PERMIT ATTACHMENTS

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PERMIT ATTACHMENTS

ATTACHMENT 1: General Facility Description

ATTACHMENT 2: Facility Maps

ATTACHMENT 3: Compliance Schedule

ATTACHMENT 4: Corrective Action Status Tables

ATTACHMENT 5: Hazardous Waste Management Unit Post-Closure Care

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ATTACHMENT 1

General Facility Description

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ATTACHMENT 1: General Facility Description

Site Location

The White Sands Test Facility (WSTF) occupies over 60,000 acres and is located along the western flank of the San Andres Mountains, one of the most prominent north-south ranges in southwestern New Mexico. The main entrance to the installation is six miles north of Organ, New Mexico. Geographic coordinates of WSTF are 32°30'30" north latitude and 106°36'30" west longitude. The Facility is located in Doña Ana County, 18 miles northeast of Las Cruces, New Mexico and 65 miles north of El Paso, Texas. Attachment 2 includes the WSTF location maps. Access to the site is provided by a paved road, which intersects U.S. Highway 70 one mile west of Organ, New Mexico.

WSTF's primary activities are in support of the national space program and include:

- Development, qualification, refurbishment, and testing of spacecraft propulsion systems, subsystems, and ground support equipment;
- Investigation of flight hardware anomalies;
- Testing of materials and components; and
- Performance of hazard and failure analyses.

History of WSTF

Construction

WSTF began operation on July 6, 1962, when NASA headquarters announced the site selection. From the date of the official announcement until January 1965, the site was officially known as the Propulsion System Development Facility (PSDF). From January until June 1965, the official designation was White Sands Operation (WSO). On June 16, 1965, the official name of the installation was changed to White Sands Test Facility.

Actual construction at the site began in May 1963, with construction of the access road from U.S. Highway 70. The road was completed in October 1963. The first permanent personnel move-in was accomplished in April 1964, and the official WSTF dedication occurred in June 1964.

Propulsion Testing

Propulsion systems testing began in September 1964 in the "300" Area Test Stand (TS) 301, with firings of the Apollo Service Propulsion Subsystem (SPS) engine in a heavyweight rig labeled F-2. A Block 2 configuration SPS test article (F-2A) was installed and tested at TS-301 from early 1966 until mid-1969, followed by development and qualification testing until mid-1971 of the Command and Service module (CSM) Reaction Control System (RCS) engines used for the Skylab project.

Test Stand 302 was originally constructed as an ambient test stand and was first used for SPS firings of the SC 001 test rig during 1965. In 1966, the stand was significantly modified by removing the ambient thrust structure, and installing a tall vacuum chamber, similar to those at TS 401 and 403. In 1972, TS 302 was further modified by lengthening the vacuum chamber by

20 feet. This test stand was equipped with mechanical vacuum pumps, and was used to characterize the start transient and minimum-impulse performance of the Lunar Module (LM) ascent engine at higher simulated altitudes (240,000 ft) than could be obtained with the steam ejector system in the "400" Area. The effects of different rocket engine configurations on soil erosion, displacement, and contamination by exhaust products were evaluated during these tests, resulting in recommendations for design changes incorporated into the flight article.

Other "300" Area tests through the mid-1970's included Navy solid rocket plume/microwave interaction tests, characterization of filters for gasses, hypergolic propellants, and cryogenic liquids, and evaluation of effects of dumping residual Apollo command module propellants on the recovery parachute risers before splashdown (Apollo 15 parachute failure).

Following the Apollo-Skylab era, the facilities in the 300 Area were modified, including propellant supply systems, environmental control, improved electrical and data systems, articulated thrust structures, and moveable shelters to accommodate extensive testing of the primary and vernier reaction control systems of the Space Shuttle Orbiter.

Exhaustive testing of the Aft Reaction Control System (ARCS), from development through operational qualification, took place at TS-301 from early 1978 through 1982, with emphasis on evaluating ARCS and Orbital Maneuvering System (OMS) interactions and thruster duty cycle effects, as well as characterization of the RCS tank propellant acquisition devices (screens) and development of checkout and servicing procedures.

Similarly, rigorous testing of the Forward ARCS was conducted at TS 328 (adjacent to TS-302) during the same time period (1978-1982) as ARCS testing. Both the 870-lb thrust primary engines and the 25-lb thrust vernier engines on each ARCS and Forward Reaction Control System (FRCS) test article were thoroughly investigated during the development and qualification tests.

Facilities in the "400" Area were originally designed around testing the Apollo LM propulsion system, and the two vacuum test chambers could contain a full-size mated LM while performing simulated vacuum firing of the descent, ascent, and RCS engines. Initial testing of the LM Ascent Propulsion Subsystem was conducted at the ambient TS-402 using the HA-3 rig beginning in 1965. Subsequent LM APS and RCS testing was conducted mostly in the TS-403, using a flight-representative test article dubbed PA-1, and encompassing the period from 1966 through late 1970. A LM ascent stage thermal test rig TM-2 and the LM descent test rig LTA-5 were also tested at the TS-403 during this period.

Vacuum Test Stand 401 (TS-401) was dedicated to testing the LM descent propulsion subsystem, using several configurations of heavyweight and flight test articles such as HD-1, PD-1, PD-2, and LTA-5. These tests were conducted from early 1966 through late 1970.

During the transition years between the Apollo and Shuttle eras, an extensive series of tests of a second stage satellite booster engine was conducted in 1972 for the Japanese Space Agency, and a pair of planetary probe insertion solid rocket motors was fired at TS-401. A program to develop rocket engine extendable nozzle technology was also conducted during this period at TS-403.

Testing of Shuttle Orbital Maneuvering Engine (OME) technology and prototype engines began in mid-1973, and all candidate OMS engines from several manufacturers were tested at TS-401 to select the OME manufacturer and define baseline data in the official OME design. The selected Aerojet engine was subject to extensive prototype, development, and qualification testing from 1974 through 1980, undergoing numerous design and operational modifications along the way.

A simulated OMS "pod" containing flight weight and configuration OMS propulsion system (but only simulated RCS) underwent development and early qualification tests at TS-403 between 1978 and mid-1979. This OMS pod was then revised to reflect correct configuration and retested at WSTF from 1981 through 1982 to the more stringent operational flight conditions of Qual II.

Other programs conducted in the "400" Area during the Shuttle era include several high-altitude tests of the primary and vernier RCS engines. These tests include helium bubble ingestion and simulated propellant leakage, tests of a DOD technology demonstration warhead intercept propulsion system, extensive characterization of the solubility of iron (from steel storage vessels and transport lines) in an oxidizer, and evaluation of methods like molecular sieves for removal of the iron nitrate from oxidizer.

In the early 1990s, WSTF performed development testing of the proposed Space Station Freedom propulsion modules. Additionally, WSTF is an Orbiter and International Space Station Depot Repair Facility and performs flight hardware assembly, repair, and acceptance testing for private aerospace manufacturers. Six test stands provide vacuum test capability, and three test stands provide ambient testing; 5,000 feet (1,100 meters) above sea level, that have been used for the Space Shuttle, International Space Station, or government agencies.

Materials Testing

Beginning in 1967, the WSTF laboratories developed a basic capability to evaluate the flammability and toxicity characteristics of non-metallic materials used in the Apollo spacecraft. This program expanded rapidly in the following years to include the measurement of properties such as total organics, odor, comparability in propellants, and mechanical and pneumatic impact. Test pressures were initially at Apollo cabin pressures with 100% oxygen. The testing is presently performed with any oxygen mixture up to 20,000 pounds per square inch absolute (psia). Standardized test fixtures, test procedures, and acceptance criteria have been developed for these environments. The need for materials testing continued from the Apollo program through Skylab, ASTP, and the Space Shuttle.

In order to provide standard facilities, efficiency, and fast response to the many materials test requirements, the many scattered facilities were consolidated into a single materials test facility that was built in 1974. Twelve permanent remote test cells were provided for conducting tests using hazardous fuels and oxidizers. Eight additional cells were provided to perform standard high pressure oxygen tests and other tasks that are hazardous to perform due to pressure, fire, and other hazards, but do not use hazardous fluids. The most recent addition to the materials testing capability consists of a high temperature, high flow rate oxygen facility that allow testing of high flow rate components and performance of particle impact investigations at elevated temperature.

In 1967, the WSTF precision cleaning laboratory began the cleaning of tools, sample collection devices, packages, and related materials for the Lunar Receiving Laboratory at Johnson Space Center (JSC). In 1973, at the request of the Lunar Curator, an intensive effort was initiated to upgrade the precision cleaning and control capabilities of this laboratory. This effort led to cleaning the Viking Lander soil samples hardware to very low levels of organic contaminants.

The WSTF laboratories have also performed a wide variety of special tests for all of the manned space efforts under many different conditions. These special tests include microelectronic circuit screen and burn-in testing, component evaluations, qualification testing of electrical and mechanical components and subsystems, failure analysis, chemical and metallurgical investigations, plus many more such activities.

Permit History

WSTF is a former treatment, storage, and disposal (TSD) facility. A Resource Conservation and Recovery Act (RCRA) Operating Permit was issued in February 1993 and Post-closure Permit for five hazardous waste management units requiring post-closure care (200, 300, 400, and 600 Area Closures) was issued in September 1994. The 2009 RCRA Permit allowed for the treatment of hazardous waste generated during Facility operations at the Evaporation Treatment Unit (ETU) and Fuel Treatment Unit (FTU). The ETU and the FTU are no longer in use and were "clean-closed" in 2014 and 2019, respectively. Corrective action at various solid waste management units (SWMUs), areas of concern (AOCs), and closed hazardous waste management units (HWMUs) was also a component of the 2009 Permit.

NASA WSTF currently manages hazardous waste generated during routine operations as a large quantity generator. Hazardous waste storage is conducted at various less than 90-day accumulation areas and does not require permitting. All hazardous waste is shipped off-site to an appropriate disposal facility. WSTF operates its hazardous waste management activities under the Environmental Protection Agency (EPA) identification number NM8800019434.

Historic releases of hazardous waste and hazardous constituents generated at WSTF in association with testing and evaluation operations at the Facility is believed to have primarily occurred at surface impoundments and storage tanks located at the 200, 300, 400, and 600 Areas. Available historical information indicates the release of contaminants to the environment likely occurred during the early 1960's through the mid-1980's. The releases resulted in soil and groundwater contamination at the Facility and surrounding areas. Primary contaminants of concern released to the environment at WSTF include N-nitrosodimethylamine (NDMA), which is believed to have originated from test evaluation operations and treatment of generated waste in the 300 and 400 Areas surface impoundment structures. The release of the halogenated volatile contaminants trichloroethene (TCE), tetrachloroethene (PCE), trichlorofluoromethane (Freon 11), 1,1,2-trichloro-1,2,2-trifluoroethene (Freon 113), and chloroform are believed to have primarily originated from the 200 Area, and potentially, to a lesser extent, from the 100, 300, 400, and 600 Areas as a result of the use and release of solvents and other chemicals at these WSTF operation areas.

Corrective action is required at identified SWMUs, AOCs, and HWMUs under post-closure care. SWMU, AOC, and HWMU location information is provided in Permit Attachment 2, including the units listed in Permit Attachments 4 (SWMUs and AOCs) and Permit Attachment 5 (HWMUs under post-closure care). This Permit requires continued corrective action at Facility SWMUs, AOCs, and five closed HWMUs under post-closure care.

Geology

WSTF is in the Mexican Highland Section of the Basin and Range Province and within a major tectonic feature – the Rio Grande Rift Zone. North trending mountain ranges and intermountain basins characterize the Rift Zone, which extends from southern Colorado to northern Mexico. WSTF is located along the western flank of the San Andres Mountains. The elevation of the adjacent plains is about 4000 feet above mean sea level.

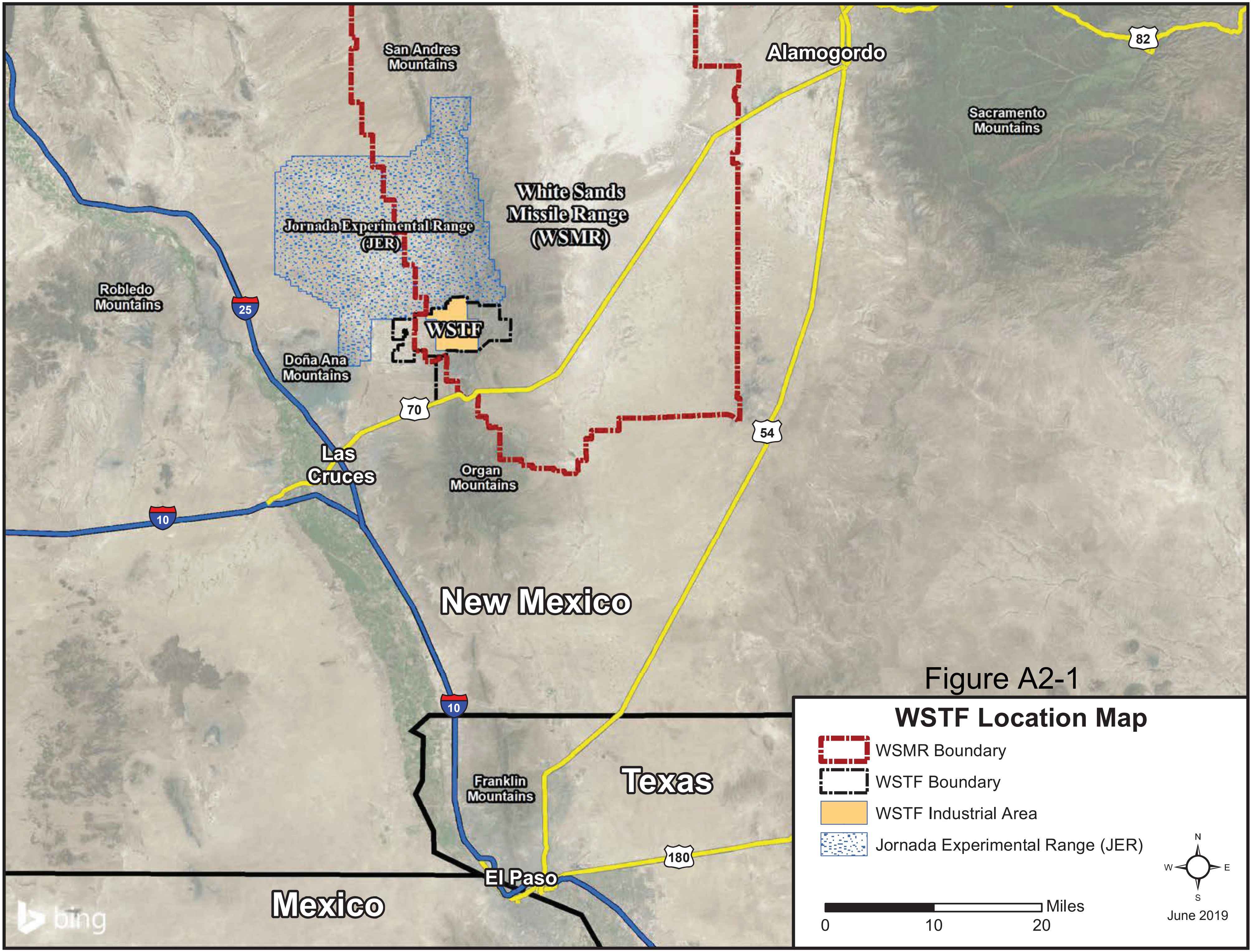
The uppermost alluvial layers upon which WSTF is located consist of silt, sand, gravel, boulders, and locally-cemented conglomerates, and range from 400 to 700 feet thick adjacent to the mountains to 100 to 200 feet thick in the basin floor. The surface of the uppermost alluvium layer is a sandy silt containing some gravel and occasional boulders, with the gravel and boulder content gradually increasing with depth.

Hydrology

The primary water supply in the area for potable, industrial, and agricultural use is from underground water resources. Immediately adjacent to the Rio Grande, water for agricultural use is diverted to fields from the river via irrigation canals. The quantity of water from this source, however, is a minor amount of the total water consumption.

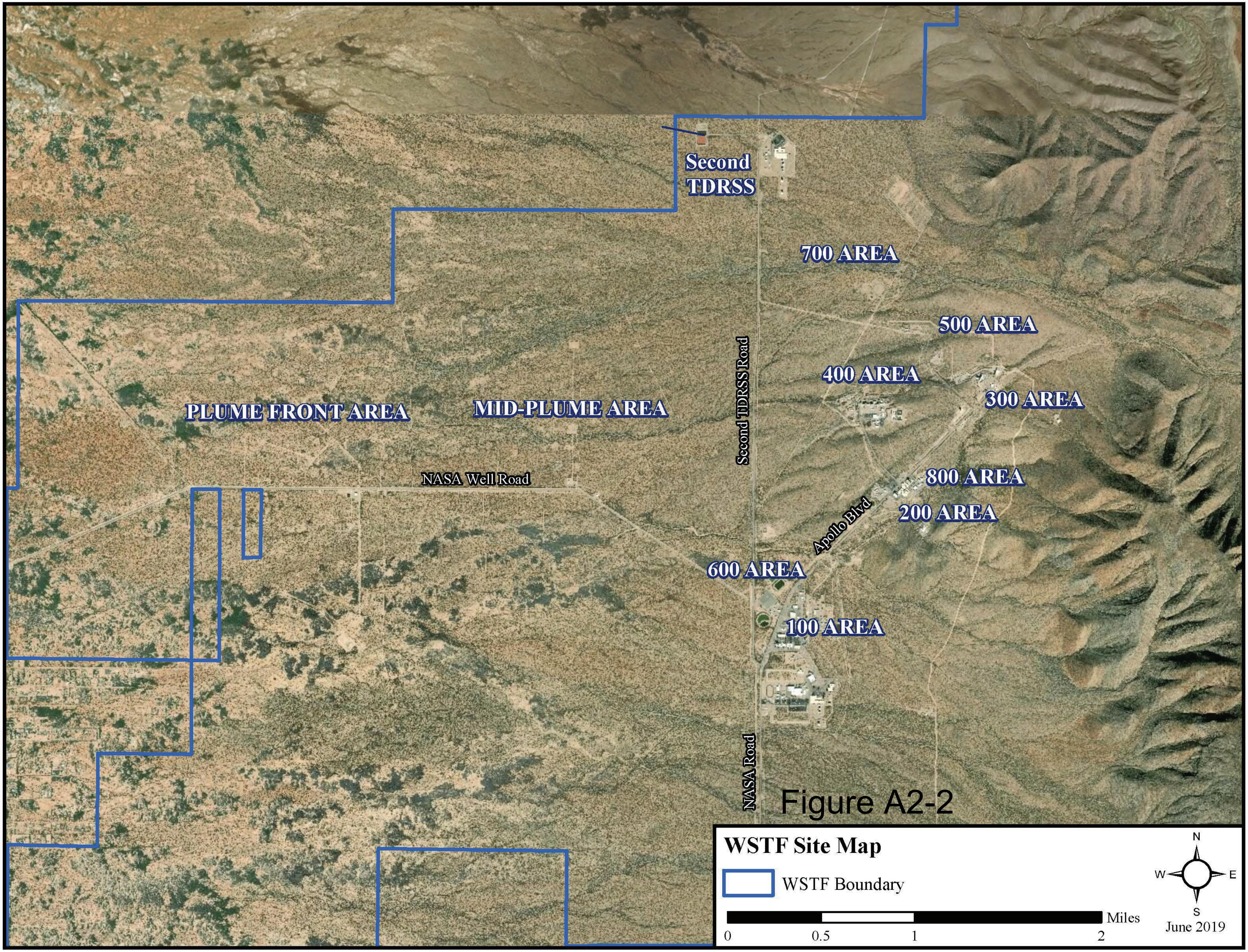
In the WSTF area, all water is from underground sources. Recharge of the ground water aquifers of the Jornada del Muerto Basin is primarily runoff from the adjacent San Andres Mountains. Approximately 75 percent of total rainfall migrates off-site as surface runoff. The runoff that does not evaporate or transpire after it reaches the alluvial fans at the base of the mountains, infiltrates and constitutes ground water recharge. Although the volume of this recharge is small and sporadic in nature, it is a continuing source of recharge.

ATTACHMENT 2
Figures



San Andres Mountains
Alamogordo
82
Sacramento Mountains
White Sands Missile Range (WSMR)
Jornada Experimental Range (JER)
Robledo Mountains
25
WSTF
Doña Ana Mountains
70
54
Las Cruces
Organ Mountains
10
New Mexico
10
Franklin Mountains
Texas
180
El Paso
Mexico
bing
WSTF Location Map
WSMR Boundary
WSTF Boundary
WSTF Industrial Area
Jornada Experimental Range (JER)
N
W
E
S
0
10
20
Miles
June 2019

Figure A2-1


Second
TDRSS
700 AREA
500 AREA
400 AREA
300 AREA
PLUME FRONT AREA
MID-PLUME AREA
Second TDRSS Road
NASA Well Road
800 AREA
200 AREA
Apollo Blvd
600 AREA
100 AREA
NASA Road
Figure A2-2
WSTF Site Map
WSTF Boundary
Miles
0
0.5
1
2
N
W
E
S
June 2019

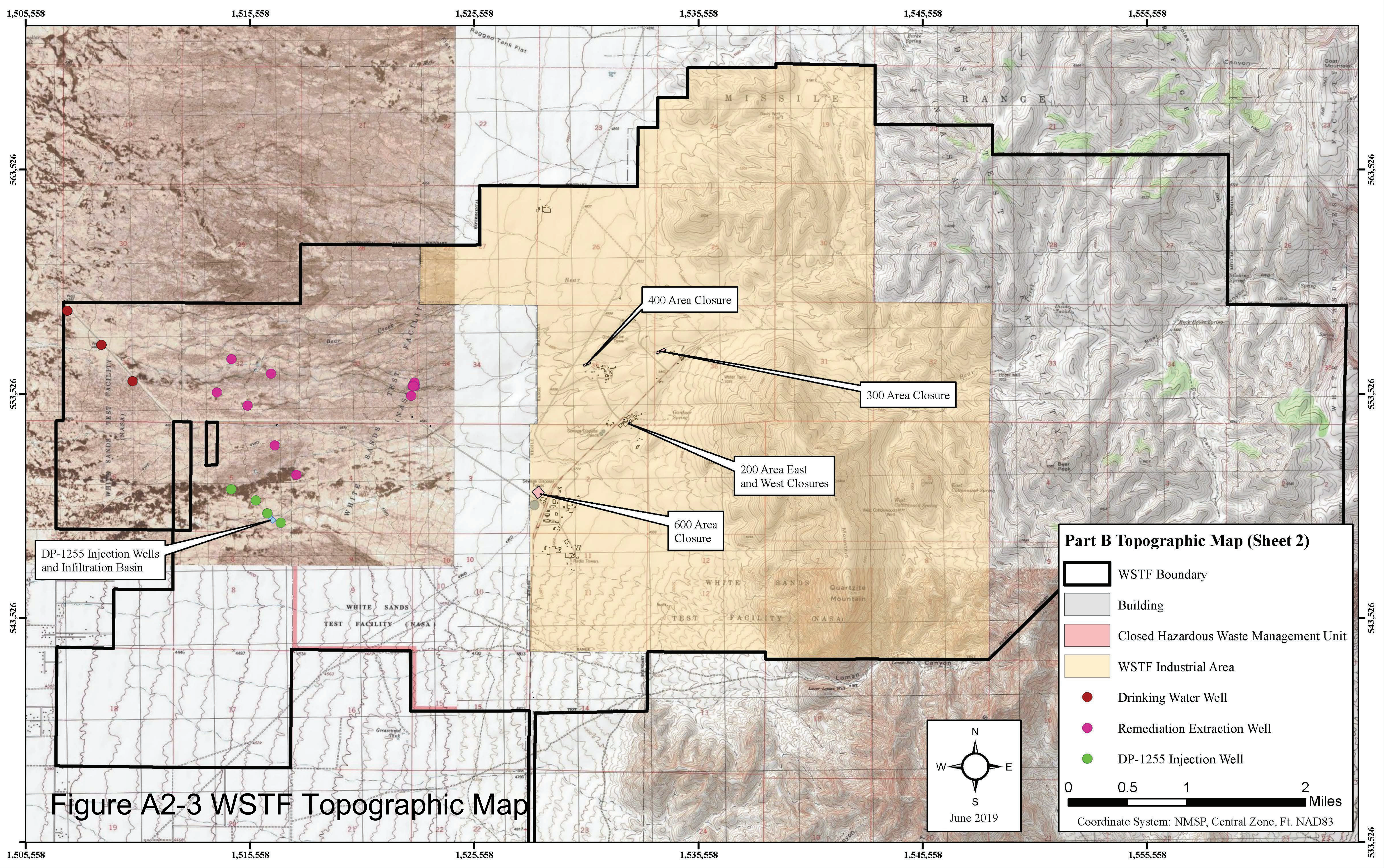
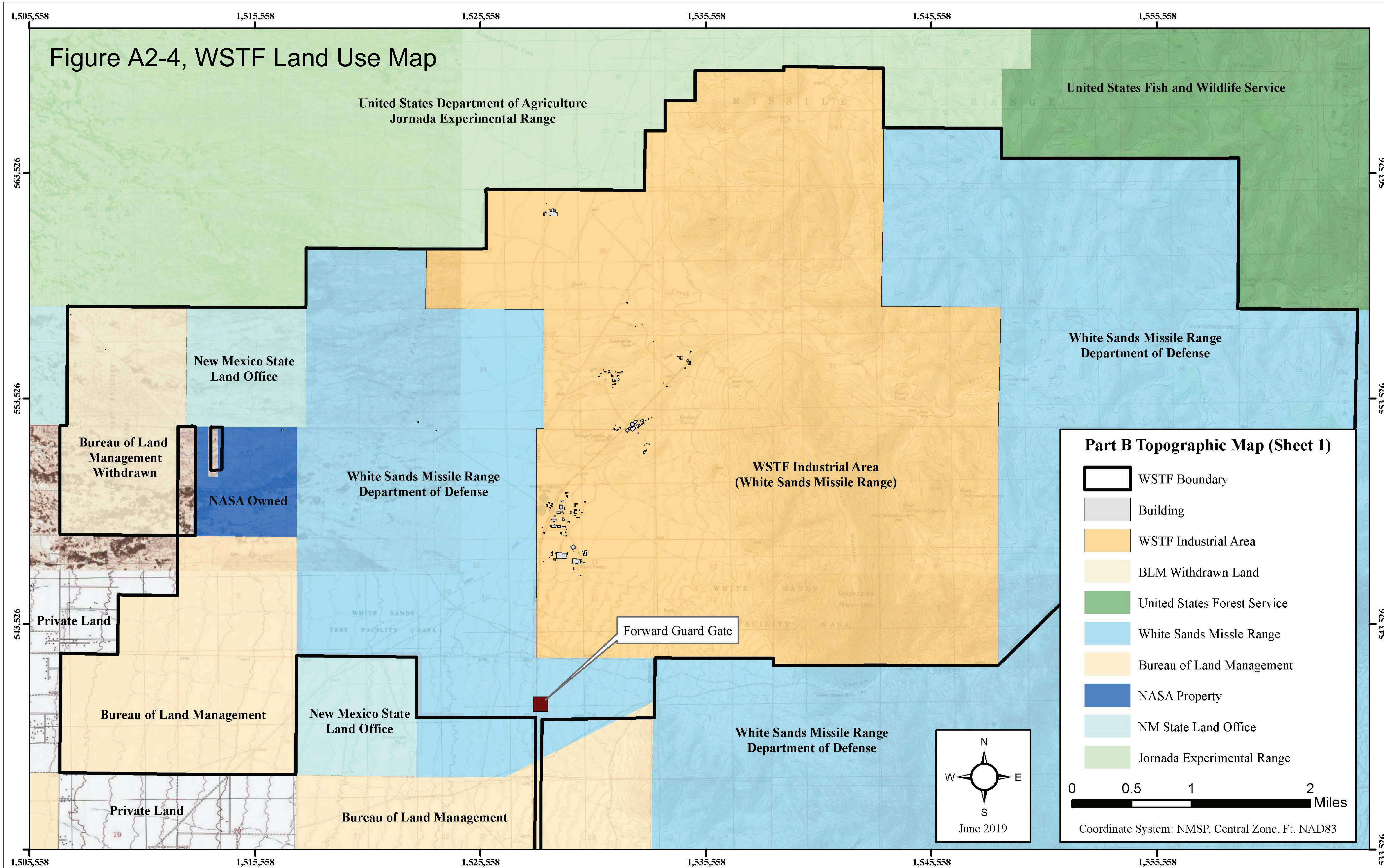


Figure A2-3 WSTF Topographic Map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543,526
533,526
Figure A2-4, WSTF Land Use Map
United States Department of Agriculture
Jornada Experimental Range
United States Fish and Wildlife Service
New Mexico State
Land Office
White Sands Missile Range
Department of Defense
Bureau of Land
Management
Withdrawn
NASA Owned
White Sands Missile Range
Department of Defense
WSTF Industrial Area
(White Sands Missile Range)
Private Land
Forward Guard Gate
Bureau of Land Management
New Mexico State
Land Office
White Sands Missile Range
Department of Defense
Private Land
Bureau of Land Management
Part B Topographic Map (Sheet 1)
WSTF Boundary
Building
WSTF Industrial Area
BLM Withdrawn Land
United States Forest Service
White Sands Missle Range
Bureau of Land Management
NASA Property
NM State Land Office
Jornada Experimental Range
N
W
E
S
June 2019
0
0.5
1
2
Miles
Coordinate System: NMSP, Central Zone, Ft. NAD83

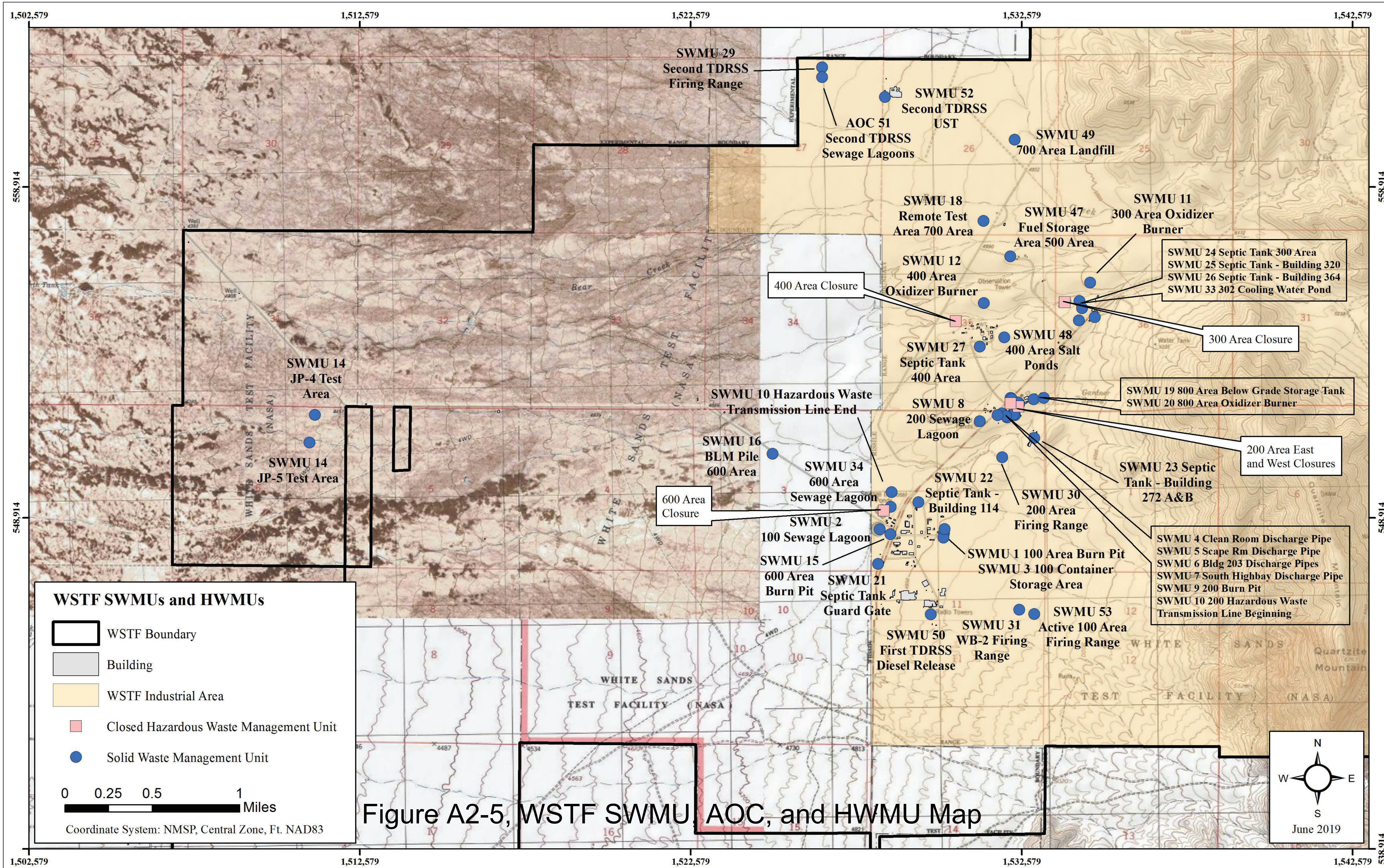

Figure A2-5, WSTF SWMU, AOC, and HWMU Map

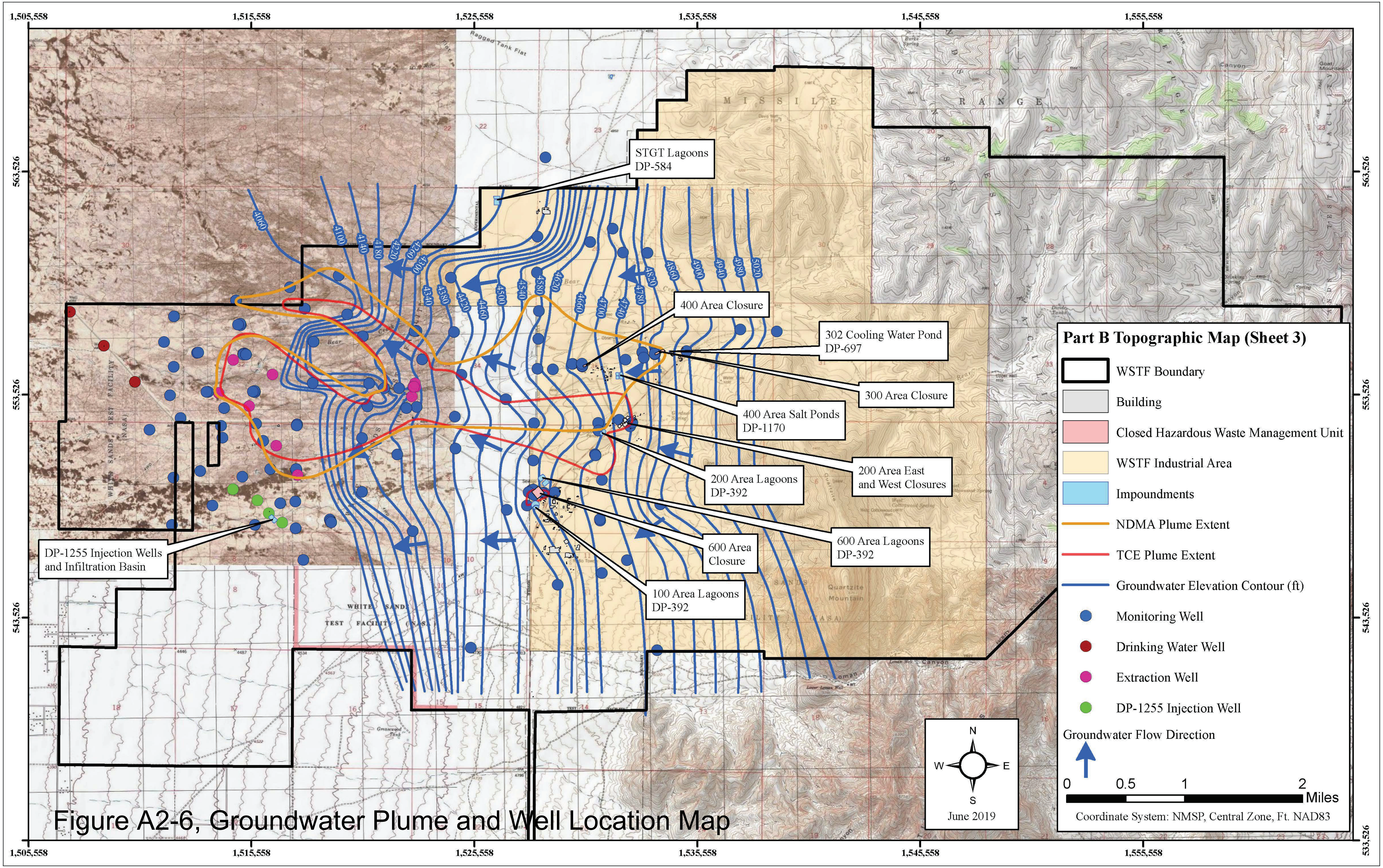

Figure A2-6, Groundwater Plume and Well Location Map

ATTACHMENT 3
Compliance Schedule

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ATTACHMENT 3

Compliance Schedule

Table 3-1: Compliance Schedule

Permit Section	Requirement	Due Date
Submittals Due After Permit Issuance		
1.9.5	Permit Renewal	180 calendar days before expiration date
2.1	Hazardous Waste Generation Locations Map	January 30th of each year
2.8.5	Biennial Report	March 1st of even numbered years
3.3.1	Facility-Wide Groundwater Monitoring Plan	April 30th of each year
3.3.7	Quarterly Periodic Groundwater Monitoring Reports	April 30th, July 30th, October 30th, and January 31 of each year
3.4	Remediation System Monitoring Plan	August 1st of each year

ATTACHMENT 4

Corrective Action Status Tables

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ATTACHMENT 4

Corrective Action Status Tables

Table 4-1: SWMUs and AOCs Requiring Corrective Action

Unit ID	Unit Description	Work Plan Submittal Date
SWMU 1	100 Area Burn Pit	Submitted 7/30/14
SWMU 2	100 Area Sewage Lagoon	Submitted 10/15/12
SWMU 3	100 Area Container Storage Area	Submitted 7/30/14
SWMU 4	200 Area Clean Room Discharge Pipe	Submitted 3/28/12
SWMU 5	200 Area Scape Room Discharge Pipe	Submitted 3/28/12
SWMU 6	200 Area Building 203 Discharge Pipe	Submitted 3/28/12
SWMU 7	200 Area South Highbay Discharge Pipe	Submitted 3/28/12
SWMU 8	200 Area Sewage Lagoons	Submitted 10/15/12
SWMU 9	200 Area Burn Pit	Submitted 3/28/12
SWMU 10	200 Area Hazardous Waste Transmission Lines	Submitted 6/29/15
SWMU 11	300 Area Oxidizer Burner	60 days prior to closure
SWMU 12	400 Area Oxidizer Burner	60 days prior to closure
SWMU 13	Removed from Permit	Not Applicable
SWMU 14	600 Area JP Remote Test Area	Submitted 8/26/13
SWMU 15	600 Area Burn Pit	Submitted 7/30/14
SWMU 16	600 Area BLM Off-Site Pile	Submitted 12/29/14
SWMU 18	700 Area High Energy Blast Facility	60 days prior to closure
SWMU 19	800 Area Below Grade Storage Tank	Submitted 6/25/15
SWMU 20	800 Area Oxidizer Burner	60 days prior to closure
SWMU 21	100 Area Septic Tank at Guard Shack	Submitted 6/27/13
SWMU 22	100 Area Septic Tank at Bldg. 114	Submitted 6/27/13
SWMU 23	200 Area Septic Tank at Bldg. 272	Submitted 6/27/13
SWMU 24	300 Area Septic Tank at Main Parking Lot	Submitted 6/27/13
SWMU 25	300 Area Septic Tank at Bldg. 320	Submitted 6/27/13
SWMU 26	300 Area Septic Tank at Bldg. 364	Submitted 6/27/13
SWMU 27	400 Area Septic Tank at Main Parking Lot	Submitted 6/27/13
SWMU 29	Small Arms Range at second TDRSS Ground Terminal (STGT)	Submitted 2/26/15
SWMU 30	200 Area Small Arms Range	Submitted 2/26/15
SWMU 31	WB-2 Small Arms Firing Range	Submitted 2/26/15
SWMU 33	300 Area Test Stand 302 Cooling Water Pond	Submitted 8/17/20
SWMU 34	600 Area Sewage Overflow Lagoons	Submitted 10/15/12
SWMU 47	500 Area Fuel Storage Area	Submitted 9/26/18
SWMU 48	400 Area Salt Ponds	90 days prior to closure
SWMU 49	700 Area Landfill	Submitted 12/28/17
SWMU 50	First TDRSS Diesel Release	Submitted 6/29/16
AOC 51	Second TDRSS Sewage Lagoons	Submitted 10/15/12

Unit ID	Unit Description	Work Plan Submittal Date
SWMU 52	Second TDRSS UST	60 days prior to closure
SWMU 53	Active Firing Range	60 days prior to closure
SWMU 54	500 Area Former Oxidizer Burner	August 31, 2022

Table 4-2: SWMUs and AOCs with Corrective Action Complete with Controls

Unit ID	Unit Description	Comments

Table 4-3: SWMUs and AOCs with Corrective Action Complete without Controls

Unit ID	Unit Description	Comments

ATTACHMENT 5

Hazardous Waste Management Unit Post-Closure Care

ATTACHMENT 5: Hazardous Waste Management Post-Closure Care

Table 5-1: Hazardous Waste Management Units Requiring Post- Closure Care

Unit ID	Unit Description	Inspection Schedule
200 Area East Closure (Chemistry Lab Tank)	The closed HWMU in the 200 Area consisted of two underground storage tanks, one concrete and one steel tank. The closure of the area was finalized in 1989, and the environmental closure cap cover is asphalt.	Once monthly for any closure cap erosion, cracks, potholes, settling, other damage, and general tidiness (e.g., removal of weeds).
200 Area West Closure (Clean Room Tanks)	The closed unit in the 200 Area consisted of two steel underground storage tanks. The closure of the area was finalized in 1989, and the environmental closure cap cover is a concrete floor beneath an existing building.	Once monthly for any closure cap cracks, settling, other damage, and general tidiness of closure area.
300 Area Closure	The closed units in the 300 Area consisted of two above-ground surface impoundments and a multi-chamber concrete mixing tank. The closure was finalized in 1989, and the environmental closure cap cover is an asphalt emulsion-sealed concrete bottom of the surface impoundments and a concrete cover for the mixing tank.	Once monthly for any closure cap erosion, cracks, potholes, settling, animal burrows, other damage, and general tidiness (e.g., removal of weeds and litter).

400 Area Closure	The closed units in the 400 Area are similar to the units in the 300 Area. The hazardous waste area consisted of two above ground surface impoundments and a multi-chamber concrete mixing tank. The closure was finalized in 1989, and the environmental closure cap cover is an asphalt emulsion-sealed concrete bottom of the surface impoundments and a concrete cover for the mixing tank.	Once monthly for any closure cap erosion, cracks, potholes, settling, animal burrows, other damage, and general tidiness (e.g., removal of weeds and litter).
600 Area Closure	The closed units in the 600 Area consisted of two surface impoundments. The units were closed under one cover, and the closure was finalized in 1989. The environmental closure cap cover is constructed of low permeability clay.	Once monthly for any closure cap erosion, cracks, potholes, settling, animal burrows, other damage, and general tidiness (e.g., removal of weeds and litter).