of Goldstone Lake at the Mojave Base Station and surrounding area (**Figure 3-48**). Concern that an upper respiratory disease was responsible for the decline and could be epidemic further prompted the final rule listing the desert tortoise as Threatened for the identified habitat. Loss and degradation of habitat, as well as excessive predation and illegal collections, are major threats to the continued existence of the tortoise. Drought is a contributing factor to the recent declines in tortoise populations. The Mojave Desert has been experiencing frequent droughts in the last 14 years.

3.3.12 Cultural Resources

This section includes a discussion of GDSCC and local archaeological resources, historic development, and cultural facilities. A definition of historic properties and NHPA requirements and implementing regulations are discussed in Section 3.1.12. Recognizing that Fort Irwin NTC is responsible for the long-term stewardship of cultural resources at GDSCC, NASA and the NTC entered into an MOU in 2011 to ensure all cultural resources issues at GDSCC would be addressed cooperatively by the two parties. Cultural resources are managed by NTC through its Integrated Cultural Resources Management Plan (ICRMP), and related NASA planning documents generated by GDSCC would be incorporated into the ICRMP (U.S. Army, 2011).

In 2005, in conjunction with Fort Irwin's Land Expansion EIS, a Programmatic Agreement (PA) with the California SHPO and the Advisory Council on Historic Preservation was signed that supersedes an earlier MOA from 1981 and amended in 1983. The 2005 PA sets forth specific procedures for cultural resources management activities on Fort Irwin, including GDSCC:

- Historic Property Identification;

- Consideration of Effects to Historic Properties based on Training Area Use Intensity;
- Prioritizing Historic Property Identification and Evaluation;
- Site Testing and Evaluation;
- Treatment of Historic Properties;
- Native American Consultation; and
- Treatment of Native American Human Remains (US Army and Fort Irwin NTC, 2008).

3.3.12.1 Archeological Resources

Fort Irwin, including GDSCC, is the location of numerous important prehistoric and historic archaeological sites. Army personnel, recognizing the value of these resources, have taken steps to improve their protection. Fort Irwin employs a resident archaeologist to document sensitive resource areas within the Fort Irwin boundary, including GDSCC. Fort Irwin has an expansive archaeological survey program with approximately 101,981 ha (252, 000 ac), or 37 percent of Fort Irwin, have been surveyed. Over 500 historic, prehistoric, and fossil sites of varying size and significance have been recorded. Forty-one unpublished cultural resource reports concerning Fort Irwin archeology are on file at Fort Irwin and the USACE Los Angeles District office. The EA for the National Training Center, Fort Irwin, CA, "Ramp Up", discusses lithic assemblages thought to be older than 10,000 years. The artifacts typically found consist of choppers, flake scrapers, and bifacially-flaked "coup-de-point-like" implements similar to those of the Old World lower paeolithic period. Because access to Fort Irwin and GDSCC is controlled, only a few archaeological sites have been discovered and recorded.

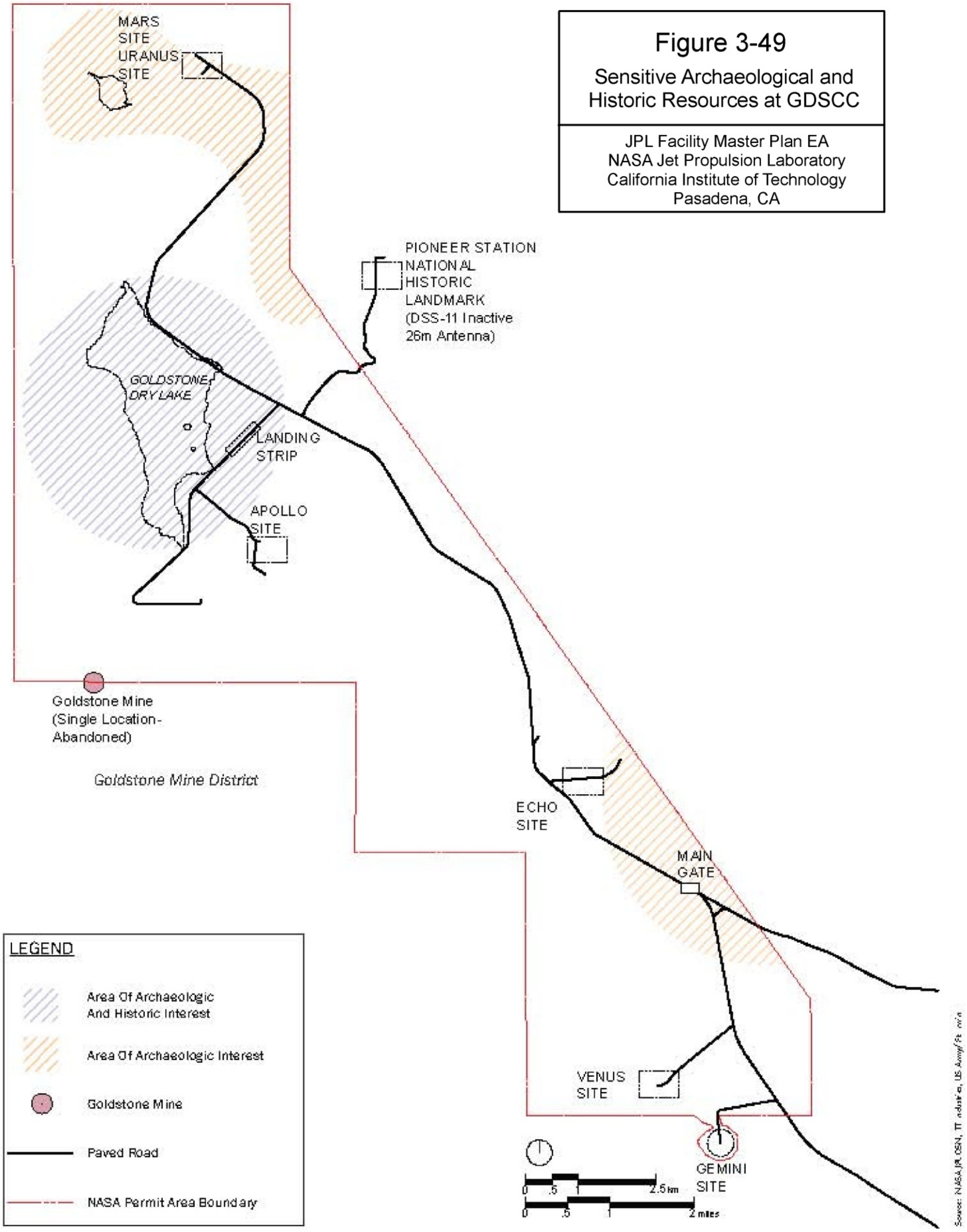
Within GDSCC, only 0.5 ha (1.3 ac), or 0.3 percent of the land area, has been surveyed for archaeological resources. There are a total of 44 recorded archaeological sites on or near GDSCC, with eight prehistoric sites and seven historic archaeological sites have been recorded at GDSCC. Known sensitive archaeologic and historic resources within GDSCC are primarily located in the northern and southeastern portions of the complex as shown in **Figure 3-49**. The Mars and Apollo Sites are in the vicinity of areas of archaeologic and/or historic interest. Documented areas with "surface scatter" and evidence of "historic battle" are also located at GDSCC, on the eastern border adjacent to Fort Irwin and east of Echo Site and the closed Microwave Test Facility (JPL 2006).

Although documented sensitive resources are located near developed areas at GDSCC, mitigation measures were incorporated during planning stages to reduce potential impacts to those resources. Prior to any development at GDSCC, Fort Irwin's resident archaeologist reviews the plans and recommends appropriate mitigation measures. Many of the records of sites in the region are believed to satisfy the criteria for inclusion in the NRHP, the State of California Listing of Historic Places, or the state's Points of Historic Interest. Areas with known sensitive archaeological or historic resources are fenced off and are identified by signs with posted warnings of trespassing penalties (JPL 2006).

3.3.12.2 Historic Resources

Three historic resource studies have been conducted examining resources at GDSCC for eligibility into the NRHP. The first study evaluated the Pioneer Deep Space Station (DSS-11), and its antenna was listed on the NRHP in 1984 and further recognized as a NHL by the U.S. Department of the Interior in 1985. While the Pioneer site and its antenna are no longer on GDSCC property, the antenna is fenced off (Page & Turnbull, 2009b). The second study, conducted between November 2008 and February 2009, evaluated 19 resources across six areas for eligibility to the NRHP. None of the sites were determined to be individually eligible for the NRHP.

Figure 3-49. Sensitive Archaeological and Historic Resources at GDSCC



Source: Deep Space Network Facilities Master Plan Update 2011-2032, 2011

GDSCC prepared a *Historic Resources Study Gate-to-Gate, NASA Goldstone Deep Space Communications Complex, Fort Irwin, CA* in 2009 (Page & Turnbull, 2009b). The study was completed to assist NASA JPL in meeting its obligations under Sections 106 and 110 of the NHPA, and resulted in an assessment of historic structures and a selective reconnaissance level survey of structures on GDSCC property.

Twenty-three of the twenty-seven resources inventoried were determined to be age-eligible (forty-five years or older in 2009) and four of the twenty-seven were identified as potentially historically significant. All twenty-seven buildings were evaluated for their eligibility to the NRHP. After evaluation, the study concluded that only one resource, G-80: 70-meter Az-El Antenna (DSS-14 at the Mars Site) is eligible for listing on the NRHP should NASA decide to nominate the buildings. This determination was based on the antenna's prototypical high-sensitivity, large-scale antenna design and its individual role in the Goldstone Solar System Radar program. The remaining twenty-six resources under review were not found eligible for the NRHP, primarily due to a lack of historic significance. The buildings which support the antennas proposed for demolition in Section 2.2.3 retain little, if any, of the functional components that contributed to any historic mission of the antennas and their operations.

NASA JPL has initiated consultation through the Section 106 process with the California SHPO. As a result of this consultation, a PA is being developed that identifies any mitigation measures to be implemented as well as preservation design guidelines for the defined character areas in GDSCC.

3.3.13 Hazardous Materials and Waste

Management of hazardous materials and wastes at GDSCC focuses on evaluation of the storage, handling, and transportation capabilities for the site. Evaluation includes the generation and disposal of hazardous wastes (fuels, solvents; acids and bases; and POL). In addition to being a threat to humans, the improper release of hazardous materials and wastes can threaten the health and well-being of wildlife, botanical habitats, soil systems, and water resources. In the event of a release of hazardous materials or wastes, the extent of contamination varies based on the soil type, topography, and water resources. Hazardous materials, hazardous substances, and hazardous wastes include elements, compounds, mixtures, solutions, and substances that, when released into the environment or otherwise improperly managed, could present substantial danger to the public health, welfare, or the environment.

Regulatory Framework

The principal Federal regulatory agency responsible for setting laws and guidelines for hazardous materials and wastes is the USEPA. The key Federal laws and regulations pertaining to hazardous materials associated with implementation of the Master Plan at GDSCC are the CERCLA; SARA; the TSCA; and RCRA. These laws and regulations are described in Section 3.1.13.1. The following sections discuss hazardous materials, hazardous wastes, pollution prevention and waste minimization, non-hazardous wastes, and toxic substances.

3.3.13.1 Hazardous Materials

A hazardous material includes any item or chemical that may cause harm to people, plants, or animals when released by spills, leaks, pumping, pouring, emitting, discharging, injecting, escaping, leaching, dumping, or disposing into the environment. Hazardous materials include any substance or chemical that is a "health hazard" or "physical hazard", including: chemicals which are carcinogens; toxic agents; irritants; corrosives; sensitizers; agents that act on the hematopoletic (blood-related) system; agents that damage the lungs, skin, eyes, or mucous membranes; chemicals that are combustible, explosive, or flammable; oxidizers or pyrophorics; unstable-reactive or water-reactive substances; and chemicals that during normal handling, use or storage may produce or release dusts, gases, fumes, vapors, mists or smoke that may have any of the previously mentioned characteristics.

OSHA is responsible for enforcement and implementation of Federal laws and regulations pertaining to worker health and safety (29 CFR Part 1910), and includes the regulation of hazardous materials in the workplace and ensures appropriate training in their handling.

3.3.13.2 Hazardous Wastes

Hazardous waste is defined as any solid, liquid, contained gaseous, or semi-solid waste; or any combination of wastes that pose a substantial present or potential hazard to human health or the environment. GDSCC uses various chemicals in R&D activities and for overall laboratory maintenance. As a result, GDSCC generates a variety of chemical wastes in small quantities. Typical wastes include mixed solvents, contaminated laboratory glassware, reaction products, and out-of-date or excess chemical reagents. Large amounts of non-hazardous waste are also generated (e.g., paper and plastic).

Certain types of hazardous wastes are subject to special management provisions intended to ease the management burden and facilitate the recycling of such materials. These are called ‘Universal Wastes’, and their associated regulatory requirements are specified in 40 CFR 273. Types of waste currently covered under the universal waste regulations include hazardous waste batteries, hazardous waste thermostats, and hazardous waste lamps.

GDSCC Hazardous Waste Generation and Handling

The hazardous waste generated at GDSCC is sent to off-site commercial facilities within 90-days of generation for reclamation and eventual reuse or destruction. The GDSCC currently has four 90-day storage yards located at the Echo Site, Venus Site, Mars Site, and Apollo Site. Hazardous waste that has been stored at the Venus Site, Mars Site, and Apollo Site is eventually transported by GDSCC personnel within the 90-day storage limit to the Echo Site for hazardous waste pick-up/hauling by certified hazardous waste contractors. All hazardous wastes stored at any of the four sites are picked-up/hauled from GDSCC within 90-days of their accumulation start date.

In addition to the four 90-day storage yards, two satellite accumulation points (SAPs) are located at the Echo Site. The SAPs are allowed to store up to 208 l (55 gal) of each type of a particular hazardous waste for up to one year. Necessary permits and documentation for the storage and handling of hazardous waste at GDSCC have been obtained and are regularly updated. In accordance with its environmental management program, GDSCC conducts all of its waste-management operations in strict compliance with environmental regulations, in a manner consistent with protection of human health and the environment.

Before any material is accepted for disposal, it must be properly contained and labeled with a Hazardous Waste Disposal Form. This form provides the chemical name, associated hazards, quantity, physical state, and other specific information. Decisions about whether a particular material is hazardous or non-hazardous are made by GDSCC in accordance with applicable state and Federal hazardous waste regulations.

No medical facility is maintained at GDSCC; therefore, medical waste management is not an ongoing management concern. Sharp containers for site personnel who require self-injections for medical conditions have been discontinued (NASA EFR, EMD, February 2009)

3.3.13.3 Pollution Prevention and Waste Minimization

GDSCC has an established strategy to provide a systematic approach to pollution prevention as presented in JPL's Pollution Prevention Plan. Plan objectives are to develop a program for preventing, reducing, reusing, and recycling waste and emissions. The plan builds on existing programs and activities that meet compliance requirements as well as identifying additional activities while trying to reduce costs associated with pollution prevention programs. The plan encourages pollution prevention concepts to be implemented in the day-to-day business processes to aid employees in understanding pollution prevention and environmentally related activities.

Waste minimization measures that have been implemented include waste stream characterization; source reduction; materials management through computerized tracking systems; centralized purchase of chemicals; use of *iProcurement* style purchasing; and hazardous waste generator training classes that include instruction on hazardous waste source reduction principals.

3.3.13.4 Non-Hazardous Wastes

Non-hazardous solid waste such as garbage generated at GDSCC is collected and disposed of daily by a disposal contractor. As needed, a large construction materials container is also removed. GDSCC sends its recyclable material to Fort Irwin to be included in that recycling stream.

3.3.13.5 Toxic Substances

Excluding laboratory chemicals, other toxic or hazardous substances that are present, or were present, at GDSCC include PCBs, asbestos, pesticides, and radiation sources. Their status, as well as information regarding chemical safety and reporting requirements, is discussed below.

PCBs

Through the 1980s up to 1993, GDSCC initiated and proceeded with a facility-wide program to identify and remove all PCB transformers and capacitors from GDSCC. A PCB transformer or capacitor is defined as an item containing more than 500 ppm PCBs. A PCB-contaminated item contains 50 to 500 ppm PCBs. Items may contain up to 500 ppm PCB per Federal definition and be classified as a non-PCB item. As part of the program, PCB transformers were either removed from the site and disposed of or reclassified as non-PCB transformers. In both cases, the PCB oil removed from the transformers and sent off site for disposal was incinerated. Regarding PCB capacitors, all were taken out of service and removed from the site. Currently, there are no PCB transformers or capacitors remaining on site. One PCB-contaminated transformer remains in service.

Asbestos

Asbestos is the only substance currently in use at GDSCC that is regulated by the Federal government under TSCA. Asbestos removal or abatement is dictated by the renovation or remodeling needs of GDSCC. Asbestos is found in spray applied fireproofing and piping insulation. Non-friable asbestos may be contained in flooring tile and adhesive. Asbestos is removed by a licensed contractor in accordance with the asbestos standard of OSHA, 29 C.F.R. 1926-58. All ACM are handled and disposed of offsite consistent with TSCA.

Pesticides

Use of insecticides, fungicides, herbicides, and rodenticides is regulated by the California Department of Food and Agriculture and the FIFRA. A range of pesticides is used at GDSCC for rodent control and grounds maintenance. Pesticides are usually applied by licensed contractors and only occasionally by the grounds maintenance workers (ant bait stations), which are both overseen by certified advisors and applicators. GDSCC reduces potential environmental impacts of pesticides in use by controlled applications, inventory inspection, and monitoring. All insecticides, fungicides, herbicides, and rodenticides are handled, applied, and disposed of consistent with the California Department of Food and Agriculture requirements and FIFRA.

Radiation

The GDSCC uses no radioactive materials in its operations. It does operate, however, several large, high-powered microwave ground transmitters used in deep space communications. These transmitters are capable of transmitting non-ionizing RF signals up to 500 kW of power. Transmission in this range produces radiation potentially hazardous to persons working nearby. The power density in the direct beam may cause severe biological damage, and the energy density in the feeding system is considered potentially lethal. Currently, DSS14 (Mars Site) is the only GDSCC antenna station that transmits high power RF on a routine basis.

JPL Safety Practice Bulletin 12-4-6 sets standards for operating antennas during transmissions. The bulletin addresses exposure hazards, exposure limits, and procedures for ensuring that safety precautions are taken prior to and during a transmission event. The bulletin requires that JPL Form 0284-S, A Safety Review of New Operation, be completed prior to modification of an existing antenna or construction of a new radio frequency transmitter. High-power microwave transmissions also can generate effects at greater distances, potentially exposing aircraft to radiation. Procedures have been established with neighboring military installations and the FAA to prevent exposure of aircraft to radiation levels greater than 10 mW/cm. These procedures include restricting the permissible angles of radiation and avoiding the supersonic corridor, establishing a prearranged schedule for transmissions, and providing airspace avoidance contour plots to cognizant external agencies.

Chemical Safety and Reporting Requirements

GDSCC complies with EPCRA and the stricter State of California community right-to-know requirements. GDSCC is in compliance with Title 19 of the CCR and California Business Plan requirements.

4.0 ENVIRONMENTAL CONSEQUENCES

This section describes the potential impacts resulting from the implementation of the two alternatives, Proposed Action and No-Action. This section concludes by addressing cumulative impacts associated with the Proposed Action, unavoidable adverse effects, the relationship between short-term uses and long-term productivity, and irreversible and irretrievable commitments of resources.

Potential impacts were identified and assessed for each environmental issue by assigning standards of significance for comparison against existing conditions, which is the No Action Alternative. As it is a master plan, the alternatives described in Section 2 are conceptual and site layouts and/or building plans have not been finalized. Therefore, impacts in this EA have been assessed assuming that development activities could affect all the resources within a development zone. However, as a more detailed design proceeds, JPL would seek to further minimize impacts by implementing mitigation measures. These measures are included for each environmental issue, as appropriate.

Impacts are described separately for construction (relocation, demolition, and construction) and operational activities, may be direct or indirect, and are described in terms or type, context, duration, and intensity, which is consistent with the CEQ regulations.

Impacts are defined in general terms and are qualified as adverse or beneficial, and as short-term or long-term. For the purposes of this EA, short-term impacts are generally considered those impacts that would have temporary effects. For example, air quality impacts from fugitive dust associated with construction would be considered short-term as they would only last for the duration of the construction activities. Long-term impacts are generally considered those impacts that would result in permanent effects. For example, the loss of vegetation, or the increase in traffic, associated with new development would be considered long-term.

The thresholds of change for the intensity of impacts are defined as follows:

- *Negligible*, the impact is localized and not measureable, or at the lowest level of detection;
- *Minor*, the impact is localized and slight, but detectable;
- *Moderate*, the impact is readily apparent and appreciable; or
- *Major*, the impact is severely adverse and highly noticeable.

4.1 NASA JPL

This section describes the potential environmental consequences associated as a result of implementing the Proposed Action or the No Action Alternative at NASA JPL.

4.1.1 Land Use

The Proposed Action would result in adverse land use impacts if it were judged to be in conflict with adopted plans and policies for the facility or surrounding communities; or if it violated zoning ordinances for the facility or surrounding communities.

4.1.1.1 Proposed Action

No short- or long-term adverse impacts to land use in surrounding areas are anticipated. The Proposed Action would occur in an area that already contains multiple buildings consisting of various types of architecture. The proposed land use plan identifies general areas on the NASA JPL site that can be grouped together based upon similar future functional relationships. Some of these similarities are related to technical laboratory, fabrication, assembly and/or testing functions. Within each land use area, open space and minor service facilities such as support infrastructure may occur.

The Proposed Action would not substantially change the existing view shed, and as impacts to visual resources are generally associated with cultural resources impacts, these are discussed under Section 4.1.12. Short-term and minor adverse impacts and long-term beneficial impacts to land use on-site at NASA JPL are anticipated as described below.

Construction Impacts

On-site land uses may be subject to short-term minor impacts due to interim relocation of existing facilities, demolition, construction, and infrastructure redevelopment. These effects would be localized, and occur when demolition or construction activities occur at immediately adjacent facilities, and would extend for the duration of those activities. Occupants of on-site buildings adjacent to areas scheduled for demolition or construction would be subject to temporary or intermittent impacts. Additionally, there would be on-site inconveniences from modified parking and pedestrian patterns, and from increases in background noise.

The Proposed Action would have no long-term impacts to land use or zoning on-site at NASA JPL because Master Plan development activities are consistent with the present use and zoning for NASA JPL.

Operational Impacts

The proposed Master Plan developments are similar in use, function, and density as the current facility and no adverse operational impacts are anticipated. There would be minor internal changes to the use of land within NASA JPL. For instance, existing parking lots would be reclaimed and redeveloped for other uses already at the facility. Conversely, existing land uses would be replaced with new parking facilities. Minor beneficial impacts to on-site land use would result from a more cohesive facility setting.

The Master Plan development strategy supports sustainable land use and contributes to the overall sustainability of the facility in the following ways:

- Activity consolidation, coupled with the loop road circulation plan, would reduce on-lab transport distances and trips of industrial vehicles such as trucks, forklifts, and police escort vehicles;
- Activity consolidation into the facility core away from hills/higher elevation areas of the Lab, and a concomitant reduction in overall uphill vehicular travel trips, would reduce fossil energy consumption and related GHG emissions;
- Creating a continuous peripheral loop road integrated with peripheral parking facilities would improve on-lab traffic flow, leading to less start and stop travel and reducing idling-related GHG emissions;
- Consolidation of activities into fewer buildings, and the resultant creation of new landscaped open space areas, is expected to reduce the heat island effect at NASA JPL and thereby reducing summer electric

cooling loads, contributing to regional cooling and reduced photo-chemical smog, and creating additional habitat for native birds; and

- Improved and landscaped pedestrian pathways and open space areas are expected to support increased employee walking, outdoor recreation, and health.

4.1.1.2 No Action Alternative

Under the No Action Alternative, there would be no changes to either land use or zoning in areas surrounding NASA JPL, or on-site; therefore, no adverse impacts to land use are anticipated.

4.1.2 Socioeconomics

This section describes the potential environmental consequences associated with socioeconomics, as a result of implementing the Proposed Action or the No Action Alternative at NASA JPL. The Proposed Action would result in adverse socioeconomic impacts if it caused a major shift in population, housing, or employment either on-site or in the surrounding areas. For the purposes of this analysis, a major change would result from a 5 percent increase or decrease to these categories. For the short term, this would infer approximately 500 or more construction workers at any one time, given the current number of employees on-site.

4.1.2.1 Proposed Action

Negligible short-term adverse and beneficial impacts on the surrounding communities are anticipated. There would be long-term beneficial effects for facility operations. No long-term adverse impacts to population, housing, or employment in surrounding areas, or on-site, are anticipated.

Construction Impacts

The addition of approximately 200 construction contractors may result in negligible short term beneficial impacts on the surrounding communities. No long-term adverse impacts to either population or demographics are anticipated because the Proposed Action is confined to on-site activities. Approximately 5,500 full time JPL employees and 4,750 non-JPL, service and contract personnel contractors and NASA employees work at JPL. The addition of approximately 200 construction workers would add less than 5 percent to the existing workforce. It is anticipated that the majority of contractors would utilize employees from within the Los Angeles and Orange County areas, and that a minimal number of specialist contractors would be brought in to the area to complete portions of the demolition, construction, and infrastructure redevelopment.

A negligible beneficial impact includes the demolition of older buildings at NASA JPL, which would eliminate deferred maintenance costs for inefficient and vacant buildings.

Operational Impacts

There would be negligible adverse impacts to JPL operations, since implementing the Proposed Action is not expected to result in any change in the number of JPL site personnel. No discernable impacts to employment levels within Los Angeles or Orange County would be expected. It is not anticipated that implementation of the Master Plan would increase the need for off-site infrastructure and public services. Implementing the Proposed Action at JPL would provide improved flexibility and adaptability by grouping buildings at the center of the facility; enhanced core capabilities by co-locating research facilities; enhanced safety and security with a new Contractor Center and Visitor Center; and reduced operating costs through the Repair-by-Replacement program for inefficient buildings.

No short-term or long-term adverse impacts to the economy in surrounding areas, or on-site, are anticipated. There may be short-term, negligible beneficial impacts to the on-site facility economy, due to increased use of the facility cafeterias (operated by Caltech) by construction contractors. In general, there would be long-term beneficial effects for facility operations. No adverse impacts to housing in surrounding areas or, on-site, are anticipated.

EO 13045 requires that Federal agencies identify and assess environmental health and safety risks that might disproportionately affect children. Neither construction nor operational activities under the Proposed Action would pose any adverse or disproportionate environmental health or safety risks to children living in the vicinity of NASA JPL. The likelihood of the presence of children at the site where proposed activities would occur is considered minimal, which further limits the potential for effects. Therefore, no adverse effects would be expected.

4.1.2.2 No Action Alternative

Under the No Action Alternative, there would be no changes to socioeconomics in areas surrounding NASA JPL, or on-site; therefore, no adverse impacts to socioeconomics are anticipated.

4.1.3 Environmental Justice

This section describes the potential environmental impacts associated with Environmental Justice, as a result of implementing the Proposed Action or the No Action Alternative at NASA JPL. EO 12898 is designed to prevent Federal policies and actions from creating disproportionately high and adverse impacts on minority and low-income populations. The order was issued as a result of concerns that minority populations and/or low-income populations bear a disproportionate amount of adverse health and environmental effects. A proposed project would result in significant impact to Environmental Justice if it were judged to be in conflict with the fair treatment for people of all races, cultures, and incomes.

4.1.3.1 Proposed Action

No adverse impacts to Environmental Justice are anticipated as a result of the Proposed Action.

Construction Impacts

No short- or long-term impacts to environmental justice are anticipated from on-site relocation, demolition, construction, and infrastructure and site improvements associated with implementation of the Proposed Action. Minority populations were identified in four census tracts in surrounding area. Census Tracts 4603.01, 4603.02, 4610, and 4604 would represent areas of potential Environmental Justice concerns. However, demolition and construction activities associated with the Proposed Action would be localized to the construction zone, and within the secured facility perimeter. Thus, construction activities would not pose a disproportionate effect on identified minority populations in the local community.

Operational Impacts

Impacts associated with operations in proposed future facilities would also be localized within NASA JPL. Noise levels would be within the same range as existing operations. Therefore, operational activities would not pose a disproportionate effect on the identified minority populations in the local community.

4.1.3.2 No Action Alternative

Under the No Action Alternative, there would be no changes to Environmental Justice either in areas surrounding NASA JPL, or on-site. The No Action Alternative would not disproportionately impact minority or low-income populations; therefore, no adverse impacts to Environmental Justice are anticipated.

4.1.4 Traffic and Transportation

This section describes the potential environmental consequences associated with traffic and transportation, as a result of implementing the Proposed Action or the No Action Alternative at NASA JPL. The Proposed Action would result in a significant transportation impact if it resulted in a substantial increase in traffic generation, a substantial increase in the use of the connecting street systems or mass transit, or if on-site parking demand would not be met by projected supply.

4.1.4.1 Proposed Action

Short- and long-term minor to moderate adverse impacts to traffic and transportation are anticipated as a result of the Proposed Action.

Construction Impacts

Temporary relocation, demolition, and construction-related activities associated with implementation of the Proposed Action are anticipated to produce short- and long-term adverse impacts on traffic generation, traffic volume, street use, and parking availability both on-site and in surrounding areas. Impacts to mass transit are anticipated to be negligible.

It is estimated that the total personnel working on-site on demolition, construction, and infrastructure redevelopment activities would be approximately 200 workers at any one time. Although these contractors would complete predominantly short-term projects, the overall redevelopment of the NASA JPL facility is comprised of sequential phases that would overlap and are expected to span the entire 20-year period through until 2032.

The Proposed Action would affect traffic generation and street system usage on-site and in surrounding areas over the short- and long-term. Increases in traffic volumes and adverse impacts to traffic flow on-site are likely due to additional traffic entering, leaving, and cycling through NASA JPL as a result of contractors performing construction-related activities. In particular, there would be an overall increase in the volume of truck and (heavy) equipment traffic as a result of removal of debris during demolition, and delivery of building materials during redevelopment. Truck traffic for equipment would be episodic and dispersed over time.

A specific short-term and minor adverse impact would be the potential for traffic congestion during peak traffic hours at the Main Gate, particularly as new subcontractors are required to undergo security at the facility south gate security checkpoint. This would cause a short-term delay for employees, other contractors, and visitors entering the NASA JPL facility. As of 2008, the peak hour traffic count for Oak Grove Drive in the morning, which summarizes vehicles entering through the main gate, was 1,094 and the peak hour traffic count in the evening, which summarizes vehicles leaving through the main gate was 1,082 (KOA Corporation, 2008).

The addition of approximately 200 contractor vpd would represent a net increase of less than 1 percent in traffic count. However, the worst case-scenario for increased traffic volumes would be approximately 12.5 percent, if all contractors were to arrive during morning peak hour volumes. While it is likely that there would be only a minor increase in net average volumes, it is likely that the peak-hour increases in traffic volumes would be moderate.

Operational Impacts

On-site operations would face short-term minor impacts as a result of increased traffic generation and elevated traffic volumes. The Proposed Action does not include any plans to increase the JPL workforce.

Parking space availability is one of the major issues facing NASA JPL. Therefore, the first phase of development slated for 2012 through 2013 is construction of a new Arroyo Parking Structure. Given the current shortage in parking at NASA JPL, short-term minor-to-moderate impacts for traffic and transportation would be anticipated concurrent with each phase of the Master Plan implementation. This would likely be more appreciable for NASA JPL operations during the first phase, because a majority of employees would be affected by using relocated interim parking facilities.

The Proposed Action would result in long-term beneficial impacts as current facility-wide parking issues would be addressed with increases in available parking spaces. Completion of the first phase of the Master Plan would markedly improve the ability of spaces to meet demand, and as a result, increase the interim distribution of available parking spaces in other areas of the facility. Increases in parking spaces would result in minor reductions in traffic generation, with less JPL employees cycling through the facility looking for available spaces.

The greatest demand for the movement of people in the Laboratory is the daily travel between parking areas located on the periphery of the facility to employee work stations located in the core of the facility. Most employees parking in the leased East Arroyo parking area use a bus service to get to their work stations, given the distance and steep grades that exist between the parking area and buildings. The proximity of the West parking area to the core of the campus makes it easier for employees to walk from the parking area to work locations, reducing dependence on facility bus services to reach work stations.

Mitigation Measures

The following is a summary of proposed mitigation measures under the Proposed Action:

- On-site bus services may be rescheduled and/or re-routed to avoid times or routes that would otherwise create localized impacts due to construction activities.

- Contractors will be provided specific construction routes designed to minimize conflicts with routine vehicular traffic. Arrivals/departures will be scheduled to avoid normal peak-traffic hours of on-site personnel. Truck traffic for construction materials coming on site and demolition debris transported off site could at times approach ten trucks per hour. All loads will have either bills of lading or manifests prior to entering/leaving the facility. Specifically, contractors will be organized into stacking spaces outside the facility to minimize time on site and ability to disrupt site traffic flow. Traffic will be redirected when construction activities occur in areas currently dedicated to vehicular travel and parking. All truck traffic will be scheduled and routed to minimize impacts on local traffic.

- Contractors will operate under limited parking availability, and will restrict employees from bringing unnecessary commuter vehicles on-site. Additionally, contractor shift start-times will be adjusted to preclude readily apparent increases in traffic volumes during peak morning and evening hours for the remainder of the JPL employees and contractors. Construction contractors will use shifts starting 30 minutes prior to peak employee traffic in efforts to start and finish daily construction activities earlier.

- All contractors performing work lasting two weeks or longer in duration will receive “Rapid-gate” badges, precluding them from having to physically check in at the gate every time they enter or leave the facility. While construction contractors will be encouraged to carpool to the facility, some contractor crews will be required to operate remote security trailers in off-site locations and then bus their employees in and out daily.

Additional and more detailed mitigation for transportation impacts will be identified as conceptual designs for individual projects are initiated.

4.1.4.2 No Action Alternative

Under the No Action Alternative, there would be no changes to traffic or transportation in areas surrounding JPL, or on-site; therefore, no adverse impacts are anticipated. The No-Action Alternative would result in moderate to major adverse impacts as current facility-wide parking issues would not be addressed.

4.1.5 Utilities and Services

This section describes the potential environmental consequences associated with utilities and services, as a result of implementing the Proposed Action or the No Action Alternative at NASA JPL. The Proposed Action would result in an adverse impact to utilities or services if the project required more than the existing infrastructure could provide, or required services in conflict with adopted plans and policies for the area. The Proposed Action would also result in an adverse impact if it resulted in a need for funding that required a separate vote of the public, or securing funds that are not currently programmed.

4.1.5.1 Proposed Action

While short-term adverse impacts to utilities and services are anticipated under the Proposed Action, beneficial impacts to utilities and services are anticipated over the long term.

Construction Impacts

Solid wastes generated through implementation of the Master Plan are likely to affect solid waste management in Los Angeles County, and short-term negligible-to-minor adverse impacts would be expected as a result of the various projects proposed under the Master Plan. These impacts are temporary in nature, with expected start and end dates coinciding with each phase of the Master Plan.

The Proposed Action would primarily involve the demolition and replacement of many obsolete or inefficient structures. The volume of solid wastes generated as a result of the Proposed Action is expected to be minor compared to the solid waste currently generated in Los Angeles County, because of the extended period of Plan implementation. The construction debris associated with the Proposed Action would not result in exceeding the capacity of any landfill, or the violation of any permit for any landfill.

Solid wastes generated through demolition and construction would consist largely of building deconstruction materials, and/or associated with new construction by-products, such as concrete, blocks, bricks, wooden framing, and metals. Contractors would recycle construction materials to the greatest extent possible, and would dispose of non-recyclable construction debris at one or more of the permitted Los Angeles County landfills, which have/have not yet been identified.

Infrastructure redevelopment is likely to result in short-term adverse impacts as construction activities may affect, disrupt, or cause outages in electrical power, natural gas supplies, and water, sanitary, and storm sewer lines. For demolition and construction, on-site generators would be available to provide back-up power for any high-power demanding equipment. Demand during temporary/planned outages is expected to be met, and impacts would be negligible.

Infrastructure improvements are likely to produce beneficial impacts over the long-term, as a result of more reliable grid connections, including updated technologies for greater efficiency and overall increases in safety. In particular, new infrastructure at NASA JPL would result in beneficial impacts in terms of reduced on-site risks at the facility level for emergency response and safety management. As part of the building redevelopment projects, all new construction would include state of the art alarm and fire suppression systems and would comply with all applicable local and national building codes.

Operational Impacts

Facility improvements planned under the Proposed Action would result in revitalization of older buildings, revitalization of entrances, installation of new transportation facilities, and construction of new administrative facilities. No activities or change in operations have been identified that would have an adverse effect on community facilities and services. Existing services such as emergency response, fire, police, and other services would continue to be able to serve NASA JPL.

The need for emergency services is related to the number of personnel or employees working at the facility. It has been noted that the maximum number of on-site contractor employees is unlikely to exceed 150 workers at any one time. The contractor would retain the primary responsibility for ensuring worker safety, and would be responsible for ensuring emergency preparedness procedures are developed and followed by contractor personnel. No additional equipment or amendments to existing emergency services agreements are anticipated.

The new buildings planned under the Proposed Action would not result in a substantial increase in electric power demand. However, in the event that future increases should occur, the new power system is designed to accommodate loads of up to 18 MW at 16.5 kv and provide adequate electrical grid connections into the foreseeable future (Uyeki, 2010c).

There are no activities identified at the master planning stages that would cause an adverse impact on existing infrastructure outside NASA JPL property; however, additional study would occur during project planning and design for utility and other infrastructure needs. As more detailed programming, planning, and preliminary design of improvements to each portion of NASA JPL is completed, NASA JPL would coordinate with the appropriate utilities to identify daily demand, peak demand, and supply.

Mitigation Measures

The following is a summary of proposed mitigation measures under the Proposed Action:

- Install faucet aerators and low-flow toilets and shower heads.
- Design landscape plans for minimum water use (e.g., plant native, drought-tolerant species).
- Minimize use of lawns because of their high water consumption (and energy consumption and air emissions from mowers).
- Plan for water conservation in lawn maintenance (set mower blades high and water slowly at night, no more than once per week with automatic, low-volume irrigation equipment), when necessary.

- Incorporate energy conservation measures into building design to mitigate impacts related to power systems.

- Recycle construction-related debris.

- Implement office recycling programs in accordance with EO 13101: *Greening the Government through Waste Prevention*, Recycling, and Federal Acquisition.

4.1.5.2 No Action Alternative

Under the No Action Alternative, there would be no changes to utilities and services in areas surrounding NASA JPL, or on-site; therefore, no adverse impacts to utilities and services are anticipated.

4.1.6 Air Quality

This section describes the potential environmental consequences for air quality associated with implementing the Proposed Action and the No Action alternative at NASA JPL.

The Proposed Action would result in an adverse air quality impact if the associated demolition, construction, or operations would result in exceeding the applicable regulatory thresholds, and/or cause deterioration in air quality.

4.1.6.1 Proposed Action

While short-term adverse impacts to air quality are anticipated, the Proposed Action would not result in any long-term adverse impacts to air quality.

Air quality impacts were analyzed utilizing guidelines and emission factors presented in the California Environmental Quality Act (CEQA) Air Quality Handbook and current CARB motor vehicle emission factors. Additionally, the analysis of potential impacts to air quality included emissions and contaminants from both operational and construction sources.

Air quality impacts for construction projects are generally summarized into four categories:

- Temporary Construction Impacts - airborne dust from grading, demolition and dirt hauling; and gaseous emissions from heavy equipment, delivery and dirt hauling trucks, employee vehicles, and paints and coatings. Construction emissions vary from day to day, depending on the level of construction and/or weather conditions.
- Local Operational Impacts - increases in pollutant concentrations, primarily CO, resulting from traffic increases in the immediate vicinity of a project, as well as any toxic and odor emissions generated on site.
- Regional Operational Impacts - primarily gaseous emissions from natural gas and electricity usage and vehicles traveling to and from NASA JPL project sites.
- Cumulative Impacts - these are typically changes resulting from an incremental impact of the Master Plan projects when added to other projects in the vicinity.

As summarized above, air quality impacts associated with a construction project may occur at both a regional and local scale. Under the Proposed Action for NASA JPL, a series of projects would be delivered in sequential phases. Representative projects that may overlap, and occur concurrently, would be building construction and reconfiguration of infrastructure or access road(s). While there may be several overlapping construction components, each phase remains an individual project subject to funding availability. Therefore, this analysis assumes that long-term impacts are a consideration for cumulative analysis, and will be discussed in Section 4.4.

General Conformity under the CAA Section 176(c) (as amended) has been evaluated for the Proposed Action according to the requirements of 40 CFR 93, Subpart B. A conformity review process was completed using URBan EMISsions (URBEMIS) 2007 model (version 9.2.4) software to verify whether emissions produced on-site under the Proposed Action would conform to the SIP, and remain below applicable thresholds.

Master Plan phases 1, 2, and 3 represent the most intense concentration of construction and demolition activities. This 2012-2015 period coincides with the anticipated re-commencement of routine facility operations with completion of the proposed West Arroyo Parking Structure and the Flight Electronics Center, and therefore represents most likely circumstances for worst case air quality scenarios under the Proposed Action (**Appendix E**, General Conformity Applicability).

Analysis for NASA JPL shows that the total direct and indirect emissions associated with the Proposed Action were below the *de minimis* threshold levels, as promulgated in 40 CFR 93.153(b). A General Conformity Applicability Analysis was not completed for the No Action Alternative, as this scenario would not result in changes to air quality in the region.

Construction Impacts

Construction impacts include airborne dust from demolition, grading, excavation and materials hauling as well as gaseous emissions from the use of heavy equipment, delivery and dirt hauling trucks, and employee vehicles. Additionally, the use of new paints and surface coatings produce VOCs. One example would be photochemically reactive VOC emissions from curing asphalt concrete. These impacts may affect regional pollutants, such as O_3, or pollutants where the impacts occur very close to the source, such as PM_{10}. There are no known sources of odors on the project site that would be released during construction.

The majority of demolition activity would be removing existing buildings and hardscapes, including blocks, steel rebar and columns, concrete, asphalt, and gravel including roadway coatings and cement sidewalks, and old infrastructure for utilities and sanitary sewer and storm drains, etc. This material would be hauled away and it is likely some would be ground in place and used as fill for replacement projects in the same or nearby areas. Construction impacts to air quality from PM_{10} and NO_X emissions are anticipated to exceed the SCAQMD threshold for significance for peak day and peak quarter, thus requiring consideration of mitigation measures. Construction impacts to O_3, CO, SO_X, and VOCs would not be expected to exceed the SCAQMD threshold for significance for peak day or peak quarter.

Soil would be disturbed during grading and excavation, or while storing project-related equipment. Table A9-9 of the CEQA Air Quality Handbook states that there would be 26.4 pounds of PM_{10} for each acre of graded surface.

Additional short-term adverse impacts would occur in conjunction with new commuter traffic generated from contractor employees and it is anticipated to result in a general increase in air quality impacts at the regional level. Different workers would be on-site at different phases of demolition, construction, and infrastructure redevelopment. The analysis assumes there would be between 150 to 200 workers on-site during the peak construction period. Worker vehicle trips are assumed at the regional average vehicle ridership of 1.135 and trip length of 18 km (11.2 mi) each way as listed in the CEQA Air Quality Handbook. Emission factors are from the URBEMIS emission model, for the period 2012-2015. Calculation sheets are contained in **Appendix E**.

Operational Impacts

Implementing the Proposed Action would not have any adverse impacts on operational air emissions for NASA JPL. The types of new facilities to be constructed are similar in use and function to the existing operations, and the number of vehicle trips vehicle miles traveled is anticipated to remain the same.

The Proposed Action would not have a substantial impact on regional CO concentrations from on-site operations. Background levels of both the one-hour and eight-hour standards are well below state and national standards in the Pasadena area, even including days when the Rose Bowl is at peak capacity and the potential for high CO concentrations is high. Peak CO concentrations typically occur in areas of heavy traffic congestion during cold weather, and predominantly during December and January. Reducing impediments to truck circulation on-Lab and consolidating service access to Lab facilities would likely have modest emissions benefits by slightly reducing truck operating time, as well as slightly increasing travel speeds.

In the context of NASA JPL, the emissions benefits associated with reductions in vehicle trip ends, or VMT would be low because daily trip rates are related to facility location, and internal vehicle trips at the Lab are constrained by site configuration, as well as the difficulty in locating vacant parking spaces during day time peak periods. However, emissions from passenger vehicles and light trucks are at their peak when engines are cool and speeds are low. Replacing more of these types of trips with a combination of walk trips and new on-site parking facilities would have greater emissions benefits than would be typical with the very modest savings of VMT through minor increases in use of transit or alternatives.

Mitigation Measures

Short term construction impacts will be mitigated through the use of proper control measures, including routine maintenance of all construction equipment, regular maintenance of the emission control devices on all construction equipment, and covering/wetting exposed soils to reduce fugitive dust during construction. Developers will be required to submit a Construction Management Plan including plans to control impacts to air quality during construction. More detailed air quality mitigation will be prepared during the conceptual design phase of individual projects.

Construction activities under the Proposed Action will comply with SCAQMD regulations, including SCAQMD Rule 402, which specifies that there shall be no dust impacts off-site sufficient to cause a nuisance, and SCAQMD Rule 403, which restricts visible emissions from construction.

4.1.6.2 No Action Alternative

Under the No Action Alternative, there would be no changes to air quality in areas surrounding NASA JPL, or on-site; therefore, no adverse impacts to air quality are anticipated.

4.1.7 Noise and Vibration

This section describes the potential environmental consequences associated with noise and vibration as a result of implementing the Proposed Action, or the No Action Alternative at NASA JPL. The Proposed Action would result in adverse impacts if noise or vibration conditions resulting from implementation of the projects exceeded established noise restrictions, or if there were long-term increases in the number of people highly annoyed by the noise/vibration environment. Adverse impacts would also occur if there are noise-associated adverse health effects to individuals; or if there are unacceptable increases to the noise environment for sensitive receptors.

4.1.7.1 Proposed Action

No substantial long-term impacts to noise and vibration levels in surrounding areas, or on-site locations, are anticipated. There would be short-term adverse impacts related to demolition and construction activities.

Construction Impacts

Over the short-term, there would be minor adverse effects from intermittent noises, and/or from general increases in background noise. The proposed projects involve the demolition of numerous buildings and construction of new facilities. There would be no actions that move surrounding streets or increase their capacity. There would be an increase in vehicle traffic equivalent to the number of employees driving to work along the streets surrounding NASA JPL. This long-term impact would be negligible.

Construction activities would be of a short-term nature, and depending on the nature of the phased construction operations, would last from seconds (e.g., a truck passing by) to months (e.g., constructing a building) over the planned 20-year redevelopment period. Construction noise is also intermittent and depends on the type of operation, location, and function of the equipment, and the equipment usage cycle. While the proposed project is being built, adjoining properties at NASA JPL would be exposed to noise from construction activities. These activities would result in adverse and short-term noise impacts.

Distances to the closest residences that could potentially be affected by phased construction activities under the Proposed Action are identified below:

Phase I – Construction of Arroyo Parking Structure - Construction of the Arroyo Parking Structure would be approximately 385 m (1,250 ft) away from the closest residence, which is located due east of the proposed location (i.e. directly east across the Arroyo Seco).

Phase II – Development of New Flight Electronics and Advanced Robotics Facilities – Construction and demolition of Building 277 (Isotope Thermoelectric Systems Application Lab) would be the closest to the boundary of NASA JPL. The distance to the closest residence is approximately 236 m (775 ft), and is located to the northeast of this location.

Phase II – Utilities (Electric/Power Line Infrastructure) - The installation of a new sub-grade power/utility line adjacent to the northeast corner of NASA JPL would be approximately 135 m (455 ft) away from the nearest residence, which is located northeast of this location.

Operational Impacts

Operational activities at NASA JPL are not expected to generate appreciable ground-borne vibrations either on-site or at off-site locations. Noise levels at NASA JPL are not sufficient to generate major structural vibrations at off-site locations from airborne sound levels. Traffic associated with the site would be minor compared to the regular off-site street traffic and would have no impact on the ambient traffic noise.

Mitigation Measures

NASA JPL is located adjacent to the residential communities of La Cañada Flintridge, Pasadena, and Altadena. As a Federal facility, NASA JPL is not directly regulated by these jurisdictions. However, contractors at NASA

JPL will adhere to work noise restriction schedules contained in municipal codes (see Section 3.1.7.1) to minimize potential impacts from demolition and construction activities on the surrounding residential properties.

The following is a summary of other proposed mitigation measures under the Proposed Action:

- All construction equipment powered by an internal combustion engine will be equipped with a properly maintained muffler.
- Air compressors will meet current USEPA noise emission standards.
- New construction equipment will be used as much as possible since it is generally quieter than older equipment.
- Nighttime construction activities will be minimized.
- Portable noise barriers within the equipment area and around stationary noise sources will be established.
- Tools and equipment will be selected to minimize noise.

4.1.7.2 No Action Alternative

Under the No Action Alternative, noise impacts would not increase over current conditions. Current traffic patterns would be maintained and traffic volumes would increase in the future even without the project, resulting in an associated increase in traffic noise. However, these traffic increases would likely be a fraction of the existing traffic volumes, and any long-term increase in traffic noise would be negligible.

4.1.8 Geology and Soils

The Proposed Action or the No Action Alternative would result in an adverse impact if:

- Regional geology were affected;
- Soils classified as prime and unique farmland were affected;
- Soils affected were considered unsuitable for development; and
- Building construction was incompatible with the seismic risk status of the project area.

4.1.8.1 Proposed Action

The Proposed Action would have negligible to minor long-term adverse impacts on local geology at the site, but would not affect regional geology. Long-term, negligible, adverse impacts to soils would occur from the proposed project. No adverse impacts to natural hazards would result from the proposed project. There would be no impacts to prime or unique farmlands since none are located in the immediate area.

Construction Impacts

Development of the project would affect local geology. The impacts to surficial, and possibly bedrock geology, (depending on extent of excavation necessary and the exact depth of bedrock in the project area) would result from the site preparation and covering of geologic features. However, there would be no adverse impacts to regional geologic features or mineral sources; therefore, long-term effects to geology would be considered negligible to minor.

There are no known voids, fissures, underground streams, or unusual geological conditions at the site that would be affected by, or impede, the construction of the proposed buildings. A subsequent detailed geotechnical study would definitively determine the need for special footings and/or other foundation requirements. It is assumed that this would be accomplished prior to initiation of construction, but this has no environmental implications.

Construction activities are not expected to have an adverse effect on the site's pre-existing geologic conditions. Final subsurface engineering studies would be undertaken in advance of final design and construction to ensure that sound building practices are implemented. Most of the impacts to existing soil conditions would occur during the individual project construction phases. Although excavation would be required for building construction, it is not expected to result in excessive disruption or displacement of soils. Some of the excavated soil on the sites would be redistributed as fill. Soil types, characteristics, and conditions are not expected to pose a major constraint to the construction of the proposed redevelopment projects.

Construction activities under the Proposed Action are not expected to have an adverse effect on the site's pre-existing seismic conditions. The proposed redevelopment projects are unlikely to trigger local seismic events, but could be impacted by such events. The State of California (Uniform) Building Code sets standards for investigation and mitigation of facility conditions related to fault movement, liquefaction, landslides, differential compactions/seismic settlement, ground rupture, ground shaking, tsunami, seiche, and seismically induced flooding. Mitigation of geological (including earthquake) and soil (geotechnical) issues must be undertaken in compliance with the California Building Code.

For facility seismic compliance, NASA JPL has established stringent structural criteria and "setback zones" from the main fault trace (Boyle, 1988). Appropriate engineering techniques would be incorporated into site design to ensure that risks from earthquakes, liquefaction, etc., are minimized. With implementation of these standard measures, there should be no adverse impacts as a result of the proposed projects.

Operational Impacts

Operation and maintenance activities under the Proposed Action are not expected to have an adverse effect on the site's pre-existing geologic conditions. Soil types, characteristics, and conditions are not expected to pose a major constraint to operations. Operational and maintenance activities under the Proposed Action are not expected to have an adverse effect on the site's pre-existing seismic conditions.

Mitigation Measures

Implementation of the following standard mitigation measures under the Proposed Action would result in negligible impacts to soils as a result of construction.

- Soil suitability will be determined and appropriate building foundation specifications will be developed.
- A detailed erosion and sedimentation control plan will be developed prior to construction, based on the requirements of the Los Angeles CRWQCB.
- Measures to be taken would include minimizing areas of disturbance, provision of silt barriers, and landscaping of unimproved areas.

- Landscaping should follow construction as soon as practicable.

4.1.8.2 No Action Alternative

Under the No Action Alternative, there would be no changes to geology and soils in areas surrounding NASA JPL, and no substantial changes to soils on-site; therefore, no adverse impacts to geology and soils are anticipated.

4.1.9 Water Resources

This section describes the potential environmental consequences associated with water resources (surface water, groundwater, floodplains), as a result of implementing either the Proposed Action or the No Action Alternative at NASA JPL. The Proposed Action would result in an adverse impact to water resources if:

- It was to violate Federal or state water quality regulations and standards for surface water or groundwater.
- Existing water resources were directly or indirectly impacted from water extraction activities due to increased demand. Water resource requirements of the project must be balanced with available supplies, and appropriate water rights and extraction procedures must be followed.
- Activities were located in a regulatory floodplain without appropriate flood study, FEMA map revisions, and mitigation measures.
- Activities fail to adequately address upstream drainage as it is conveyed through the study area.
- Activities change historic drainage flows and/or patterns, potentially impacting downstream areas.

4.1.9.1 Proposed Action

No long-term adverse impacts to surface water, groundwater, or floodplains are anticipated under the Proposed Action. There would be short-term adverse impacts related to demolition and construction activities.

Construction Impacts

Construction or paving activities at the facility is not expected to substantially alter on-site drainage patterns over the long-term because the majority of construction is confined to the already highly developed main areas of the facility. While demolition and construction activities would not increase stormwater runoff, they would likely produce minor short-term adverse impacts with disruptions to storm water collection, flow, and transportation, particularly while storm sewer infrastructure systems are relocated. Adverse impacts on surface water at NASA JPL would be minimized by employing BMPs and meeting regulatory NPDES requirements (or state equivalent).

Groundwater is approximately 61 m (200 ft) below the ground surface in the location of the proposed redevelopment projects. Redevelopment activities are not expected to require excavation into the water table and adverse impact on groundwater resources is not anticipated. Hazardous material usage would be minimal; BMPs would help to minimize the potential of contaminants to migrate through the soil to groundwater aquifers.

Demolition and construction activities would result in a marginal increase in water use because of the increased number of workers at the site, and increased demand for direct construction uses, such as dust controls, equipment washing, and site cleanup. It is expected that the increase in water use by additional workers would be small compared to the overall facility water use.

Dust suppression and other construction-related water uses would be performed using water from tanker trucks filled from local hydrants. Water for these purposes could be withdrawn from the raw water system. The increase in water use would be localized and limited to demolition and construction areas, and would be either intermittent in duration or directly relative to the timing of construction traffic and construction, such as for dust suppression.

Although FEMA has not mapped floodplains surrounding NASA JPL, it is unlikely that the floodplain of the Arroyo Seco would be affected during construction because of the concrete lines banks on both sides of the water course adjacent to areas currently under use as parking for the NASA JPL employees.

Negligible adverse impacts on floodplain resources would occur under the Proposed Action. Contractors would avoid adverse impacts on the 100-year floodplain associated with the Arroyo Seco by limiting construction activities to the elevated ground above Arroyo Seco embankments, and ensuring coordination with the County of LACDPW during and after high intensity or ongoing rainfall events if construction activities were to occur on or below the embankments. Adverse effects on floodplain resources will be minimized by implementing erosion and sediment control and stormwater management practices during and after construction.

Operational Impacts

Current and historical NPDES permitted discharges from NASA JPL appear to have minimal impact on the water quality of the Arroyo Seco.

The planned infrastructure at NASA JPL includes improvements to the current water system, which would result in long-term beneficial impacts. The increase in workforce is not expected to adversely impact facility water use, or affect facility operations as the increase in workforce related water use is expected to be lower than the typical daily employee usage since portable toilets would be utilized for sanitary waste disposal.

Mitigation Measures

The following is a summary of proposed mitigation measures to minimize impacts to surface water or groundwater under the Proposed Action:

- NASA JPL will implement erosion and sediment control practices, such as sediment trapping, filtering, and other BMPs, as individual projects are constructed. Storm water management plans will also be prepared on a project-by-project basis to address long-term runoff and pollutant discharge.
- NASA JPL will prepare a SWPPP to include time frames when soil would be re-stabilized after being disturbed, the type of stabilization to be used, record of weekly storm events inspections, and maintenance necessary to keep BMPs employed until the site reaches 70 percent stabilization. The SWPPP will address BMPs employed to control erosion and sediment loss at the project sites. Minimum BMPs or Best Pollution Practices to be used will include a construction site entrance, silt fencing, storm drain protection, straw mulching, and reseeding of bare surfaces as soon as possible.
- Post-project BMPs may include the use of permeable pavers and bio-retention areas such as rain-gardens. Use of these BMPs would result in either a decrease in permeable surface areas, or preclude net increases in impermeable surface areas with additional developments, and would allow for greater infiltration of rain into the soil and consequently reduce stormwater runoff and pollution potential.

- As required by law, on-site stormwater management controls will be provided to limit the amount of storm runoff leaving the site during a storm event and to reduce the amount of contaminants in that runoff. Stormwater quantity and quality management practices required by Los Angeles CRWQCB will ensure no increase in post-development runoff peak flow and would mitigate the impacts of increased stormwater runoff on the combined sewer system.

- Long term designs for Master Plan set to offset increases in hardscape with increases in semi-permeable surfaces or high infiltration capacity soils.

- The amount of irrigated/mowed lawns will be minimized.

- Integrated pest management techniques will be used during landscaping and turf maintenance practices to reduce the potential for altering groundwater quality.

4.1.9.2 No Action Alternative

Under the No Action Alternative, there would be no changes to water resources in areas surrounding, or on-site, at JPL; therefore, no adverse impacts to water resources are anticipated.

4.1.10 Biological Resources

This section describes potential environmental impacts associated with biological resources (vegetation, wetlands, and wildlife), as a result of implementing the Proposed Action and the No Action Alternative at NASA JPL.

The level of impact on biological resources is based on: (1) the importance (i.e., legal, commercial, recreational, ecological, or scientific) of the resource; (2) the proportion of the resource that would be affected relative to its occurrence in the region; (3) the sensitivity of the resource to the proposed activities; and (4) the duration of ecological ramifications. The impacts on biological resources are adverse if species or habitats of high concern are negatively affected over relatively large areas. Impacts are also considered adverse if disturbances cause reductions in population size or distribution of a species of high concern.

4.1.10.1 Proposed Action

Under the Proposed Action, no short- or long-term adverse impacts to vegetation or wildlife are anticipated under either construction or operational activities. NASA JPL has been extensively altered over time and the project area is permanently disturbed with existing facilities and paved roads.

Construction Impacts

Proposed construction activities would occur solely within the improved areas of the campus. There are no naturally occurring vegetation communities within the region of influence (ROI) of the construction activities. Land disturbing activities associated with construction and demolition are limited to lawn and landscaped areas. Affected areas would be mulched and revegetated with native plants following the construction and demolition period to prevent nonnative, invasive plant growth. Short-term, localized effects on vegetation could be expected in proximity to the construction and demolition sites. Therefore, negligible adverse effects on vegetation would be expected as a result of the implementation of the Proposed Action.

Wildlife habitat within the improved areas of NASA JPL is limited due to fragmentation by the existing facilities, roads, and impervious surfaces at NASA JPL. Furthermore, most of the area associated with the Proposed Action consists of disturbed, landscaped, paved, or mowed lands. Construction activities would not impact habitat available to the mammals, birds, or reptiles that occur at NASA JPL. This assessment is based on the limited extent of areas that would be affected by the Proposed Action. Therefore, no adverse effects on wildlife would be expected to result from the Proposed Action.

Operational Impacts

Negligible adverse effects on vegetation would be expected as a result of the implementation of the Proposed Action. Potential effects on wildlife are also a function of noise produced by operations. Predictors of wildlife response include prior experience with existing and similar operations, stage in the breeding cycle, activity or context, age, and sex composition. Previous experience with similar operations is the most important of these indicators. The maximum sound level projected for the NASA JPL operations under the Proposed Action would be the same or less than current conditions. Therefore, no adverse effects on wildlife would be expected to result from operations under the Proposed Action.

4.1.10.2 No Action Alternative

Under the No Action Alternative, there would be no changes to biological resources in areas surrounding, or on-site, at NASA JPL; therefore, no adverse impacts to biological resources are anticipated.

4.1.11 Threatened Endangered and Other Sensitive Species

This section describes the potential environmental consequences associated with threatened, endangered, or sensitive species, as a result of implementing the Proposed Action and the No Action Alternative at NASA JPL. As a requirement under the ESA, Federal agencies must provide documentation that ensures that agency actions do not adversely affect the existence of any threatened or endangered species. The ESA requires that all Federal agencies avoid “taking” threatened or endangered species (which includes jeopardizing threatened or endangered species habitat). Section 7 of the ESA establishes a consultation process with USFWS that ends with USFWS concurrence or a determination of the risk of jeopardy from a Federal agency project.

4.1.11.1 Proposed Action

No Federal or state-listed species have been identified at NASA JPL; therefore, under the Proposed Action, no short- or long-term adverse impacts to threatened, endangered, or sensitive plant or animal species are anticipated under either construction or operational activities.

A search of the USFWS database indicated that there are no records of threatened or endangered species in the project area, and thus no further consultation under §7 of the ESA is necessary. Likewise, search of the CDFG database indicated there are no state-listed species or designated critical or essential habitat in the proposed project area. As projects are funded and approved, an additional review of the USFWS and CDFG database would be conducted prior to the start of any major construction at NASA JPL and agency coordination would be conducted as appropriate.

4.1.11.2 No Action Alternative

Under the No Action Alternative, there would be no changes to threatened, endangered, or sensitive species in areas surrounding, or on-site, at JPL; therefore, no adverse impacts to threatened, endangered, or sensitive species are anticipated.

4.1.12 Cultural Resources

Cultural resources are evaluated for nomination to the NRHP according to the Criteria for Evaluation shown at 36 CFR 60.4, as summarized below:

> *The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and*
>
> *a) that are associated with events that have made a significant contribution to the broad patterns of our history; or*
>
> *b) that are associated with the lives of persons significant in our past; or*
>
> *c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or*
>
> *d) that have yielded, or may be likely to yield, information important in prehistory or history.*

Integrity is the "ability of a property to convey its significance." In order to retain historical integrity, a property will always possess several, and usually most, of the seven aspects. Eligible sites are those that satisfy one or more of the aforementioned criteria and retain integrity. Non-eligible sites are those that do not satisfy any of the evaluation criteria and/or lack integrity.

Adverse impacts on cultural resources might include physically altering, damaging, or destroying all or part of a resource; altering characteristics of the surrounding environment that contribute to the resource's significance; introducing visual or audible elements that are out of character with the property or alter its setting; neglecting the resource to the extent that it deteriorates or is destroyed; or the sale, transfer, or lease of the property out of agency ownership (or control) without adequate legally enforceable restrictions or conditions to ensure preservation of the property's historical significance.

4.1.12.1 Proposed Action

The most relevant impacts on cultural resources at NASA JPL would be related to the direct impacts from building alteration and ground-disturbing activities. There are no known potential prehistoric or historic site locations in the areas where ground-disturbing activities are planned. The areas are not considered to have a high sensitivity for cultural resources. Furthermore, the area has suffered heavy disturbance in the past.

There is no potential for degradation of the setting from noise and visual intrusion related to the construction activities or operations proposed in this EA, nor are there potential for structural damage from noise and low-frequency sound vibrations associated with the construction activities or operations.

Two structures listed as NHLs on NASA JPL, Building 230–Space Flight Operations, and Building 150–25-ft Space Simulator, would not be affected by construction under the Proposed Action. Based on the 2010 Historic Survey of the NASA JPL site, seven structures were identified to be eligible for listing in the NRHP. According to the Master Plan Update, the potential exists for the removal or major alteration of these seven structures.

NASA has initiated consultation through the Section 106 process with the California SHPO. As a result of this consultation, a PA is being developed that identifies any mitigation measures to be implemented as well as preservation design guidelines for the defined character areas in NASA JPL. All coordination with the California SHPO is provided in **Appendix F**. These design guidelines will be incorporated into the final Master Plan.

As design for individual projects commences, NASA JPL would continue to consult with the California SHPO regarding potential impacts to identified historic properties. When applicable, specific mitigation measures would be detailed as part of the conceptual design process.

4.1.12.2 No Action Alternative

Under the No Action Alternative, there would be no changes to cultural resources in areas surrounding NASA JPL, or on-site; therefore, no adverse impacts to cultural resources are anticipated.

4.1.13 Hazardous Materials and Waste

Impacts to hazardous material management would be considered adverse if the Proposed Action resulted in noncompliance with applicable Federal and state regulations, or increased the amounts generated or procured beyond current NASA waste management procedures and capacities.

Impacts on pollution prevention would be considered adverse if the Proposed Action resulted in worker, resident, or visitor exposure to these materials, or if the action generated quantities of these materials beyond the capability of current management procedures. Impacts on the Environmental Restoration Program (ERP) would be considered adverse if the Proposed Action disturbed (or created) contaminated sites resulting in negative effects on human health or the environment.

4.1.13.1 Proposed Action

Short- and long-term negligible to minor adverse impacts to hazardous wastes and materials are anticipated. No adverse construction or operational impacts on the existing NPL sites are anticipated

Construction Impacts

Wastes containing hazardous materials or substances such as ACM, LBP, pesticides, and herbicides would be produced during deconstruction activities. Because of the age of the existing buildings and historical uses, many of the facility buildings and equipment may contain hazardous substances, such as ACM, LBP, PCBs, and mercury. In addition, soils may contain organic and metal contaminants.

During demolition and deconstruction, these materials may be disturbed and/or require specific handling requirements. If not initially segregated and removed, these items can also contaminate the non-hazardous components of the demolition wastes or be released to the environment. Additionally, certain wastes, such as ACM, could become airborne of proper controls are not implemented. It is anticipated that the hazardous and chemical wastes generated from facility demolition would result in short-term minor adverse effects.

Products containing hazardous materials or substances such as fuels, oils and lubricants would be procured and used during deconstruction and construction activities. While it is anticipated that the quantity of such hazardous materials used would be minimal, their duration of use would be long term due to the extended period of Master Plan implementation, resulting in minor adverse effects.

Accidental spills could occur as a result of the construction. A spill could potentially result in adverse effects on wildlife, soils, water, and vegetation. However, the amount of hazardous materials at construction sites would be limited and the equipment necessary to quickly contain any spill would be present at all times. Contractors would coordinate the management of hazardous materials and wastes with NASA JPL.

Operational Impacts

Under the Proposed Action, it is anticipated that procurement of products containing hazardous materials would be comparable with existing conditions. Therefore, it is estimated that hazardous material procurement would remain comparable to the baseline condition.

It is anticipated that the volume, type, classifications, and sources of hazardous wastes associated with the Proposed Action would be similar in nature with the baseline condition waste streams. Hazardous waste would be handled, stored, transported, disposed of, or recycled in accordance with the NASA JPL Hazardous Waste Management Plan.

Mitigation Meausures

Removal of contaminated building structures, equipment and soil will be accomplished by means of an approved Demolition Design Work Plan or similar, which will be consistent with NASA policies and Federal, state, and local requirements, and include both BMPs and appropriate construction management practices.

4.1.13.2 No Action Alternative

Under the No Action Alternative, there would be no changes to hazardous materials and wastes in areas surrounding JPL, or on-site; therefore, no adverse impacts to hazardous materials and wastes are anticipated.

4.2 Table Mountain Facility

4.2.1 Land Use

This section describes the potential environmental consequences associated with land use, as a result of implementing the Proposed Action or the No Action Alternative at TMF.

The Proposed Action would result in adverse land use impacts if it:

- Judged to be in conflict with adopted plans and policies for the surrounding area or adjacent communities;
- Violated zoning ordinances for surrounding areas or communities;
- Judged to be in conflict with adopted plans and policies for the facility; or
- Violated zoning designations for the facility.

4.2.1.1 Proposed Action

No short- or long-term adverse impacts to land use in surrounding areas are anticipated. Short-term adverse impacts to land use on-site at TMF are anticipated as described below. Most areas of TMF are currently and in the future designated for research. Secondary areas for administrative and other forms of support are also indicated. In all cases, planned land use areas for research, community/office, and TMF support were identified by expanding existing land use areas into adjacent potential development sites giving the greatest additional allocation of land to future research functions and sufficient space for community/office and TMF support functions.

As has been previously discussed, the entire area surrounding TM-15 and currently unused has been designated into a land use category called ‘NASA Reserve’ which could be used by various future users not necessarily needing regular contact with the main TMF area located on the upper Table Mountain ridge. Most of the TMF site is taken up by hillsides that would remain as natural forest.

Construction Impacts

In general, on-site land uses may be subject to minor short-term impacts due to internal changes as construction and infrastructure redevelopment occurs. These effects would be localized, and occur when construction activities occur at immediately adjacent facilities, and would extend for the duration of those activities. During construction, occupants of on-site buildings adjacent to areas scheduled for construction would be impacted; however these impacts would be temporary, or intermittent. Additionally, there would be on-site inconveniences from modified parking and pedestrian patterns, and from general increases in background noise.

The Proposed Action is not expected to impact surrounding ANF designated land uses, because development activities are consistent with the present use and zoning for TMF. The Proposed Action would have no impacts to land use or zoning in the neighboring community of Wrightwood due to the distance between the two locations.

Operational Impacts

Overall, the Master Plan developments proposed at TMF are similar in use and function as the current facility, and although the density would increase marginally, no operational impacts are anticipated.

4.2.1.2 No Action Alternative

Under the No Action Alternative, there would be no changes to either land use or zoning in areas surrounding TMF, or on-site; therefore, no adverse impacts to land use are anticipated.

4.2.2 Socioeconomics

This section describes the potential environmental consequences associated with socioeconomics, as a result of implementing the Proposed Action or the No Action Alternative at TMF. The Proposed Action would result in adverse socioeconomic impacts if it caused a major shift in population, housing, or employment either on-site, or in the surrounding areas. For the purposes of this analysis, a major change would result from a 5 percent increase or decrease to any of these locations.

4.2.2.1 Proposed Action

Negligible short-term adverse and beneficial impacts on the surrounding communities are anticipated. No long-term adverse impacts to population, housing, or employment in surrounding areas, or on-site, are anticipated.

Construction Impacts

Implementation of the Proposed Action could provide a negligible beneficial impact to the economy of nearby Wrightwood due to minimal increases in employment opportunities for the construction workforce and revenues for local businesses and governments generated from these additional construction activities and workers. Several TMF employees live in Wrightwood and most employees of TMF visit the community on a regular basis for dining and/or shopping purposes. However, any increase in workforce and revenue would be temporary and negligible, lasting only as long as construction.

Operational Impacts

There would be negligible adverse impacts to TMF operations, since implementation of the Proposed Action is not expected to result in change in the number of site personnel. No discernable impacts to employment levels within the project vicinity would be expected.

It is not anticipated that implementation of the Master Plan would increase the need for off-site infrastructure and public services. No short-term or long-term adverse impacts to the economy in surrounding areas, or on-site, are anticipated. In general, there would be long-term beneficial effects for facility operations. No adverse impacts to housing in surrounding areas or, on-site, are anticipated.

Also included with socioeconomics are concerns pursuant to EO 13045, "Protection of Children from Environmental Health Risks and Safety Risks." This EO directs Federal agencies to identify and assess environmental health and safety risks that might disproportionately affect children. The Proposed Action would not pose any adverse or disproportionate environmental health and safety risks to children living on or in the vicinity of TMF. The project area would be fenced and the likelihood of the presence of children at the site of the proposed action is considered minimal, which further limits the potential for any effects.

4.2.2.2 No Action Alternative

Under the No Action Alternative, there would be no changes to socioeconomics in areas surrounding TMF, or on-site; therefore, no adverse impacts to socioeconomics are anticipated.

4.2.3 Environmental Justice

This section describes the potential environmental consequences associated with Environmental Justice, as a result of implementing the Proposed Action or the No Action Alternative at TMF. EO 12898 is designed to prevent Federal policies and actions from creating disproportionately high and adverse impacts on minority and low-income populations. A proposed project would result in a significant environmental justice impact if it were judged to be in conflict with the fair treatment for people of all races, cultures, and incomes.

4.2.3.1 Proposed Action

No adverse impacts to Environmental Justice are anticipated as a result of the Proposed Action.

Construction Impacts

No long-term impacts to environmental justice are anticipated from construction and infrastructure and site improvements associated with implementation of the Proposed Action. A low income population was identified in the neighboring Wrightwood community, and, albeit small, it would represent an area of potential environmental concern. However, construction activities associated with the Proposed Action would be localized to the construction zone, and within the secured TMF perimeter. Thus, construction activities would not pose a disproportionate effect on identified minority populations in the adjacent community.

Operational Impacts

Impacts associated with operations in proposed future facilities would also be localized within TMF. Noise levels would be within the same range as existing operations. Therefore, operational activities would not pose a disproportionate effect on the identified minority populations in the local community.

4.2.3.2 No Action Alternative

Under the No Action Alternative, there would be no changes to Environmental Justice either in areas surrounding TMF, or on-site. The No Action Alternative would not disproportionately impact minority or low-income populations; therefore, no adverse impacts to Environmental Justice are anticipated.

4.2.4 Traffic and Transportation

This section describes the potential environmental consequences for traffic and transportation, as a result of implementing the Proposed Action or the No Action Alternative. The Proposed Action would result in a major transportation impact if it resulted in a substantial increase in traffic generation, a substantial increase in the use of the local connecting road and access-ways, or if on-site parking demand would not be met by projected supply.

4.2.4.1 Proposed Action

Minor adverse short- and long-term impacts to traffic and transportation are anticipated under the Proposed Action.

Construction Impacts

Construction-related activities under the Proposed Action are anticipated to produce short-term adverse impacts on traffic generation, traffic volume, street use, and parking availability on-site. Construction activities under the Proposed Action would result in short-term increases in sub-contractors performing the construction and/or infrastructure redevelopment. Increases in traffic volumes associated with proposed construction activity would be temporary.

Operational Impacts

While no long-term impacts to transportation systems on-site are anticipated, on-site operations would face short-term minor impacts as a result of increased traffic generation and elevated traffic volumes. The Proposed Action does not include any plans to substantially increase the total TMF workforce on-site. In the long term, the Proposed Action would result in beneficial impacts as current facility-wide parking issues would be addressed with increases in available parking spaces. Increases in parking spaces would result in minor reductions in traffic generation.

The proposed project does not include any changes to the transportation network in or around TMF.

Mitigation Measures

The following is a summary of proposed mitigation measures under the Proposed Action. To minimize temporary impacts to transportation, construction routes will be designed to minimize conflicts with vehicular traffic, and arrivals/departures will be scheduled around normal work hours. Traffic will be redirected when construction activities occur in areas currently dedicated to vehicular travel and parking. Truck traffic for construction materials coming on site and demolition debris transported off-site could at times approach ten trucks per hour. All loads will have either bills of lading or manifests prior to leaving the facility. All truck traffic will be scheduled and routed to minimize impacts on local traffic.

Contractors will operate under limited parking availability, and will restrict employees from bringing unnecessary commuter vehicles on-site. Additionally, contractor shift start-times would be adjusted to preclude readily apparent increases in traffic volumes during peak morning and evening hours for the remainder of the TMF employees and contractors. Additional and more detailed mitigation for transportation impacts will be identified as conceptual designs for individual projects are initiated.

4.2.4.2 No Action Alternative

Under the No Action Alternative, there would be no changes to traffic or transportation in the areas surrounding TMF, or on-site; therefore, no adverse impacts to traffic and transportation in areas surrounding TMF, or on-site are anticipated.

4.2.5 Utilities and Services

This section describes the potential environmental consequences associated with utilities and services, as a result of implementing the Proposed Action or the No Action Alternative at TMF. The Proposed Action would result in an adverse impact to utilities or services if the project required more than the existing infrastructure could provide or required services in conflict with adopted plans and policies for the area. The Proposed Action would also result in an adverse impact if it resulted in a need for funding that required a separate vote of the public or securing funds that are not currently programmed.

4.2.5.1 Proposed Action

Short-term adverse impacts to utilities and services are anticipated. Beneficial impacts to utilities and services are anticipated over the long term.

Construction Impacts

Solid wastes generated during construction are likely to affect solid waste management in San Bernardino County, and short-term negligible to minor short-term adverse impacts would be expected. The volume of solid wastes generated as a result of the Proposed Action is expected to be minor compared to the solid waste currently generated in San Bernardino County, due to the extended period of Plan implementation. The construction debris associated with the Proposed Action would not result in exceeding the capacity of any landfill, or the violation of any permit for any landfill.

Solid wastes generated through construction would consist largely of new construction by-products, such as concrete, blocks, bricks, wooden framing and metals. Contractors would recycle construction materials to the greatest extent possible, and would dispose of non-recyclable construction debris at one or more of the permitted San Bernardino County landfills, which have/have not yet been identified.

Infrastructure redevelopments are likely to result in short-term adverse impacts as construction activities may affect or disrupt or cause outages in electrical power, natural gas supplies, and water, sanitary, and storm sewer lines. On-site generators would be available to provide back-up power for any high-power demanding equipment. Demand during temporary/ planned outages is expected to be met, and impacts would be negligible.

Infrastructure improvements are likely to produce beneficial impacts over the longer term, as a result of more reliable grid connections, including updated technologies for greater efficiency and overall increases in safety. In particular, new infrastructure at TMF would result in beneficial impacts in terms of reduced on-site risks at the facility level for emergency response and safety management. As part of the building redevelopment projects, all new construction would include state of the art alarm and fire suppression systems, and would comply with all applicable local and national building codes.

Operational Impacts

No activities or change in operations have been identified that would have an adverse effect on employee facilities and services. Existing services such as emergency response, fire, police and other services would continue to be able to serve TMF. The need for emergency services is related to the number of personnel or employees working at the facility. The contractor would retain the primary responsibility for ensuring worker safety, and would be responsible for ensuring emergency preparedness procedures are developed and followed by contractor personnel. No additional equipment or amendments to existing emergency services agreements are anticipated.

The new buildings planned under the Proposed Action, the OCTL-2 and Remote Sensing Facility, would not result in a substantial increase in electric power demand. However, in the event that future increases should occur, the new power system is designed to accommodate anticipated loads and provide adequate electrical grid connections into the foreseeable future.

There are no activities that have been identified in the Master Plan that would cause an adverse impact on existing infrastructure outside TMF property; however, additional study would occur during project planning and design for utility and other infrastructure needs. TMF would coordinate with the appropriate utilities to identify daily demand, peak demand, and supply.

Mitigation Measures

The following is a summary of proposed mitigation measures under the Proposed Action:

- Design landscape plans for minimum water use (e.g., plant native, drought-tolerant species);
- Minimize use of lawns because of their high water consumption (and energy consumption and air emissions from mowers);
- Plan for water conservation in lawn maintenance when necessary (set mower blades high and water slowly at night no more than 1 in per week with automatic, low-volume irrigation equipment);
- Incorporate energy conservation measures into building design to mitigate impacts related to power systems;
- Recycle construction related debris; and
- Implement office recycling programs in accordance with EO 13101: Greening the Government through Waste Prevention, Recycling, and Federal Acquisition.

4.2.5.2 No Action Alternative

Under the No Action Alternative, there would be no changes to utilities and services in areas surrounding TMF, or on-site; therefore, no adverse impacts to utilities and services are anticipated.

4.2.6 Air Quality

The proposed project would result in an adverse air quality impact if the activities associated with its construction or operation would result in exceeding the NAAQS or CAAQS thresholds or cause deterioration in air quality.

4.2.6.1 Proposed Action

While short-term adverse impacts to air quality are anticipated, the Proposed Action would not result in any long-term adverse impacts to air quality. Air quality impacts associated with a construction project may occur at both a regional and local scale, and are generally summarized into four categories (see Section 4.1.6.1 for a description of these categories):

- Temporary Construction Impacts
- Local Operational Impacts
- Regional Operational Impacts
- Cumulative Impacts

Therefore, analysis of potential impacts to air quality included emissions and contaminants from both construction and operational sources. A General Conformity review and applicability analysis was completed using URBEMIS modeling software to verify whether construction and operation emissions produced on-site under the Proposed Action would conform to the SIP, and remain below applicable regional air quality thresholds. General Conformity under the CAA Section 176(c) (as amended) was therefore evaluated for the Proposed Action according to the requirements of 40 CFR 93, Subpart B.

The Master Plan calls for site redevelopment to start in CY 2014, and overall Master Plan projects including all associated utility and infrastructure upgrades to be completed by the end of CY 2018. The levels of construction are anticipated to be greatest, and involve the highest levels of construction-related air pollution production during development of the new OCTL facility adjacent to TM-2 in CY 2016.

There is no construction proposed for CY 2017, whereas CY 2018 will involve substantial use of heavy equipment for site grading and earth movement as part of the TM-2 road and utility infrastructure developments. Thus, as a result of gradual increases in operational emissions through CY 2017 as the new facility components are brought online, the worst case scenario for air pollution production at TMF is anticipated to be CY 2018 when operational emissions are expected to be at final levels, and occurring concurrently with the last major set of proposed construction activities.

The General Conformity review indicated that cumulative peak year direct and indirect emissions at TMF (i.e., the sum of construction and facility operations) for CY 2018 would *not* exceed the 25 tons per year (tpy) *de minimis* levels for either of the precursors (nitrogen oxides [NO_X], and VOC/reactive organic gases [ROG]) of the criteria pollutant of concern (O_3). Because the direct and indirect emissions from the worst year, 2018, are below the *de minimis* thresholds and it was shown that the project emissions would not exacerbate air quality, increase violations of non-attainment pollutants, or delay the region from attaining the NAAQS in a timely manner, the Proposed Action is in conformance with the SIP. The full General Conformity Applicability Analysis for TMF is included as **Appendix G**, and includes the URBEMIS modeling summary and construction schedule.

While there may be several overlapping construction components, each activity remains an individual project subject to funding availability. Therefore, this assessment assumes that long-term impacts are a consideration for cumulative analysis, and will be discussed in Section 4.4.

Construction Impacts

Construction impacts include airborne dust from demolition, grading, excavation and materials hauling as well as gaseous emissions from the use of heavy equipment, delivery and dirt hauling trucks, and employee vehicles. Additionally, the use of new paints and surface coatings produce VOCs. One example would be photo chemically reactive VOC emissions from curing asphalt concrete. These impacts may affect regional pollutants, such as O_3, or pollutants where the impacts occur very close to the source, such as PM_{10}. There are no known sources of odors on the project site that would be released during construction. Soil would be disturbed during grading and excavation, or while storing project-related equipment.

Additional short-term adverse impacts would occur in conjunction with new commuter traffic generated from contractor employees and it is anticipated to result in an increase in air quality impacts at the regional level. Different types of contractors would be on-site at different times, utilizing different equipment according to the construction or infrastructure redevelopment taking place. The analysis performed under this assessment assumes there would be a maximum or between 25 to 30 workers on-site during the peak construction period. Calculation summaries are contained in the General Conformity Applicability Analysis in **Appendix G**.

Operational Impacts

Implementing the Proposed Action is anticipated to result in minor increases in operational air emissions due to the addition of new facilities. The new facilities being constructed would be similar in use and function to the existing operations, and while the operating capacity of TMF is increasing, the overall number of employees and vehicle trips are anticipated to remain at current levels. The Proposed Action would not have a substantial impact to regional ozone concentrations from on-site operations. AVAQMD monitoring data indicates background levels of both the 74 and 84 part per billion (ppb) eight-hour ozone standards are well below state and national standards in the Wrightwood area (SCAQMD, 2010).

Mitigation Measures

Short term construction impacts can be mitigated through the use of proper control measures, including routine maintenance of all construction equipment, regular maintenance of the emission control devices on all construction equipment, and covering/wetting exposed soils to reduce fugitive dust during construction. Developers will be required to submit a Construction Management Plan including plans to control impacts to air quality during construction.

The following is a summary of proposed mitigation measures under the Proposed Action:

- CARB certified ultra low-sulfur diesel fuel containing a maximum of 15 ppm sulfur content will be used on all diesel powered construction equipment;
- Contractors will only use heavy construction equipment with emissions control technology to meet Tier-II California Emissions Standards as specified in CCR Title 13, § 2423(b)(I);
- Restrict engine idling to 10-minute interval maximums;
- CARB certified and ANF/USFS approved non-toxic soil binders will be applied per manufacturer recommendations to active unpaved roadways, unpaved staging areas, and unpaved parking areas throughout construction, to reduce fugitive dust emissions.
- Water the disturbed areas of the active construction sites at least three times per day, and more often if uncontrolled fugitive dust is noted;

- Schedule construction delivery traffic outside of peak-hour traffic patterns for the local community, and other construction traffic will be minimized to the extent feasible.

More detailed air quality mitigation measures will be prepared during the conceptual design phase of individual projects.

4.2.6.2 No Action Alternative

Under the No Action Alternative, there would be no changes to air quality in areas surrounding TMF, or on-site; therefore, no adverse impacts to air quality are anticipated.

4.2.7 Noise and Vibration

This section describes the potential environmental consequences associated with noise and vibration as a result of implementing the Proposed Action or the No Action Alternative at TMF.

The Proposed Action would result in adverse impacts if noise or vibration conditions resulting from implementation of the projects exceeded established noise restrictions, or if there were long-term increases in the number of people highly annoyed by the noise/vibration environment.

Adverse impacts would also occur if there are noise-associated adverse health effects to individuals; or if there are unacceptable increases to the noise environment for sensitive receptors. A sensitive receptor is any person or group of persons in an environment where low noise levels are expected, such as schools, day cares, hospitals, and nursing homes.

4.2.7.1 Proposed Action

In general, while short-term minor adverse impacts are likely, there would be no substantial long-term impacts to noise and vibration levels in on-site locations. No adverse impacts to surrounding areas are anticipated.

Construction Impacts

Over the short-term, there would be minor adverse effects from high intermittent noises, and/or from general increases in background noise. TMF is surrounded on all sides by the ANF, and the expected levels of noise and vibrations are only anticipated to impacts on-site locations. Construction activities which would produce noise or vibrations are likely to cease during winter months due to heavy snow and climatic conditions. Therefore, MHN tubing operations, or visitors using any of the Mountain High resorts which occur at nearby locations, are not expected to be affected.

Operational Impacts

Activities and operations at TMF are not expected to change as a result of implementation of the Master Plan. TMF is not anticipated to generate appreciable ground-borne vibrations either on-site or at off-site locations, and noise levels at TMF are not sufficient to generate significant structural vibrations at off-site locations from airborne sound levels.

Mitigation Measures

The following is a summary of proposed mitigation measures under the Proposed Action:

- All construction equipment powered by an internal combustion engine will be equipped with a properly maintained muffler;

- Air compressors will meet current USEPA noise emission standards;
- New construction equipment will be used as much as possible since it is quieter than older equipment;
- Nighttime construction activities will be minimized;
- Portable noise barriers within the equipment area and around stationary noise sources will be established; and
- Tools and equipment will be selected to minimize noise.

4.2.7.2 No Action Alternative

Under the No Action Alternative, there would be no changes to noise and vibration in areas surrounding TMF, or on-site; therefore, no adverse impacts to noise and vibration are anticipated.

4.2.8 Geology and Soils

The Proposed Action or the No Action Alternative would result in an adverse impact if:

- Regional geology were affected;
- Soils classified as prime and unique farmland were affected;
- Soils affected were considered unsuitable for development; and
- Building construction was incompatible with the seismic risk status of the project area.

4.2.8.1 Proposed Action

Short-term negligible and long-term minor adverse impacts to geology and soils are anticipated from construction activities under the Proposed Action. No operational impacts are anticipated.

Construction Impacts

Redevelopment activities under the Proposed Action would affect local geology at TMF. The impacts to surface and possibly bedrock geology (depending on the extent of excavation necessary and the exact depth of bedrock in the project area) would result from the site preparation and covering of geologic features. However, there would be no adverse impacts to regional geologic features, and therefore long-term effects to geology would be considered negligible.

Soils would be disturbed during construction and removed as a result of implementing the Proposed Action, resulting in a long-term, minor adverse impact. However, this soil complex is not considered prime or unique, and has been disturbed in the past by development (roads, buildings, landfill) at TMF. TMF would employ proper engineering design and techniques such as using deep foundations; backfilling excavated areas with material; compacting the building site before construction begins; and installing surface and subsurface drains near foundations.

Mitigation Measures

The following is a summary of proposed mitigation measures under the Proposed Action. Implementation of these standard measures would result in negligible impacts to soils as a result of construction.

- Soil suitability will be determined and appropriate building foundation specifications would be developed.
- A detailed erosion and sedimentation control plan will be developed prior to construction, based on the requirements of the Lahontan CRWQCB.
- Measures to be taken would include minimizing areas of disturbance, provision of silt barriers, and landscaping of unimproved areas.
- Landscaping will follow construction as soon as practicable.

4.2.8.2 No Action Alternative

Under the No Action Alternative, there would be no changes to geology and soils in areas surrounding TMF, and no substantial changes to soils on-site; therefore, no adverse impacts to geology and soils are anticipated.

4.2.9 Water Resources

This section describes potential environmental impacts associated with water resources (surface water, groundwater, floodplains), as a result of implementing either the Proposed Action or the No Action Alternative.

The Proposed Action would result in an adverse impact to water resources if:

- It was to violate Federal or state water quality regulations and standards for surface water or groundwater.
- Existing water resources were directly or indirectly impacted from water extraction activities due to increased demand. Water resource requirements of the project must be balanced with available supplies, and appropriate water rights and extraction procedures must be followed.
- Activities were located in a regulatory floodplain without appropriate flood study, FEMA map revisions, and mitigation measures.
- Activities fail to adequately address upstream drainage as it is conveyed through the study area.
- Activities change historic drainage flows and/or patterns, potentially impacting downstream areas.

4.2.9.1 Proposed Action

Since there are no surface waters, groundwater, or floodplains at TMF, no long-term adverse impacts to these resources are anticipated under the Proposed Action. There would be short-term adverse impacts related to demolition and construction activities.

Construction Impacts

Construction or paving activities at the facility is not expected to substantially alter on-site drainage patterns over the long-term because the majority of construction is confined to the already highly developed main areas of the facility. While demolition and construction activities would not increase stormwater runoff, they would likely produce minor short-term adverse impacts with disruptions to storm water flow, and transportation. There are no stormwater collection and treatment devices at the site. The main TMF site and east TM-2 site are located on hilltops, which allow the surface stormwater runoff to be conveyed to the surrounding slopes through natural relief or graded swales.

Demolition and construction activities would result in a marginal increase in water use because of the increased number of workers at the site, and increased demand for direct construction uses, such as dust controls, equipment washing, and site cleanup. It is expected that the increase in water use by additional workers would be small compared to the overall facility water use. Dust suppression and other construction-related water uses would be performed using water from the 1,192,405-l (315,000-gal) steel tank owned by the USFS. The increase in water use for these purposes would be localized and limited to demolition and construction areas, and would be either intermittent in duration, or directly relative to the timing of construction traffic and construction activities, such as in the case of dust suppression.

Operational Impacts

No increase in workforce is expected so there would be no adverse impacts to facility water use, and there would be no effect on facility operations.

4.2.9.2 No Action Alternative

Under the No Action Alternative, there would be no changes to water resources in areas surrounding, or on-site at TMF; therefore, no adverse impacts to water resources are anticipated.

4.2.10 Biological Resources

This section describes the potential environmental consequences associated with biological resources (vegetation, wetlands, and wildlife), as a result of implementing the Proposed Action and the No Action Alternative at TMF.

The level of impact on biological resources is based on (1) the importance (i.e., legal, commercial, recreational, ecological, or scientific) of the resource, (2) the proportion of the resource that would be affected relative to its occurrence in the region, (3) the sensitivity of the resource to the proposed activities, and (4) the duration of ecological ramifications. The impacts on biological resources are adverse if species or habitats of high concern are negatively affected over relatively large areas. Impacts are also considered adverse if disturbances cause reductions in population size or distribution of a species of high concern.

4.2.10.1 Proposed Action

Under the Proposed Action, no long term adverse impacts to vegetation or wildlife are anticipated under either construction or operational activities. There are no wetlands at TMF so there would be no adverse wetlands impacts.

Construction Impacts

Proposed construction activities under the Proposed Action would occur within the fenced area of the facility. Future redevelopment activities could result in direct adverse impacts to ground-dwelling amphibian and reptile species and would likely result in temporary or permanent loss of habitat. Avoidance of tree removal during the breeding season would be necessary in order to avoid direct impacts to nesting special-status and migratory birds.

Short-term and localized minor adverse effects on vegetation could be expected in proximity to the construction sites. This assessment is based on the limited areal extent of areas that would be directly impacted by the Proposed Action.

Operational Impacts

Potential effects on wildlife are also a function of noise produced by operations. Predictors of wildlife response include prior experience with existing and similar operations, stage in the breeding cycle, activity or context, age, and sex composition. Previous experience with similar operations is the most important of these indicators. The maximum sound level (L_{max}) projected for the TMF operations under the Proposed Action would be the same or less than current conditions. Therefore, no long term adverse effects on wildlife would be expected to result from operations under the Proposed Action.

Mitigation Measures

The following is a summary of proposed mitigation measures under the Proposed Action:

- Maintain large green space to provide for wildlife habitat and movement corridors.
- Re-vegetation of removed or damaged vegetation, as a result of construction activities, would also mitigate impacts to terrestrial biota. Careful siting of new buildings within identified zones would help mitigate potentially adverse impacts.
- Non-native and invasive vegetation will be removed and replaced with native species on a project by project basis. To the extent practical, TMF will implement measures to avoid impacts to larger tree specimens native to the surrounding area. More detailed planting plans and tree save measures will be prepared with individual projects.

4.2.10.2 No Action Alternative

Under the No Action Alternative, there would be no changes to biological resources in areas surrounding, or on-site at TMF; therefore, no adverse impacts to biological resources are anticipated.

4.2.11 Threatened, Endangered, and Other Sensitive Species

This section describes the potential environmental consequences associated with threatened, endangered, or sensitive species, as a result of implementing the Proposed Action and the No Action Alternative at TMF. As a requirement under the ESA, Federal agencies must provide documentation that ensures that agency actions do not adversely affect the existence of any threatened or endangered species. The ESA requires that all Federal agencies avoid "taking" threatened or endangered species (which includes jeopardizing threatened or endangered species habitat). Section 7 of the ESA establishes a consultation process with USFWS that ends with USFWS concurrence or a determination of the risk of jeopardy from a Federal agency project.

4.2.11.1 Proposed Action

Under the Proposed Action, no long-term adverse impacts to threatened, endangered, or sensitive plant or animal species are anticipated under either construction or operational activities.

A search of the USFWS database indicated that there are no records of threatened or endangered species in the project area, and thus no further consultation under §7 of the ESA is necessary. Likewise, search of the CDFG database indicated there are no state-listed species or designated critical or essential habitat in the proposed project area. As projects are funded and approved, an additional review of the USFWS and CDFG database would be conducted prior to the start of any major construction at TMF and agency coordination would be conducted as appropriate.

Construction Impacts

Proposed construction activities under the Proposed Action would occur solely within the fenced area of the facility. Except for the loss of foraging habitat, future facility expansion activities would be unlikely to directly affect special status wildlife species. Construction-related noise could potentially disturb transient bird species, but these adverse impacts would be 1) temporary, lasting only as long as construction, and 2) negligible, because suitable habitat for transient birds is found throughout the region. Short-term, localized effects on sensitive plant species could be expected in proximity to the construction and demolition sites.

Focused plant surveys for four special-status plant species, Big Bear Valley woollypod (*Astragalus leucolobus*), crested milk vetch (*Astragalus bicristatus*), Parish's onion (*Allium parishii*), and pine-green gentian (*Swertia neglecta*),would need to be conducted at an appropriate time of year for identification prior to any proposed ground-disturbing activities to ensure that plants are adequately flagged and protected and to determine specific locations of crested milkvetch, Parish's onion, and pine green gentian. Focused surveys should also determine presence/absence of the 20 special-status plants with a potential to occur on site.

Operational Impacts

If special status bird species are determined to occur on site and future facility operations would require removal of trees or buildings, temporary or permanent removal of nesting habitat would result. Avoidance of tree removal during the breeding season would likely be necessary in order to avoid direct impacts to nesting special-status and migratory birds.

No long term adverse effects on sensitive wildlife species would be expected to result from operations under the Proposed Action.

Mitigation Measures

Proposed mitigation measures under the Proposed Action include avoiding known locations of special-status species. Appropriate mitigation measures will be applied if future facility operations would disturb these areas.

4.2.11.2 No Action Alternative

Under the No Action Alternative, there would be no changes to threatened, endangered, or sensitive species in areas surrounding, or on-site at TMF; therefore, no adverse impacts to threatened, endangered, or sensitive species are anticipated.

4.2.12 Cultural Resources

Cultural resources are evaluated for nomination to the NRHP according to the Criteria for Evaluation shown at 36 CFR 60.4 (see Section 4.1.12 for a summary of these criteria). Eligible sites are those that satisfy one or more of the aforementioned criteria and retain integrity. Non-eligible sites are those that do not satisfy any of the evaluation criteria and/or lack integrity.

Adverse impacts on cultural resources might include physically altering, damaging, or destroying all or part of a resource; altering characteristics of the surrounding environment that contribute to the resource's significance; introducing visual or audible elements out of character with the property or alter its setting; neglecting the resource so that it deteriorates or is destroyed; or the sell, transfer, or lease of the property out of agency ownership or control without legally enforceable restrictions or conditions to ensure preservation of the property's historic significance.

4.2.12.1 Proposed Action

No archaeological resources are known to be located immediately offsite or within the TMF boundary; therefore no long- or short-term adverse impacts to archaeological resources are anticipated under the Proposed Action.

The most relevant impacts on cultural resources at TMF would be related to the direct impacts from building alteration and ground-disturbing activities. There is no potential for degradation of the setting from noise and visual intrusion related to the proposed construction activities or operations, nor are there potential for structural damage from noise and low-frequency sound vibrations associated with the construction activities or operations.

Based on the 2010 Historic Survey of the TMF site, one structure (TM-2) was identified to be eligible for listing in the NRHP. According to the Master Plan Update, there would not be any alteration to this structure. TMF has initiated consultation through the Section 106 process with the California SHPO. As a result of this consultation, a programmatic agreement is being developed that identifies any mitigation measures to be implemented as well as preservation design guidelines for the defined character areas in TMF. All coordination with the California SHPO is provided in **Appendix F**. These design guidelines will be incorporated into the final Master Plan.

As design for individual projects commences, TMF will continue to consult with the California SHPO regarding potential impacts to identified historic properties. When applicable, specific mitigation measures will be detailed as part of the conceptual design process.

4.2.12.2 No Action Alternative

Under the No Action Alternative, there would be no changes to cultural resources in areas surrounding TMF, or on-site; therefore, no adverse impacts to cultural resources are anticipated.

4.2.13 Hazardous Materials and Waste

Impacts to hazardous material management would be considered adverse if the Proposed Action resulted in noncompliance with applicable Federal and state regulations, or increased the amounts generated or procured beyond current NASA waste management procedures and capacities. Impacts on pollution prevention would be considered adverse if the Proposed Action resulted in worker, resident, or visitor exposure to these materials, or if the action generated quantities of these materials beyond the capability of current management procedures.

4.2.13.1 Proposed Action

Short-term minor adverse impacts to hazardous wastes and materials are anticipated during construction activities. No long-term impacts from operations are anticipated.

Construction Impacts

Products containing hazardous materials or substances such as fuels, oils and lubricants would be procured and used during construction activities. While it is anticipated that the quantity of such hazardous materials used would be minimal, their duration of use would be long term due to the extended period of Master Plan implementation. It is anticipated that the quantity of hazardous and petroleum wastes generated from construction would be negligible.

Accidental spills could occur as a result of the construction. A spill could potentially result in adverse effects on wildlife, soils, water and vegetation. However, the amount of hazardous materials at construction sites would be limited and the equipment necessary to quickly contain any spill would be present at all times. Contractors would coordinate the management of hazardous materials and wastes with TMF.

Operational Impacts

Under the Proposed Action, it is anticipated that procurement of products containing hazardous materials would be comparable with existing conditions. Therefore, it is estimated that hazardous material procurement would remain comparable to the baseline condition.

It is anticipated that the volume, type, classifications, and sources of hazardous wastes associated with the Proposed Action would be similar with the baseline condition waste streams. Hazardous waste would be handled, stored, transported, disposed of, or recycled in accordance with the TMF Hazardous Waste Management Plan.

Mitigation Measures

Removal of contaminated equipment and soil would be accomplished by means of an approved Demolition Design Work Plan or similar, which would be consistent with NASA policies and Federal, state and local requirements, and include both BMPs and appropriate construction management practices.

4.2.13.2 No Action Alternative

Under the No Action Alternative, there would be no changes to hazardous materials and wastes in areas surrounding TMF, or on-site; therefore, no adverse impacts to hazardous materials and wastes are anticipated.

4.3 Goldstone Deep Space Communications Complex

4.3.1 Land Use

This section describes the potential environmental consequences associated with land use, as a result of implementing the Proposed Action or the No Action Alternative at GDSCC.

The Proposed Action would result in adverse land use impacts if it:

- Judged to be in conflict with adopted plans and policies for the surrounding area or adjacent communities;
- Violated zoning ordinances for surrounding areas or communities;
- Judged to be in conflict with adopted plans and policies for the facility; or
- Violated zoning designations for the facility.

4.3.1.1 Proposed Action

No short- or long-term adverse impacts to land use in surrounding areas are anticipated. Short-term adverse impacts to land use on-site at GDSCC are anticipated as described below. In general, on-site land uses may be subject to minor short-term impacts due to internal changes as construction and infrastructure redevelopment occurs. These effects would be localized, and occur when construction activities occur at immediately adjacent facilities, and would extend for the duration of those activities. During construction, occupants of on-site buildings adjacent to areas scheduled for construction would be impacted; however these impacts would be temporary, or intermittent. Additionally, there would be on-site inconveniences from general increases in background noise.

The Proposed Action is not expected to impact surrounding designated land uses, because development activities are consistent with the present use and zoning for GDSCC. The Proposed Action would have no impacts to land use or zoning in the community of Barstow due to the distance between the two locations.

Overall, the Master Plan developments proposed at GDSCC are similar in use and function as the current facility, and although the density would increase marginally, no operational impacts are anticipated.

4.3.1.2 No Action Alternative

Under the No Action Alternative, there would be no changes to either land use or zoning in areas surrounding GDSCC, or on-site; therefore, no adverse impacts to land use are anticipated.

4.3.2 Socioeconomics

This section describes the potential environmental consequences associated with socioeconomics, as a result of implementing the Proposed Action or the No Action Alternative at GDSCC. The proposed project would result in adverse socioeconomic impacts if it caused a major shift in population, housing, or employment in the study area, or the City of Barstow. For the purpose of this analysis, a major change would result from a 5 percent increase or decrease to any of these indicators. For the short term, this would infer approximately 40 to 50 construction workers at any one time, given the current number of employees on-site.

4.3.2.1 Proposed Action

Implementation of the Proposed Action would have no effect on the area's population because the actions would be confined to GDSCC property. There would be no impact on demographics.

Construction Impacts

Implementation of the Proposed Action could provide a negligible beneficial impact to the economy of Barstow due to minimal increases in employment opportunities for the construction workforce and revenues for local businesses and governments generated from these additional construction activities and workers. Many GDSCC employees live in Barstow and most employees of GDSCC visit the community on a regular basis for dining and/or shopping purposes. However, any increase in workforce and revenue would be temporary and negligible, lasting only as long as construction.

Operational Impacts

There would be negligible adverse impacts to GDSCC operations, since implementation of the Proposed Action is not expected to result in any change in the number of GDSCC personnel. No discernable impacts to employment levels in Barstow would be expected. It is not anticipated that implementation of the Master Plan would increase the need for off-site infrastructure and public services. No short-term or long-term adverse impacts to the economy in surrounding areas, or on-site, are anticipated. In general, there would be long-term beneficial effects for facility operations. No adverse impacts to housing in surrounding areas or, on-site, are anticipated.

Also included with socioeconomics are concerns pursuant to EO 13045, "Protection of Children from Environmental Health Risks and Safety Risks." The Proposed Action would not pose any adverse or disproportionate environmental health and safety risks to children living on or in the vicinity of GDSCC. The likelihood of the presence of children at the site of the proposed action is considered minimal, which further limits the potential for any effects.

4.3.2.2 No Action Alternative

Under the No Action Alternative, there would be no changes to socioeconomics in areas surrounding GDSCC, or on-site; therefore, no adverse impacts to socioeconomics are anticipated.

4.3.3 Environmental Justice

EO 12898 is designed to prevent Federal policies and actions from creating disproportionately high and adverse impacts on minority and low-income populations. A proposed project would result in a significant environmental justice impact if it were judged to be in conflict with the fair treatment for people of all races, cultures, and incomes.

4.3.3.1 Proposed Action

No adverse impacts to Environmental Justice are anticipated as a result of the Proposed Action.

Construction Impacts

In general, no long-term impacts to environmental justice are anticipated from construction and infrastructure and site improvements associated with implementation of the Proposed Action. Large minority populations were identified for Barstow and San Bernardino County that would represent an area of potential environmental concern. However, construction activities associated with the Proposed Action would be localized to the construction zone, and within the secured GDSCC perimeter. Thus, construction activities would not pose a disproportionate effect on identified minority populations in Barstow or San Bernardino County.

Operational Impacts

Impacts associated with operations in proposed future facilities would also be localized within GDSCC. Noise levels would be within the same range as existing operations. Therefore, operational activities would not pose a disproportionate effect on the identified minority populations in Barstow or San Bernardino County.

4.3.3.2 No Action Alternative

Under the No Action Alternative, there would be no changes to Environmental Justice either in areas surrounding GDSCC, or on-site. The No Action Alternative would not disproportionately impact minority or low-income populations; therefore, no adverse impacts to Environmental Justice are anticipated.

4.3.4 Traffic and Transportation

This section describes the potential environmental consequences for traffic and transportation, as a result of implementing the Proposed Action or the No Action Alternative. The Proposed Action would result in a significant transportation impact if it resulted in a substantial increase in traffic generation, a substantial increase in the use of the local connecting road and access-ways, or if on-site parking demand would not be met by projected supply.

4.3.4.1 Proposed Action

While no long-term adverse effects are expected. Short-term, minor adverse impacts to traffic and transportation are anticipated during construction as a result of the Proposed Action.

Construction Impacts

Construction-related activities under the Proposed Action are anticipated to produce short-term adverse impacts on traffic generation, traffic volume, and street use on-site. Construction activities under the Proposed Action would result in short-term increases in sub-contractors performing the construction and/or infrastructure redevelopment. Increases in traffic volumes associated with proposed construction activity would be temporary.

Operational Impacts

No short- or long-term impacts to transportation systems on-site are anticipated. The Proposed Action to install a new 34-m Beam Wave Guide antenna does not include any plans to increase the total GDSCC workforce on-site. The proposed project does not include changes to the transportation network in or around GDSCC.

Mitigation Measures

The following is a summary of proposed mitigation measures under the Proposed Action:

- In order to minimize temporary impacts to transportation, construction routes will be designed to minimize conflicts with vehicular traffic, and arrivals/departures will be scheduled around normal work hours. Traffic will be redirected when construction activities occur in areas currently dedicated to vehicular travel and parking. All loads will have either bills of lading or manifests prior to leaving the facility. All truck traffic will be scheduled and routed to minimize impacts on local traffic.

- Contractors will operate under limited parking availability, and will restrict employees from bringing unnecessary commuter vehicles on-site. Additionally, contractor shift start-times would be adjusted to preclude readily apparent increases in traffic volumes during peak morning and evening hours for the remainder of the GDSCC employees and contractors.

4.3.4.2 No Action Alternative

Under the No Action Alternative, there would be no changes to traffic or transportation in the areas surrounding GDSCC, or on-site; therefore, no adverse impacts to traffic and transportation in areas surrounding GDSCC, or on-site are anticipated.

4.3.5 Utilities and Services

This section describes the potential environmental consequences for utilities and infrastructure, as a result of implementing the Proposed Action or the No Action Alternative. The proposed project would result in an adverse utility or service impact if the project required more than the existing infrastructure could provide or required services in conflict with adopted plans and policies for the area. The proposed project would also result in an adverse impact if it resulted in a need for funding that required a separate vote of the public or securing funds that are not currently programmed. This analysis considers impacts that could occur from all phases of the proposed project in relation to services, including construction activities and operation of the proposed project.

4.3.5.1 Proposed Action

While short-term adverse impacts to utilities and services are anticipated under the Proposed Action, beneficial impacts to utilities and services are anticipated over the long term.

Construction Impacts

Under the Proposed Action, facility improvements would include the replacement/upgrade of some existing infrastructure. In general, infrastructure redevelopments are likely to result in short-term adverse impacts as construction activities may affect or disrupt or cause outages in electrical power, natural gas supplies, and water, sanitary, and storm sewer lines. On-site generators would be available to provide back-up power for any high-power demanding equipment. Demand during temporary/ planned outages is expected to be met, and impacts would be negligible.

Operational Impacts

Infrastructure improvements are likely to produce beneficial impacts over the longer term, as a result of more reliable grid connections, including updated technologies for greater efficiency and overall increases in safety. In particular, new infrastructure at GDSCC would result in beneficial impacts in terms of reduced on-site risks at the facility level for emergency response and safety management.

No activities or change in operations have been identified that would have an effect on community facilities and services. Existing services such as emergency response, fire, police and other services would continue to be able to serve GDSCC.

As more detailed programming, planning, and preliminary design of proposed improvements to GDSCC is completed, GDSCC would coordinate with the appropriate utilities to identify daily demand, peak demand, and supply. These enhancements would give GDSCC in some cases an opportunity to enhance utilities and other infrastructure. There are no activities that have been identified at the master planning stages that would cause an adverse impact on existing infrastructure outside the GDSCC property; however, additional study would occur during project planning and design for utility and other infrastructure needs.

4.3.5.2 No Action Alternative

Under the No Action Alternative, there would be no changes to utilities and services in areas surrounding GDSCC, or on-site; therefore, no adverse impacts to utilities and services are anticipated.

4.3.6 Air Quality

The proposed project would result in an adverse air quality impact if the activities associated with its construction or operation would result in exceeding the NAAQS thresholds or cause deterioration in air quality.

4.3.6.1 Proposed Action

While short-term adverse impacts to air quality are anticipated, the Proposed Action would not result in any long-term adverse impacts to air quality. Air quality impacts associated with a construction project may occur at both a regional and local scale, and are generally summarized into four categories:

- Temporary Construction Impacts
- Local Operational Impacts
- Regional Operational Impacts
- Cumulative Impacts

Therefore, analysis of potential impacts to air quality included emissions and contaminants from both construction and operational sources. A General Conformity review and applicability analysis was completed using URBEMIS modeling software to verify whether construction and operation emissions produced on-site under the Proposed Action would conform to the SIP, and remain below applicable regional air quality thresholds. General Conformity under the CAA Section 176(c) (as amended) was therefore evaluated for the Proposed Action according to the requirements of 40 CFR 93, Subpart B.

The Master Plan calls for utility infrastructure improvements to start in CY 2012, and continue on an as needed basis to be completed by the end of CY 2025. The levels of construction are anticipated to be greatest, and involve the highest levels of construction-related air pollution production during development of the new 34-m Beam Wave Guide antenna at Apollo Site in CY 2026. Thus, as a result of substantial use of heavy equipment for site grading and earth movement, the worst case scenario for air pollution production at GDSCC is anticipated to be CY 2026 when operational emissions are expected to be at final levels, and occurring concurrently with the last major set of proposed construction activities.

The General Conformity review indicated that total cumulative peak year direct and indirect emissions at GDSCC (i.e., the sum of construction and facility operations) for CY 2026 would *not* exceed the 100 tpy *de minimis* levels for PM_{10} (the criteria pollutant of concern), or for either of the O_3 precursors NO_X, and VOC/ROG. Because the direct and indirect emissions from the worst year, 2026, are below the *de minimis* thresholds and it was shown that the project emissions will not exacerbate air quality, increase violations of non-attainment pollutants, or delay the region from attaining the NAAQS in a timely manner the Proposed Action is considered to be conforming to the SIP. The full General Conformity Applicability Analysis is included as **Appendix H**, and includes the URBEMIS modeling summary and construction schedule.

While there may be several overlapping construction components, each activity remains an individual project subject to funding availability. Therefore, this assessment assumes that long-term impacts are a consideration for cumulative analysis, and will be discussed in Section 4.4.

Construction Impacts

Construction impacts include airborne dust from demolition, grading, excavation and materials hauling as well as gaseous emissions from the use of heavy equipment, delivery and dirt hauling trucks, and employee vehicles. Additionally, the use of new paints and surface coatings produce VOCs. One example would be photochemically reactive VOC emissions from curing asphalt concrete. These impacts may affect pollutants where the impacts occur very close to the source, such as PM_{10}, or regional pollutants, such as O_3. There are no known sources of odors on the project site that would be released during construction. Soil would be disturbed during grading and excavation, or while storing project-related equipment.

Additional short-term adverse impacts would occur in conjunction with new commuter traffic generated from contractor employees and it is anticipated to result in a general increase in air quality impacts at the regional level. Different types of contractors would be on-site at different times, utilizing different sets of equipment according to the type of construction or infrastructure redevelopment taking place. The analysis performed under this assessment assumes there would be a maximum of 50 workers on-site during the peak construction period. Calculation summaries are contained in the General Conformity Applicability Analysis in **Appendix H**.

Operational Impacts

Implementing the Proposed Action is anticipated to result in minor increases in operational air emissions, due to the increased size of the proposed facility. The types of new facilities being constructed are similar in use and function to the existing operations, and while the operating capacity of the new facility is increasing, the overall number of employees and vehicle trips are anticipated to remain at current levels. The Proposed Action would not have a substantial impact to regional ozone concentrations from on-site operations.

Mitigation Measures

Short term construction impacts can be mitigated through the use of proper control measures, including routine maintenance of all construction equipment, regular maintenance of the emission control devices on construction equipment, and covering/wetting exposed soils to reduce fugitive dust during construction. Developers will be required to submit a Construction Management Plan including plans to control impacts to air quality during construction. The following is a summary of proposed mitigation measures under the Proposed Action:

- CARB certified ultra low-sulfur diesel fuel containing a maximum of 15 ppm sulfur content will be used on all diesel powered construction equipment;
- Contractors will only use heavy construction equipment with emissions control technology to meet Tier-II California Emissions Standards as specified in CCR Title 13, § 2423(b)(I);
- Restrict engine idling to 10-minute interval maximums;
- CARB certified non-toxic soil binders will be applied per manufacturer recommendations to active unpaved roadways, unpaved staging areas, and unpaved parking areas throughout construction, to reduce fugitive dust emissions.
- Water the disturbed areas of the active construction sites at least three times per day, and more often if uncontrolled fugitive dust is noted;
- Schedule construction delivery traffic outside of peak-hour traffic patterns for the local community, and other construction traffic will be minimized to the extent feasible.

Additionally, although MDAQMD does not operate a PM_{10} monitoring station at their closest station (Barstow), Fort Irwin conducts air quality monitoring for particulate matter throughout the installation. GDSCC would utilize Fort Irwin data to monitor localized particulate levels throughout Master Plan projects and gauge construction-related impacts, and where necessary adjust mitigation measures.

More detailed air quality mitigation measures will be prepared during the conceptual design phase of individual projects.

4.3.6.2 No Action Alternative

Under the No Action Alternative, there would be no changes to air quality in areas surrounding GDSCC, or on-site; therefore, no adverse impacts to air quality are anticipated.

4.3.7 Noise and Vibration

The proposed project would result in an adverse noise or vibration impact if it resulted in conditions that violated established noise guidelines or if there are long-term increases in the number of people highly annoyed by the noise/vibrational environment. Adverse impacts would also occur if there are noise-associated adverse health effects to individuals; or if there are unacceptable increases to the noise environment for sensitive receptors. A sensitive receptor is any person or group of persons in an environment where low noise levels are expected.

4.3.7.1 Proposed Action

In general, while short-term minor adverse impacts are likely, there would be no substantial long-term impacts to noise and vibration levels in on-site locations. No adverse impacts to surrounding areas are anticipated.

Construction Impacts

Over the short-term, there would be minor adverse effects from high intermittent noises, and/or from general increases in background noise. Equipment at each of the outlying GDSCC stations and other major facilities contributes to the overall noise environment. However, even the loudest of hydro-mechanical equipment, generators, and pumps results in a highly localized noise level that does not extend more than a few hundred feet from each facility. As the Goldstone Lake airstrip is located a substantial distance from any other site (see **Figure 1-6**), aircraft operations would not result in major noise impacts.

Operational Impacts

Because of its remote location and minimal noise-generating activities, the GDSCC does not impact on-site or off-site land uses. The complex, however, is subject to some noise disturbance by Fort Irwin military training exercises.

Activities at GDSCC are not expected to generate appreciable ground-borne vibrations either on-site or at off-site locations. Noise levels at GDSCC are not sufficient to generate significant structural vibrations at off-site locations from airborne sound levels.

Mitigation Measures

The following is a summary of proposed mitigation measures under the Proposed Action:

- All construction equipment powered by an internal combustion engine will be equipped with a properly maintained muffler;
- Air compressors will meet current USEPA noise emission standards;
- New construction equipment will be used as much as possible since it is generally quieter than older equipment;
- Nighttime construction activities will be minimized;
- Portable noise barriers within the equipment area and around stationary noise sources will be established; and
- Tools and equipment will be selected to minimize noise.

4.3.7.2 No Action Alternative

Under the No Action Alternative, there would be no changes to noise in areas surrounding GDSCC, or on-site; therefore, no adverse impacts to noise quality are anticipated.

4.3.8 Geology and Soils

The proposed project or the alternatives would result in an adverse impact if regional geology were affected; if soils classified as prime and unique farmland were affected; or if the soils affected were considered unsuitable for development. The proposed project or the alternatives would result in a significant natural hazards impact if building construction was incompatible with the seismic risk status of the project area.

4.3.8.1 Proposed Action

The Proposed Action would have negligible to minor long-term adverse impacts on local geology at the site, but would not affect regional geology. Long-term, negligible, adverse impacts to soils would occur from the proposed project. No adverse impacts to natural hazards would result from the proposed project. There would be no impacts to prime or unique farmlands since none are located in the immediate area.

Construction Impacts

Development of the project would affect local geology. The impacts to surface, and possibly bedrock geology, (depending on the extent of excavation necessary and the exact depth of bedrock in the project area) would result from the site preparation and covering of geologic features. However, there would be no adverse impacts to regional geologic features or mineral sources; therefore, long-term effects to geology would be considered negligible to minor.

There are no known voids, fissures, underground streams, or unusual geological conditions at the site that would be affected by, or impede, the construction of the proposed antenna site. A subsequent detailed geotechnical study would definitively determine the need for special footings and/or other foundation requirements. It is assumed that this would be accomplished prior to initiation of construction, but this has no environmental implications.

Construction activities are not expected to have an adverse effect on the site’s pre-existing geologic conditions. Final detailed subsurface engineering studies would be undertaken in advance of final design and construction in order to ensure that sound building practices are implemented. Most impacts to existing soil conditions would occur during construction of the proposed projects. Although some excavation would be required for the antenna placement, it is not expected to result in excessive disruption or displacement of soils. Some of the excavated soil on the site would be redistributed as fill. Soil types, characteristics, and conditions are not expected to pose a major constraint to project construction activities.

Construction activities under the Proposed Action are not expected to have an adverse effect on the site’s pre-existing seismic conditions. The proposed redevelopment projects are unlikely to trigger any local seismic events, but could be impacted by such events. The California Building Code sets standards for investigation and mitigation of facility conditions related to fault movement, liquefaction, landslides, differential compactions/seismic settlement, ground rupture, ground shaking, tsunami, seiche, and seismically induced flooding. Mitigation of geological (including earthquake) and soil (geotechnical) issues must be undertaken in compliance with the California Building Code.

Appropriate engineering techniques would be incorporated into site design to ensure that risks from earthquakes, liquefaction, etc., are minimized. With implementation of these standard measures, there should be no adverse impacts as a result of the proposed project.

Operational Impacts

Operation and maintenance activities under the Proposed Action are not expected to have an adverse effect on the site's pre-existing geologic conditions. Soil types, characteristics, and conditions are not expected to pose a major constraint to operation under the Proposed Action. Operational and maintenance activities under the Proposed Action are not expected to have an adverse effect on the site's pre-existing seismic conditions.

Mitigation Measures

The following is a summary of proposed mitigation measures under the Proposed Action. Implementation of these standard measures would result in negligible impacts to soils as a result of construction.

- Soil suitability will be determined and appropriate building foundation specifications will be developed.
- A detailed erosion and sedimentation control plan will be developed prior to construction, based on the requirements of the Lahontan CRWQCB.

4.3.8.2 No Action Alternative

Under the No Action Alternative, there would be no changes to geology and soils in areas surrounding GDSCC, or on-site; therefore, no adverse impacts to geology and soils are anticipated.

4.3.9 Water Resources

The proposed project would result in an adverse water resources impact if the project were to impact surface water, groundwater, drainage and floodplain, or water quality. Adverse surface and groundwater impacts would result if existing water resources were directly or indirectly impacted from water resource extraction. Water resource requirements of the project must be balanced with available supplies, and appropriate water rights and extraction procedures must be followed. The Proposed Action would result in an adverse impact to water resources if:

- It was to violate Federal or state water quality regulations and standards, for either surface water or groundwater.
- Existing water resources were directly or indirectly impacted from water extraction activities due to increased demand. Water resource requirements of the project must be balanced with available supplies, and appropriate water rights and extraction procedures must be followed.
- Activities were located in a regulatory floodplain without appropriate flood study, FEMA map revisions, and mitigation measures.
- Activities fail to adequately address upstream drainage as it is conveyed through the study area.
- Activities change historic drainage flows and/or patterns, potentially impacting downstream areas.

4.3.9.1 Proposed Action

No long-term adverse impacts to surface water, groundwater, or floodplains are anticipated under the Proposed Action. There would be short-term adverse impacts during construction activities.

Construction Impacts

Construction activities at GDSCC are not expected to substantially alter on-site drainage patterns over the long-term. While construction activities would not increase stormwater runoff, they would likely produce minor short-term adverse impacts with disruptions to storm water collection, flow, and transportation. Adverse impacts on surface waters at GDSCC would be negligible due to the distance of the two existing playas from the proposed antenna site. Any potential impacts would be minimized by employing BMPs and meeting regulatory NPDES requirements (or state equivalent).

Development activities are not expected to require excavation into the water table and adverse impact on groundwater resources is not anticipated. Hazardous material usage would be minimal; BMPs would help to minimize the potential of contaminants to migrate through the soil to groundwater aquifers.

Demolition and construction activities would result in a marginal increase in water use because of the increased number of workers at the site, and increased demand for direct construction uses, such as dust controls, equipment washing, and site cleanup. It is expected that the increase in water use by additional workers would be small compared to the overall facility water use. Dust suppression and other construction-related water uses would be employed. The increase in water use for these purposes would be localized and limited to demolition and construction areas, and would be either intermittent in duration, or directly relative to the timing of construction traffic and construction activities, such as in the case of dust suppression.

FEMA has digitally mapped floodplains in the vicinity of Fort Irwin; however, it has not performed a detailed study within the boundaries of GDSCC. The anticipated Master Plan project areas are characterized by FEMA as 'Zone D,' which indicates that flood hazards have not been determined, but are possible (www.fema.gov, accessed on 7/27/10). Approximately 90 percent of the land area in the southeast desert of California is classified as Zone D, and no analysis of flood hazards has been conducted. It is unlikely that the floodplain of the Goldstone Lake would be affected during construction. Negligible adverse impacts on floodplain resources would occur under the Proposed Action.

Operational Impacts

Current and historical NPDES permitted discharges from GDSCC appear to have minimal impact on surrounding water quality. The planned infrastructure at GDSCC includes improvements to the current water system, which would result in long-term beneficial impacts. No increase in workforce is expected so there would be no adverse impact on facility water use, and no affect on facility operations.

Mitigation Measures

The following is a summary of proposed mitigation measures under the Proposed Action:

- As individual projects are constructed, implementation of erosion and sediment control practices, such as sediment trapping, filtering, and other BMPs, will help avoid temporary impacts to water quality. Stormwater management plans will also be prepared on a project by project basis to address long-term runoff and pollutant discharge.

- Adverse effects on floodplain resources will be minimized by implementing erosion and sediment control and stormwater management practices during and after construction.

As required by law, on-site stormwater management controls would be provided to limit the amount of storm runoff leaving the site during a storm event and to reduce the amount of contaminants in that runoff. Stormwater quantity and quality management practices required by Lahontan RWQCB would ensure no increase in post-development runoff peak flow and would mitigate the impacts of increased stormwater runoff on the combined sewer system.

4.3.9.2 No Action Alternative

Under the No Action Alternative, there would be no changes to water resources in areas surrounding GDSCC, or on-site; therefore, no adverse impacts to water resources are anticipated.

4.3.10 Biological Resources

This section describes the potential environmental consequences associated with biological resources (vegetation, wetlands, and wildlife), as a result of implementing the Proposed Action and No Action Alternative at GDSCC.

The level of impact on biological resources is based on (1) the importance (i.e., legal, commercial, recreational, ecological, or scientific) of the resource, (2) the proportion of the resource that would be affected relative to its occurrence in the region, (3) the sensitivity of the resource to the proposed activities, and (4) the duration of ecological ramifications. The impacts on biological resources are adverse if species or habitats of high concern are negatively affected over relatively large areas. Impacts are also considered adverse if disturbances cause reductions in population size or distribution of a species of high concern.

4.3.10.1 Proposed Action

While short-term minor adverse effects due to construction activities could occur under the Proposed Action, no long term adverse impacts to vegetation, wetlands, or wildlife are anticipated under either construction or operational activities.

Construction Impacts

Proposed construction activities would occur solely within the fenced area of the facility. Development activities could result in direct adverse impacts to ground-dwelling reptile species and would likely result in temporary or permanent loss of habitat. Review of the NWI within the Fort Irwin and GDSCC boundaries do not indicate any wetlands requiring permits under USACE jurisdiction. Short-term and localized minor adverse effects on vegetation could be expected in proximity to the construction sites. Overall, this assessment is based on the limited areal extent of areas that would be directly impacted by the Proposed Action.

Operational Impacts

Potential effects on wildlife are also a function of noise produced by operations. Predictors of wildlife response include prior experience with existing and similar operations, stage in the breeding cycle, activity or context, age, and sex composition. Previous experience with similar operations is the most important of these indicators. The maximum sound level (L_{max}) projected for the GDSCC operations under the Proposed Action would be the same or less than current conditions. Therefore, no long term adverse effects on wildlife would be expected to result from operations under the Proposed Action.

Mitigation Measures

The following is a summary of proposed mitigation measures under the Proposed Action:

- Re-vegetation of removed or damaged vegetation, as a result of construction activities, would also mitigate impacts to terrestrial biota. Careful siting of the new 34-m Beam Wave Guide antenna within identified zones will help mitigate potentially adverse impacts.

- Non-native and invasive vegetation will be removed and replaced with native species on a project by project basis.

4.3.10.2 No Action Alternative

Under the No Action Alternative, there would be no changes to biological resources in areas surrounding, or on-site at GDSCC; therefore, no adverse impacts to biological resources are anticipated.

4.3.11 Threatened, Endangered, and Other Sensitive Species

This section describes the potential environmental consequences associated with threatened, endangered, or sensitive species, as a result of implementing the Proposed Action and the No Action Alternative at GDSCC. As a requirement under the ESA, Federal agencies must provide documentation that ensures that agency actions do not adversely affect the existence of any threatened or endangered species. The ESA requires that all Federal agencies avoid "taking" threatened or endangered species (which includes jeopardizing threatened or endangered species habitat). Section 7 of the ESA establishes a consultation process with USFWS that ends with USFWS concurrence or a determination of the risk of jeopardy from a Federal agency project.

4.3.11.1 Proposed Action

Under the Proposed Action, no long-term adverse impacts to threatened, endangered, or sensitive plant or animal species are anticipated under either construction or operational activities.

The CDFG issued a *Programmatic Biological Opinion* to NASA in 1998 that (a) provides for the protection of sensitive biological resources at the GDSCC; (b) avoids the need to consult on a project-by-project basis; and (c) implements terms and conditions and identify responsible parties to ensure that future construction projects at the GDSCC are in compliance with the ESA (CMBC 2003). Specifically, *"It is the opinion of the Service that the proposed actions are not likely to jeopardize the continued existence of the desert tortoise or the Lane Mountain milkvetch, or to adversely modify critical habitat of the desert tortoise. Critical habitat has not been proposed for the Lane Mountain milkvetch."*

Since a 20.7 sq km (8 sq mi) area of critical habitat for the gopher tortoise is located on the GDSCC south of Goldstone Lake at the Mojave Base Station and surrounding area (**Figure 3-45**), coordination with the USFWS would take place according to the terms of the *Programmatic Biological Opinion* prior to the start of any major construction activity.

In April 2010, the USFWS initiated status review for the Mojave Ground Squirrel, and as of January 2011 is conducting further review to determine if the species should be listed as endangered. If the endangered status of the Mojave Ground Squirrel is confirmed, the USFWS would subsequently make a determination on suitable critical habitat, which could affect areas of both GDSCC and Fort Irwin (USFWS, 2010). GDSCC would monitor this determination as to the potential effect of the proposed project on the Mojave Ground Squirrel's critical habitat determination.

Proposed construction activities would be unlikely to directly affect special status plant or wildlife species. Construction-related noise could potentially disturb transient bird species, but these adverse impacts would be 1) temporary, lasting only as long as construction, and 2) negligible, because suitable habitat for transient birds is found throughout the region.

No short- or long term adverse effects on sensitive wildlife species would be expected to result from operations under the Proposed Action.

Mitigation Measures

Proposed mitigation measures under the Proposed Action include avoiding known locations of special-status species. Appropriate mitigation measures will be applied if future facility operations would disturb these areas.

4.3.11.2 No Action Alternative

Under the No Action Alternative, there would be no changes to threatened, endangered, or sensitive species in areas surrounding, or on-site at GDSCC; therefore, no adverse impacts to threatened, endangered, or sensitive species are anticipated.

4.3.12 Cultural Resources

Cultural resources are evaluated for nomination to the NRHP according to the Criteria for Evaluation shown at 36 CFR 60.4 (see Section 4.1.12 for a summary of these criteria). Eligible sites are those that satisfy one or more of the aforementioned criteria and retain integrity. Non-eligible sites are those that do not satisfy any of the evaluation criteria and/or lack integrity.

Adverse impacts on cultural resources might include physically altering, damaging, or destroying all or part of a resource; altering characteristics of the surrounding environment that contribute to the resource's significance; introducing visual or audible elements that are out of character with the property or alter its setting; neglecting the resource to the extent that it deteriorates or is destroyed; or the sell, transfer, or lease of the property out of agency ownership (or control) without adequate legally enforceable restrictions or conditions to ensure preservation of the property's historic significance.

4.3.12.1 Proposed Action

Construction Impacts

Proposed GDSCC development activities are not expected to have discernible impacts on historic resources. Historical evaluations would be performed prior to activities that may potentially affect historical structures at GDSCC. The evaluations include, but are not limited to, Section 106 and NHPA.

Based on the 2010 Historic Survey of the GDSCC site, one structure, the G-80: 70-meter Antenna (DSS-14 at the Mars Site), was identified to be eligible for listing in the NRHP. According to the Master Plan Update, there would not be any alteration to this structure. GDSCC has initiated consultation through the Section 106 process with the California SHPO. As a result of this consultation, a PA is being developed that identifies any mitigation measures to be implemented as well as preservation design guidelines for the defined character areas in GDSCC. All coordination with the California SHPO is provided in **Appendix F**. These design guidelines will be incorporated into the final Master Plan.

Known sensitive archaeologic and historic resources within the GDSCC are primarily located in the northern and southeastern portions of the complex as shown in **Figure 3-46**. Both the Mars and Apollo Sites are in the vicinity of areas of archaeologic and/or historic interest, and the proposed 34-m Beam Wave Guide antenna would be located within the Apollo site. Prior to any development, Fort Irwin's resident archaeologist would review the plans and recommend appropriate mitigation measures.

Operational Impacts

No short- or long term adverse effects on cultural resources would be expected to result from operations under the Proposed Action. GDSCC has initiated consultation through the Section 106 process with the CA SHPO and all coordination correspondence is provided in **Appendix F**. As design for individual projects commences, GDSCC will continue to consult with the CA SHPO regarding impacts to identified historic properties. When applicable, specific mitigation measures will be detailed as part of the conceptual design process.

4.3.12.2 No Action Alternative

Under the No Action Alternative, there would be no changes to cultural resources in areas surrounding GDSCC, or on-site; therefore, no adverse impacts to cultural resources are anticipated.

4.3.13 Hazardous Materials and Waste

Impacts to hazardous material management would be considered adverse if the Proposed Action resulted in noncompliance with applicable Federal and state regulations, or increased the amounts generated or procured beyond current NASA waste management procedures and capacities. Impacts on pollution prevention would be considered adverse if the Proposed Action resulted in worker, resident, or visitor exposure to these materials, or if the action generated quantities of these materials beyond the capability of current management procedures.

4.3.13.1 Proposed Action

Short-term minor adverse impacts to hazardous wastes and materials are anticipated during construction activities. No long-term impacts to hazardous materials and wastes from operations are anticipated.

Construction Impacts

Products containing hazardous materials or substances such as fuels, oils and lubricants would be procured and used during construction activities. While it is anticipated that the quantity of such hazardous materials used would be minimal, their duration of use would be long term due to the extended period of Master Plan implementation. It is anticipated that the quantity of hazardous and petroleum wastes generated from construction would be negligible.

Accidental spills could occur as a result of construction. A spill could potentially result in adverse effects on wildlife, soils, water and vegetation. However, the amount of hazardous materials at construction sites would be limited and the equipment necessary to quickly contain any spill would be present at all times. Contractors would coordinate the management of hazardous materials and wastes with GDSCC and their subcontractors.

Operational Impacts

Under the Proposed Action, it is anticipated that procurement of products containing hazardous materials would be comparable with existing conditions. Therefore, it is estimated that hazardous material procurement would remain comparable to the baseline condition.

It is anticipated that the volume, type, classifications, and sources of hazardous wastes associated with the Proposed Action would be similar in nature with the baseline condition waste streams. Hazardous waste would be handled, stored, transported, disposed of, or recycled in accordance with the GDSCC Hazardous Waste Management Plan.

Mitigation Measures

Removal of contaminated equipment and soil would be accomplished by means of an approved Demolition Design Work Plan or similar, which would be consistent with NASA policies and Federal, state and local requirements, and include both BMPs and appropriate construction management practices.

4.3.13.2 No Action Alternative

Under the No Action Alternative, there would be no changes to hazardous materials and wastes in areas surrounding GDSCC, or on-site; therefore, no adverse impacts to hazardous materials and wastes are anticipated.

4.4 Cumulative Impacts

The CEQ regulations require assessment of cumulative impacts in the decision-making process for Federal projects. Cumulative impacts are defined as "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 such actions" (40 CFR 1508.7). Cumulative impacts were determined by combining the incremental impacts of each alternative with other past, present, and reasonably foreseeable future actions.

4.4.1 Past Actions

4.4.1.1 NASA JPL

NASA JPL was developed over many years, beginning in the early 1940's and continuing to the present. The area that is now NASA JPL was originally open fields. NASA JPL first used these fields for experimentation in propulsion, which lead to the construction of a few small shacks and some buried bunkers used to test propellants and other fuels. In 1940, the facility was acquired by the U.S. Army and construction of permanent/semi-permanent buildings began. The first permanent structure, described as an engineering building was added to the facility in 1942 with the start of activities supporting World War II efforts.

At least 97 additional buildings/structures were constructed on the facility during the remainder of the 1940's. Some of the earlier, temporary buildings or inadequate facilities were replaced at this time with more permanent structures. During the 1950's, another 60 buildings/structures were completed. Once again, some of these buildings replaced earlier inadequate facilities. During the 1960's, 78 buildings/structures were constructed. Some of these replaced older, outdated structures. During the period 1970 to 1980, 51 additional buildings/structures were constructed at the facility as either new construction or to replace outdated facilities. In the 1980's, 10 buildings were added to the facility.

From 1990 to 2010, an additional 49 buildings/structures were constructed. A significant number of these structures were temporary trailer offices. Over the life of NASA JPL, more than 325 facilities have been constructed on site. Of these, 222 buildings/structures are still standing.

From a cumulative perspective, past development of NASA JPL from its initial appearance as open fields to the urban setting that exists at the current time has been a major impact. However, the existing footprint of the Laboratory has been in place for approximately 50 years. The construction of new facilities and continuation of future operations at NASA JPL does not create a major impact in relation to the overall impact of the Laboratory.

4.4.1.2 Table Mountain Facility

From a cumulative perspective, past development of the TMF facility from its initial appearance as mountain forests to the semi-rural setting that exists at the current time has been a major impact. However, the existing footprint of the facility has been in place for approximately 50 years. The construction of new facilities and future operations at TMF does not create a major impact in relation to the overall impact of the facility.

4.4.1.3 Goldstone Deep Space Communications Complex

The construction of new facilities and future operations at GDSCC does not create a major impact in relation to the overall impact of the complex.

4.4.2 Planned or Reasonably Foreseeable Projects

4.4.2.1 NASA JPL

The major regional project planned for the Pasadena area is the Tehachapi Renewable Transmission Project (TRTP), an approximately $2 billion effort by SCE to develop electric transmission lines and substations that will deliver electricity from renewable sources such as wind farms, solar arrays and geothermal generation stations in the Tehachapi area to the California transmission grid. The California Public Utilities Commission (CPUC) approved TRTP in March 2007, and was the first major effort to meet California's renewable energy goals. Construction is now underway on segments 1 through 3. Segments 4 through 11 of the TRTP are scheduled for construction in 2015 and involve construction projects throughout multiple Los Angeles County municipalities, including La Canada Flintridge, Pasadena and Altadena (**Figure 4-1**).

Figure 4-1 depicts the location of two substations and two transmission lines to be constructed as Segment 11 in the immediate vicinity of NASA JPL. A 500-kV line will be constructed through the San Gabriel Mountains, running south from Tehachapi into La Canada Flintridge where it will connect with a power substation located adjacent to the HWP, and a 2.35 km (1.46 mi) northwest of NASA JPL. A 220-kV transmission line would run from this substation east across the Arroyo Seco and along the northern boundary of Altadena, before heading south through Pasadena adjacent to the Easton Canyon Creek. The second local substation will be constructed in Pasadena, 9.25 km (5.75 mi) southeast of the NASA JPL, adjacent to West Foothills Boulevard and I 210.

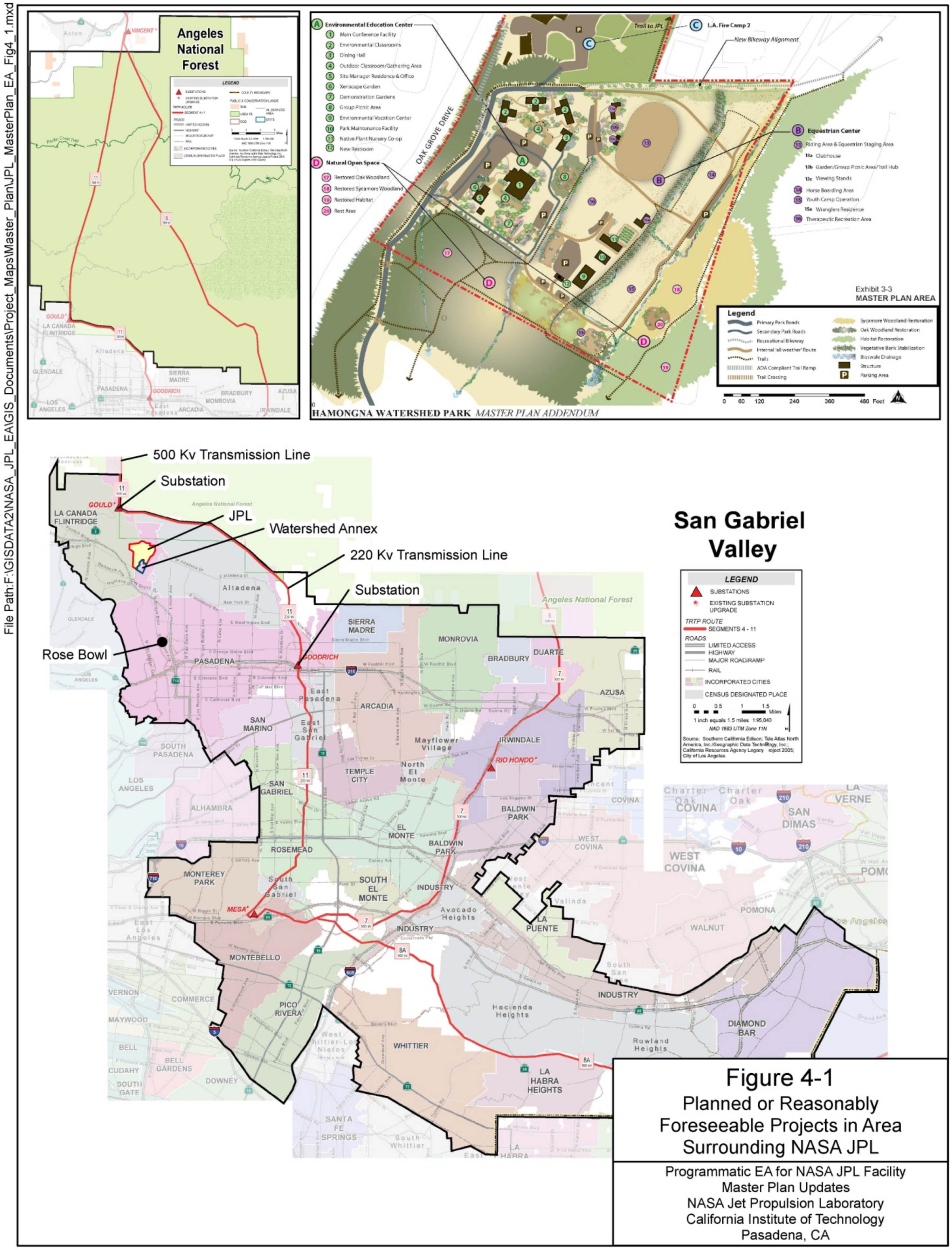
The majority of local projects planned for the area surrounding NASA JPL area are municipal projects created under the City of Pasadena 2011 – 2015 Capital Improvements Program (CIP). On June 14, 2010 the City of Pasadena released their CIP with plans to invest more than $1.3 billion during the five fiscal years to 2015. The Pasadena CIP is a regional collaborative effort to create a long-range plan, integrating multiple public works, infrastructure, transportation and municipal redevelopment projects. The following two projects in particular face heightened visibility with respect to NASA JPL, due to proximity and location within the Arroyo Seco which is located immediately adjacent to the NASA JPL facility:

Rose Bowl Improvements - The City of Pasadena has earmarked $189,959,443 in CIP funding for improvements under a strategic plan for redevelopment of the Rose Bowl. The Pasadena schedule indicates stadium renovation projects are slated for 2011, 2012 and 2013 and incorporate redevelopment of the surrounding amenities, including the adjacent Brookside golf course and club house.

Arroyo Seco Projects - The City of Pasadena has allotted $162,220,094 across three sets of project areas in the Arroyo Seco. The HWP and Hahamongna Annex redevelopments are located immediately adjacent to the eastern and southern boundaries of NASA JPL, and will receive the majority of funding, forecast to be $7,599,088.

The Rose Bowl is approximately 3.65 km (2.25 mi) south of NASA JPL, and therefore would not be anticipated to produce cumulative impacts if construction occurred concurrently with the Proposed Action at NASA JPL. However, the proximity of the HWP, and in particular the location of the Hahamongna Annex immediately adjacent to the southern NASA JPL boundary are anticipated to produce minor cumulative impacts due to increased volumes of traffic along Oak Grove Drive, between the North Arroyo exit from the Interstate 210 and NASA JPL.

Figure 4-1. Planned or Reasonably Foreseeable Projects in Area Surrounding NASA JPL



Other Pasadena CIP projects proposed for the reasonably foreseeable future that are relevant to the study area, are listed below together with forecast funding to indicate relative size of the projects:

- Pasadena Water System Improvements - $598,915,334;
- Pasadena Transportation and Parking facilities - $56,317,123;
- Pasadena Electric System Improvements $589,915,334;
- Pasadena Street and Streetscape Upgrades- $47,525,937;
- Street Lighting and Electric Undergrounding - $58,719,420; and
- Pasadena Municipal Buildings & Systems - $40,081,506.

The remainder of these projects, should they be constructed as anticipated, are not expected to result in any cumulative impacts associated with the Proposed Action.

4.4.2.2 Table Mountain Facility

The projects planned for the area surrounding TMF with more localized impacts are predominantly USFS projects within the surrounding ANF, and involve pro-active management of forest resources under the applicable Ranger District mandates. The following two projects, should they be completed as anticipated, are not expected to result in any cumulative impacts associated with the Proposed Action.

San Gabriel River Ranger District & San Dimas Experimental Forest, Invasive Plant Treatment Project - The San Gabriel River Ranger District and San Dimas Experimental Forest are proposing to treat invasive plant species in the San Gabriel, Big and Little Dalton, and San Dimas drainages within the ANF. Treatment prescriptions would follow integrated weed management and could include biological control, manual/mechanical, fire-wilting, herbicide, and combinations of treatment methods.

San Gabriel River Ranger District, Tanbark Fuel Break Maintenance Project - The San Gabriel River Ranger District is proposing prescriptive maintenance to 378.8 ha (936 ac) of forest involving fuels designated as ‘hazardous fuels’ along the existing Tanbark Fuel Break, in order to enhance wildfire protection for the communities of Glendora, San Dimas, La Verne and Claremont. The project also proposes to treat approximately 0.8 ha (2 ac) of non-native invasive species with herbicides in order to limit their further spread.

There are two major regional projects planned for the Wrightwood area which are anticipated to coincide with implementation of the Master Plan at TMF. The first and largest project is the TRTP, an approximately $2 billion effort by SCE to develop electric transmission lines and substations that will deliver electricity from renewable sources such as wind farms, solar arrays and geothermal generation stations located in the Tehachapi area to the greater California transmission grid.

The second major regional project planned for the Wrightwood area is the Angeles Crest Scenic Byway Corridor Management Plan, and could reasonably be anticipated to produce the majority of cumulative impacts in conjunction with implementation of the Master Plan at TMF. Given the largely undeveloped nature of the area surrounding TMF, and it’s relatively isolated location in conjunction with less than five thoroughfares, cumulative effects analysis will focus on two main resources: impacts to traffic and transportation, and/or impacts to local and regional air quality resulting from construction activities.

Angeles Crest Scenic Byway Corridor Management Plan - The Angeles Crest Scenic Byway (ACSB) was designated a California State Scenic Highway on March 12, 1971 and a National Forest Scenic Byway on October 5, 1990. This 88.5 km (55-mi) stretch of SR 2 travels through the San Gabriel Mountains and provides access to spectacular scenery, geological features, historic sites, recreational opportunities, important ecological and biological areas, and mountain communities within driving distance of Los Angeles. The western terminus of State Route 2 begins in La Cañada Flintridge within the Los Angeles Basin, and extends north and east into the San Gabriel Mountains through the ANF to the Los Angeles/San Bernardino County line located in Wrightwood.

The ACSB Corridor Management Plan "specifies the actions, procedures, operational and administrative practices" providing development and management recommendations to both enhance use and protect the natural resources of the surrounding San Gabriel range (USDA USFS, 2010).

Tehachapi Renewable Transmission Project - The TRTP is comprised of eleven 'segments' or project components. Construction on Segments 1 through 3 started in March, 2010. The proposed TRTP would include rebuilding three existing transmission lines within two existing SCE rights-of-way within the ANF:

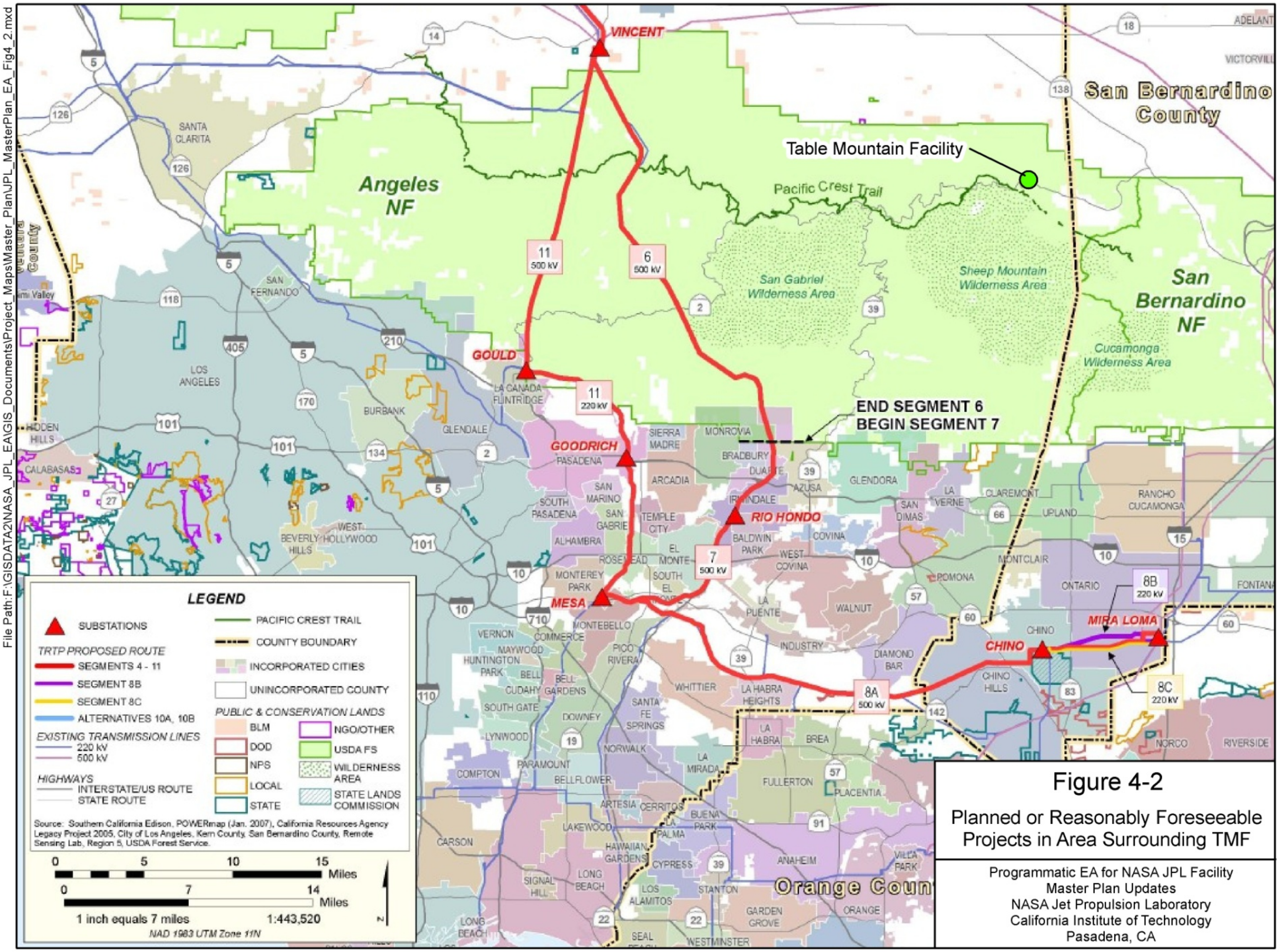
- Segment 6: A rebuild of 51.5 km (32 mi) of existing 220-kV transmission line to 500-kV standards from an existing Vincent Substation to the southern boundary of the ANF. This segment includes the rebuild of 43.4 km (27 mi) of SCE's existing Antelope-Mesa 220-kV transmission line and 8 km (5 mi) of the existing Rio Hondo-Vincent 220-kV No. 2 transmission line; and

- Segment 11: A rebuild of 30.6 km (19 mi) of existing 220-kV transmission line to 500-kV standards between SCE's existing Vincent and Gould Substations. This segment includes the removal of 6.4 km (4 mi) of the existing Vincent-Pardee No. 1 220-kV transmission line and 24.1 km (15 mi) of the existing Eagle Rock-Pardee 220-kV transmission line.

Figure 4-2 depicts the segment closest to Wrightwood (Segment 6), initiating adjacent to the town of Vincent and running south southeast through the San Gabriel Mountains into the greater metropolitan Los Angeles area to its connection with Segment 7 and a substation located in Rio Hondo. Segment 11 is located 4 to 17 km (2.5 to 7.5 mi) west of Segment 6 (**Figure 4-2**). The Segment 6 route will cross the Pacific Crest Trail, and SR 2 in a location 32 km (20 mi) west of TMF, and 32 to 40 km (20 to 25 mi) west of Wrightwood. Both segments are scheduled to begin construction in 2015. The majority of Segment 6 is located within the ANF, and both segments would produce similar effects, although Segment 11 is anticipated to produce diminished levels of affects with increasing distance away from TMF.

These two projects exhibit similar characteristics to development plans at TMF, due to the isolated nature of the construction within undeveloped national forest, and to the 'linear' or 'point' locations for proposed development within the surrounding ANF. They are anticipated to produce similar impacts which could be considered 'cumulative'. Therefore, cumulative impacts associated with development activities at TMF, TRTP, and the ACSB are expected to impact resources associated with locations of local and regional transportation routes.

Figure 4-2. Planned or Reasonably Foreseeable Projects in Area Surrounding TMF



File Path:F:\GISDATA2\NASA_JPL_EA\GIS_Documents\Project_Maps\Master_Plan\JPL_MasterPlan_EA_Fig4_2.mxd

The current Master Plan development schedule for TMF includes upgrades to TM-17 and TM-28 in CY 2015 and is anticipated to involve only minor levels of construction and/or site development. Increases in construction activities and construction related traffic to TMF would coincide with increased levels of traffic and transportation along the Pacific Crest Trail, SR 2, SR 138, and the Pine Crest Highway.

Localized traffic congestion is already a major issue in winter months due to ski-visit generated traffic at the neighboring Mountain High Ski Resorts. However, construction activities at TMF are likely to be seasonal and would therefore avoid the majority of winter ski season traffic.

Additionally, the majority of construction traffic heading to TMF is not anticipated to use either ACSB from the west or Highway 39 as these roads are smaller windy mountain routes not generally considered suitable to either commuting or equipment and materials delivery. The ACSB route west from Wrightwood is the main transportation route to access TMF. However, both the TRTP and ACSB CMP projects are anticipated to utilize both east and western access points. Therefore, relative to other similar, related regional projects, the Master Plan developments at TMF are anticipated to produce an overall lower level of impacts, within a smaller zone of effect. As a result, adverse cumulative impacts to traffic and transportation are anticipated to be minor.

By its nature, air pollution is largely a cumulative impact. And impacts to regional air quality due to the ability of construction and development projects to impact other areas: the potential geographic extent of cumulative impacts to air quality covers two air basins, two counties, and three local air quality regulatory jurisdictions. However, while any increase in emissions of nonattainment pollutants or their precursors would cause an adverse impact to the downwind local air basin, the three local regulatory jurisdictions exhibit similar long-term trends and only minor spatial variation is anticipated.

Furthermore, the identification of cumulative impacts to air quality generally ranges from within 1.6 km (1 mi) of a Proposed Action, and as far as 9.6 km (6 mi) or more as the effect of downwind dispersion eliminates the potential for adverse project-level cumulative air quality impacts over areas larger than a few square miles. Therefore, cumulative impacts to air quality associated with construction and redevelopment activities at TMF are anticipated to be ‘individually minor’ per CEQA guidelines (CEQA Guidelines [with amendments], 2010).

4.4.2.3 Goldstone Deep Space Communications Complex

The projects planned for the area surrounding GDSCC with more localized impacts are predominantly Fort Irwin projects. The following projects, should they be completed as anticipated, are not expected to result in cumulative impacts associated with the Proposed Action: Fort Irwin Solar Power Development Projects; Fort Irwin / NTC Military Maneuvers and Operations; Lane Mountain Milkvetch Conservation Area; and Calico Solar Project.

Fort Irwin Solar Development Projects - On October 15, 2009, the US Army signed an MOU to develop 500 MW of solar derived power at Fort Irwin. In 2010, this project was described by Fort Irwin as consisting of approximately 1,500 MW of power that would in a large part be constructed upon the lands contained within GDSCC (**Figure 3-36**). The technologies proposed for development include photovoltaic and concentrated solar, to be developed under an Enhanced Use Lease agreement with the Clark Energy and ACCIONA companies. Development plans for this project is undecided, but would likely involve several direct construction and operational elements with associated impacts on GDSCC.

Fort Irwin / NTC Military Maneuvers and Operations - Fort Irwin and the NTC are currently working with NASA to identify foreseeable military operations which may affect resources at Goldstone through either shared-use, or redevelopment. The primary project under investigation is an NTC analysis of suitable locations for a low-level aircraft over-flight corridor across the GDSCC facility. This would represent an approximately 1000-m (305-ft) wide flight-path extending from 61 m (200 ft) agl to 304 m (1000 ft) agl and connecting the NTC training areas east of GDSCC, across the Goldstone site to a new desert battlefield exercise area to the southwest, to be used for around-the-clock operational maneuvers and training purposes.

Lane Mountain Milkvetch Conservation Area - Lane Mountain Milkvetch is a federally listed (endangered) species that is known to occur on Fort Irwin, including GDSCC. The population of the milkvetch on GDSCC is near the Venus Station, and has been fenced to prevent vehicle access (US Army and NTC, 2008). In 2008, Fort Irwin created the Lane Mountain Milkvetch Conservation Area adjacent to a portion of the southern boundary of the GDSCC lease area to protect the species, as formal critical habitat designations from the USFWS had yet to be implemented. While it was first listed as endangered on October 6, 1998 conflict surrounding which areas of habitat should formally be considered as 'critical' for the preservation of Milkvetch had continued through into 2010

In April 2010, the USFWS proposed 5,694 ha (14,069 ac) as critical habitat for the Milkvetch, which included 519 ha (1,282 ac) or roughly nine percent as DoD land under control of Fort Irwin, and which included GDSCC (Industrial Economics, 2010). The final implications of the USFWS proposal are yet to be realized regarding ongoing requirements for the habitat on Fort Irwin and GDSCC. It is anticipated that Milkvetch habitat on GDSCC and Fort Irwin may require additional analysis and fencing type activities to improve protection.

Various Renewable Energy (Solar) Projects - The desert area of eastern California, in particular San Bernardino County, has been designated as having high solar energy potential, in part based on the large tracts of publicly held BLM lands which surround much of Fort Irwin and China Lake to the east, south, and west. The California Energy Commission has authorized and approved the following solar energy development projects near GDSCC:

- The Caithness Soda Mountain Solar Project is solar photovoltaic power generating facility located in the Mojave Desert. The project would employ 1.5 million solar panels mounted on a one-axis tracking system to generate 350 MW of electricity. It would be sited on approximately 1,214 ha (3,000 ac) of land managed by the BLM. The valley in which the project is located already contains multiple utility and vehicular corridors. The high level of isolation, existing high voltage electric transmission lines, excellent vehicular access and the pre-existing industrial uses of the area make this a particularly suitable site for solar power development (www.blm.gov, 2011).

- The Calico Solar Project is an 850 MW solar energy plant and associated facilities on 3,367 ha (8,320 ac) of Federal land in San Bernardino County located north of Interstate 4-, approximately 60 km (37 mi) east of Barstow, 92 km (57 mi) northeast of Victorville, and 185 km (115 mi) east of Los Angeles. The project was approved on October 20, 2010, and would include construction of 26,450 concentrated-solar 'SunCatchers' together with an on-site 230-kV substation, 3.2 km (2-mi) of 230-kV interconnecting transmission line, as well as administration and maintenance buildings, access roads, and other facilities (www.blm.gov, 2011). The project is expected to generate 400 jobs during the construction phase, and 136 jobs during the operations phase (www.blm.gov, 2011).

4.5 Unavoidable Adverse Effects

Unavoidable adverse impacts would result from implementation of the Proposed Actions for NASA JPL, TMF, and GDSCC.

Geology and Soils. Under each Proposed Action, construction activities such as grading, excavating, and re-contouring of the soil, would result in soil disturbance. Implementation of BMPs during construction would limit potential impacts resulting from construction activities. Standard erosion control would also reduce potential impacts related to these characteristics.

Biological Resources. Site grading associated with construction would remove minimal vegetation and associated small animal life occupying and utilizing affected areas. The affected sites already heavily disturbed and do not presently provide suitable habitat for many species.

Safety. The potential for accidents or spills at fuel storage facilities, and the generation of hazardous wastes are unavoidable conditions associated with the Proposed Actions. However, the potential for these unavoidable situations would not increase over baseline conditions.

Energy. The use of nonrenewable resources is an unavoidable occurrence, although this use is negligible compared with total use of energy. The Proposed Actions would require the use of fossil fuels, a non-renewable natural resource. Energy supplies, although relatively small, would be committed to the Proposed Action or No Action Alternative.

4.6 Relationship Between Short-Term Uses and Long-Term Productivity

Short-term uses of the biophysical components of man’s environment include direct construction-related disturbances and direct impacts associated with an increase in population and activity that occur over a period of less than five years. Long-term uses of human environment include those impacts occurring over a period of more than five years, including permanent resource loss.

Several kinds of activities could result in short-term resource uses that compromise long-term productivity. Filling of wetlands or loss of other especially important habitats and consumptive use of high-quality water at nonrenewable rates are examples of actions that affect long-term productivity.

The long-term benefits of the proposed development activities under the Master Plans for NASA JPL, TMF, and GDSCC would occur at the expense of short-term impacts in the surrounding vicinities. These short-term effects would occur during the period of construction, and would include localized noise and air pollution, as well as potential increased sedimentation and erosion. However, these impacts are temporary and proper controls would be utilized to prevent these impacts from having a lasting effect on the environment.

Short-term gains to the respective local economies would occur in varying degrees as local companies and workers are hired and local businesses provide services and supplies during the construction of new building(s), structure(s), and required infrastructure. Furthermore, the Proposed Actions would provide long-term revenue sources to NASA JPL, TMF, and GDSCC that will sustain these facilities.

4.7 Irreversible and Irretrievable Commitments of Resources

The irreversible environmental changes that would result from implementation of the Proposed Actions for NASA JPL, TMF, and GDSCC involve the consumption of material resources, energy resources, land, biological habitat, and human resources. The use of these resources is considered to be permanent.

Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that use of these resources will have on future generations. Irreversible effects primarily result from use or destruction of a specific resource that cannot be replaced within a reasonable time frame (e.g., energy and minerals).

Material Resources. Material resources used for the Proposed Action include building materials (for construction of facilities), concrete and asphalt (for roads), and various material supplies (for infrastructure). Most of the materials that would be consumed are not in short supply and would not limit other un-related construction activities.

Energy Resources. Energy resources used for the Proposed Action would be irretrievably lost. These include petroleum-based products, such as gasoline, diesel, natural gas, and electricity. During construction, gasoline and diesel would be used for the operation of construction vehicles, and gasoline would be used for the operation of private and government-owned vehicles. Natural gas and electricity would be used by operational activities. Consumption of these energy resources would not place an overburdening demand on their regional availability.

Biological Habitat. The Proposed Action would not result in the loss of vegetation or wildlife habitat on proposed construction sites. Proposed construction is occurring on already disturbed land that is classified as industrial use. Furthermore, the Proposed Action would not remove open space or undeveloped land currently functioning as biological habitat.

Human Resources. The use of human resources for construction and operation is considered an irretrievable loss, only in that it would preclude such personnel from engaging in other work activities. However, the use of human resources for the Proposed Action represents employment opportunities, and is considered beneficial.

The Proposed Action would not result in a major impact associated with the irreversible or irretrievable commitment of resources.

The No Action Alternative assumes that no changes would occur. Therefore, this alternative would not result in any impact associated with the irreversible or irretrievable commitment of resources.

5.0 CONSULTATION AND COORDINATION

5.1 Agencies and Organization

Agencies and organizations contacted for information, or that assisted in identifying important issues or analyzing impacts, or that will review and comment upon the EA include:

5.1.1 Federal Agencies

Advisory Council on Historic Preservation
Federal Aviation Administration
Federal Emergency Management Agency
Federal Highway Administration
National Aeronautics and Space Administration
San Bernardino National Forest
U.S. Army Corps of Engineers
U.S. Bureau of Land Management
U.S. Department of Housing and Urban Development
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Forest Service National Aeronautics and Space Administration
U.S. Geological Survey

5.1.2 State Agencies

Antelope Valley Air Quality Management District
California Air Resources Board
California Department of Fish and Game
California Department of Food and Agriculture
California Department of Resources Recycling and Recovery
California Department of Toxic Substances Control
California Department of Transportation
California Division of Mines and Geology
California Environmental Protection Agency
California Geological Survey
California Integrated Waste Management Board
California Native Plant Society
California Office of Historic Preservation
California Public Utilities Commission
California State Water Resources Control Board
Los Angeles Regional Water Quality Control Board
South Coast Air Quality Management District

5.1.3 City and County Agencies

City of Pasadena Police Department
City of Pasadena Department of Public Works
City of Pasadena Department of Water and Power
City of Pasadena Fire Department

Los Angeles County Department of Public Works
Los Angeles County Fire Department
Los Angeles County Health Department
Los Angeles County Metropolitan Transit Authority
Los Angeles County Sanitation District
Los Angeles Department of Transportation

5.1.4 Other Organizations

Lincoln Avenue Water Company
Mountain High Resorts Associates, LLC
National Audobon Society
Southern California Edison
Southern California Gas Company

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APPENDIX A

NASA JPL Facility Master Plan Environmental Assessment NEPA Checklist

NASA JPL Facility Master Plan Programmatic Environmental Assessment NEPA Checklist

Project Name:

Project Description

Project Location:

Project Manager:________________________________

Phone: **Email:**

Project Contact *(if different from project manager)***:**

Proposed Project Start Date and Duration:

This checklist is to be completed for proposed projects at the NASA Jet Propulsion Laboratory and its component and remote sites (Goldstone Deep Space Communication Complex [GDSCC] and Table Mountain Facility [TMF], respectively) only. The purpose of this checklist is to determine if the action would be covered by the 2011 NASA JPL Facility Master Plan Programmatic Environmental Assessment (EA). Any "Yes" or "Maybe" responses would require a comment and could result in further analysis and exclusion from coverage by the EA. If the applicable sections of the checklist have been completed and the proposed action qualifies for coverage by the EA, a Record of Environmental Consideration (REC) will be prepared documenting this determination and no further NEPA documentation would be required. If the checklist indicates the need for additional analysis, or if the proposed action is not otherwise covered by the NASA/JPL Facility Master Plan, then a REC will be prepared which documents that need for further NEPA analysis.

***Type of Project, Check one*:** ☐**New Construction** ☐ **Repair/Renovation/Relocation**

☐**Demolition**

Facility location: ☐ **JPL- Oak Grove** ☐**GDSCC** ☐**Table Mountain Facility**

***If none of the above apply, stop here. This project cannot be covered by the JPL Facility Master Plan EA! Please contact the JPL EAPO for further guidance*.**

A. Applicability	**Yes**	**No**	**May be**
1. The proposed project (or its derivation) has not been analyzed in the 2011 JPL Facility Master Plan Programmatic EA?			

If Yes, which one of the proposed projects in the Master Plan Programmatic EA?

B. Land Use	**Yes**	**No**	**May be**
1. Proposed project would occur outside of the facility perimeter fence?	☐	☐	☐

	Yes	No	Maybe
2. Proposed project does not fit within the overall site mission and would not be of similar type and character of structure/amenity already in place at the site (e.g., office building, science instrument, laboratory, etc)?	☐	☐	☐
3. Proposed project would require a change in on-site zoning?	☐	☐	☐
4. Proposed project would increase on-site operational transportation distances and trips of industrial vehicles (e.g., forklifts and delivery trucks)	☐	☐	☐
5. Proposed project would increase the overall operational uphill vehicular travel?	☐	☐	☐
Comments:			

C. Socioeconomics and Environmental Justice	**Yes**	**No**	**May be**
1. Proposed project would cause a major long-term shift (>5%) in area population, housing, or employment.	☐	☐	☐
2. Proposed project would increase the need for off-site infrastructure and public services.	☐	☐	☐
3. Proposed project would create disproportionately high and adverse impact on minority and low-income populations	☐	☐	☐
Comments:			

D. Public Services and Utilities	**Yes**	**No**	**May be**
1. Proposed project would exceed capacity for an existing utility infrastructure (e.g., stormwater, industrial waste water, etc)?	☐	☐	☐
Comments:			

E. Noise	**Yes**	**No**	**May be**
1. Proposed project would generate long-term noise above the local community noise standard?	☐	☐	☐
2. Proposed project would generate a noise that would impact sensitive receptors over the long-term.	☐	☐	☐
Comments:			

F. Geology and Soils	**Yes**	**No**	**May be**
1. Proposed project would impact regional geology?	☐	☐	☐
2. Proposed project would impact soils classified as prime and unique farmland?	☐	☐	☐
3. Proposed project would impact the site's pre-existing seismic conditions?	☐	☐	☐
Comments:			

G. Water Resources	Yes	No	Maybe
1. Proposed project would cause long-term impacts to surface water, wetlands, groundwater, or floodplains?	☐	☐	☐
Comments:			

H. Biological Resources	Yes	No	Maybe
1. Proposed project would impact plant or animal species or habitats of high concern over a relatively large area?	☐	☐	☐
2. Proposed project would reduce the population size of a plant or animal species of high concern	☐	☐	☐
Comments:			

I. Cultural Resources	Yes	No	Maybe
1. Proposed project would physically alter, destroy, or damage all or part of a National Historic Landmark?	☐	☐	☐
2. Proposed project would physically alter, destroy, or damage all or part of an eligible structure?	☐	☐	☐
3. Ground-disturbing activities associated with a proposed project would take place in an area with known potential prehistoric or historic sites?	☐	☐	☐
Comments:			

J. Hazardous Materials and Hazardous Waste	Yes	No	Maybe
1. Proposed project would result in noncompliance with applicable Federal and state regulations?	☐	☐	☐
2. Proposed project would increase the amounts of hazardous materials procured, or hazardous waste generated, beyond current procedures and capacities?	☐	☐	☐
3. Proposed project would result in worker or visitor hazardous materials exposure?	☐	☐	☐
4. Proposed project would disturb known, or create new, contaminated sites which would negatively impact human health of the environment?	☐	☐	☐
Comments:			

APPENDIX B
Summary of Existing NASA JPL Facilities

Summary of Existing NASA JPL Facilities

NASA Jet Propulsion Laboratory Property		Capacity (sq ft)	
Facility Number	Name	NASA	Physical Size (SF)
103	ELECTRONIC FABRICATION SHOP	23,861.00	23,861
107	LASER RESEARCH LABORATORY	5,461.00	5,461
11	SPACE SCIENCES LABORATORY	9,043.00	9,043
111	TECHNICAL INFORMATION	44,390.00	44,390
114	ADMINISTRATION	9,317.00	9,317
114A	Coffee Cart Shelter	240	240
117	LIQUID AND SOLID PROPELLANT LAB.	4,148.00	4,148
121	ANALYTICAL INSTRUMENTS LABORATORY	3,543.00	3,543
122	ENERGY CONVERSION SYSTEMS	7,373.00	7,373
125	COMBINED ENGINEERING SUPPORT	66,114.00	66,114
126	INFORMATION SYSTEMS DEVELOPMENT	52,584.00	52,584
129	COMBUSTION RESEARCH LABORATORY	2,499.00	2,499
138	MISSION OPERATIONS	11,385.00	11,385
140	PROPULSION MATERIALS STORAGE	203	203
141	PROPULSION MATERIALS STORAGE	127	127
143	SOLID ROCKET DOCK	420	420
144	ENVIROMENTAT LABORATORY	35,019.00	35,019
145	MAGIZINE - PROPELLANT	58	58
148	ENERGY CONVERSION LABORATORY	6,611.00	6,611
149	ENERGY CONVERSION DEVELOPMENT	5,494.00	5,494
150	SPACE SIMULATOR FACILITY	26,809.00	26,809
156	COMPUTER PROGRAM OFFICES	23,995.00	23,995
157	APPLIED MECHANICS	29,918.00	29,918
158	MATERIALS RESEARCH PROCESSING LAB.	29,707.00	29,707
161	TELECOMMUNICATIONS LABORATORY	37,273.00	37,273
167	CAFETERIA	37,006.00	37,006
168	INSTRUMENTS SYSTEMS	42,132.00	42,132
169	EARTH SPACE SCIENCE	42,500.00	42,500
170	FABRICATION SHOP	35,533.00	35,533
171	MATERIAL SERVICES	74,028.00	74,028

NASA Jet Propulsion Laboratory Property		Capacity (sq ft)	
Facility Number	Name	NASA	Physical Size (SF)
173	TEST SHELTER	278	278
177	TRANSPORTATION	5,081.00	5,081
179	SPACECRAFT ASSEMBLY FACILITY	64,723.00	64,723
18	STRUCTURAL TEST LABORATORY	15,416.00	15,416
180	ADMINISTRATION	105,568.00	105,568
183	PHYSICAL SCIENCES LABORATORY	96,483.00	96,483
184	TELECOMMUNICATIONS	2,066.00	2,066
185	PROGRAMMING OFFICE	1,978.00	1,978
186	PUBLIC OUTREACH ADMINISTRATION	23,744.80	23,745
189	ELECTRONIC LABORATORY ANNEX	3,232.00	3,232
190	PROCUREMENT OFFICES	16,451.00	16,451
197	SOLID PROPELLANT ENGINEERING LAB.	7,987.00	7,987
198	CONTROL SYSTEMS LABORATORY	67,172.00	67,172
199	CELESTRIAL SIMULATOR	3,366.00	3,366
200	FACILITIES ENGINEERING & SERVICE	29,491.00	29,491
201	ADMINISTRATIVE SUPPORT SYSTEMS	12,000.00	12,000
202	PROCUR. & COMMUNICATIONS SUPPORT	17,416.00	17,416
212	ANTENNA LABORATORY	10,562.00	10,562
218	CREDIT UNION	2,621.00	2,621
220	ICS TERMINAL	38	38
226	SOLVENT STORAGE	74	74
229	SHIELDED ROOM BUILDING	371	371
230	SPACE FLIGHT OPERATIONS COMMAND FAC	134,779.00	134,779
231	MICROWAVE TECHNOLOGY SUPPORT	8,353.00	8,353
233	SYSTEMS DEVELOPMENT	43,313.00	43,313
234	LUMBER STORAGE	2,133.00	2,133
238	TELECOMMUNICATIONS	84,174.00	84,174
239	PROPELLANT CONDITIONING LAB	860	860
241	RECEIVING & SHIPPING & ADMIN	26,752.00	26,752
243	REMOTE ANTENNA RANGE CONTROL	1,298.00	1,298
244	CHEMICAL ENGINEERING	3,680.00	3,680
245	SPECTROSCOPY LABORATORY	4,158.60	4,159

NASA Jet Propulsion Laboratory Property		Capacity (sq ft)	
Facility Number	Name	NASA	Physical Size (SF)
246	SOILS TEST LABORATORY	750	750
248	TEN-FOOT SPACE SIMULATOR	13,469.00	13,469
249	VISITORS RECEPTION	4,873.00	4,873
251	GYRO LABORATORY	6,280.00	6,280
253	MAGNETIC LABORATORY	1,552.00	1,552
256	MODEL RANGE CONTROL	597	597
260	ILLUMINATOR EQUIPMENT	479	479
262	RADIOMETER	49	49
264	SPACE FLIGHT SUPPORT	126,504.00	126,504
272	EAST ILLUMINATOR	106	106
275	PYROTECHNIC STORAGE	328	328
276	PROPELLANT STORAGE	352	352
277	ISOTOPE THERMOELECTRIC SYS. LAB.	23,782.00	23,782
280	STATIC TEST FACILITY	1,440.00	1,440
284	TRANSPORTATION FACILITY OFFICE	1,225.00	1,225
288	PROJECT EQUIPMENT STORAGE	3,444.00	3,444
290	ANTENNA INSPECTION	596	596
291	ACQUISTIONS ADMN SUPPORT	7,492.00	7,492
293	INSTRUMENTATION CABLE AMPLIFIER	333	333
295	ANTENNA TEST FACILITY	181	181
298	FREQUENCY STANDARDS LAB	18,772.44	18,772
299	ASSEMBLY HANDLING & SHIPPING EQUIP.	10,860.00	10,860
300	EARTH & SPACE SCIENCE LABORATORY	103,904.00	103,904
301	CENTRAL ENGINEERING	201,856.00	201,856
302	MICRODEVICES LABORATORY	74,567.00	74,567
303	ENGINEERING SUPPORT BUILDING	82,855.00	82,855
306	OBSERVATIONAL INSTRUMENTS LAB	79,444.00	79,444
309	MAINTENANCE STORAGE FACILITY	4,000.00	4,000
310	Emergency Services Facility - Bldg. 310	21,495.00	21,495
312	SHELTER MAINTENANCE FACILITY	1,678.00	1,678
313	ENVIRONMENTAL TESTING	3,988.00	3,988
316	HAZARDOUS MATERIALS STORAGE FACILITY	3,835.00	3,835

NASA Jet Propulsion Laboratory Property		Capacity (sq ft)	
Facility Number	Name	NASA	Physical Size (SF)
317	In-Situ Instruments Lab	18,309.00	18,309
318	Optical Interferometry Development Laboratory (OID	16,050.00	16,050
320	Environmental Test Laboratory Support Facility	1,225.00	1,225
321	Flight Projects Center	194,602.00	194,602
322	General Storage Facility	4,354.00	4,354
323	Monolithic Microwave Integrated Circuit Assembly	3,120.00	3,120
324	Recycling Facility	1,350.00	1,350
325	Flight Hardware Logistics Program Bldg 325	6,794.00	6,794
336	Mars Yard Support Building	12,917.00	-9,383
338	Cryogenic Services Office	192	192
35	Security Radio Equipment	160	160
35A	Radio/Repeater Complex	160	160
600	Woodbury Building II	35,600.00	35,600
600LHI1	Woodbury Building II - LHI1		0
601	Woodbury Complex	55,000.00	55,000
602	Woodbury Technical Building	35,062.00	35,062
606	Lincoln Palms Building	5,000.00	5,000
67	MATERIAL RESEARCH	14,523.00	14,523
79	LOW -TEMP LABORATORY	21,527.00	21,527
82	HIGH VACUUM LABORATORY	11,407.00	11,407
83	QUALITY ASSURANCE	10,302.00	10,302
84	CHEMICAL MATERIALS LABORATORY	1,415.00	1,415
86	SOLID OXIDIZER LABORATORY	534	534
87	PROPELLANT CONDITIONING LABORATORY	182	182
88	Bio-Chemical Cold Room	624	624
89	LASER LABORATORY	2,011.00	2,011
90	PYROTECHNICS LABORATORY	797	797
98	SOLID FUEL LABORATORY	1,773.00	1,773
T1701	Trailer	1,650.00	1,650
T1702	Trailer	1,650.00	1,650
T1703	Trailer	1,650.00	1,650
T1704	Trailer	1,650.00	1,650

NASA Jet Propulsion Laboratory Property		Capacity (sq ft)	
Facility Number	Name	NASA	Physical Size (SF)
T1705	Trailer	1,650.00	1,650
T1706	Trailer	1,650.00	1,650
T1707	Trailer	1,650.00	1,650
T1708	Trailer	1,650.00	1,650
T1709	Trailer	1,650.00	1,650
T1710	Trailer	1,650.00	1,650
T1711	Trailer	1,650.00	1,650
T1712	Trailer	1,650.00	1,650
T1713	Trailer	550	550
T1714	Trailer	5,200.00	5,200
T1715	Trailer	550	550
T1716	Trailer - Modular Office	5,040.00	5,040
T1717	Trailer - Rest Room	720	720
T1718	Trailer - Modular Office	2,160.00	2,160
T1719	Trailer	1,440.00	1,440
T1720	Trailer	12,240.00	12,240
T1721	Two Story Modular	6,528.00	6,528
T1722	Mars Exploration I	7,200.00	7,200
T1723	Mars Exploration II	9,360.00	9,360
T1724	Mars Modular 1722 Restroom	720	720
T1725	Mars Modular 1723 Restroom	720	720
T1726	East Lot Security Trailer	0	0
		2,790,714.84	2,768,415.00

Notes: sq ft = square feet

APPENDIX C
NASA JPL Hazardous Waste Streams (California and RCRA) CY2006

NASA JPL Hazardous Waste Streams (California and RCRA) CY2006

California Waste Code (CWC) Name	CWC on UHWM	EPA Waste Code on UHWM
Alkaline solution w/ out metals (pH >=12.5)	122	D001, D002
Unspecified alkaline solution	123	D001,D002
Unspecified alkaline solution	123	D001,D002,D004
Unspecified alkaline solution	123	D002
Unspecified alkaline solution	123	D002,D010
Aqueous solution w/ total organic residues 10% or more	133	NA
Aqueous solution w/ total organic residues less than 10%	134	NA
Unspecified aqueous solution	135	NA
Off-specification, aged, or surplus inorganics	141	NA
Asbestos	151	NA
Other inorganic solid waste	181	D001
Other inorganic solid waste	181	D002
Other inorganic solid waste	181	D004
Other inorganic solid waste	181	D008
Other inorganic solid waste	181	F003
Other inorganic solid waste	181	NA
Halogenated solvents	211	D035,F002,F003,F005
Oxygenated solvents	212	D001
Unspecified solvent mixture	214	D001,D018,D035,F002,F003,F005
Unspecified solvent mixture	214	D001,022,D040,F003,F005,U002,U080, U220,U226,U228,U239
Waste oil and mixed oil	221	NA
Off-specification, aged, or surplus organics	331	D001
Off-specification, aged, or surplus organics	331	D001,D002,U037
Off-specification, aged, or surplus organics	331	D001,D005,D011,F003,F005,U003
Off-specification, aged, or surplus organics	331	D001,D021,U037
Off-specification, aged, or surplus organics	331	D001,F002,F003
Off-specification, aged, or surplus organics	331	D001,U154,U002
Off-specification, aged, or surplus organics	331	NA
Off-specification, aged, or surplus organics	331	U213,D001
Organic liquids w/ halogens	341	F002

NASA JPL Hazardous Waste Streams (California and RCRA) CY2006

California Waste Code (CWC) Name	CWC on UHWM	EPA Waste Code on UHWM
Unspecified organic liquid mixture	343	D001,D018
Other organic solids	352	D001
Other organic solids	352	D001,D007
Other organic solids	352	D001,D007,D007,D019,D035,F001, F003,F005,U107
Other organic solids	352	D001,D008
Other organic solids	352	D001,D018,F002,F003,F005
Other organic solids	352	D001,D035,F002,F003,F005
Other organic solids	352	D001,F003
Other organic solids	352	D001,F003,F005
Other organic solids	352	D008
Other organic solids	352	F002,F003
Other organic solids	352	NA
Empty containers less than 30 gallons	513	NA
Photochemicals/ photoprocessing waste	541	D011
Laboratory waste chemicals	551	D001
Laboratory waste chemicals	551	D001,D002
Laboratory waste chemicals	551	D001,D002,D004,D008,D021,D022, F002,F003,U037
Laboratory waste chemicals	551	D001,D002,D007
Laboratory waste chemicals	551	D001,D002,D038,F003,U196
Laboratory waste chemicals	551	D001,D002,F003
Laboratory waste chemicals	551	D001,D002,F003,U008
Laboratory waste chemicals	551	D001,D002,U099
Laboratory waste chemicals	551	D001,D003
Laboratory waste chemicals	551	D001,D004,D006,F003
Laboratory waste chemicals	551	D001,D007
Laboratory waste chemicals	551	D001,D008
Laboratory waste chemicals	551	D001,D038,U117,U162,U196
Laboratory waste chemicals	551	D001,F003
Laboratory waste chemicals	551	D001,U113,U118
Laboratory waste chemicals	551	D002
Laboratory waste chemicals	551	D002,D001

NASA JPL Hazardous Waste Streams (California and RCRA) CY2006

California Waste Code (CWC) Name	CWC on UHWM	EPA Waste Code on UHWM
Laboratory waste chemicals	551	D002,D004,D005
Laboratory waste chemicals	551	D002,D005
Laboratory waste chemicals	551	D002,D006
Laboratory waste chemicals	551	D002,D007
Laboratory waste chemicals	551	D002,D008,D022,D024,U052
Laboratory waste chemicals	551	D002,D009
Laboratory waste chemicals	551	D002,U123
Laboratory waste chemicals	551	D003
Laboratory waste chemicals	551	D004,D002
Laboratory waste chemicals	551	D004,D005,D007,D008,D011,D040, F001,F002
Laboratory waste chemicals	551	D004,D006
Laboratory waste chemicals	551	D004,D006,D007,D008,D011
Laboratory waste chemicals	551	D004,D010
Laboratory waste chemicals	551	D004,D012,U058
Laboratory waste chemicals	551	D004,D022
Laboratory waste chemicals	551	D004,D022,U044,D005
Laboratory waste chemicals	551	D004,D022,U044,U080
Laboratory waste chemicals	551	D008
Laboratory waste chemicals	551	D008,D011
Laboratory waste chemicals	551	D009
Laboratory waste chemicals	551	D011,F003
Laboratory waste chemicals	551	NA
Laboratory waste chemicals	551	U138
Liquids w/ polychlorinated biphenyls >= 50Mg/L	731	NA
Liquids w/ pH <= 2	791	D001,D002
Liquids w/ pH <= 2	791	D001,D002,D004
Liquids w/ pH <= 2	791	D002,D007
Liquids w/ pH <= 2	791	D002,D007,D010

Notes: CWC= California Waste Code; UHWM=Uniform Hazardous Waste Manifest

APPENDIX D
Master Vegetation and Wildlife Species List for TMF

MASTER VEGETATION AND WILDLIFE SPECIES LIST FOR TMF	
Scientific Name	Common Name
PLANTS	
PTERIDACEAE	BRAKE FAMILY
Pellaea mucronata	Bird's-foot fern
CUPRESSACEAE	CYPRESS FAMILY
Calocedrus decurrens	Incense cedar
Taxodiaceae	Bald cypress family
Sequoiadendron giganteum	Giant Sequoia
PINACEAE	PINE FAMILY
Abies concolor	White fir
Pinus jeffreyi	Jeffrey Pine
Pinus monophylla	Single-leaf pinyon pine
ANACARDIACEAE	SUMAC OR CASHEW FAMILY
Rhus trilobata	Skunkbrush
APIACEAE	CARROT FAMILY
Oreonana vestita	wolly mountain-parsley
Tauschia parishii	Parish's umbrellawort
ASTERACEAE	SUNFLOWER FAMILY
Agoseris sp.	Agoseris
Artemisia dracunculus	Tarragon
Artemisia tridentata	Basin big sagebrush
Chrysothamnus nauseosus	Mojave rabbitbrush
Cirsium occidentale var. californicum	Cobweb thistle
Coreopsis bigelovii	tickseed
Erigeron foliosus	*Erigeron foliosus*
Erigeron foliosus Eriophyllum confertiflorum	golden yarrow
Gutierrezia sarothrae	broom matchweed
Machaeranthera sp.	Goldenweed
Malacothrix glabrata	desert dandelion
Salsola tragus	Prickly Russian thistle
Stephanomeria spinosa	Spiny skeletonweed
Tetradymia canescens	gray horsebush
BORAGINACEAE	BORAGE FAMILY
Cryptantha echinella	hedgehog cryptantha
Cryptantha muricata	prickly cryptantha
BRASSICACEAE	MUSTARD FAMILY
Descurainia pinnata	western tansy-mustard
Erysimum capitatum	western wallflower
* *Hirshfeldia incana*	short-podded mustard
* *Sisymbrium altissimum*	tumble mustard
CAPRIFOLIACEAE	HONEYSUCKLE FAMILY
Sambucus mexicana	Mexican elderberry
Symphoricarpos rotundifolius	roundleaf snowberry
CARYOPHYLLACEAE	PINK FAMILY
Arenaria macradenia	Mojave Sandwort
Silene verecunda	San Francisco campion
CHENOPODIACEAE	GOOSEFOOT FAMILY
Chenopodium fremontii	Fremont's goosefoot
CONVOLVULACEAE	MORNING-GLORY FAMILY
Calystegia occidentalis ssp. fulcrata	chaparral false bindweed
ERICACEAE	HEATH FAMILY
Arctostaphylos patula	Greenleaf manzanita
Sarcodes sanguinea	snow plant
EUPHORBIACEAE	SPURGE FAMILY
Euphorbia palmeri	woodland spurge

FABACEAE	LEGUME FAMILY
Astragalus bicristatus	Crested milkvetch
Astragalus douglasii	jacumba milkvetch
Astragalus leucolobus	Bear Valley milkvetch
Lotus procumbens	silky deerweed
Lupinus sp.	lupine
Lupinus excubitus	grape soda lupine
FAGACEAE	OAK FAMILY
Quercus chrysolepis	canyon live oak
Quercus kelloggii	Black Oak
GENTIANACEAE	GENTIAN FAMILY
Frasera neglecta	Pine Green gentian
GERANIACEAE	GERANIUM FAMILY
* *Erodium cicutarium*	red-stemmed filaree
HYDROPHYLLACEAE	WATERLEAF FAMILY
Phacelia curvipes	Washoe phacelia
Phacelia imbricata	imbricate phacelia
LAMIACEAE	MINT FAMILY
Monardella australis	Southern monardella
PAPAVERACEAE	POPPY FAMILY
Argemone munita	prickly poppy
Eriastrum densifolium	woollystar
POLEMONIACEAE	PHLOX FAMILY
Eriastrum sapphirinum	sapphire wollystar
Gilia sp.	Gilia
Gilia modocensis	Modoc gilia
Gilia splendens	splendid gilia
Linanthus breviculus	mojave linanthus
POLYGONACEAE	BUCKWHEAT FAMILY
Eriogonum davidsonii	Davidson's buckwheat
Eriogonum microthecum var. johnstonii	Johnston's Buckwheat
Eriogonum nudum	Naked buckwheat
Eriogonum saxatile	rock buckwheat
Eriogonum umbellatum	sulfer buckwheat
Eriogonum wrightii	Wright's buckwheat
PORTULACACEAE	PURSLANE FAMILY
Claytonia perfoliata	miner's lettuce
RANUNCULACEAE	BUTTERCUP FAMILY
Delphinium parishii	desert larkspur
RHAMNACEAE	BUCKTHORN FAMILY
Ceanothus cordulatus	whitethorn ceanothus
ROSACEAE	ROSE FAMILY
Cercocarpus betuloides	birch-leaf mountain-mahogany
Cercocarpus ledifolius	curl-leaf mountain mahogany
RUBIACEAE	MADDER FAMILY
Galium angustifolium	narrow-leaved bedstraw
SALICACEAE	WILLOW FAMILY
Salix lasiolepis	arroyo willow
SCROPHULARIACEAE	FIGWORT FAMILY
Castilleja applegatei	applegate's paintbrush
Collinsia torreyi	Torrey's blue-eyed Mary
Cordylanthus sp.	bird's-beak
Penstemon grinnellii	Grinnell's beardtongue
Penstemon labrosus	San Gabriel beardtongue

Penstemon speciosus	royal penstemon
STERCULIACEAE	CACAO FAMILY
Fremontodendron californicum	Flannelbush
LILIACEAE	LILY FAMILY
Allium parishii	Parish's onion
Muilla maritima	Sea Muilla
POACEAE	GRASS FAMILY
Achnatherum hymenoides	Indian ricegrass
Bromus carinatus	California brome
* *Bromus diandrus*	ripgut grass
Bromus inermis	smooth brome
* *Bromus tectorum*	cheat grass
* *Cynodon dactylon*	Bermuda grass
Elymus multisetus	big squirreltail
Poa fendleriana longtounge	mutton grass
Stipa Speciosa	Desert needlegrass/Barkworth
WILDLIFE	
LEPIDOPTERA	BUTTERFLIES
Hydropsychidae	Caddisflies
Diplectrona californica	California Deplectronan cadisfly
REPTILIA	REPTILES
Phrynosomatidae	Phrynosomatids
Sceloporus graciosus vandenburgianus	Southern sagebrush lizard
Sceloporus orcutti	Granite spiny lizard
Uta stansburiana	Side-blotched lizard
AVES	BIRDS
Accipitridae	Raptors
** *Aquila chrysaetos*	Golden eagle
Odontophoridae	Quail
Callipepla californica	California quail
Corvidae	Jays and crows
Aphelocoma californica	Western scrub-jay
Corvus corax	Common raven
Paridae	Titmice and chickadees
Poecile gambeli	Mountain chickadee
Sittidae	Nuthatches
Sitta carolinensis	White-breasted nuthatch
Emberizidae	Towhees and sparrows
Junco hyemalis	Dark-eyed junco
MAMMALIA	MAMMALS
Sciuridae	Squirrels
Spermophilus beecheyi	California ground squirrel
Sciurus griseus	Western gray squirrel
Canidae	Dogs/wolves/foxes
Canis latrans	Coyote (scat, tracks)
Urocyon cinereoargenteus	Common gray fox (tracks, scat)

Source:
NOTES:
* = non-native
** = CDFG Special
*** = CDFG or USFW Threatened or Endangered

APPENDIX E

Agency Coordination

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APPENDIX F
General Conformity Applicability Analysis for NASA JPL

EXECUTIVE SUMMARY

Agencies:	National Aeronautics and Space Administration (NASA), Jet Propulsion Laboratory (JPL)
Designation:	Clean Air Act General Conformity Analysis
Affected Location:	JPL Oak Grove Campus, Pasadena, CA
Proposed Action:	Implement Master Plan

Abstract:

Section 176 (c) of the Clean Air Act (CAA) (42 U.S.C. § 7506(c)) requires any entity of the Federal Government that engages in, supports, or in any way provides financial support for, licenses or permits, or approves any activity to demonstrate that the action conforms to the applicable State Implementation Plan (SIP) required under Section 110 (a) of the CAA before the action is otherwise approved. In this context, conformity means that such Federal actions must be consistent with a SIP's purpose of eliminating or reducing the severity and number of violations of national ambient air quality standards (NAAQS) and achieving expeditious attainment of national ambient air quality standards.

JPL is currently undertaking analysis of existing facilities and infrastructure, while simultaneously forecasting future needs and objectives to enable NASA to continue to meet its mission. JPL is proposing the development of a comprehensive planning strategy through the implementation of a Master Plan which would cover development at the JPL Oak Grove facility in Pasadena, California over the next two decades. This document represents the General Conformity Analysis completed by NASA/JPL, including analysis of potential impacts to air quality as a result of implementing the proposed Master Plan; analysis of the General Conformity applicability; and documentation of the findings.

Conformity Analysis:

After careful and thorough consideration of the conformity analysis contained herein, the project proponent finds that the total direct and indirect emissions associated with the Proposed Action at the JPL Oak Grove Campus would not exceed the applicable *de minimis* thresholds, and that the Proposed Action would therefore be exempt from the requirements of the Federal Conformity Rule consistent with the objectives as set forth in Section 176(c) of the CAA, as amended, and its implementing regulation, 40 CFR Part 93, Subpart B, Determining Conformity of General Federal Actions to State and Local Implementation Plans.

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E 1.0 INTRODUCTION

Section 176 (c) of the Clean Air Act (CAA) (42 U.S.C. § 7506(c)) requires any entity of the Federal Government that engages in, supports, or in any way provides financial support for, licenses or permits, or approves any activity to demonstrate that the action conforms to the applicable State Implementation Plan (SIP) required under Section 110 (a) of the CAA before the action is otherwise approved. In establishing the Final General Conformity Rule, the U.S. Environmental Protection Agency (USEPA) requires Federal agencies to evaluate a proposed Federal action and ensure that it does not:

- Cause a new violation of a national ambient air quality standards (NAAQS)
- Contribute to an increase in the frequency or severity of violations of NAAQS
- Delay the timely attainment of any NAAQS, interim progress milestones, or other milestones toward achieving compliance with the NAAQS

The General Conformity Rule requires that Federal agencies consider total direct and indirect emissions of criteria pollutants. Conformity must be shown for those pollutants (or precursors of those pollutants) emitted in areas designated as nonattainment, as well as for those pollutants which an area has been redesignated from nonattainment to attainment (i.e., a maintenance area). In this context, conformity means that such Federal actions must be consistent with a SIP's purpose of eliminating or reducing the severity and number of violations of NAAQS and achieving expeditious attainment of national ambient air quality standards. Each Federal agency must determine that any action that is proposed by the agency and that is subject to the regulations implementing the conformity requirements will, in fact, confirm to the applicable SIP before the action is taken.

NASA JPL is currently undertaking analysis of existing facilities and infrastructure, while simultaneously forecasting future needs and objectives to enable NASA to continue meeting its mission. NASA JPL is proposing the development of a comprehensive planning strategy through the implementation of a Master Plan which would cover development at the NASA JPL facility in Pasadena, California over the next two decades. This document represents the General Conformity Analysis completed by NASA JPL, including analysis of potential impacts to air quality as a result of implementing the proposed Master Plan; analysis of the General Conformity applicability; and documentation of the findings.

E 1.1 Document Organization

Section E 1.0 of this document serves as a general introduction to the Proposed Action, and the applicable requirements associated with air quality regulations that must be fulfilled in order for the project proponent (NASA JPL) to approve and commence the action. The section includes an outline of this document; the regulatory background and regulatory requirements of the General Conformity Rule; the General Conformity Exemptions & Applicability; CAA General Conformity Criteria; and other potentially applicable SIP Implementation Plan Consistency Requirements.

Section E 2.0 of this document completes an applicability analysis for the Proposed Project in terms of the General Conformity rules, and examines the Proposed Action within the regional air quality scenario. The section includes the purpose of the Conformity Analysis; a description of the NASA JPL facility and the Proposed

Action; existing air quality conditions in the region, and their relationships to this Conformity Analysis; and the applicability of the conformity rule to the proposed implementation of the Master Plan at the NASA JPL facility. Section E 3.0 provides the emissions estimations attached to this analysis; details the calculation methodologies; and provides the conformity analysis results for the Proposed Action. The section identifies the sources included in the conformity analysis; provides the total direct and indirect emissions calculations; and provides the applicability analysis results. Finally, Section E 4.0 provides the conclusion and findings of the conformity review and applicability analysis.

E 1.2 Background

The CAA and Clean Air Act Amendments (CAAA) were passed by Congress and corresponding rules were promulgated by USEPA because it was determined that certain pollutants have the potential to cause an adverse effect on public health and the environment when certain concentrations are exceeded in ambient air. In order to control and regulate the main air pollutants and better maintain air quality levels, NAAQS were established for seven 'criteria pollutants'. These pollutants included carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter less than 10 microns in diameter (PM_{10}), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), sulfur oxides (SO_x), and lead (Pb). The USEPA then established a set of 'primary' NAAQS to protect the public health with an adequate margin of safety, and a 'secondary' set of NAAQS to protect public welfare.

Air quality 'conformity' provisions first appeared in the CAA of 1977. These provisions stated that no Federal agency could engage in; support in any way; provide financial assistance for; license, permit, or approve any activity that did not conform to a SIP after approval and promulgation. Section 176 of the CAA (42 United States Code 7506c) as amended in 1990, further explained conformity to an implementation plan as meaning conformity to the plan's purpose of eliminating or reducing the severity of violations of the NAAQS, and achieving timely attainment of these standards.

In November 1993, the USEPA promulgated regulations and requirements that clarified the applicability, procedures, and analyses necessary to ensure that Federal facilities comply with the CAA. Then in 1997, the USEPA initiated work on new General Conformity rules and guidance to reflect the new 8-hour O_3, $PM_{2.5}$, and regional haze standards that were also promulgated that year. However as a result of litigation, implementation of the new O_3 and $PM_{2.5}$ ambient air quality standards were delayed and these new conformity requirements were not completed by the USEPA until 2006 when the $PM_{2.5}$ *de minimis* levels were added.

The latest revision of the General Conformity rules occurred on April 5, 2010 (USEPA 2010). In this revision the USEPA sought to clear up identified issues, reduce specific regulatory burdens, and modify the rules to be helpful to states revising their SIP for implementing the revised NAAQS while assuring Federal agency actions continue to conform. Several of the burden reduction measures changes made to the General Conformity applicability in 40 CFR 93.153 included the following four items:

- Deleting the provision that requires Federal agencies to conduct a conformity determination for regionally significant actions under (40 CFR 93-153) where the direct and indirect emission of any pollutant represent 10 percent or more of a nonattainment or maintenance area's emission inventory for that pollutant, even though the total direct and indirect emissions are below *de minimis* levels. This provision previously applied even though the total direct and indirect emissions from the actions were below the *de minimis* emission levels, or if the actions were otherwise "presumed to conform."

- Adding new types of actions that Federal Agencies can include in their “presumed to conform” lists and permitting States to establish in their General Conformity SIPs “presumed to conform” lists for actions within their State.

- Finalizing an exemption for the emissions from stationary sources permitted under the minor source New Source Review (NSR) programs similar to the USEPA’s existing General Conformity regulation which already provides for exemptions for emissions from major NSR sources.

- Establishing procedures to follow in extending the 6-month conformity exemption for actions taken in response to an emergency.

E 1.3 General Conformity Exemptions and Applicability

Source Exemptions

The general conformity provisions identify specific Federal actions or portions of actions that are exempt from the conformity procedural requirement, because the USEPA has deemed these actions to conform. These actions include those that must undergo thorough air quality analysis to comply with other statutory requirements; actions that would result in no emission increase or an increase in emissions that is *clearly de minimis*; or actions presumed to conform by the agency through separate rule-making actions.

De minimis Emission Thresholds

The Conformity Rule requires that Federal agencies complete a conformity applicability analysis to determine whether a formal conformity determination is required. The primary criteria used in an applicability analysis are the *de minimis* threshold levels promulgated in 40 CFR 93.153(b). The total direct and indirect emissions associated with a proposed action are quantified, to enable comparison to the *de minimis* thresholds.

The conformity rule defines direct and indirect emissions based upon the timing and location of the emissions. “Direct” emissions are those that are caused or initiated by the Federal actions, and occur at the same time and place as the action and are reasonably foreseeable. “Indirect” emissions are those that originate in the same nonattainment or maintenance area, but occur at a different time or place from the Federal action. In addition, the conformity rule limits the scope of indirect emissions to those that are ***reasonably foreseeable*** by the agency at the time of analysis, and those emissions that the Federal agency can practicably control and maintain control of through its continuing program responsibility.

The definitions of direct and indirect emissions do not distinguish among specific source categories; point, area, and mobile sources are given equal consideration in the conformity requirements. All substantive procedural requirements of the General Conformity Rule apply to the total of the net increases and decreases in direct and indirect emissions resulting from the action.

The applicability determination procedures presented in the rule include the following elements:

- Define the applicable emission sources for the Federal action

- Calculate the total direct and indirect emissions of nonattainment pollutants from these sources

- Compare these emission rates against the appropriate *de minimis* emission levels

Table E-1 below presents the applicable *de minimis* thresholds promulgated for use under the General Conformity Rule. If the total of direct and indirect emissions of pollutants in nonattainment or maintenance status produced by the action reach or exceed the *de minimis* applicability threshold values, the Federal agency must perform a Conformity Determination to demonstrate the positive conformity of the action with the applicable SIP. The *de minimis* emission levels vary by criteria pollutant and severity of the region's nonattainment conditions.

Table E-1. Conformity *de minimis* Emission Thresholds

Pollutant	Status	Classification	*de minimis* Limit (tpy)
Ozone (measured as NO_x or VOCs)	Nonattainment	Extreme Severe Serious Moderate/marginal (inside ozone transport region) All others	10 25 50 50 (VOCs)/100 (NO_x) 100
	Maintenance	Inside ozone transport region Outside ozone transport region	50 (VOCs)/100 (NO_x) 100
Carbon Monoxide (CO)	Nonattainment/ maintenance	All	100
Particulate Matter (PM_{10})	Nonattainment/ maintenance	Serious Moderate Not applicable	70 100 100
Sulfur Dioxide (SO_2)	Nonattainment/ maintenance	Not applicable	100
Nitrogen Oxides (NO_2)	Nonattainment/ maintenance	Not applicable	100
Lead (PB)	Nonattainment/ maintenance	All	25

Source: 40 CFR 93.153
tpy: tons per year

E 1.4 CAA General Conformity Criteria

If the Proposed Action is not exempt from the conformity demonstration requirements, the General Conformity Rule defines conformity and provides five basic criteria to determine whether a Federal action conforms to an applicable SIP. These criteria assess conformity based upon emission analyses and/or dispersion modeling for the nonattainment pollutants. If the Federal action meets the conformity criteria and requirements, the action is demonstrated to conform to the applicable SIP. If the action cannot meet the criteria and requirements, the agency must develop an enforceable implementation plan to mitigate effectively (e.g., completely offset) the increased emissions from the Proposed Action to meet the conformity requirements. The Federal action cannot proceed unless positive conformity can be demonstrated.

The General Conformity Rule provides the option to select any one of several criteria to analyze the conformity of the Proposed Action. Presented in 40 CFR 93.158, the criteria are primarily based upon the type of pollutant and the status of the applicable SIP. If the applicability analysis concludes that further conformity analyses are required to demonstrate positive conformity (i.e., *de minimis* thresholds are exceeded), the following conformity criteria (paraphrased below) can be used to demonstrate conformity for a proposed action in a nonattainment area:

- The total direct and indirect emissions for the Proposed Action are specifically identified and accounted for in the SIP's attainment or maintenance demonstration. [40 CFR 93.158(a) (1)].

- The total direct and indirect emissions of O_3 precursors are fully offset within the same nonattainment or maintenance area through a revision to the applicable SIP or a similarly enforceable measure so that there is a no net increase in emissions [40 CFR 93.158(a)(2)].

- State made a revision to the area's attainment or maintenance demonstration after 1990 and either:
  - Determines and documents that the action, together with all other emissions in the nonattainment (or maintenance) area, *would not* exceed the emissions budget specified in the applicable SIP.
  - Determines that the action, together with all other emissions in the nonattainment (or maintenance) area, *would* exceed the emissions budget specified in the applicable SIP but the State's Governor or designee for SIP actions makes a written commitment to the USEPA to demonstrate CAA conformity through specific measures and scheduled actions [40 CFR 93.158(a)(5)(i)(A & B)].

- The Federal action fully offsets its entire emissions within the same nonattainment area through a revision to the SIP or a similar measure so that there is no net increase in nonattainment pollutant emissions [40 CFR 93.158(a)(5)(iii)].

- The State has not made a revision to the approved SIP since 1990, and the total emissions from the action do not increase emissions above the baseline emissions which are either:
  - Calendar Year 1990 (CY 90) emissions or another calendar year that was the basis for the nonattainment area designation) [40 CFR 93.158(a) (5)(iv)(A)].
  - Historic activity levels and emissions calculated for future years using appropriate emission factors and methods for future years.

- Dispersion modeling analysis demonstrates that direct and indirect emissions from the Federal action will not cause or contribute to violations of Federal ambient air quality standards [40 CFR 93.158(b)].

E 1.5 Other State Implementation Plan Consistency Requirements

The conformity analysis must also demonstrate that total direct and indirect emissions from the Proposed Action will be consistent with the applicable SIP requirements and milestones, including reasonable further progress schedules; assumptions specified in the attainment or maintenance demonstration; and SIP prohibitions, numerical emissions limits, and work practice requirements

Comparison of the Federal action's emissions to any existing SIP emission budgets that have been specifically established may be required for the Federal facility or the affected region. If the action would cause an increase in emissions such that the established SIP emissions budgets would be exceeded, a formal conformity determination and other applicable rule requirements would apply.

E 2.0 APPLICABILITY ANALYSIS

The following subsections describe the NASA JPL facility, the Proposed Action and criteria, and how the General Conformity procedures pertain to this conformity analysis.

E 2.1 Purpose

The purpose of this General Conformity Analysis is to document JPL's compliance with CAA requirements in accordance with 40 CFR 93 Subpart B and South Coast Air Quality Management District Rules and Regulations, Regulation XIX (Federal Conformity Regulations) Rule 1901 (General Conformity). This conformity analysis will analyze the air quality impact for emissions of the criteria pollutants resulting from the proposed Federal action that are in nonattainment status or have completed changes in maintenance designation(s), in order to determine whether the Proposed Action will be subject to the Federal conformity rules.

E 2.2 Facility Description & Proposed Action

NASA JPL is located in the northern metropolitan Los Angeles (LA) area, between the cities of Pasadena and La Cañada Flintridge, and the unincorporated community of Altadena in Los Angeles County (**EA Figure 1-1**). Situated on the south-facing slope of the San Gabriel foothills, NASA JPL is surrounded by natural settings on the northern, eastern, and southern boundaries. JPL is situated above the surrounding community and is a prominent visual feature in the area. Built on sloping terrain, its buildings and roads are terraced into the hillside.

The purpose of the current Master Plan initiative is to affirm NASA's mission at NASA JPL and provide a physical framework for implementing this mission over the next 20 years. Facilities at NASA JPL are deteriorating because of age. The Master Plan identifies facility and infrastructure needs and develops an implementation strategy that helps guide facilities renewal related to research, building construction, administrative services, parking, and circulation at JPL. The master planning process provides the opportunity for the transformation of NASA JPL's infrastructure and facilities to reflect long-range plan and mission, and NASA-wide goals and objectives. The Master Plan emphasizes five primary objectives:

- Replace scattered aging, obsolete, and inefficient facilities with fewer modern facilities designed to match current and future mission requirements;
- Achieve work-flow efficiencies, synergies, and added safety through the consolidation of related activities into singular structures and building groups;
- Where possible, group similar facilities, such as clean rooms and data centers, to achieve energy, maintenance, and other operational savings;
- Build new facilities to state-of-the art standards in order to properly house high-tech equipment owned by NASA, fully support fabrication, assembly and testing of robotic spacecraft, achieve high levels of workplace health, and attain high levels of sustainability; and

- Create facilities that inspire space exploration activities among employees and visitors, and promote the learning of science, technology, engineering, and mathematics.

As outlined in **Table E-2**, the individual projects which collectively fulfill the eight objectives, and together comprise the Master Plan developments will be completed between 2012 and 2032. **Table E-2** also summarizes how NASA JPL plans to conduct a phased and sequential redevelopment approach for the implementation of proposed Master Plan activities over those 20-years.

The Master Plan divides the Proposed Action into six main 'phases' of construction, each completing one functional component of the new NASA JPL facility. Removal of the thirty three sub-standard buildings slated for demolition, and upgrades and rehabilitation to seventeen others is not only anticipated to increase the efficiency of overall operations at JPL, but to result in reductions of operations emissions.

The Master Plan also calls for four phases of utility and infrastructure upgrades. Attachment B-1 summarizes the temporal distribution of these ten phases across each calendar year. On average, one project is proposed to take place every second year, based on ten projects across a twenty year time period. However, all four utility and infrastructure phases are scheduled to occur between 2013 and 2017. As a result, construction of the Flight Electronics Center (between January 2014 and December 2015), and the Advanced Robotics Center (between June 2017 and 2018) will overlap with phases of utility and infrastructure redevelopment. The completion of the fourth phase of utility upgrades will coincide with the first six months of Phase 3 (Advanced Robotics facility). The second set of utility upgrades will coincide with the second year of Phase 2 (Flight Electronics facility) for a period of 12 months. Construction is slated to occur for 6 months in 2019, 2021, and no construction is slated for any of the seven years of 2022, 2025, 2026, 2027, 2030, 2031 and 2032. The remaining periods of construction will see one project undertaken at a time. The level of construction is therefore anticipated to be the most intense during CY 2015.

Table E-2. Proposed Project Phasing Under Master Plan

Phase	Proposed Activities	Timeframe
1	New Parking Structure: • Relocate existing surface parking • Demolition of Buildings 322, 1714, and 1715 • Construction of new Parking Structure • Parking Relocation	2012-2013
2	New Flight Electronics Facility & Advanced Robotics R&D Facility • Relocate employees to temporary quarters • Demolition of Buildings 18, 280, 288, 277, 1722, and 1723 • Construction of new Flight Electronics Facility and Advanced Robotics R&D Facility • Relocate to new Flight Electronics Facility and Advanced Robotics R&D Facility • Integration of localized Infrastructure and Utility Upgrades (1 – 4)	2013-2017
3	New Mechanical Development Facility:	2018-2022

Phase	Proposed Activities	Timeframe
	• Demolition of Buildings 82, 83, 226, 296, 122, and 125 • Construction of new Mechanical Development Facility • Relocation to new Mechanical Development Facility	
4	New R&TD Facility: • Demolition of Buildings 189, 199, and 1720 • Construction of new R&TD Facility • Relocate to new R&TD Facility	2023-2027
5	Advanced Optical Development Test Facility • Construction of new Advanced Optical Development Test Facility • Relocate to new Advanced Optical Development Test Facility	2028-2032
6	• Demolition of Buildings 180, 161/184, 198, and 177 for Build-Out Plan • Full Build-out Plan • Relocate to Full Build-Out Plan • Other buildings to be Removed	TBD

Source: Information obtained from JPL Preliminary 5-Year Recapitalization Plan, Implementation Plan, dated August 16, 2010.

E 2.3 Existing Air Quality

Air Basins/Air Quality Control Regions and the SIP

The NASA JPL facility is located within Los Angeles County in the South Coast Air Basin (SCAB) of southern California. The regulatory agencies with primary responsibility for air quality management in the SCAB include the South Coast Air Quality Management District (SCAQMD) and California Air Resources Board (CARB), with oversight by the USEPA. The USEPA has delegated authority to SCAQMD to implement and enforce the NAAQS in the SCAB. As the district agency, the SCAQMD must prepare regional plans [Air Quality management District Plans (AQMPs)] to support the broader state SIP, as well as to meet the goals of the California Clean Air Act (CCAA).

Every three years the SCAQMD must prepare and submit to CARB an AQMP to demonstrate how the SOCAB will attain and maintain the NAAQS and the California Air Quality Standards. These AQMPs also form the basis for SIP and attainment status designations. In the case of NASA JPL, the currently approved SIPs for the SOCAB are summarized below:

- O_3 – SIP approved by the USEPA on April 10, 2000 (65 FR 18903), based on the 1997 AQMP and a 1999 amendment to the 1997 AQMP.

- PM_{10} – SIP approved by the USEPA on April 18, 2003 (68 19315), based on the 1997 AQMP, amendments to the 1997 AQMP submitted in 1998 and 1999, and further modifications to the 19997 AQMP submitted in a status report to the EPA in 2002.

- $PM_{2.5}$ – There is no USEPA-approved SIP.
- CO – SIP approved by the USEPA on May 11, 2007 (72 FR 26718), based on 2005 redesignation request and maintenance plan. In this SIP approval, the EPA also redesignated the SOCAB from nonattainment to attainment/maintenance for CO.
- NO_2 – SIP approved by the USEPA on July 24, 1998 (3 FR 39747), based on the 1997 AQMP. In this SIP approval, the USEPA also re-designated the SOCAB from nonattainment to attainment/maintenance for NO_2.

Ambient Air Quality Attainment Designations for Affected Air Quality Control Region

The portion of the SCAB where NASA JPL is located is in an area that is currently designated as attainment of the NAAQS for SO_2 and Pb, and nonattainment of the NAAQS for O_3 (eight-hour average), PM_{10}, and $PM_{2.5}$. In addition, the severity of the nonattainment status for this areas has been classified as 'extreme' for O_3 and 'serious' for PM_{10}. It is not classified for $PM_{2.5}$. On July 24, 1998 this area was redesignated from nonattainment/maintenance status for NO_2 by the EPA (63 FR 39747). More recently the area was redesignated by the EPA from nonattainment to attainment/maintenance for CO (72 FR 2678), effective June 11, 2007. On June 4, 2010 the SOCAB was reclassified from 'severe' to 'extreme' nonattainment area for the eight-hour O_3 NAAQS (75 FR 24409, May 5^{th}, 2010). This reclassification lowered the general conformity de minimis emission threshold for NOx and VOCs/ROG from 25 tpy to 10 tpy.

$PM_{2.5}$& O_3 Precursors in Nonattainment or Maintenance Status

$PM_{2.5}$ can be emitted from emission sources directly as very fine dust and/or liquid mist or formed secondarily in the atmosphere as condensable particulate matter typically forming nitrate and sulfate compounds. The pollutant $PM_{2.5}$ consists of primary particulate matter (directly emitted) and secondary particulate matter (formed in the atmosphere from precursor compounds) and may ultimately be composed of many separate chemical compounds. Secondary (indirect) emissions vary by region depending upon the predominant emission sources, thus the precursors that are considered significant for $PM_{2.5}$ formation or are identified for ultimate control will also vary.

Based on SCAQMD data released for the SOCAB (http://www.aqmd.gov/Default.htm, 2010) the total mass of $PM_{2.5}$ is more likely associated with combustion related sources and secondary particles formed through combustion or incomplete combustion, than primary particles which represent a relatively small proportion of total $PM_{2.5}$ mass. SCAQMD data also indicates ammonium nitrates and ammonium sulfates represent a dominant fraction of $PM_{2.5}$ components in the SOCAB.

Generally, the main precursors of secondary $PM_{2.5}$ include oxides of nitrogen (NO_x), oxides of sulfur (SO_x), and ammonia. However, organic carbon compounds (VOC) also contribute to the formation of $PM_{2.5}$. Dynamic reactions between these precursor compounds emitted into the atmosphere by the sources of interest will affect the amount of $PM_{2.5}$ attributable to the Federal Actions. If net emissions of any of these precursor compounds exceed the *de minimis* emission thresholds for $PM_{2.5}$, then the Federal action is subject to a general conformity evaluation for $PM_{2.5}$. Ammonia emissions are not associated with the sources that are included in the proposed Federal action, therefore no further analysis has been conducted for ammonia as a $PM_{2.5}$ precursor.

Ozone is a brown odorless gas, O_3 can cause irritation of the respiratory tract in humans and animals, and can damage vegetation. The maximum effect of the precursor emissions on O_3 formation may be many miles from the source because O_3 is a by-product of a photochemical reaction.

Ozone is not typically emitted directly from emission sources, but rather is formed in the atmosphere by photochemical reactions involving sunlight and other emitted pollutants, or "ozone precursors." These ozone precursors consist primarily of nitrogen oxides (NO_x) and volatile organic compounds (VOCs), which are emitted directly from a wide range of stationary and mobile sources. Therefore, O_3 concentrations in the atmosphere are controlled through limiting the emissions of NO_x and VOCs. For this reason, regulatory agencies attempt to limit atmospheric O_3 concentrations by controlling NO_x and VOC pollutants [also identified as reactive organic gases (ROG) in the State of California]. The *de minimis* emission threshold for O_3 is therefore based on the primary emissions of its precursor pollutants (VOC/ROG and NOx), so if the net emissions of either VOC/ROC or NO_x exceed the threshold *de minimis* emission rate then the Federal action would be subject to a general conformity evaluation for O_3.

E 2.4 General Conformity as Applies to Proposed Action at NASA JPL

The General Conformity Rule applies to Federal actions in areas that are failing to meet one or more of the Federal air quality standards (designated as nonattainment areas), and/or areas that are or have been subject to attainment maintenance plans (designated as maintenance areas).

As a result of the current nonattainment status, and the history of maintenance designations in the region affected by NASA JPL operations this conformity analysis will address the following criteria pollutants for the purposes of the conformity applicability criteria requirements:

- O_3 (eight-hour average), and the applicable O_3 precursors [VOCs (ROGs) and NO_x];
- PM_{10}
- $PM_{2.5}$ direct emissions, and applicable $PM_{2.5}$ precursors [SO_2 and NO_x];
- NO_2
- CO

This analysis does not address the pollutants for which affected areas are in 'attainment' - sulfur oxides (SO_x) and Lead (Pb). The applicable *de minimis* emissions thresholds for the Proposed Action at NASA JPL are shown in **Table E-3** below, in relation to the attainment designation for the South Coast Air Basin.

Table E-3. *De minimis* Emission Thresholds for NASA JPL Applicability Analysis

Pollutant	SOCAB Attainment Designation	*De minimis* Threshold (tpy)
Ozone (measured as NO_x or VOCs/ROG)	Nonattainment / Severe – 17[a]	10[a]
Particulate Matter - PM_{10}	Nonattainment / Serious	70
Particulate Matter – $PM_{2.5}$ (and each separate precursor)[b/c]	Nonattainment	100
Nitrogen Dioxide (NO_2)	Attainment / Maintenance	100

Carbon Monoxide (CO)	Attainment / Maintenance	100

a. The U.S. EPA reclassified the SOCAB as 'extreme' nonattainment for the 8-hour ozone NAAQS under 75 FR 24409 on May 5th, 2010 to be effective on June 4, 2010.

b. The PM2.5 precursors in the region include Sox, NOx, VOC/ROG and ammonia.

c. Ammonia emissions are not anticipated from the Proposed Action (construction, operation or direct/indirect); therefore, no further analysis is conducted for ammonia as a PM2.5 precursor.

E 3.0 GENERAL CONFORMITY ANALYSIS & RESULTS

This section of the conformity analysis describes the applicability analysis of the Proposed Action (implementation of the Master Plan at the NASA JPL facility) to the General Conformity Rule requirements.

E 3.1 Sources Included in the Conformity Analysis

In accordance with the General Conformity Rule, total direct and indirect emissions resulting from proposed Federal action includes several types of stationary and mobile sources. These emissions would occur during construction [Proposed Action] and operational conditions [routine facility operations]. As defined by the rule and applied to the Proposed Action at the NASA JPL facility, direct emissions would result from emissions sources not subject to air permitting as well as operations at the proposed redeveloped facility. Examples of direct emissions sources include demolition and construction activities, and routine facility operations. Indirect pollutant emissions for the proposed project include activities that JPL can control as part of the Federal action, and include privately-owned vehicles (POVs), and government-owned vehicles (GOVs) that provide transportation to and from, and/or provide services or complete support activities that occur at the facility.

E 3.2 Analysis Methodology

Air modeling analysis was performed using Urban Emissions 2007 (URBEMIS) Version 9.2.4 to estimate direct and indirect emissions at JPL. URBEMIS is a California-specific computer model that estimates construction, area, mobile, and CO2 emissions based on land uses. Both the CARB and the USEPA have approved use of URBEMIS air modeling program for use in NEPA environmental documents involving air quality analysis. Version 9.2.4 is the most recent version of the URBEMIS software, and it uses current South Coast Air Basin and Los Angeles County specific emission factors and emission reductions. The URBEMIS input data is based on the 'Emfac2007 V2.3 [Nov 1, 2006] version of On-Road Vehicle Emissions, and incorporates the 'OFFROAD2007' version of Off-Road Vehicle Emissions. The URBEMIS program then provides data output summarizing emissions resulting from construction phase of the Proposed Action, alongside area source emissions summarizing routine facility operations.

For the construction phase, pollutants of concern are considered NO_x, VOC/ROG, PM_{10} and $PM_{2.5}$. During construction PM_{10} and $PM_{2.5}$ are primarily produced during mass and fine grading activities. NO_x, VOC/ROG, PM_{10} and $PM_{2.5}$ are produced during the combustion of diesel and gasoline fuels by heavy duty construction equipment and contactor vehicles. Operational emissions consist of area and vehicle emissions. Operational pollutants of concern are the same as with construction, with the addition of CO, a typically localized pollutant which dissipates rapidly.

The level of construction activities undertaken during CY 2015 were anticipated to be significantly higher than any other single year, due to the overlap of two Master Plan phases comprising construction of the new Flight Electronics Facility, and the secondary utility and infrastructure upgrades. The Flight Electronics facility represents removal of twenty of the oldest and NASA JPL buildings, in conjunction with the second largest section of the existing facility. Furthermore, a large part of the Master Planning effort has either seen a reduction in planned project operations due to relocation, or an inability to complete routine operations in temporary housing. This is expected to produce two main results. Firstly, the level of operational emissions produced at NASA JPL is anticipated to decrease due to a draw-down in operations during construction. Secondly, with completion of the first two facilities constructed under the Master Plan effort is anticipated to signify a gradual reduction in operational emissions at NASA JPL. In consideration of these scenarios, the CY 2015 period was therefore deemed the 'worst case' scenario for construction related emissions. Data inputs for the emissions modeling was then based on twelve months of construction activities for two over-lapping phases, both to be initiated at the beginning of January of CY 2015, and to be completed at the of December 2015.

E 3.3 Total Direct and Indirect Emission Calculations

The estimates of the net changes in nonattainment pollutant emissions that would result from implementation of the Proposed Action at the NASA JPL Facility are presented in the spreadsheet attachment of this Appendix. These calculations are based on CY 2015, which is anticipated to produce the worst case scenario of emissions produced at NASA JPL, and integrates both construction and operations of the new facilities proposed under the Master Plan together with existing area source data. The resulting analyses indicate that the majority of the potential pollutant impacts would result from three elements of the Proposed Action: (1) routine facility operations at NASA JPL, including from regular NASA JPL commuter traffic from full-time employees, (2) 'direct' demolition and construction activities at NASA JPL, and (3) vehicle emissions, from construction-specific equipment, and construction-contractor motor vehicles. The net changes in direct and indirect O_3 (eight-hour average), and the applicable O_3 precursors [VOCs (ROGs) and $NO_{x]}$; PM_{10}; $PM_{2.5}$ direct emissions, and applicable $PM_{2.5}$ precursors [SO_2 and NO_x]; $NO_{2;}$ and CO emissions from these elements of the Proposed Action are presented below.

NASA JPL Routine Operations

NASA JPL air emission sources include boilers, internal combustion engines as emergency generators, painting operations, degreasers, fuel storage tanks, dispensers, and various other research and development processes. Various types of these individual emissions units currently operate under SCAQMD permits.

Construction Activities

PM_{10} and PM2.5 emissions would be generated in the form of fugitive dust from concrete demolition, material transfer, and truck/equipment movement. All criteria pollutants would also be emitted during construction as combustion by-products from diesel-fueled construction equipment and truck hauling vehicles. VOC evaporative emissions would occur due to equipment and building interior painting. Additional emissions would result from construction worker commuter traffic that would occur during the entire execution of the Proposed Action. The construction worker commuter emissions are accounted for in the following section.

Motor Vehicle Emissions

Motor vehicle emissions include commuter emissions associated with the routine operations at NASA JPL (i.e., NMO staff, and all Caltech and NASA JPL operations, contractors and support staff), and with anticipated levels of onsite contractors associated with the construction projects (i.e. demolition, site grading, utility and construction crews) proposed under the Master Plan. Commuter vehicle emissions associated with temporary construction workers and activities are included in the construction emissions in **Table E-4** below.

The Proposed Action is expected to require approximately 150 to 200 onsite contractors during peak periods of construction activities. The NASA JPL facility is not expected to see increased levels of employees due to changes in facility or operational capability as a result of implementing the Master Plan. Commuter traffic levels are therefore not expected to increase. Over the longer term, in with increases in public transportation options as a result of the City of Pasadena CIP it is anticipated both commuter levels to NASA JPL, and pass-by trips will decrease over the longer term after CY 2015.

Table E-4 presents the estimated annual emissions of the nonattainment pollutants generated during construction activities at NASA JPL, with mitigation factors included. As shown, the greatest total annual pollutant emission rates for construction activities are projected to occur during CY 2013.

Table E-4. Construction Activity Emissions - Proposed Action at NASA JPL (tpy)

CY	VOC/ ROG	NO_x	CO	SO_2	PM_{10}	PM_{10} (Dust)	PM_{10} (Exhaust)	$PM_{2.5}$	$PM_{2.5}$ (Dust)	$PM_{2.5}$ (Exhaust)
2015	5.84	6.77	9.63	0.02	2.50	2.23	0.27	0.72	0.48	0.24

CY: Calendar Year
tpy: tons per year

E 3.4 Applicability Analysis Results

NASA JPL Net Emissions

Table E-5 summarizes the net Proposed Action emissions and compares those impacts to the applicable General Conformity *de minimis* thresholds. The results of the applicability analysis indicate that net peak year direct and indirect emissions at NASA JPL (i.e., the sum of construction and facility operations) within the SOCAB (and SCAQMD) would *not* exceed the 10, 70 and 100 tpy *de minimis* levels for any of the criteria pollutants of concern, or for the applicable precursors of criteria pollutants. Therefore, state and Federal General Conformity rules are not applicable, and no conformity determination is required for this Proposed Action.

Table E-5. Comparison of Estimated NASA JPL Net Emissions to *de minimis* Thresholds

Criteria Pollutant	Ozone Attainment Status [1]	*de minimis* Threshold (tpy)	Estimated Net Emissions (Direct & Indirect) JPL Proposed Action (tpy)
NO_x (as precursor for an O_3 and $PM_{2.5}$)	Maintenance	10	8.17
VOC/ROG (as an O_3 precursor)	Maintenance	10	8.38
PM_{10}	Nonattainment	70	10.72
$PM_{2.5}$	Nonattainment	100	2.30
SO_2 (as an $PM_{2.5}$ precursor)	Nonattainment	100	0.05
CO	Nonattainment/maintenance	100	26.92

E 4.0 FINDINGS & CONCLUSION

The purpose of this analysis is to determine whether implementation of the Master Plan at NASA JPL would conform to the applicable SIP, based upon the criteria established in the General Conformity Rule and promulgated in 40 CFR 93.158. Emissions produced through construction of new buildings, and/or as a result of routine operations at the existing NASA JPL facility will not reach levels anticipated in CY 2015. CY 2015 emissions are considered 'worst case', and annual emissions from other years will be lower than 2015. Because the direct and indirect emissions from the worst year, 2015, are below the *de minimis* thresholds and it was shown that the project emissions will not exacerbate air quality, increase violations of non-attainment pollutants, or delay the region from attaining the NAAQS in a timely manner the Proposed Action is considered to be conforming with the SIP.

The regulatory basis and specific criteria for this analysis were presented in Section C 1.0 above. Section C 2 presented the applicability analysis. Section E 3 provided the conformity analysis and emissions calculations generated under the Proposed Action, indicating that the reasonably foreseeable project emissions of NO_2, VOC, $PM_{2.5}$, and SO_2 would not exceed the General Conformity Rule *de minimis* levels. This conclusion is supported by the calculations attached to this analysis. This Section, E 4.0 presents the following findings and conclusion for the conformity analysis for the Proposed Action at NASA JPL:

After careful and thorough consideration of the conformity analysis contained herein, the project proponent finds that the total direct and indirect emissions associated with the Proposed Action at NASA JPL would not exceed the applicable *de minimis* thresholds, and that the Proposed Action would therefore be exempt from the requirements of the Federal Conformity Rule consistent with the objectives as set forth in Section 176(c) of the CAA, as amended, and its implementing regulation, 40 CFR Part 93, Subpart B, Determining Conformity of General Federal Actions to State and Local Implementation Plans.

REFERENCE LIST

USEPA 2005	USEPA. 2005. "Air Quality Designations and Classifications for the Fine Particles (PM2.5) National Ambient Air Quality Standards." Federal Register, January 5, 2005, Volume 70, Number 3, pages 944.
USEPA 2008a	Federal Register. 2008. "National Ambient Air Quality Standards for Ozone." Federal Register, March 27, 2008, Volume 73, Number 60, pages 16436.
USEPA 2008b	Federal Register. 2008. "National Ambient Air Quality Standards for Lead." Federal Register, November 12, 2008, Volume 73, Number 219, pages 66964.
USEPA 2010a	Federal Register. 2010. "Primary National Ambient Air Quality Standards for Nitrogen Dioxide." Federal Register, February 9, 2010, Volume 75, Number 26, pages 6474.
USEPA 2010b	Federal Register. 2010. "Revisions to General Conformity Regulations." Federal Register, April 5, 2010, Volume 75, Number 64, pages 17254-17257.
USEPA 2010c	Federal Register. 2010. "Primary National Ambient Air Quality Standard for Sulfur Dioxide." Federal Register, June 22, 2010, Volume 75, Number 119, pages 35520.

APPENDIX G
General Conformity Applicability Analysis for Table Mountain Facility

EXECUTIVE SUMMARY

Agencies: National Aeronautics and Space Administration (NASA), Jet Propulsion Laboratory (JPL)

Designation: Clean Air Act General Conformity Analysis

Affected Location: Table Mountain Facility (TMF), Wrightwood, CA

Proposed Action: Implement Master Plan

Abstract: Section 176 (c) of the Clean Air Act (CAA) (42 U.S.C. § 7506(c)) requires any entity of the Federal Government that engages in, supports, or in any way provides financial support for, licenses or permits, or approves any activity to demonstrate that the action conforms to the applicable State Implementation Plan (SIP) required under Section 110 (a) of the CAA before the action is otherwise approved. In this context, conformity means that such Federal actions must be consistent with a SIP's purpose of eliminating or reducing the severity and number of violations of national ambient air quality standards (NAAQS) and achieving expeditious attainment of national ambient air quality standards.

JPL is currently undertaking analysis of existing facilities and infrastructure, while simultaneously forecasting future needs and objectives to enable NASA to continue to meet its mission. JPL is proposing the development of a comprehensive planning strategy through the implementation of a Master Plan which would cover development at TMF, located near Wrightwood, California over the next two decades. This document represents the General Conformity review completed by NASA/JPL, including analysis of potential impacts to air quality as a result of implementing the proposed Master Plan; analysis of the General Conformity applicability; and documentation of the findings.

Conformity Analysis: After careful and thorough consideration of the conformity analysis contained herein, the project proponent finds that the total direct and indirect emissions associated with the Proposed Action at the TMF would not exceed the applicable *de minimis* thresholds, and that the Proposed Action would therefore be exempt from the requirements of the Federal Conformity Rule consistent with the objectives as set forth in Section 176(c) of the CAA, as amended, and its implementing regulation, 40 CFR Part 93, Subpart B, Determining Conformity of General Federal Actions to State and Local Implementation Plans.

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G 1.0 INTRODUCTION

G 1.1 Introduction

Section 176 (c) of the Clean Air Act (CAA) (42 United States Code § 7506(c)) requires any entity of the Federal Government that engages in, supports, or in any way provides financial support for, licenses or permits, or approves any activity to demonstrate that the action conforms to the applicable State Implementation Plan (SIP) required under Section 110 (a) of the CAA before the action is otherwise approved.

In establishing the Final General Conformity Rule, the U.S. Environmental Protection Agency (USEPA) requires Federal agencies to evaluate a proposed Federal action and ensure that it does not:

- Cause a new violation of a national ambient air quality standard (NAAQS)
- Contribute to an increase in the frequency or severity of violations of NAAQS
- Delay the timely attainment of any NAAQS, interim progress milestones, or other milestones toward achieving compliance with the NAAQS

The General Conformity Rule requires that Federal agencies consider total direct and indirect emissions of criteria pollutants. Conformity must be shown for those pollutants (or precursors of those pollutants) emitted in areas designated as nonattainment, as well as for those pollutants which an area has been redesignated from nonattainment to attainment (i.e., a maintenance area). In this context, conformity means that such Federal actions must be consistent with a SIP's purpose of eliminating or reducing the severity and number of violations of NAAQS and achieving expeditious attainment of national ambient air quality standards. Each Federal agency must determine that any action that is proposed by the agency and that is subject to the regulations implementing the conformity requirements will, in fact, confirm to the applicable SIP before the action is taken.

The Jet Propulsion Laboratory (JPL) is currently undertaking analysis of existing facilities and infrastructure, while simultaneously forecasting future needs and objectives to enable National Aeronautics and Space Administration (NASA) to continue meeting its mission. JPL is proposing the development of a comprehensive planning strategy through the implementation of a Master Plan which would cover development at the Table Mountain Facility (TMF) near Wrightwood, California over the next two decades. This document represents the General Conformity Analysis completed by NASA/JPL, including analysis of potential impacts to air quality as a result of implementing the proposed Master Plan; analysis of the General Conformity applicability; and documentation of the findings.

G 1.2 Document Organization

Section G 1.0 of this document serves as a general introduction to the Proposed Action, and the applicable requirements associated with air quality regulations that must be fulfilled in order for the project proponent (NASA/JPL) to approve and commence the action. The section includes an outline of this document; the regulatory background and outline of the regulatory requirements of the General Conformity Rule; the General Conformity Exemptions & Applicability; CAA General Conformity Criteria; and other potentially applicable SIP Implementation Plan Consistency Requirements.

Section G 2.0 completes an applicability analysis for the Proposed Action in terms of the General Conformity rules, and examines the Proposed Action within the regional air quality scenario. The section includes the purpose of the Conformity Analysis; a description of TMF and the Proposed Action; summary of the existing air quality conditions in the region and their relationships to this Conformity Analysis; and the applicability of the conformity rule to the proposed implementation of the Master Plan at the JPL TMF. Section G 3.0 provides the emissions estimations attached to this analysis; details the calculation methodologies; and provides the conformity analysis results for the Proposed Action. The section identifies the sources includes in the conformity analysis; provides the total direct and indirect emissions calculations; and provides the applicability analysis results. Finally, Section G 4.0 provides the conclusion and findings of the conformity review and applicability analysis.

G 1.3 Background

The CAA and Clean Air Act Amendments (CAAA) were passed by Congress and corresponding rules were promulgated by USEPA because it was determined that certain pollutants have the potential to cause an adverse effect on public health and the environment when certain concentrations are exceeded in ambient air. In order to control and regulate the main air pollutants and better maintain air quality levels, NAAQS were established for seven 'criteria pollutants'. These pollutants included carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter less than 10 microns in diameter (PM_{10}), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), sulfur oxides (SO_x), and lead (Pb). The USEPA then established a set of 'primary' NAAQS to protect the public health with an adequate margin of safety, and a 'secondary' set of NAAQS to protect public welfare.

Air quality 'conformity' provisions first appeared in the CAA of 1977. These provisions stated that no Federal agency could engage in; support in any way; provide financial assistance for; license, permit, or approve any activity that did not conform to a SIP after approval and promulgation. Section 176 of the CAA (42 United States Code 7506c) as amended in 1990, further explained conformity to an implementation plan as meaning conformity to the plan's purpose of eliminating or reducing the severity of violations of the NAAQS, and achieving timely attainment of these standards.

In November 1993, the USEPA promulgated regulations and requirements that clarified the applicability, procedures, and analyses necessary to ensure that Federal facilities comply with the CAA. Then in 1997, the USEPA initiated work on new General Conformity rules and guidance to reflect the new 8-hour O_3, $PM_{2.5}$, and regional haze standards that were also promulgated that year. However as a result of litigation, implementation of the new O_3 and $PM_{2.5}$ ambient air quality standards were delayed and these new conformity requirements were not completed by the USEPA until 2006 when the $PM_{2.5}$ *de minimis* levels were added.

The latest revision of the General Conformity rules occurred on April 5, 2010 (USEPA 2010). In this revision the USEPA sought to clear up identified issues, reduce specific regulatory burdens, and modify the rules to be helpful to states revising their SIP for implementing the revised NAAQS while assuring Federal agency actions continue to conform. Several of the burden reduction measures changes made to the General Conformity applicability in 40 CFR 93.153 included the following four items:

- Deleting the provision that requires Federal agencies to conduct a conformity determination for regionally significant actions under (40 CFR 93-153) where the direct and indirect emission of any pollutant represent 10 percent or more of a nonattainment or maintenance area's emission inventory for that pollutant, even though the total direct and indirect emissions are below *de minimis* levels.

This provision previously applied even though the total direct and indirect emissions from the actions were below the *de minimis* emission levels, or if the actions were otherwise "presumed to conform."

- Adding new types of actions that Federal Agencies can include in their "presumed to conform" lists and permitting States to establish in their General Conformity SIPs "presumed to conform" lists for actions within their State.

- Finalizing an exemption for the emissions from stationary sources permitted under the minor source New Source Review (NSR) programs similar to the USEPA's existing General Conformity regulation which already provides for exemptions for emissions from major NSR sources.

- Establishing procedures to follow in extending the 6-month conformity exemption for actions taken in response to an emergency.

G 1.4 General Conformity Exemptions and Applicability

Source Exemptions

The general conformity provisions identify specific Federal actions or portions of actions that are exempt from the conformity procedural requirement, because the USEPA has deemed these actions to conform. These actions include those that must undergo thorough air quality analysis to comply with other statutory requirements; actions that would result in no emission increase or an increase in emissions that is *clearly de minimis*; or actions presumed to conform by the agency through separate rule-making actions.

De minimis Emission Thresholds

The Conformity Rule requires that Federal agencies complete a conformity applicability analysis to determine whether a formal conformity determination is required. The primary criteria used in an applicability analysis are the *de minimis* threshold levels promulgated in 40 CFR, 93.153(b). The total direct and indirect emissions associated with a proposed action are quantified, to enable comparison to the *de minimis* thresholds.

The conformity rule defines direct and indirect emissions based upon the timing and location of the emissions. "Direct" emissions are those that are caused or initiated by the Federal actions, and occur at the same time and place as the action and are reasonably foreseeable. "Indirect" emissions are those that originate in the same nonattainment or maintenance area, but occur at a different time or place from the Federal action. In addition, the conformity rule limits the scope of indirect emissions to those that are ***reasonably foreseeable*** by the agency at the time of analysis, and those emissions that the Federal agency can practicably control and maintain control of through its continuing program responsibility.

The definitions of direct and indirect emissions do not distinguish among specific source categories; point, area, and mobile sources are given equal consideration in the conformity requirements. All substantive procedural requirements of the General Conformity Rule apply to the total of the net increases and decreases in direct and indirect emissions resulting from the action.

The applicability determination procedures presented in the rule include the following elements:

- Define the applicable emission sources for the Federal action

- Calculate the total direct and indirect emissions of nonattainment pollutants from these sources

- Compare these emission rates against the appropriate *de minimis* emission levels

Table G-1 presents the applicable *de minimis* thresholds promulgated for use under the General Conformity Rule.

Table G-1. General Conformity Rule de minimis Emission Thresholds

Pollutant	Status	Classification	*de minimis* Limit (tpy)
Ozone (measured as NO_x or VOCs)	Nonattainment	Extreme Severe Serious Moderate/marginal (inside ozone transport region) All others	10 25 50 50 (VOCs)/100 (NO_x) 100
	Maintenance	Inside ozone transport region Outside ozone transport region	50 (VOCs)/100 (NO_x) 100
Carbon Monoxide (CO)	Nonattainment/ maintenance	All	100
Particulate Matter (PM_{10})	Nonattainment/maintenance	Serious Moderate Not applicable	70 100 100
Sulfur Dioxide (SO_2)	Nonattainment/ maintenance	Not applicable	100
Nitrogen Oxides (NO_2)	Nonattainment/ maintenance	Not applicable	100
Lead (PB)	Nonattainment/ maintenance	All	25

Source: 40 CFR 93.153
tpy: tons per year

If the total of direct and indirect emissions of pollutants in nonattainment or maintenance status produced by the action reach or exceed the *de minimis* applicability threshold values, the Federal agency must perform a Conformity Determination to demonstrate the positive conformity of the action with the applicable SIP. The *de minimis* emission levels vary by the criteria pollutant and the severity of the region's nonattainment conditions.

G 1.5 Clean Air Act General Conformity Criteria

If the Proposed Action is not exempt from the conformity demonstration requirements, the General Conformity Rule defines conformity and provides five basic criteria to determine whether a Federal action conforms to an applicable SIP. These criteria assess conformity based upon emission analyses and/or dispersion modeling for the nonattainment pollutants. If the Federal action meets the conformity criteria and requirements, the action is demonstrated to conform to the applicable SIP. If the action cannot meet the criteria and requirements, the agency must develop an enforceable implementation plan to mitigate effectively (e.g., completely offset) the increased emissions from the Proposed Action to meet the conformity requirements. The Federal action cannot proceed unless positive conformity can be demonstrated.

The General Conformity Rule provides the option to select any one of several criteria to analyze the conformity of the Proposed Action. Presented in 40 CFR 93.158, the criteria are primarily based upon the type of pollutant and the status of the applicable SIP. If the applicability analysis concludes that further conformity analyses are required to demonstrate positive conformity (i.e., *de minimis* thresholds are exceeded) the following conformity criteria (paraphrased below) can be used to demonstrate conformity for a proposed action in a nonattainment area:

- The total direct and indirect emissions for the Proposed Action are specifically identified and accounted for in the SIP's attainment or maintenance demonstration. [40 CFR 93.158(a)(1)].

- The total direct and indirect emissions of O_3 precursors are fully offset within the same nonattainment or maintenance area through a revision to the applicable SIP or a similarly enforceable measure so that there is a no net increase in emissions [40 CFR 93.158(a)(2)].

- State made a revision to the area's attainment or maintenance demonstration after 1990 and either:
  - Determines and documents that the action, together with all other emissions in the nonattainment (or maintenance) area, *would not* exceed the emissions budget specified in the applicable SIP.
  - Determines that the action, together with all other emissions in the nonattainment (or maintenance) area, *would* exceed the emissions budget specified in the applicable SIP but the State's Governor or designee for SIP actions makes a written commitment to the USEPA to demonstrate CAA conformity through specific measures and scheduled actions [40 CFR 93.158(a)(5)(i)(A & B)].

- The Federal action fully offsets its entire emissions within the same nonattainment area through a revision to the SIP or a similar measure so that there is no net increase in nonattainment pollutant emissions [40 CFR 93.158(a)(5)(iii)].

- The State has not made a revision to the approved SIP since 1990, and the total emissions from the action do not increase emissions above the baseline emissions which are either:
  - Calendar Year 1990 (CY 90) emissions or another calendar year that was the basis for the nonattainment area designation) [40 CFR 93.158(a)(5)(iv)(A)].
  - Historic activity levels and emissions calculated for future years using appropriate emission factors and methods for future years.

- Dispersion modeling analysis demonstrates that direct and indirect emissions from the Federal action will not cause or contribute to violations of Federal ambient air quality standards [40 CFR 93.158(b)].

G 1.6 Other State Implementation Plan Consistency Requirements

The conformity analysis must also demonstrate that total direct and indirect emissions from the Proposed Action will be consistent with the applicable SIP requirements and milestones, including:

- Reasonable further progress schedules
- Assumptions specified in the attainment or maintenance demonstration
- SIP prohibitions, numerical emissions limits, and work practice requirements

Comparison of the Federal action's emissions to any existing SIP emission budgets that have been specifically established may be required for the Federal facility or the affected region. If the action would cause an increase in emissions such that the established SIP emissions budgets would be exceeded, a formal conformity determination and other applicable rule requirements would apply.

G 2.0 APPLICABILITY ANALYSIS

The following subsections describe the TMF, the Proposed Action and criteria, and how the General Conformity procedures pertain to this conformity analysis.

G 2.1 Purpose

The purpose of this General Conformity Analysis is to document JPL's compliance with CAA requirements in accordance with 40 CFR 93 Subpart B and Antelope Valley Air Quality Management District Rules and Regulations, Regulation XIX (Federal Conformity Regulations) Rule 1901 (General Conformity). This conformity analysis will analyze the air quality impact for emissions of the criteria pollutants resulting from the proposed Federal action that are in nonattainment status or have completed changes in maintenance designation(s), in order to determine whether the Proposed Action will be subject to the Federal conformity rules.

G 2.2 Facility Description & Proposed Action

TMF is located 116 kilometers (km) (72 miles [mi]) northeast of JPL at an elevation of 2,286 meters (m) (7,500 feet [ft]) approximately two miles west of Wrightwood. The site is in the Santa Clara/Mohave Rivers Ranger District of the Angeles National Forest (ANF). In a remote location with excellent viewing conditions and fine transparent skies, the TMF is increasingly sought after as a site for scientific investigation of the earth's atmosphere, solar radiation, and solar system astronomy. Due to its relative proximity to JPL JPL, TMF is rapidly accessible to JPL scientists and engineers. Since it includes dormitory, food service, office and small conference capabilities, it can be used on a 24-hour basis for conducting various observational and research activities.

The TMF is managed, technically directed, and operated for NASA by JPL. The TMF is a unique asset which directly supports multiple NASA space science and earth science programs, and can be classified as critical to the success of several NASA programs. The purpose of the current Master Plan initiative is to affirm NASA's mission at TMF and provide a physical framework for implementing this mission over the next 20 years. Facilities at TMF are deteriorating because of age. The Master Plan identifies facility and infrastructure needs and develops an implementation strategy that helps guide facilities renewal related to research, building construction, administrative services, parking, and circulation at TMF. The master planning process provides the opportunity for the transformation of TMF's infrastructure and facilities to reflect long-range plan and mission, and NASA-wide goals and objectives. The Master Plan includes the following twelve objectives:

- Construct an independent water storage and fire suppression system to achieve JPL/NASA water and safety readiness and reliability;
- Improve and expand the existing "dry-type" fire suppression system into Buildings TM-1, TM-2, TM-12 and TM-27;
- Install a new perimeter fence system that meets NASA standards and that withstands and functions better under heavy snow conditions;

- Explore alternative main gate locations and/or access requirements for Table Mountain Road adjacent to and in relation to Mountain High North;
- Maintain unobstructed vehicular access to the TMF site to assure 24-hour use by JPL/NASA programmatic and support users;
- Provide for rapid vehicular access to TMF facilities in support of emergency services providers;
- Provide for reasonable access to all TMF facilities in compliance with the Americans with Disabilities Act (ADA);
- Provide for safe pedestrian and vehicular site access under a range of weather conditions;
- Improve the livability of on-site dormitory facilities including upgrades to heating, ventilating and air conditioning systems (HVAC);
- Provide sufficient on-site opportunities for indoor and outdoor study, collegial interaction, and outdoor passive recreation;
- Develop alternative physical development scenarios that would accommodate up to three 2-3 m (6.6-9.8 ft) instruments associated with a future expansion of the Optical Communications Telescope Laboratory (OCTL) program; and
- Reexamination of earlier parking facility locations based on current needs and seismic understandings.

The Master Plan divides the Proposed Action into four main 'phases' of construction, with each phase representing two 'objectives' or 'functional' components of the new TMF.

- Retrofit Fire Suppression TM-1, 2, 12, 27
- Upgrade Power, Comm. & Back Up Infrastructure
- Upgrade TM-17
- Addition to TM-28
- Upgrade TM-27 for 1.3m Telescope
- OCTL Phase 2
- Perimeter Security Fence
- TM-2 Road and Utility Infrastructure

The Master Plan calls for site redevelopment to start in CY 2014, and overall Master Plan projects including all associated utility and infrastructure upgrades to be completed by the end of CY 2018. Attachment B-2 summarizes the temporal distribution of these four construction phases across each calendar year. While the removal of the portions of sub-standard buildings or mechanical components, proposed upgrades and rehabilitation is anticipated to increase the efficiency of overall operations at JPL, the addition of new facilities is also anticipated to result in minor net increases of operation related emissions at TMF.

Construction levels are anticipated to be greatest, and involve the highest levels of construction-related air pollution during development of the new OCTL facility adjacent to TM-2 in CY 2016. However, there is no construction proposed for CY 2017. Thus, as a result of anticipated increases in operational emissions, the worst case scenario for air pollution production is anticipated to be 2018 when operational emissions are expected to be at final levels, and occur concurrent with the fourth and last phase, which involves substantial use of heavy equipment for site grading and earth movement in the TM-2 road and utility infrastructure developments.

G 2.3 Existing Air Quality

The TMF is located within Los Angeles County in the Mohave Desert Air Basin (MDAB) of southern California. The regulatory agencies with primary responsibility for air quality management in the MDAB include the Antelope Valley Air Quality Management District (AVAQMD), the Mohave Desert Air Quality Management District (MDAQMD), and the California Air Resources Board (CARB), with oversight by the USEPA. The current de minimis thresholds for the AVAQMD are summarized below in **Tables G-2** and **G-3**.

Table G-2. Criteria Pollutant *de minimis* Emission Thresholds for AVAQMD

Criteria Pollutant	AVAQMD Attainment Designation	Annual *de minimis* Threshold (tons)
Carbon Monoxide (CO)	Attainment *(State of CA - Attainment)*	100
Oxides of Nitrogen (NO_x)	Federal – Unclassified *(State of CA – Nonattainment)*	25
Volatile Organic Compounds (VOC [ROG])	N/A	25
Oxides of Sulfur (SO_x)	Attainment / Unclassified	25
Particulate Matter - PM_{10}	Unclassified *(State of CA – Nonattainment)*	15
Particulate Matter – $PM_{2.5}$	Unclassified / Attainment *(State of CA– Unclassified)*	15

Source: AVAQMD CEQA and Federal Conformity Guidelines (AVAQMD, 2008b)

Table G-3. Pollutant Precursor *de minimis* Emission Thresholds for AVAQMD

Pollutant Precursor	MDAB Attainment Designation	Annual *de minimis* Threshold (tons)
Nitrogen Dioxide (NO_2) [measured as NO_x]	Federal – Unclassified *(State of CA – Nonattainment)*	25
Ozone (O_3) [measured as NO_x, or VOCs/ROG)	Federal 8-Hr 84 ppb - Nonattainment / Severe – 17 Federal 8-Hr 75 ppb - Nonattainment *(expected)* *(State of CA - Nonattainment / Extreme)*	25
$PM_{2.5}$ (for each separate precursor)[a]	Unclassified / Attainment *(State of CA– Unclassified)*	15

a. The $PM_{2.5}$ precursors in the MDAB include SO_x, NO_x, VOC/ROG and ammonia.

Source: AVAQMD CEQA and Federal Conformity Guidelines (AVAQMD, 2008b)

Ambient Air Quality Attainment Designations and the SIP

The Antelope Valley is the desert, or eastern portion of Los Angeles County, and is considered downwind of Los Angeles and the South Coast Air Basin (SOCAB), and to a lesser extent is considered downwind of the San Joaquin Valley. Prevailing winds transport ozone and ozone precursors into and through the Antelope valley during the summer ozone season. Local Antelope Valley emissions contribute to exceedances of the NAAQS and State of California Ambient Air Quality Standards (CAAQS) for ozone, but the Antelope Valley would be in attainment of both standards without the influence of this transported air pollution from upwind regions.

As a result, the AVAQMD has been designated as nonattainment for the 8-hour ozone NAAQS by the USEPA as a portion of the Western Mohave Desert non-attainment area (per 40 CFR 81.305). The ozone designation value classifies the area as a moderate nonattainment area with 2010 as the required attainment year (per U.S.C. 7511(1)(2); FCAA§181(a)(2)). Every three years, the AVAQMD must prepare and submit an Air Quality Management Plan (AQMP) to CARB to support the broader state SIP, as well as to demonstrate how they will attain and maintain the NAAQS and the California Air Quality Standards for their jurisdiction. These AQMPs also form the basis for SIP and attainment status designations.

The South Coast Air Quality Management District (SCAQMD), and the Antelope Valley Air Pollution Control District (AVAPCD) were the previous regulatory agencies with jurisdiction over the desert portion of Los Angeles County and the Antelope Valley. The SCAQMD addressed this area in their 1991, 1994, and 1997 AQMPs. The 1994 AQMP is the most recent ozone attainment plan for the desert portion of Los Angeles County that has been approved by the USEPA. The USEPA had approved a revision to the 1997 AQMP that was adopted after the formation of the AVAPCD. The AVAQMD adopted the AVAQMD Ozone Attainment plan on April 20, 2004 (AVAQMD, 2008a). The AVAQMD Federal 8-Hour Ozone Attainment Plan is the most recent document, which replaces or updates all previously submitted Federal ozone plans (AVAQMD, 2008a).

Ozone Precursors in Nonattainment or Maintenance Status

Ozone is a brown odorless gas, which can cause irritation of the respiratory tract in humans and animals, and can damage vegetation. The maximum effect of the precursor emissions on O_3 formation may be many miles from the source because O_3 is a by-product of a photochemical reaction: in the presence of ultraviolet radiation, both NO_x and VOCs go through a number of complex chemical reactions to form ozone. Ozone is not typically emitted directly from emission sources, but rather is formed in the atmosphere by photochemical reactions involving sunlight and other emitted pollutants, or "ozone precursors." These ozone precursors consist primarily of nitrogen oxides (NO_x) and volatile organic compounds (VOCs), which are emitted directly from a wide range of stationary and mobile sources. Therefore, O_3 concentrations in the atmosphere are controlled through limiting the emissions of NO_x and VOCs.

For this reason, regulatory agencies attempt to limit atmospheric O_3 concentrations by controlling NO_x and VOC pollutants [also identified as reactive organic gases (ROG) in the State of California]. The *de minimis* emission threshold for O_3 is therefore based on the primary emissions of its precursor pollutants (VOC/ROG and NOx), so if the net emissions of either VOC/ROC or NO_x exceed the threshold *de minimis* emission rate, then the Federal action would be subject to a general conformity evaluation for O_3.

Nitrogen Dioxide

Nitrogen oxides and/or dioxide pollutant compounds are typically byproducts produced through incomplete combustion of fuels. The majority of NOx emitted from combustions sources is in the form of nitrogen oxide

(NO), while the balance is mainly NO_2. NO is oxidized by oxygen (O_2) in the atmosphere to form NO_2, but some level of photochemical activity is needed for this conversions. For this reason, the highest concentrations of NO_2 generally appear during autumn months, and not in winter when atmospheric conditions favor the trapping of ground level releases of NO but lack significant radiation intensity (due to less direct sunlight) to oxidize NO to NO_2. In the summer months, the conversion rates on NO to NO_2 are high, but the climatic conditions with relatively high temperatures and comparatively higher levels of wind serve to disperse pollutants, preventing the accumulation of NO_2 to levels approaching the 1-hour ambient NAAQS. NO is also oxidized by O_3 to form NO_2. The formation of NO_2 in the summer with the help of O_3 occurs according to the following reaction:

$$NO + O_3 \rightarrow NO_2 + O_2$$

In urban areas, the ozone concentration level is typically high. That level will drop substantially during nighttime hours as the reaction no longer takes place without solar radiation. Furthermore, the increased availability of NO in urban areas has an indirect correlation to the ground level ozone concentrations, given its ability to produce the aforementioned reaction. This reaction explains why ozone concentrations in urban areas tend to decrease with proximity to ground level, and why in downwind rural areas or at increasing altitudes (which lack the reciprocal NO_X emission sources), the ozone concentrations tend to remain relatively high.

Volatile Organic Compounds

Federal ozone planning requirements refer to emissions and pollutants in terms of 'Volatile Organic Compounds', while the State of California ozone planning requirements refer to emissions and pollutants in terms of 'Reactive Organic Gases'. Ethane is now excluded from either group, and due to changes in the definition of each, there is no effective difference between the two terms. Thus, for the purposes of this applicability analysis, the two terms will be considered interchangeable.

G 2.4 General Conformity as Applies to Proposed Action at TMF

The General Conformity Rule applies to Federal actions in areas that are failing to meet one or more of the Federal air quality standards (designated as nonattainment areas), and/or areas that are or have been subject to attainment maintenance plans (designated as maintenance areas). As a result of the current nonattainment status, and the history of maintenance designations in the region affected by TMF operations, this conformity analysis will address the following criteria pollutants for the purposes of the conformity applicability criteria requirements:

- O_3 (eight-hour average), and the applicable O_3 precursors which are considered to be VOCs (ROGs), and oxides of nitrogen (NO_x).

In the case of TMF, the applicable ozone AQMP is the currently approved AVAQMD Ozone Attainment Plan, as summarized below:

- Federal 8-Hour Ozone (84 ppb) Attainment Plan – Adopted May 20, 2008; targeting NO_x and VOC (ROG); with planned attainment in 2021.

This analysis does not address the pollutants for which affected areas are in 'attainment' –CO, NO_2, SO_x, and Pb, or for those which are currently unclassified – PM_{10}, $PM_{2.5}$. The applicable de minimis emissions thresholds for the Proposed Action at TMF are shown in **Table G-4** in relation to the attainment designation for the AVAQMD.

Table G-4. Ozone Pollutant Precursor de minimis Emission Thresholds for TMF

Criteria Pollutant	AVAQMD Attainment Designation	Annual *de minimis* Threshold (tons)	Daily *de minimis* Threshold (pounds)
Oxides of Nitrogen (NO_x)	Federal–Unclassified *(State of CA–Nonattainment)*	25	137
Volatile Organic Compounds (VOC [ROG])	N/A	25	137
Ozone (O_3) [measured as NO_x, or VOCs/ROG)	Federal 8-Hr 84 ppb- Nonattainment/Severe–17 Federal 8-Hr 75 ppb- Nonattainment *(expected)* *(State of CA-Nonattainment/Extreme)*	25	Ozone (O_3) [measured as NO_x, or VOCs/ROG)

Source: AVAQMD CEQA and Federal Conformity Guidelines (AVAQMD, 2008b)

G 3.0 GENERAL CONFORMITY ANALYSIS & RESULTS

This section of the conformity analysis describes the applicability analysis of the Proposed Action (implementation of the Master Plan at the TMF) to the General Conformity Rule requirements.

G 3.1 Sources Included in the Conformity Analysis

In accordance with the General Conformity Rule, total direct and indirect emissions resulting from proposed Federal action includes several types of stationary and mobile sources. These emissions would occur during construction and operational conditions [routine facility operations] under the Proposed Action. As defined by the rule and applied to the Proposed Action at the TMF, direct emissions would result from emissions sources not subject to air permitting as well as operations at the proposed redeveloped facility.

Direct impacts are the result of the project itself (from its construction and operation), in the form of project activity and trips generated by the project. Examples of direct emissions sources include equipment exhausts, wind erosion, and tire wear and vehicle exhaust from project deliveries, or trips to and from the construction site.

Indirect impacts are the result of changes that would not occur without the project. In the case of TMF, indirect impacts on the surrounding area could be generated in many ways. Pollutant emissions for the proposed project include activities that TMF can control as part of the Federal action, and include privately-owned vehicles (POVs), and government-owned vehicles (GOVs) that provide transportation to and from, and/or provide services or complete support activities that occur at the facility; changes in traffic circulation patterns, that result in increased congestion and delays; or those that they cannot control, such as use and occupation of local housing or restaurant facilities.

G 3.2 Analysis Methodology

Air modeling analysis was performed using Urban Emissions 2007 (URBEMIS) Version 9.2.4 to estimate direct and indirect emissions at TMF. URBEMIS is a California-specific computer model that estimates construction, area, mobile, and CO2 emissions based on land uses. Both the CARB and the USEPA have approved use of URBEMIS air modeling program for use in National Environmental Policy Act (NEPA) environmental documents involving air quality analysis. Version 9.2.4 is the most recent version of the URBEMIS software, and it uses current regional California specific emission factors and emission reductions. The URBEMIS input data is based on the 'Emfac2007 V2.3 [Nov 1, 2006] version of On-Road Vehicle Emissions, and incorporates the

‘OFFROAD2007’ version of Off-Road Vehicle Emissions. The URBEMIS program then provides data output summarizing emissions resulting from construction phase of the Proposed Action, alongside area source emissions summarizing routine facility operations.

During construction, NO_x, VOC/ROG, $PM_{10,}$ and $PM_{2.5}$ are produced during the combustion of diesel and gasoline fuels by heavy duty construction equipment and contactor vehicles. For the CY 2018 Master Plan construction phase at TMF, pollutants of concern are considered NO_x, and VOC/ROG. Operational emissions consist of operational/area and vehicle emissions. Operational pollutants of concern are the same as for construction.

G 3.3 Total Direct and Indirect Emission Calculations

The estimates of the net changes in nonattainment pollutant emissions that would result from implementation of the Proposed Action at the TMF are presented in the spreadsheet attachment of this Appendix. These calculations are based on CY 2018, which is anticipated to produce the worst case scenario of emissions produced at TMF, and integrates both construction and operations of the new facilities proposed under the Master Plan together with existing area source data. The resulting analyses indicate that the majority of the potential pollutant impacts would result from three elements of the Proposed Action: (1) routine facility operations at TMF, including from regular TMF commuter traffic from full-time employees, (2) ‘direct’ demolition and construction activities at TMF, and (3) vehicle emissions, from construction-specific equipment, and construction-contractor motor vehicles. The net changes in direct and indirect O_3 (eight-hour average), and the applicable O_3 precursors (VOCs [ROGs] and NO_x); emissions from these elements of the Proposed Action are presented below.

TMF Routine Operations

TMF air emission sources include boilers, internal combustion engines as emergency generators, painting operations, degreasers, fuel storage tanks, dispensers, and various other research and development processes. Various types of these individual emissions units currently operate under SCAQMD permits.

Construction Activities

PM_{10} and PM2.5 emissions would be generated in the form of fugitive dust from concrete demolition, material transfer, and truck/equipment movement. All criteria pollutants would also be emitted during construction as combustion by-products from diesel-fueled construction equipment and truck hauling vehicles. VOC evaporative emissions would occur due to equipment and building interior painting. Additional emissions would result from construction worker commuter traffic that would occur during the entire execution of the Proposed Action. The construction worker commuter emissions are accounted for in the following section.

Motor Vehicle Emissions

Motor vehicle emissions include commuter emissions associated with routine operations at TMF, and with anticipated levels of onsite contractors associated with the construction projects (i.e. demolition, site grading, utility and construction crews) proposed under the Master Plan. Construction commuter vehicle emissions associated with temporary construction workers and activities are included in **Table G-5** below. **Table G-5** presents the estimated annual emissions of the nonattainment pollutants generated during construction activities at TMF, with mitigation factors included.

Table G-5. Construction Activity Emissions - Proposed Action at TMF (tpy)

CY	VOC / ROG (tpy)	NO_x (tpy)
2018	8.04	1.43

CY: Calendar Year; tpy: tons per year; VOC/ROG = Volatile Organi

G 3.4 Applicability Analysis Results

Table G-6 below summarizes the combined direct and indirect ozone or ozone precursor emissions associated with implementation of the Master Plan at TMF, and compares those impacts to the applicable General Conformity *de minimis* thresholds. The net emissions data was produced through use of the Urbemis modeling program, and mitigation measures are summarized in **Attachment G-1**, together with the full emissions summary.

Table G-6 indicates that the combined direct and indirect emissions associated with implementation of the Master Plan at TMF are substantially below the *de minimis* emissions thresholds of 25-tpy for the applicable O_3 precursors (NO_X, and VOC/ROGs). Therefore, state and Federal General Conformity rules are not applicable, and no conformity determination is required for this Proposed Action.

Table G-6. Nitrogen Oxides, Volatile Organic Compounds Emissions – Comparison to Conformity *de minimis* Thresholds for AVAQMD

Criteria Pollutant	*de minimis* Threshold (tpy)	Estimated Net Emissions (Direct & Indirect) TMF Proposed Action (tpy)
NO_x (as a precursor for an O_3)	25	2.64
VOC/ROG (as a precursor for an O_3)	25	1.82

tpy: tons per year; VOC/ROG = Volatile Organic Compounds/Reactive Organic Gases; NO_x= nitrogen oxides

G 4.0 FINDINGS & CONCLUSION

The purpose of this analysis is to determine whether implementation of the Master Plan at TMF would conform to the applicable SIP, based upon the criteria established in the General Conformity Rule and promulgated in 40 CFR 93.158. Emissions produced as a result of routine operations at the existing TMF are not anticipated to reach maximum levels until CY 2018. Emissions produced through construction of new buildings, site development and/or redevelopment are anticipated to peak in CY 2018. Annual emissions from preceding years of development are anticipated to be lower than in 2018, and CY 2018 emissions are therefore considered 'worst case' or 'peak year' for the purposes of this analysis.

The General Conformity applicability analysis was performed using the Urbemis air quality modeling program, which indicated that total cumulative peak year direct and indirect emissions at TMF (i.e., the sum of construction and facility operations) within the AVAQMD would *not* exceed the 25 tpy *de minimis* levels for either of the precursors of the criteria pollutant of concern (O_3). Because the direct and indirect emissions from the worst year, 2018, are below the *de minimis* thresholds and it was shown that the project emissions will not exacerbate air quality, increase violations of non-attainment pollutants, or delay the region from attaining the NAAQS in a timely manner, the Proposed Action is considered to be conforming with the SIP.

The regulatory basis and specific criteria for this analysis were presented in Section G 1.0, and Section G 2 presented the applicability analysis. Section G 3 provided the conformity analysis and emissions calculations generated under the Proposed Action, indicating that the reasonably foreseeable project emissions of NO_x and VOCs would not exceed the General Conformity Rule *de minimis* levels. This conclusion is supported by the calculations attached to this analysis. This section presents the following findings and conclusion for the conformity analysis for the Proposed Action at TMF:

After careful and thorough consideration of the conformity analysis contained herein, the project proponent finds that the total direct and indirect emissions associated with the Proposed Action at the TMF would not exceed the applicable *de minimis* thresholds, and that the Proposed Action would therefore be exempt from the requirements of the Federal Conformity Rule consistent with the objectives as set forth in Section 176(c) of the CAA, as amended, and its implementing regulation, 40 CFR Part 93, Subpart B, Determining Conformity of General Federal Actions to State and Local Implementation Plans.

REFERENCES

AVAQMD, 2008a AVAQMD. May, 2008. AVAQMD Federal 8-Hour Ozone Attainment plan (Western Mohave Desert Non-attainment Area).

AVAQMD, 2008b AVAQMD Stationary Sources Section. December, 2008. California Environmental Quality Act (CEQA) and Federal Conformity Guidelines.

APPENDIX H
General Conformity Applicability Analysis for GDSCC

EXECUTIVE SUMMARY

Agencies:	National Aeronautics and Space Administration (NASA), Jet Propulsion Laboratory (JPL)
Designation:	Clean Air Act General Conformity Analysis
Affected Location:	Goldstone Deep Space Communications Complex (GDSCC), Fort Irwin, CA
Proposed Action:	Implement Master Plan

Abstract: Section 176 (c) of the Clean Air Act (CAA) (42 U.S.C. § 7506(c)) requires any entity of the Federal Government that engages in, supports, or in any way provides financial support for, licenses or permits, or approves any activity to demonstrate that the action conforms to the applicable State Implementation Plan (SIP) required under Section 110 (a) of the CAA before the action is otherwise approved. In this context, conformity means that such Federal actions must be consistent with a SIP's purpose of eliminating or reducing the severity and number of violations of national ambient air quality standards (NAAQS) and achieving expeditious attainment of national ambient air quality standards.

JPL is currently undertaking analysis of existing facilities and infrastructure, while simultaneously forecasting future needs and objectives to enable NASA to continue to meet its mission. JPL is proposing the development of a comprehensive planning strategy through the implementation of a Master Plan which would cover development at GDSCC, located on Fort Irwin and approximately 37 miles north of Barstow, California between 2012 and 2032. This document represents the General Conformity review completed by NASA/JPL, including analysis of potential impacts to air quality as a result of implementing the proposed Master Plan; analysis of the General Conformity applicability; and documentation of the findings.

Conformity Analysis: After careful and thorough consideration of the conformity analysis contained herein, the project proponent finds that the total direct and indirect emissions associated with the Proposed Action at the GDSCC would not exceed the applicable *de minimis* thresholds, and that the Proposed Action would therefore be exempt from the requirements of the Federal Conformity Rule consistent with the objectives as set forth in Section 176(c) of the Clean Air Act (CAA), as amended, and its implementing regulation, 40 CFR Part 93, Subpart B, Determining Conformity of General Federal Actions to State and Local Implementation Plans.

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H 1.0 INTRODUCTION

Section 176 (c) of the Clean Air Act (CAA) (42 U.S.C. § 7506(c)) requires any entity of the Federal Government that engages in, supports, or in any way provides financial support for, licenses or permits, or approves any activity to demonstrate that the action conforms to the applicable State Implementation Plan (SIP) required under Section 110 (a) of the CAA before the action is otherwise approved.

In establishing the Final General Conformity Rule, the EPA requires Federal agencies to evaluate a proposed Federal action and ensure that it does not:

- Cause a new violation of a national ambient air quality standards (NAAQS)
- Contribute to an increase in the frequency or severity of violations of NAAQS
- Delay the timely attainment of any NAAQS, interim progress milestones, or other milestones toward achieving compliance with the NAAQS

The General Conformity Rule requires that Federal agencies consider total direct and indirect emissions of criteria pollutants. Conformity must be shown for those pollutants (or precursors of those pollutants) emitted in areas designated as nonattainment, as well as for those pollutants which an area has been redesignated from nonattainment to attainment (i.e., a maintenance area). In this context, conformity means that such Federal actions must be consistent with a SIP's purpose of eliminating or reducing the severity and number of violations of NAAQS and achieving expeditious attainment of national ambient air quality standards. Each Federal agency must determine that any action that is proposed by the agency and that is subject to the regulations implementing the conformity requirements will, in fact, confirm to the applicable SIP before the action is taken.

JPL is currently undertaking analysis of existing facilities and infrastructure, while simultaneously forecasting future needs and objectives to enable NASA to continue meeting its mission. JPL is proposing the development of a comprehensive planning strategy through the implementation of a Master Plan which would cover development at the GDSCC in Fort Irwin, approximately 40 miles north of Barstow, California between 2012 and 2032. This document represents the General Conformity Analysis completed by NASA/JPL, including analysis of potential impacts to air quality as a result of implementing the proposed Master Plan; analysis of the General Conformity applicability; and documentation of the findings.

H 1.1 Document Organization

Section H 1.0 of this document serves as a general introduction to the Proposed Action, and the applicable requirements associated with air quality regulations that must be fulfilled in order for the project proponent (NASA/JPL) to approve and commence the action. The section outlines this document; presents the regulatory background, and outlines the regulatory requirements of the

General Conformity Rule; outlines the General Conformity Exemptions & Applicability; summarizes the CAA General Conformity Criteria; and discusses other potentially applicable SIP Implementation Plan Consistency Requirements.

Section H 2.0 of this document completes an applicability analysis for the Proposed Project in terms of the General Conformity rules, and examines the Proposed Action within the regional air quality scenario. The section identifies the purpose of the Conformity Analysis; describes the GDSCC facility, and presents the Proposed Action; summarizes the existing air quality conditions in the region, and discusses their relationships to this Conformity Analysis; and details the applicability of the conformity rule to the proposed implementation of the Master Plan at the GDSCC facility.

Section H 3.0 provides the emissions estimations attached to this analysis; details the calculation methodologies; and provides the conformity analysis results for the Proposed Action. This section identifies the sources includes in the conformity analysis; provides the total direct and indirect emissions calculations; and provides the applicability analysis results. Finally, Section H 4.0 provides the conclusion and findings of the conformity review and applicability analysis.

H 1.2 Background

The CAA and Clean Air Act Amendments (CAAA) were passed by Congress and corresponding rules were promulgated by USEPA because it was determined that certain pollutants have the potential to cause an adverse effect on public health and the environment when certain concentrations are exceeded in ambient air. In order to control and regulate the main air pollutants and better maintain air quality levels, NAAQS were established for seven 'criteria pollutants'. These pollutants included carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter less than 10 microns in diameter (PM_{10}), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), sulfur oxides (SO_x), and lead (Pb). The EPA then established a set of 'primary' NAAQS to protect the public health with an adequate margin of safety, and a 'secondary' set of NAAQS to protect public welfare.

Air quality 'conformity' provisions first appeared in the CAA of 1977. These provisions stated that no Federal agency could engage in; support in any way; provide financial assistance for; license, permit, or approve any activity that did not conform to a SIP after approval and promulgation. Section 176 of the CAA (42 United States Code 7506c) as amended in 1990, further explained conformity to an implementation plan as meaning conformity to the plan's purpose of eliminating or reducing the severity of violations of the NAAQS, and achieving timely attainment of these standards.

In November 1993, the USEPA promulgated regulations and requirements that clarified the applicability, procedures, and analyses necessary to ensure that Federal facilities comply with the CAA. Then in 1997, the USEPA initiated work on new General Conformity rules and guidance to reflect the new 8-hour O_3, $PM_{2.5}$, and regional haze standards that were also promulgated that year. However as a result of litigation, implementation of the new O_3 and $PM_{2.5}$ ambient air quality standards were delayed and these new conformity requirements were not completed by the USEPA until 2006 when the $PM_{2.5}$ de minimis levels were added.

The latest revision of the General Conformity rules occurred on April 5, 2010 (USEPA 2010). The USEPA sought to clear up identified issues, reduce specific regulatory burdens, and modify the rules to be helpful to states revising their SIP for implementing the revised NAAQS while assuring Federal agency actions continue to conform. Several of the burden reduction measure changes made to the General Conformity applicability in 40 CFR 93.153 included the following four items:

- Deleting the provision that requires Federal agencies to conduct a conformity determination for regionally significant actions under (40 CFR 93-153) where the direct and indirect emission of any pollutant represent 10 percent or more of a nonattainment or maintenance area's emission inventory for that pollutant, even though the total direct and indirect emissions are below de minimis levels. This provision previously applied even though the total direct and indirect emissions from the actions were below the *de minimis* emission levels, or if the actions were otherwise "presumed to conform."

- Adding new types of actions that Federal Agencies can include in their "presumed to conform" lists and permitting States to establish in their General Conformity SIPs "presumed to conform" lists for actions within their State.

- Finalizing an exemption for the emissions from stationary sources permitted under the minor source New Source Review (NSR) programs similar to the EPA's existing General Conformity regulation which already provides for exemptions for emissions from major NSR sources.

- Establishing procedures to follow in extending the 6-month conformity exemption for actions taken in response to an emergency.

H 1.3 General Conformity Exemptions and Applicability

Source Exemptions

The general conformity provisions identify specific Federal actions or portions of actions that are exempt from the conformity procedural requirement, because the USEPA has deemed these actions to conform. These actions include those that must undergo thorough air quality analysis to comply with other statutory requirements; actions that would result in no emission increase or an increase in emissions that is *clearly de minimis*; or actions presumed to conform by the agency through separate rule-making actions.

De minimis Emission Thresholds

The Conformity Rule requires that Federal agencies complete a conformity applicability analysis to determine whether a formal conformity determination is required. The primary criteria used in an applicability analysis are the *de minimis* threshold levels promulgated in 40 Code of Federal Regulations (CFR), 93.153(b). The total direct and indirect emissions associated with a proposed action are quantified, to enable comparison to the *de minimis* thresholds.

The conformity rule defines direct and indirect emissions based upon the timing and location of the emissions. “Direct” emissions are those that are caused or initiated by the Federal actions, and occur at the same time and place as the action and are reasonably foreseeable. “Indirect” emissions are those that originate in the same nonattainment or maintenance area, but occur at a different time or place from the Federal action. In addition, the conformity rule limits the scope of indirect emissions to those that are ***reasonably foreseeable*** by the agency at the time of analysis, and those emissions that the Federal agency can practicably control and maintain control of through its continuing program responsibility.

The definitions of direct and indirect emissions do not distinguish among specific source categories; point, area, and mobile sources are given equal consideration in the conformity requirements. All substantive procedural requirements of the General Conformity Rule apply to the total of the net increases and decreases in direct and indirect emissions resulting from the action.

The applicability determination procedures presented in the rule include the following elements:

- Define the applicable emission sources for the Federal action
- Calculate total direct and indirect emissions of nonattainment pollutants from sources
- Compare these emission rates against the appropriate *de minimis* emission levels

Table H-1 below presents the applicable *de minimis* thresholds promulgated for use under the General Conformity Rule.

Table H-1. General Conformity Rule *de minimis* Emission Thresholds

Pollutant	Status	Classification	*de minimis* Limit (tpy)
Ozone (measured as NO_x or VOCs)	Nonattainment Maintenance	Extreme Severe Serious Moderate/marginal (inside ozone transport region) All others Inside ozone transport region Outside ozone transport region	10 25 50 50 (VOCs)/100 (NO_x) 100 50 (VOCs)/100 (NO_x) 100
Carbon Monoxide (CO)	Nonattainment/ maintenance	All	100
Particulate Matter (PM_{10})	Nonattainment/maintenance	Serious Moderate Not applicable	70 100 100
Sulfur Dioxide (SO_2)	Nonattainment/ maintenance	Not applicable	100
Nitrogen Oxides (NO_2)	Nonattainment/ maintenance	Not applicable	100
Lead (PB)	Nonattainment/ maintenance	All	25

Source: 40 CFR 93.153
tpy: tons per year

If the total of direct and indirect emissions of pollutants in nonattainment or maintenance status produced by the action reach or exceed the *de minimis* applicability threshold values, the Federal agency must perform a Conformity Determination to demonstrate the positive conformity of the action with the applicable SIP. The *de minimis* emission levels vary by the criteria pollutant and the severity of the region's nonattainment conditions.

H 1.4 CAA General Conformity Criteria

If the Proposed Action is not exempt from the conformity demonstration requirements, the General Conformity Rule defines conformity and provides five basic criteria to determine whether a Federal action conforms to an applicable SIP. These criteria assess conformity based upon emission analyses and/or dispersion modeling for the nonattainment pollutants. If the Federal action meets the conformity criteria and requirements, the action is demonstrated to conform to the applicable SIP. If the action cannot meet the criteria and requirements, the agency must develop an enforceable implementation plan to mitigate effectively (e.g., completely offset) the increased emissions from the Proposed Action to meet the conformity requirements. The Federal action cannot proceed unless positive conformity can be demonstrated.

The General Conformity Rule provides the option to select any one of several criteria to analyze the conformity of the Proposed Action. Presented in 40 CFR 93.158, the criteria are primarily based upon the type of pollutant and the status of the applicable SIP. If the applicability analysis concludes that further conformity analyses are required to demonstrate positive conformity (i.e., *de minimis* thresholds are exceeded) the following conformity criteria (paraphrased below) can be used to demonstrate conformity for a proposed action in a nonattainment area:

- Total direct and indirect emissions for the Proposed Action are specifically identified and accounted for in the SIP's attainment or maintenance demonstration. [40 CFR 93.158(a)(1)].
- Total direct and indirect emissions of O_3 precursors are fully offset within the same nonattainment or maintenance area through a revision to the SIP or a similarly enforceable measure so that there is a no net increase in emissions [40 CFR 93.158(a)(2)].
- The State has made a revision to the area's attainment or maintenance demonstration after 1990 and the State either:
  - Determines and documents that the action, together with all other emissions in the nonattainment (or maintenance) area, *would not* exceed the emissions budget specified in the applicable SIP.

  - Determines that the action, together with all other emissions in the nonattainment (or maintenance) area, *would* exceed the emissions budget specified in the applicable SIP but the State's Governor or designee for SIP actions makes a written commitment to the USEPA to demonstrate CAA conformity through specific measures and scheduled actions [40 CFR 93.158(a)(5)(i)(A & B)].

- The Federal action fully offsets its entire emissions within the same nonattainment area through a revision to the SIP or a similar measure so that there is no net increase in nonattainment pollutant emissions [40 CFR 93.158(a)(5)(iii)].

- The State has not made a revision to the approved SIP since 1990, and the total emissions from the action do not increase emissions above the baseline emissions which are either:

  - Calendar Year 1990 (CY 90) emissions or another calendar year that was the basis for the nonattainment area designation) [40 CFR 93.158(a)(5)(iv)(A)].

  - Historic activity levels and emissions calculated for future years using appropriate emission factors and methods for future years.

- Dispersion modeling analysis demonstrates that direct and indirect emissions from the Federal action will not cause or contribute to violations of Federal ambient air quality standards [40 CFR 93.158(b)].

H 1.5 Other State Implementation Plan Consistency Requirements

The conformity analysis must also demonstrate that total direct and indirect emissions from the Proposed Action will be consistent with the applicable SIP requirements and milestones, including:

- Reasonable further progress schedules
- Assumptions specified in the attainment or maintenance demonstration
- SIP prohibitions, numerical emissions limits, and work practice requirements

Comparison of the Federal action's emissions to any existing SIP emission budgets that have been specifically established may be required for the Federal facility or the affected region. If the action would cause an increase in emissions such that the established SIP emissions budgets would be exceeded, a formal conformity determination and other applicable rule requirements would apply.

H 2.0 APPLICABILITY ANALYSIS

The following subsections describe the GDSCC, the Proposed Action and criteria, and how the General Conformity procedures pertain to this conformity analysis.

H 2.1 Purpose

The purpose of this General Conformity Analysis is to document JPL's compliance with CAA requirements in accordance with 40 CFR 93 Subpart B and Mojave Desert Air Quality Management District Rules and Regulations, Regulation XX (Conformity) Rule 2002 (General Federal Actions Conformity). This conformity analysis will analyze the air quality impact(s) for emissions of the criteria pollutant(s) resulting from the proposed Federal action that are in nonattainment status or have completed changes in maintenance designation, in order to determine whether the Proposed Action will be subject to the Federal conformity rules.

Although it is not a requirement, this analysis will also consider criteria pollutant emissions from non-point or mobile sources associated with GDSCC commuter traffic and linkages, and their ability to affect the SIP, given the proximity of the GDSCC to the Western Mojave Desert Ozone nonattainment area.

H 2.2 Facility Description & Proposed Action

The GDSCC is located in San Bernardino County, California, approximately 64.4 km (40 mi) north of Barstow, CA, and 257.5 km (160 mi) northeast of Pasadena, CA, where JPL is located. The 114-sq km (44-sq mi) GDSCC facility lies in a natural, bowl-shaped depression in the Mojave Desert, within the southwestern part of the Fort Irwin National Training Center (NTC). The GDSCC is a working community (including Ft. Irwin, Southern California Edison, and outside contractors) with its own roads, airstrip, cafeteria, electrical power, and telephone systems, and it is equipped to conduct all necessary maintenance, repair, and domestic support services. Facilities at the GDSCC include approximately 90 buildings and structures that were constructed from the 1950s through the present.

The GDSCC is managed, technically directed, and operated for NASA by JPL. The GDSCC is a unique asset which directly supports multiple NASA space science and earth science programs, and can be classified as critical to the success of several NASA programs. The purpose of the current Master Plan initiative is to affirm NASA's mission at GDSCC and provide a physical framework for implementing this mission over the next 20 years. Facilities at GDSCC are deteriorating because of age. The Master Plan identifies facility and infrastructure needs and develops an implementation strategy that helps guide facilities renewal related to research, building construction, administrative services, parking, and circulation at GDSCC. The master planning process provides the opportunity for the transformation of GDSCC's infrastructure and facilities to reflect long-range plan and mission, and NASA-wide goals and objectives. The Master Plan includes the following objectives:

- Evolve the DSN operations concept and architecture to provide unified mission support within the context of the NASA-wide space communications and navigation architecture;

- Define candidate pathways towards enhanced deep space communications capability and implement selected new capabilities as appropriate;

- Define candidate pathways towards enhanced deep space tracking and navigation capability and implement selected new capabilities as appropriate;

- Leverage the migration towards a unified space communications and navigation architecture to improve reliability and operability for missions and cost-effectiveness for program elements;

- Devise a robust and affordable multicenter approach for supporting robotic and crewed missions operating in the 20,000 to 2,000,000 km region from Earth;

- Capitalize on the role of deep space communications for NASA missions to inspire and mentor the new generations of scientists, technologists, engineers and mathematicians. Engage the public at large, and enhance general technical and scientific literacy; and

- Enable new capabilities by conducting advanced development of deep space communications, tracking, navigation, and information and science systems when funding becomes available.

The Master Plan translates those two objectives into a Proposed Action, comprised of two projects, and two sets of construction or developments:

- Construct a 34-meter Beam Wave Guide Antenna at Apollo Site

- Provide infrastructure improvements as necessary to maintain reliability and comply with Federal and state regulations, including water, power, communications, and sewer.

The Master Plan proposes GDSCC site redevelopment to start in CY 2012, with the redevelopment of utility infrastructure scheduled to occur intermittently. The 34-meter BWG Antenna is proposed for development in 2026, and the overall Master Plan redevelopments including all associated utility and infrastructure upgrades are proposed to be completed by the end of CY 2032. The levels of construction are anticipated to be greatest, and involve the highest levels of construction-related air pollution production during development of the new 34-meter BWG antenna adjacent to Apollo in CY 2026. There is no substantial construction between 2012 and 2026. Thus the worst case scenario for air pollution production at GDSCC is anticipated to be 2026, based on substantial use of heavy equipment for foundation excavations, site grading, and earth movement for site redevelopment as part of the new 34-meter BWG antenna installation.

H 2.3 Existing Air Quality

GDSCC is located within San Bernardino County in the Mojave Desert Air Basin (MDAB) of southern California. The MDAB is an assemblage of mountain ranges interspersed with long broad valleys that often contain dry lakes. Many of the lower mountains which dot the vast terrain rise from

300 to 1200 meters (1,000 to 4,000 feet) above the valley floor. This area experiences hot summers, mild winters, infrequent rainfall, and moderate afternoon winds, and is classified as a dry-hot desert. Much of the time, air quality in rural San Bernardino County is fair to good. There are also times when the area does not meet NAAQS due to locally generated and/or wind transported pollutants.

The MDAB is largely undeveloped, and high levels of particulate matter concentrations in the Mojave Desert are typically the result of wind erosion on exposed or already disturbed land areas. Localized activities and land-uses create fugitive dust and entrain wind-borne particulates. These are predominantly associated with military operations at the China Lake Naval Air Weapons Center and Fort Irwin but also include civilian off-highway/all terrain vehicle travel on both unpaved roads and off-road areas. All Department of the Army areas are already disturbed surfaces, and therefore under the right climatic conditions ongoing operations exacerbate creation of fugitive dust in an area already subject to substantial amounts of wind-blown particulates.

The southern and western portions of the Mojave Desert Air Basin below the 90 Transverse Mercator (UTM) grid line have been designated as nonattainment for the 8-hour ozone NAAQS by the EPA and described as the Western Mojave Desert non-attainment area (per CFR 81.305). The ozone designation value classifies the area below this line as a moderate nonattainment area with 2010 as the required attainment year (per U.S.C. 7511(1)(2); FCAA§181(a)(2)). GDSCC is located north of this line, and is therefore not located in the Federal O_3 nonattainment area. GDSCC and specifically the locations where the Master Plan Proposed Actions will be undertaken are within the Mojave Desert Planning Area which is classified as a (Federal) nonattainment designation for Particulate Matter 10 micros in size (PM_{10}).

HF 2.4 General Conformity Applicability at GDSCC

The General Conformity Rule applies to Federal actions in areas that are failing to meet one or more of the Federal air quality standards (designated as nonattainment areas), and/or areas that are or have been subject to attainment maintenance plans (designated as maintenance areas). The Proposed Action would include approval by a Federal agency, and is located in a federal nonattainment area for PM_{10}. Therefore General Conformity regulations apply to the Proposed Action. However, if the Proposed Action(s) meet the following requirement, a full conformity determination would not be required, pursuant to 40 CFR 93.153(c):

As a result of the current nonattainment status, and the history of maintenance designations in the region affected by GDSCC operations this conformity analysis will address the following criteria pollutants for the purposes of the conformity applicability criteria requirements:

- PM_{10} (eight-hour average)

Particulate Matter (PM_{10})

Particulate matter is a generic term that defines a broad group of chemically and physically different particles (either liquid droplets or solids) that can exist over a wide range of sizes. PM_{10} refers to particulate matter that measures 10 micros or less in diameter. One micron is the equivalent of onemillionth of a meter, also known as a micrometer (µm). Examples of atmospheric particles include those produced from combustion (diesel soot or fly ash), light produced (urban haze), seas spray produced (salt particles), and soil-like particles from re-suspended dust.

The applicable *de minimis* emissions thresholds for the Proposed Action at GDSCC are shown in **Table H-2** below, in relation to the PM_{10} nonattainment designation for the Mojave Desert Air Quality Management District (MDAQMD).

Table H-2. *De minimis* Emission Thresholds for GDSCC Applicability Analysis

Criteria Pollutant	MDAQMD Attainment Designation	Annual *de minimis* Threshold (tons)
Particulate Matter - PM_{10}	Nonattainment	100

Ambient Air Quality Attainment Designations and the SIP

The MDAQMD is the regulatory agency with primary responsibility for most of the MDAB. The MDAQMD is directed by the California Air Resources Board (CARB), with ultimate oversight by the USEPA. Every three years the MDAQMD must prepare and submit an Air Quality Management Plan (AQMP) to CARB to support the broader state SIP, as well as to demonstrate how they will attain and maintain the NAAQS and the California Air Quality Standards for their jurisdiction. These AQMPs also form the basis for SIP and attainment status designations. The CARB oversees California air quality policies and is responsible for preparing and submitting the SIP to the USEPA.

In the case of GDSCC, the applicable AQMP for management of Federal daily and annual PM_{10} is the currently approved MDAQMD PM_{10} Attainment Plan, as summarized below:

- Mojave Desert Planning Area Federal PM_{10} Attainment Plan – MDAQMD, July 31, 1995.

A General Conformity analysis does not need to address pollutants for which affected areas are in 'attainment' under Federal NAAQS designations–carbon monoxides (CO), nitrogen dioxides, (NO_2), sulfur oxides (SO_x) and Lead (Pb), or for those which are currently unclassified – $PM_{2.5}$. However, this review will include discussion and analysis of O_3 or O_3 precursors produced by commuter traffic, or associated with linkages from GDSCC due to the adjacent O_3 nonattainment area.

O_3 and O_3 Precursors for Nonattainment or Maintenance Areas

Ozone is a brown odorless gas, which can cause irritation of the respiratory tract in humans and animals, and can damage vegetation. The maximum effect of the precursor emissions on O_3 formation may be many miles from the source because O_3 is a by-product of a photochemical reaction: in the presence of ultraviolet radiation, both NO_X and VOCs go through a number of complex chemical reactions to form ozone.

Ozone is not typically emitted directly from emission sources, but is formed in the atmosphere by photochemical reactions involving sunlight and other emitted pollutants, or "ozone precursors." These ozone precursors consist primarily of nitrogen oxides (NO_x) and volatile organic compounds (VOCs), which are emitted directly from a wide range of stationary and mobile sources. Therefore, O_3 concentrations in the atmosphere are controlled through limiting the emissions of NO_x and VOCs. For this reason, regulatory agencies attempt to limit atmospheric O_3 concentrations by controlling NO_x and VOC pollutants [also identified as reactive organic gases (ROG) in California]. The *de minimis* emission threshold for O_3 is based on the primary emissions of its precursor pollutants (VOC/ROG and NO_X), so if the net emissions of either VOC/ROC or NO_x exceed the threshold *de minimis* emission rate, the Federal action would be subject to a general conformity evaluation for O_3.

Nitrogen Dioxide (NO_2)

Nitrogen oxides and/or dioxide pollutant compounds are typically byproducts produced through incomplete combustion of fuels. The majority of NO_X emitted from combustions sources is in the form of nitrogen oxide (NO), while the balance is mainly nitrogen dioxide (NO_2). NO is oxidized by oxygen (O_2) in the atmosphere to form NO_2, but some level of photochemical activity is needed for this conversions. For this reason, the highest concentrations of NO_2 generally appear during autumn months, and not in winter when atmospheric conditions favor the trapping of ground level releases of NO but lack significant radiation intensity (due to less direct sunlight) to oxidize NO to NO_2. In the summer months the conversion rates on NO to NO_2 are high, but the climatic conditions with relatively high temperatures and comparatively higher levels of wind serve to disperse pollutants, preventing the accumulation of NO_2 to levels approaching the 1-hour ambient NAAQS. NO is also oxidized by O_3 to form NO_2. The formation of NO_2 in the summer with the help of O_3 occurs according to the following reaction:

$$NO + O_3 \rightarrow NO_2 + O_2$$

In urban areas, the ozone concentration level is typically high. That level will drop substantially during nighttime hours as the reaction no longer takes place without solar radiation. Furthermore, the increased availability of NO in urban areas has an indirect correlation to the ground level ozone concentrations, given its ability to produce the aforementioned reaction. This reaction explains why ozone concentrations in urban areas tend to decrease with proximity to ground level, and why in downwind rural areas or at increasing altitudes (which lack the reciprocal NO_X emission sources) the ozone concentrations tend to remain relatively high.

Volatile Organic Compounds

Federal ozone planning requirements refer to emissions and pollutants in terms of 'Volatile Organic Compounds', while the State of California ozone planning requirements refer to emissions and pollutants in terms of 'Reactive Organic Gases'. Ethane is now excluded from either group, and due to changes in the definition of each, there is no effective difference between the two terms. Thus for the purposes of this applicability analysis, the two terms will be considered interchangeable.

H 3.0 GENERAL CONFORMITY ANALYSIS & RESULTS

This section of the conformity analysis describes the applicability analysis of the Proposed Action (implementation of the Master Plan at the GDSCC) to the General Conformity Rule requirements.

H 3.1 Sources Included in the Conformity Analysis

In accordance with the General Conformity Rule, total direct and indirect emissions resulting from proposed Federal action includes several types of stationary and mobile sources. These emissions would occur during construction [Proposed Action] and operational conditions [routine facility operations]. As defined by the rule and applied to the Proposed Action at GDSCC, direct emissions would result from emissions sources not subject to air permitting as well as operations at the proposed redeveloped facility.

Direct impacts are the result of the project itself (from its construction and operation), in the form of project activity and trips generated by the project. Examples of direct emissions sources include equipment exhausts, wind erosion, and tire wear and vehicle exhaust from project deliveries, or trips to and from the construction site.

Indirect impacts are the result of changes that would not occur without the project. In the case of GDSCC, indirect impacts on the surrounding area could be generated in many ways. Pollutant emissions for the proposed project include activities that GDSCC can control as part of the Federal action, and include privately-owned vehicles (POVs), and government-owned vehicles (GOVs) that provide transportation to and from, and/or provide services or complete support activities that occur at the facility; changes in traffic circulation patterns, that result in increased congestion and delays; or those that they cannot control, such as use and occupation of local housing or restaurant facilities.

H 3.2 Analysis Methodology

Air modeling analysis was performed using Urban Emissions 2007 (URBEMIS) Version 9.2.4 to estimate direct and indirect emissions at JPL. URBEMIS is a California-specific computer model that estimates construction, area, mobile, and CO_2 emissions based on land uses. Both the CARB and the USEPA have approved use of URBEMIS air modeling program for use in NEPA environmental documents involving air quality analysis. Version 9.2.4 is the most recent version of the URBEMIS software, and it uses current regional California specific emission factors and emission reductions. The URBEMIS input data is based on the 'Emfac2007 V2.3 [Nov 1, 2006] version of On-Road Vehicle Emissions, and incorporates the 'OFFROAD2007' version of Off-Road Vehicle Emissions. The URBEMIS program then provides data output summarizing emissions resulting from construction phase of the Proposed Action, alongside area source emissions summarizing routine facility operations.

During construction NO_x, VOC/ROG, PM_{10} and $PM_{2.5}$ are produced during the combustion of diesel and gasoline fuels by heavy duty construction equipment and contactor vehicles. For the CY 2026 Master Plan construction phase at GDSCC, pollutants of concern will be considered PM_{10}, as well as

NO_x, and VOC/ROG. Operational emissions consist of operational/area and vehicle emissions. Operational pollutants of concern are the same as for construction.

H 3.3 Total Direct and Indirect Emission Calculations

Estimates of the net changes in nonattainment pollutant emissions that would result from implementation of the Proposed Action at GDSCC are presented in the spreadsheet attachment of this Appendix. These calculations are based on CY 2026, which is anticipated to produce the worst case scenario of emissions produced at GDSCC, and integrates both construction and operations of the new facilities proposed under the Master Plan together with existing area source data.

Assumptions and URBEMIS inputs are based on construction of 46542 square-meters (500,000 square-feet) and disturbance of 10-hectares (25-acres) in CY2026; use of 40 civilian contractors onsite 5 days per week, and commuting back and forth between Barstow; and use of a minimum standard of Tier II engines in construction equipment, and watering twice per day during construction for base mitigation measures.

GDSCC Routine Operations

GDSCC air emission sources include boilers, internal combustion engines as emergency generators, painting operations, degreasers, fuel storage tanks, dispensers, and various other research and development processes. Various types of these individual emissions units currently operate under MDAQMD permits.

Construction Activities

PM_{10} and $PM_{2.5}$ emissions would be generated in the form of fugitive dust from concrete demolition, material transfer, and truck/equipment movement. All criteria pollutants would also be emitted during construction as combustion by-products from diesel-fueled construction equipment and truck hauling vehicles. VOC evaporative emissions would occur due to equipment and building interior painting. Additional emissions would result from construction worker commuter traffic that would occur during the entire execution of the Proposed Action. The construction worker commuter emissions are accounted for in the following section.

Table H-3 presents a breakdown of the estimated annual emissions for the nonattainment pollutant of concern generated during construction activities at GDSCC (with mitigation factors included).

Table H-3. PM Construction Related Emissions - Proposed Action at GDSCC (tpy)

CY	PM_{10} Dust	PM_{10} Exhaust	PM_{10}
2026	2.99	0.12	3.11

CY: Calendar Year; tpy:

Motor Vehicle Emissions

Motor vehicle emissions include commuter emissions associated with the routine operations at GDSCC (i.e., all GDSCC operations, contractors and support staff, as well as other research scientists), and with anticipated levels of onsite contractors associated with the construction projects (i.e. demolition, site grading, utility and construction crews) proposed under the Master Plan.

H 3.4 Applicability Analysis Results

GDSCC Operations

Table H-4 below summarizes the combined direct and indirect ozone or ozone precursor emissions associated with implementation of the Master Plan at GDSCC, and compares those impacts to the applicable General Conformity *de minimis* thresholds. The net emissions data was produced through use of the Urbemis modeling program, and mitigation measures are summarized in **Attachment H-1** together with the full emissions summary. **Table H-4** indicates the combined direct and indirect emissions associated with implementation of the Master Plan at GDSCC are substantially below the de minimis emissions threshold of 100-tpy for PM_{10}. Therefore, state and Federal General Conformity rules are not applicable, and no conformity determination is required for this Proposed Action.

Table H-4. Comparison of PM_{10} Emissions to *de minimis* Thresholds for MDAQMD

Criteria Pollutant	*de minimis* Threshold(tpy)	Estimated Net Emissions (Direct & Indirect) GDSCC Proposed Action (tpy)
PM_{10}	100	13.01

Table H-5 lists *de minimis* thresholds for the nearby O_3 nonattainment area, and compares them to estimates for net emissions (direct and indirect) from the Proposed Action at GDSCC. This figure provides an indication of a likely scenario representing potential emissions associated with commuter traffic and linkages between GDSCC and the nearby ozone nonattainment area. **Table H-5** indicates that the level of O_3 precursors generated at GDSCC through implementation of the Master Plan are also substantially below the General Conformity de minimis thresholds, and shows that even if GDSCC were to be located within the O_3 nonattainment area, then development and associated activities associated with the Proposed Action would still remain below these lower threshold values.

Table H-5. Nitrogen Oxides (NO_x), Volatile Organic Compounds (VOC) Emissions – Comparison to Conformity *de minimis* Thresholds for MDAQMD

Criteria Pollutant	*de minimis* Threshold (tpy)	Estimated Net Emissions (Direct & Indirect) TMF Proposed Action (tpy)
NO_x (as a precursor for an O_3)	25	13.24
VOC/ROG (as a precursor for an O_3)	25	10.75

H 4.0 FINDINGS & CONCLUSION

The purpose of this analysis is to determine whether implementation of the Master Plan at GDSCC would conform to the applicable SIP, based upon the criteria established in the General Conformity Rule and promulgated in 40 CFR 93.158.

Emissions produced through construction of new buildings, site development and/or redevelopment at GDSCC are anticipated to peak in CY 2026. Annual emissions from preceding years of development are anticipated to be lower than in 2026, and CY 2026 emissions are therefore considered as representative of 'worst case' or 'peak year' for the purposes of this analysis.

The General Conformity applicability analysis was performed using the Urbemis air quality modeling program, which indicated that net direct and indirect emissions generated under the peak year (worst case scenario) from of the Proposed Action at GDSCC would *not* exceed the MDAQMD *de minimis* threshold of 100 tpy for PM_{10}, as the applicable criteria pollutant of concern for a location within a nonattainment area. This analysis also considered GDSCC's location adjacent to an O_3 nonattainment area, and performed additional modeling which indicated that even if the Proposed Action were located within this O_3 nonattainment area the Proposed Action would still generate levels of O_3 precursors substantially below the [lower] thresholds associated with the adjacent nonattainment area. Because the direct and indirect emissions from the worst year, 2026, are below the *de minimis* thresholds and it was shown that the project emissions will not exacerbate air quality, increase violations of non-attainment pollutants, or delay the region from attaining the NAAQS in a timely manner the Proposed Action is considered to be conforming to the SIP.

The regulatory basis and specific criteria for this analysis were presented in Section H 1. Section H 2 presented the applicability analysis. Section H 3 provided the conformity analysis and emissions calculations generated under the Proposed Action, indicating that the reasonably foreseeable project emissions of PM_{10} would not exceed the General Conformity Rule *de minimis* levels. This conclusion is supported by the calculations attached to this analysis. This Section, H 4.0 presents the following findings and conclusion for the conformity analysis for the Proposed Action at GDSCC:

After careful and thorough consideration of the conformity analysis contained herein, the project proponent finds that the total direct and indirect emissions associated with the Proposed Action at the GDSCC would not exceed the applicable *de minimis* thresholds, and that the Proposed Action would therefore be exempt from the requirements of the Federal Conformity Rule consistent with the objectives as set forth in Section 176(c) of the CAA, as amended, and its implementing regulation, 40 CFR Part 93, Subpart B, Determining Conformity of General Federal Actions to State and Local Implementation Plans.

REFERENCES

MDAQMD, 2009 — MDAQMD. February, 2009. *California Environmental Quality Act (CEQA) And General Conformity Guidelines*. Prepared by the MDAQMD Planning and Rule Making Section.

APPENDIX I

EA Review Comments

- *Native American Heritage Commission   January 5, 2012 (next page)*

STATE OF CALIFORNIA
GOVERNOR'S OFFICE *of* PLANNING AND RESEARCH
STATE CLEARINGHOUSE AND PLANNING UNIT

EDMUND G. BROWN JR.
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January 5, 2012

Steve Slaten
National Aeronautics and Space Administration
4800 Oak Grove Drive
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Subject: Draft Programmatic Environmental Assessment for the NASA JPL Facility Master Plan Updates
SCH#: 2011124002

Dear Steve Slaten:

The State Clearinghouse submitted the above named Environmental Assessment to selected state agencies for review. On the enclosed Document Details Report please note that the Clearinghouse has listed the state agencies that reviewed your document. The review period closed on January 4, 2012, and the comments from the responding agency (ies) is (are) enclosed. If this comment package is not in order, please notify the State Clearinghouse immediately. Please refer to the project's ten-digit State Clearinghouse number in future correspondence so that we may respond promptly.

Please note that Section 21104(c) of the California Public Resources Code states that:

> "A responsible or other public agency shall only make substantive comments regarding those activities involved in a project which are within an area of expertise of the agency or which are required to be carried out or approved by the agency. Those comments shall be supported by specific documentation."

These comments are forwarded for use in preparing your final environmental document. Should you need more information or clarification of the enclosed comments, we recommend that you contact the commenting agency directly.

This letter acknowledges that you have complied with the State Clearinghouse review requirements for draft environmental documents, pursuant to the California Environmental Quality Act. Please contact the State Clearinghouse at (916) 445-0613 if you have any questions regarding the environmental review process.

Sincerely,

Scott Morgan
Director, State Clearinghouse

Enclosures
cc: Resources Agency

1400 10th Street P.O. Box 3044 Sacramento, California 95812-3044
(916) 445-0613 FAX (916) 323-3018 www.opr.ca.gov

Document Details Report
State Clearinghouse Data Base

SCH# 2011124002
Project Title Draft Programmatic Environmental Assessment for the NASA JPL Facility Master Plan Updates
Lead Agency National Aeronautics and Space Administration

Type EA Environmental Assessment

Description This Programmatic Environmental Assessment evaluates individual Facility Master Plan updates for each of three NASA facilities programmatically assigned to the JPL: (1) the NASA JPL facility in Pasadena, CA; (2) the Table Mountain Facility in Wrightwood, CA; and (3) the Goldstone Deep Space Communications Complex, Fort Irwin National Training Center, CA. In the EA, NASA analyzes the potential impacts of feasible alternatives, including the No-Action Alternative, for facilities improvements identified within each Master Plan. Even though the draft EA analyzes three different sites, the main JPL site information was used to complete this NOC form.

Lead Agency Contact

Name Steve Slaten
Agency National Aeronautics and Space Administration
Phone 818 393 6683 **Fax**
email
Address 4800 Oak Grove Drive
City Pasadena **State** DC **Zip** 91109

Project Location

County Los Angeles
City Pasadena
Region
Lat / Long 34° 12.6' 4.902" N / 118° 10.24' 3.294" W
Cross Streets Foothill Blvd
Parcel No.
Township **Range** **Section** **Base**

Proximity to:

Highways Hwy 210
Airports
Railways
Waterways Arroyo Seco
Schools La Canada HS
Land Use Federally Funded Research and Development Center

Project Issues Air Quality; Archaeologic-Historic; Biological Resources; Flood Plain/Flooding; Geologic/Seismic; Traffic/Circulation; Landuse; Cumulative Effects

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Reviewing Agencies Resources Agency; Department of Fish and Game, Region 5; Department of Parks and Recreation; Department of Water Resources; California Highway Patrol; Caltrans, District 7; Regional Water Quality Control Board, Region 4; Native American Heritage Commission

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Date Received 12/09/2011 **Start of Review** 12/09/2011 **End of Review** 01/04/2012

Note: Blanks in data fields result from insufficient information provided by lead agency.

STATE OF CALIFORNIA Edmund G. Brown, Jr., *Governor*

NATIVE AMERICAN HERITAGE COMMISSION
915 CAPITOL MALL, ROOM 364
SACRAMENTO, CA 95814
(916) 653-6251
Fax (916) 657-5390
Web Site www.nahc.ca.gov
e-mail: ds_nahc@pacbell.net

EA
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1/4/2012
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RECEIVED
DEC 23 2011
STATE CLEARING HOUSE

December 19, 2011

Mr. Steve Slaten
National Aeronautics and Space Administration (NASA)
4800 Oak Grove Drive
Pasadena, CA 91109

Re: SCH#2011124002; NEPA Environmental Assessment for the **"Proposed Draft Programmatic Environmental Assessment for the NASA JPL Facility Master Plan Updates Project;"** located on the Main 1) JPL Campus in Pasadena 2) at the Table Mountain Facility (TMF) in Wrightwood and the Goldstone Deep Space Communications Complex (GDSCC) at Fort Irwin National Training Center Los Angeles and San Bernardino Counties, California, respectively.

Dear Mr. Slaten:

The Native American Heritage Commission (NAHC) is the California State 'Trustee Agency' pursuant to Public Resources Code §21070 for the protection of California's Native American Cultural Resources. The NAHC is also a 'reviewing agency' for environmental documents prepared under the National Environmental Policy Act (NEPA; 42 U.S.C. 4321 *et seq*), 36 CFR Part 800.3, .5 and are subject to the Tribal and interested Native American consultation as required by the National Historic Preservation Act, as amended (Section 106) (16 U.S.C. 470; Section 106 [f] 110 [f] [k], 304). The provisions of the Native American Graves Protection and Repatriation Act (NAGPRA) (25 U.S.C. 3001-3013) and its implementation (43 CFR Part 10.2), and California Government Code §27491 may apply to this project if Native American human remains are inadvertently discovered.

The NAHC is of the opinion that the federal standards, pursuant to the above-referenced Acts and the Council on Environmental Quality (CSQ; 42 U.S.C. 4371 *et seq*) are similar to and in many cases more stringent with regard to the 'significance' of historic, including Native American items, and archaeological, including Native American items at least equal to the California Environmental Quality Act (CEQA.). In most cases, federal environmental policy require that any project that causes a substantial adverse change in the significance of an historical resource, that includes archaeological resources, is a 'significant effect' requiring the preparation of an Environmental Impact Statement (EIS).

The NAHC conducted a Sacred Lands File (SLF) search of its Inventory and Native American Cultural Resources **were not identified** in the project area you specified; early and quality consultation with the Native American on the attached list may provide detailed information of sites with which they are aware. Also, the absence of archaeological resources does not preclude their existence. Even though no Native American cultural resources were identified in the NAHC search, this area is known to the California NAHC to contain substantial archaeological/Native American cultural resources.

The NAHC Sacred Lands File Inventory of the Native American Heritage Commission is established by the California Legislature pursuant to California Public Resources Code

§§5097.94(a) and 5097.96. The NAHC Sacred Lands Inventory is populated by submission to the data by Native American tribes and Native American elders; In this way it differs from the California and National Register of Historic Places under the jurisdiction of the U.S. Secretary of the Interior.

The NAHC, pursuant to Appendix B of the Guidelines to the California Environmental Quality Act (CEQA) is designated as the agency with expertise in the areas of issues of cultural significance to California Native American communities. Also, in the 1985 California Appellate Court decision (170 Cal App 3rd 604), the court held that the NAHC has jurisdiction and special expertise, as a state agency, over affected Native American resources, impacted by proposed projects including archaeological, places of religious significance to Native Americans and burial sites

Culturally affiliated tribes are to be consulted to determine possible project impacts pursuant to the National Historic Preservation Act, as amended. Early consultation with Native American tribes in your area is the best way to avoid unanticipated discoveries once a project is underway. The NAHC recommends as part of 'due diligence', that you also contact the nearest Information Center of the California Historical Resources Information System (CHRIS) of the State Historic Preservation Office (SHPO) for other possible recorded sites in or near the APE (contact the Office of Historic Preservation at 916-445-7000).

Attached is a list of Native American contacts is attached to assist you; they may have knowledge of cultural resources in the project area. It is advisable to contact the persons listed and seek to establish a 'trust' relationship with them; if they cannot supply you with specific information about the impact on cultural resources, they may be able to refer you to another tribe or person knowledgeable of the cultural resources in or near the affected project area.

Lead agencies should consider avoidance, in the case of cultural resources that are discovered. A tribe or Native American individual may be the only source of information about a cultural resource; this is consistent with the NHPA (16 U.S.C. 470 *et seq* Sections. 106, 110, and 304) Section 106 Guidelines amended in 2009. Also, federal Executive Orders Nos. 11593 (preservation of cultural environment), 13175 (coordination & consultation) and 13007 (Sacred Sites) are helpful

NEPA regulations provide for provisions for accidentally discovered archeological resources during construction and mandate the processes to be followed in the event of an accidental discovery of any human remains in a project location other than a 'dedicated cemetery. Even though a discovery may be in federal property, California Government Code §27460 should be followed in the event of an accidental discovery of human remains during any groundbreaking activity; in such cases California Government Code §27491 and California Health & Safety Code §7050.5 will apply and construction cease in the affected area.

If you have any questions about this response to your request, please do not hesitate to contact me at (916) 653-6251.

Sincerely,

Dave Singleton
Cc: Native American Contacts list

NASA JPL Response to Comment from the Native American Heritage Commission

NASA JPL thanks the Native American Heritage Commission for their response and direction to addressing the protection of Native American cultural resources. NASA JPL will comply with the necessary Native American cultural resources regulations to insure that the proper procedures for the protection of Native American cultural resources are fully implemented. If any assistance is required in regards to Native American cultural resources, NASA JPL will communicate with the appropriate Native American contacts provided